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The National Estuary Program's Watershed Protection Approach: An Analysis of Local Governments, constituency Organizations and Watershed Residents in Addressing Nonpoint Source Pollution in the Buzzards Bay Project

Paula Renier Jewell
University of Rhode Island

THE NATIONAL ESTUARY PROGRAM'S WATERSHED PROTECTION APPROACH: AN ANALYSIS OF LOCAL GOVERNMENTS, CONSTITUENCY ORGANIZATIONS AND WATERSHED RESIDENTS IN ADDRESSING NONPOINT SOURCE POLLUTION IN THE BUZZARDS BAY PROJECT

BY

PAULA RENIER JEWELL

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PAULA RENIER JEWELL

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LIST OF ABBREVIATIONS

ACOE	Army Corps of Engineers
BBP	Buzzards Bay Project
BMP(s)	best management practice(s)
BOH	Board of Health
CC	Conservation Commission
CCMP	Comprehensive Conservation and Management Plan
CNPCP	Coastal Nonpoint Pollution Control Program
CSWGPP(s)	Comprehensive Source and Ground Water Protection Program(s)
CWA	Clean Water Act (Federal Water Pollution Control Act)
CZARA	Coastal Zone Act Reauthorization Amendments of 1990
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act of 1972
DEP	Department of Environmental Protection (MA)
DMF	Department of Marine Fisheries (MA)
EOEA	Executive Office of Environmental Affairs (MA)
EPA	Environmental Protection Agency (USEPA)
FDA	Food and Drug Administration
GIS	Geographic Information System
IEM	Integrated Environmental Management
MA	Massachusetts
MC	Management Conference

MEPA	Massachusetts Environmental Policy Act
MOU(s)	Memorandum(a) of Understanding
NENYIAC	New England-New York Interagency Committee
NEP	National Estuary Program
NERBC	New England River Basin Commission
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint source pollution
RI	Rhode Island
SDWA	Safe Drinking Water Act
SRF	State revolving funds
SWCD	Soil and Water Conservation District
TMDL(S)	total maximum daily load(s)
USDA	United States Department of Agriculture
USDC	United States Department of Commerce
USEPA	United States Environmental Protection Agency (EPA)
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Service
WISC	Watershed Initiative Steering Committee
WPA	watershed protection approach
WRC	Water Resources Council(s)
WRWA	Westport River Watershed Alliance
WQS	Water Quality Standards

ABSTRACT

Reduction of coastal nonpoint source (NPS) pollution requires an innovative approach. Efforts must comprehensively address the cumulative effects of individual behaviors. Therefore, program objectives must apply to the entire contributing watershed, but emphasize local implementation. Local governments must be empowered to install regulatory and other mechanisms to reduce NPS pollution. Local citizen organizations, such as watershed associations, must effectively educate watershed citizens about their role in NPS pollution. Watershed citizens must change their behaviors which contribute to the problem.

However, developing a vibrant constituency around NPS pollution itself remains a serious challenge to mitigation efforts. As a geographically defined, holistic approach stressing the role of local government and watershed citizens, the watershed protection approach holds great promise as a tool to address NPS pollution.

This paper examines mitigation efforts as part of the Buzzards Bay National Estuary Program with special attention on the increasing role of local government and citizen activism. In concludes with recommendations for improved nonpoint source pollution outreach and education efforts.

To Jeff

CHAPTER ONE

NONPOINT SOURCE POLLUTION

IDENTIFICATION OF THE PROBLEM

The 1972 Federal Water Pollution Control Act (Clean Water Act - CWA) has contributed to improved water quality by effectively mitigating point sources of water pollution. However, nonpoint source pollution (NPS)[1] was not addressed until the 1987 CWA amendments. This diffuse pollution is now considered the principal cause of water quality impairment in many rivers, streams and coastal areas, including the Buzzards Bay area of Cape Cod (see Figure 1)(USEPA 1994a).

Nonpoint source pollution originates from numerous sources such as plowed fields, city streets, and suburban backyards (see Appendix 1). When rainwater and snowmelt run over land, contaminants including soil particles, nutrients, and pesticides are washed into groundwater, rivers, lakes, wetlands and coastal waters (National Geographic Society and Conservation Foundation 1995, 7).

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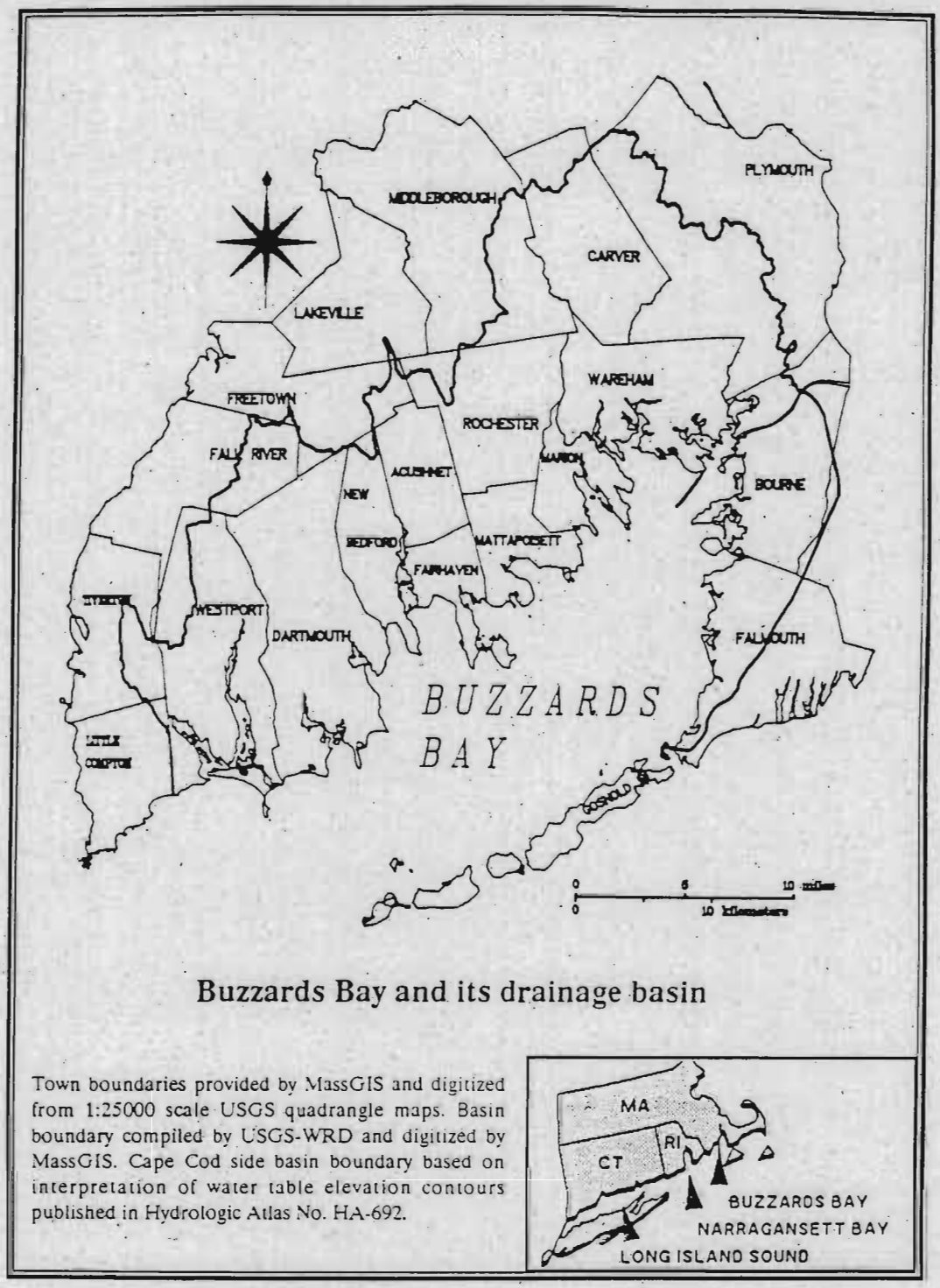
[1] There are many excellent sources of detailed information about nonpoint source pollution. Therefore, this paper does not include a detailed discussion of this subject. Several sources used in development of this paper are included in the Works Cited.



Buzzards Bay and its drainage basin

Town boundaries provided by MassGIS and digitized from 1:25000 scale USGS quadrangle maps. Basin boundary compiled by USGS-WRD and digitized by MassGIS. Cape Cod side basin boundary based on interpretation of water table elevation contours published in Hydrologic Atlas No. HA-692.

Figure 1. (Buzzards Bay Project 1991b, 14).

The manner in which NPS enters ground and surface waters is diffuse since it originates from various human activities over a wide geographic area (Griffin 1991). Water quality impairments are attributed to agricultural sources in 72% of assessed rivers, 56% of assessed lakes and 43% of assessed coastal waters; urban runoff and storm sewer are implicated in 11% of rivers, 24% of lakes and 43% of estuaries[2] (Perciasepe 1995, 48). The dominant contributors in estuarine waters such as Buzzards Bay are urban runoff (including some construction activities and onsite disposal systems) and agriculture (see Table 1). Secondary contributors include silviculture, marinas, and hydromodification (US Department of Commerce and US Environmental Protection Agency 1993, 1).

Water quality data from the Buzzards Bay estuary supports this finding. A Section 208 planning study found organic, inorganic and biological contaminants in Buzzards Bay. These contaminants came primarily from urban stormwater runoff. Runoff from roads contributes 33,000 pounds/year of petroleum hydrocarbons to Buzzards Bay (Northern Virginia Soil and Water Conservation District 1994, 42). Total annual loading of anthropogenic nitrogen

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[2]Estuaries are defined as distinctive areas found wherever significant supplies of fresh water meet the sea. Estuaries are marked by high productivity due to the influx of suspended and dissolved nutrients carried by freshwater (Harvey, Mann, Podolsky and Conkling 1995, 122).

from the 432 square mile Buzzards Bay watershed is 2246 metric tons (4,952,430 pounds)(Buzzards Bay Project 1991b, 37).

The economic, ecological and aesthetic values of the bay are most negatively impacted by pathogen contamination, toxic contamination and nitrogen inputs (Buzzards Bay Project 1991b, 25).

Source	Pollutants of Concern
Erosion	Sediment and attached soil nutrients, organic matter, and other adsorbed pollutants
Atmospheric deposition	Hydrocarbons emitted from automobiles, dust, aromatic hydrocarbons, metals, and other chemicals released from industrial and commercial activities
Construction materials	Metals from flashing and shingles, gutters and downspouts, galvanized pipes and metal plating, paint, and wood
Manufactured products	Heavy metals, halogenated aliphatics, phthalate esters, PAHs, other volatiles, and pesticides and phenols from automobile use, pesticide use, industrial use, and other uses
Plants and animals	Plant debris and animal excrement
Non-storm water connections	Inadvertent or deliberate discharges of sanitary sewage and industrial wastewater to storm drainage systems
Onsite disposal systems	Nutrients and pathogens from failing or improperly sited systems

Table 1. Sources of Urban Runoff Pollutants (USEPA 1993, 4-8).

REGULATION OF NONPOINT SOURCE POLLUTION

Growth management is an essential component of dealing with NPS pollution (Alliance for the Chesapeake Bay 1991, 5). The authority to implement tools of growth management, such as zoning, overlay districts, and setback lines, rests with local government entities. Agencies including Planning Boards, Boards of Health and Conservation Commissions, rather than state or federal agencies, make most of the decisions affecting growth and build-out in specific communities.

It is suggested that due to this local authority, nonpoint source pollution is better controlled by local strategies rather than by a "top down" federal regulatory programs. Two basic principles involving land use practices are particularly appropriate NPS strategies: reducing the volume of runoff by increasing the land's ability to retain water[3] and minimizing the kinds and amount of pollutants in runoff[4] (Griffin 1991).

Strategies based on watershed[5] approaches offer better opportunities to tailor pollution controls to specific

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[3] Common techniques include maximizing vegetative cover and using natural channels instead of pavement to transport storm water runoff.

[4] Examples include citizen waste oil recycling programs and prudent application of pesticides, fertilizers, and road salts.

[5] Although a definition for the term watershed (see Appendix 2) has not been universally accepted (Goldfarb

problems and reduce the inefficiencies of more broad-based regulations (Perciasepe 1995, 50). Such strategies, available through the provisions of the Coastal Zone Management Act (CZMA) and the CWA, place the onus of protective control on local governments. Methods to control NPS available to municipalities include open space retention, concentrating future growth and demanding best management practices (BMPs)[6] (Alliance for the Chesapeake Bay 1991, 5).

Coastal Zone Management Act

Section 6217

In the 1990 reauthorization of the Coastal Zone Management Act (Coastal Zone Act Reauthorization Amendments

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1994), there are common features among all definitions. A watershed is typically defined as a geographic area in which water, sediments, and dissolved materials drain to a common outlet such as a stream, lake, aquifer, estuary or the ocean (USEPA 1991, 1). Watersheds are defined as natural boundaries shaped by geologic forces which are defined by topography. Watershed boundaries define the basin or catchment area that "sheds" rainwater or snowmelt from the land area into creeks or streams and eventually into rivers to the sea, and are also known as drainage basins. Within a watershed, complex processes convey, store, distribute, filter and utilize water and sustain aquatic and terrestrial life (Naegel, Harvey, Podolsky and Meyer 1995, 145).

[6] Best management practices are defined as the method or combination of methods that are determined to be the most effective and practicable (including technological, economic, and institutional considerations) means of controlling point and nonpoint pollutants at levels compatible environmental quality goals (USEPA 1993, 2-107).

of 1990 (CZARA), 16 USC 1455b) Congress determined that coastal waters warranted special protection from nonpoint source pollution. Section 6217, the Coastal Nonpoint Pollution Control Program (CNPCP), was created to try to provide that protection. The provisions involve the 29 states and territories with approved coastal zone management (CZM) programs, including Massachusetts.

The goal of the CNPCP is to restore and protect coastal waters by enhancing state and local efforts to manage those land use activities which negatively impact coastal waters and habitats. The National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA) joined forces to provide guidance to the states regarding program development and management measures and to approve state programs (Gordon, Jansen and Beier 1994, 127). Once approved, the CNPCP will be implemented through changes to state NPS programs under Section 319 of the CWA and Section 306 of the CZMA (US Department of Commerce and USEPA 1993, v). The state CZM agency under Section 306 (MA CZM) and the NPS management agency under Section 319 (MA Department of Environmental Protection) have a "dual and co-equal" role and responsibility for development and implementation of the CNPCP (USDC and USEPA 1993, 1). Table 2 demonstrates what must be included in state coastal nonpoint source programs.

STATE COASTAL NONPOINT SOURCE CONTROL PROGRAM

- *Coordinate with existing state programs* under CWA and CZARA to ensure an integrated approach;
- *Include a sufficient geographic scope* to ensure implementation of protective management measures. If necessary, modify boundaries based on coastal watersheds to improve management;
- *Provide for procedures for implementation of management measures.* These measures must address agricultural, urban, and silvicultural runoff; hydromodification, including shoreline erosion; dams; marinas; wetlands; riparian areas; and, vegetated filter strips;
- *Provide for the implementation of additional management measures.* This process begins by identifying waters not meeting current quality standards, land uses impairing water quality, and critical coastal areas. Then, additional management measures, including pollutant trading techniques, are selected and implemented as needed;
- *Provide technical assistance* to municipalities and the public;
- *Provide opportunities for public participation throughout* program development and implementation, including public education and volunteer water quality monitoring;
- *Coordinate administration* among relevant state, regional and local agencies; and,
- *Contain enforceable policies and mechanisms for implementation*, such as regulatory (permitting, zoning, overlay districts) and non-regulatory (economic incentives, pollution trading, performance bonds, education) approaches.

Table 2. (USDC and USEPA 1993).

Clean Water Act

The primary goal of the national water quality program is to ensure the physical, chemical and biological integrity of the nation's waters. The past twenty years have focused on 1) controlling the effects of municipal and industrial point source pollution through the National Pollutant Discharge Elimination System (NPDES); and 2) construction and improvements of wastewater treatment plants (USEPA 1995a, 1-8). As water quality regulations achieved success in controlling point sources of pollution, stormwater and other nonpoint sources have taken on greater relative importance.

The 1987 amendments to the Clean Water Act offer two important policy innovations regarding nonpoint source pollution: the creation of the National Estuary Program and nonpoint source pollution reduction programs (McCreary et al. 1992). There are five other features of the Clean Water Act (CWA) that are relevant to watershed planning and NPS: 1) water quality standards, 2) state revolving funds, 3) total maximum daily loads (TMDLs), 4) the Clean Lakes program, and 5) groundwater protection. Table 3 briefly addresses these five programs. Subsequent sections address the state NPS reduction program (Section 319) and the NEP (Section 320) in more detail.

WATERSHED PLANNING AND NPS IN THE CLEAN WATER ACT

- *Water quality standards (WQS).* Meeting water quality standards is the impetus behind state water quality programs. Besides setting specific criteria, these programs also identify beneficial designated uses of a waterbody (e.g., fishing) and develop antidegradation policies. Watershed plans strive for these standards.

- *State Revolving Funds (SRF).* Part of the 1987 CWA amendment included an effort to shift financial responsibility for municipal treatment systems to the states and municipalities. To that end, the CWA provided a state revolving loan program. These funds are available for nonpoint source activities consistent with Section 319 once sewage treatment construction needs are met. Certain watershed projects may be eligible for this funding.

- *Total Maximum Daily Loads (TMDLs).* Section 303(d) requires TMDLs[7] be established where water quality standards have not yet been met. Some watersheds may be selected for watershed approach projects because TMDLs are needed.

- *Clean Lakes Program.* Section 314 established a program identifying publicly owned lakes with impaired water quality, including NPS pollution. These programs have a watershed focus and encourage interagency coordination.

- *Groundwater Protection.* The Clean Water Act encourages NPS programs to coordinate surface and groundwater protection strategies using tools such as the watershed approach.

Table 3. (USEPA 1995a).

[7] Defined as the sum of the wasteload allocation for point sources and load allocation for NPS that a waterbody can assimilate and still meet water quality standards (USEPA 1995a, 1-11).

Section 319

The first national program to authorize Federal funding for nonpoint source control began when Section 319 was added to the 1987 Clean Water Act. This section provided for a national program to control nonpoint sources of water pollution. To be eligible for federal funding, an assessment of nonpoint sources and a management program to control them had to be implemented. The USEPA may issue grants to assist in NPS pollution management implementation. All states and territories currently have approved NPS assessments and some level of management programs (US Department of Commerce and USEPA 1993, Appendix E-1).

Section 320

In recognition of the unique vulnerability of estuarine systems to water pollution, Congress established the National Estuary Program[8] in 1987 by passing Section 320 (Mei 1994, 1). The mission of the NEP is to focus on point and nonpoint source pollution in geographically targeted, nationally significant estuaries, including Buzzards Bay. Design of the NEP recognized that narrow

[8] CWA Section 320 established the NEP as a national demonstration program to protect and restore the water quality and living resources of 21 estuaries around the nation.

"command and control" programs would not adequately address the complexity of the estuaries. The purpose of the National Estuary Program is to develop management plans utilizing existing federal, state, and local scientific knowledge, regulations and management options (USEPA 1992).

To achieve this goal, the NEP emphasizes comprehensive planning and management. Its regional programs are expected to:

1. systematically develop priorities for attention among water quality problems;
2. identify and analyze action alternatives;
3. coordinate implementation across political jurisdictions; and,
4. monitor the efficacy of actions taken (Leschine 1990, 296).

The NEP serves as a model of the watershed protection approach (WPA). The National Estuary Program protects estuaries and living resources through cooperative problem-solving by a broad geographically defined partnership of federal, state, local and public stakeholders (Mlay 1992). These programs find their strength in two principles: the focus on ecological regions rather than political units (Vestal, Rieser, et al. 1995, 67), and the inclusion of all stakeholders throughout the planning process, including determining priority actions (Mlay 1992).

To begin the NEP process, the EPA Administrator convenes a Management Conference (MC) (see Appendix 3), an umbrella organization funded by a five-year grant. The Management Conference oversees activities through a committee structure (Figure 2 and Appendix 3, page 2). The main tasks of the MC are:

- to characterize the estuary;
- to provide a forum for collaboration among disparate interests; and
- to convene these stakeholders to write the Comprehensive Conservation and Management Plan (CCMP)[9] (Mei 1994).

The CCMP is the cornerstone of the NEP because it:

1. defines goals and objectives for each program;
2. recommends corrective actions to meet those objectives; and,
3. provides detailed plans for implementation, funding and monitoring strategies.

The CCMP provides the context for decision-making about cumulative impacts, such as controlling NPS pollution (Vestal, et al. 1995, 67). The focus of the CCMP of the Buzzards Bay Project and other NEPs reflects this emphasis (US Department of Commerce and USEPA 1993, App. E-1).

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[9] The Buzzards Bay CCMP consists of three volumes: Volume I: Management Recommendations and Action Plans, Volume II: Financial Plan and Volume III: Monitoring Plan.

GENERIC MANAGEMENT CONFERENCE COMMITTEE STRUCTURE

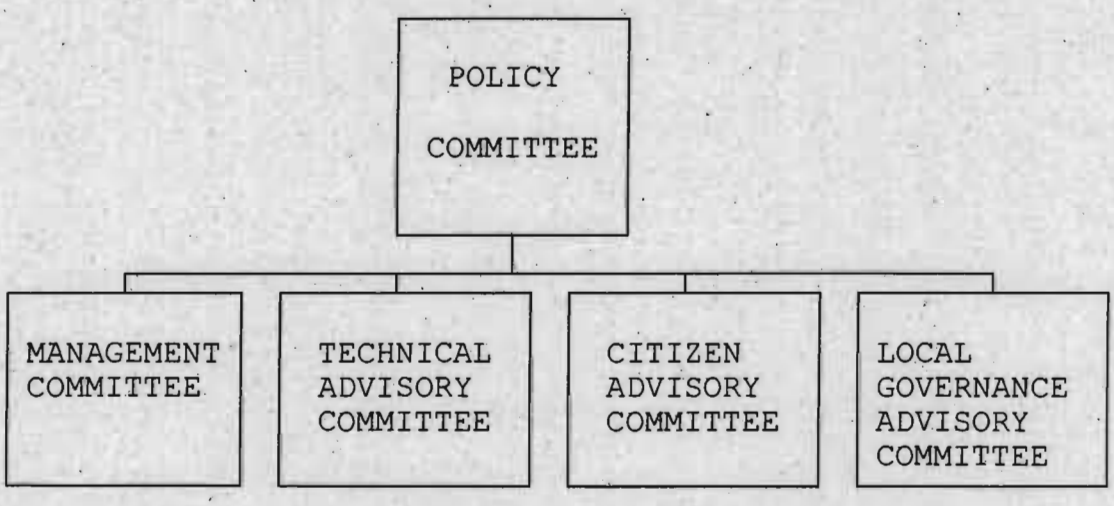

Figure 2. (Mei 1994, 7).

Bioregionalism

The NEP is one of the first practical applications of a bioregional[10] watershed-based approach to management, as illustrated below. The area of focus in the CCMP is the estuary watershed. The comprehensive assessment of the environmental problems and development of appropriate solutions included in the CCMP are focused on those communities within the watershed boundary. Water quality control efforts focus on improving ecosystem[11] health, not

[10] Bioregionalism refers to those issues and events that occur in transboundary settings, such as within river basins and watersheds (Foster 1984, vii) (see Chapter 2).

[11] Ecosystems are made up of all the organisms in a given area interacting with the physical environment so that flows of energy and cycles of materials are

just managing for one particular resource. All levels of government and the private sector throughout the estuary watershed take regulatory and non-regulatory actions to seek ecological improvements for both the short- and the long-term (Mei 1994). As examined in Chapter Two, the concepts of bioregionalism and river basin planning are important both historically and currently in water resource management.

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established between the living and non-living part of the system (Lowrance and Joyce 1985, 40).

CHAPTER TWO

THE HISTORY OF RIVER BASIN PLANNING AND BIOREGIONALISM

WATER CONVEYANCE AS ECOSYSTEM CENTER

Rivers and other water conveyors are the center of ecosystems contributing to coastal water quality (River Network 1994, 2). These watershed ecosystems are responsible for the production and transport of chemicals and sediments which may later be implicated as pollutants. To meet certain watershed goals, such as controlling the negative impacts from these substances, the basin ecosystems must be analyzed and managed as a unit. Such watershed management acknowledges the river as the convergence of interactions among living and non-living parts throughout the terrestrial and aquatic features of the ecosystem. The health of river systems and riparian areas has become increasingly identified as the cornerstone of watershed protection (Lowrance and Joyce 1985).

This realization has led to a focus on conservation of rivers and watersheds. The 1990s have been called the "Decade of River Conservation" in recognition of the equation between our collective ability to protect the integrity of our rivers with our ability to protect the overall "environment" (Lavigne 1993).

Nationally, there are 2,000 organizations dedicated to river and watershed protection (River Network 1994, 2). These organizations represent a pyramid of national, state and local interests. Grass-roots citizen activism forms the pyramid's base. State and regional river councils and citizen advocacy groups create the middle level. National organizations, working toward passage of protective federal policy and legislation, occupy the top tier (River Network 1994).

HISTORICAL APPROACHES TO WATERSHED PROTECTION

Bioregionalism, watershed approaches and river basin planning are not new, but have changed forms over time. The evolution of the concept of river basin (watershed) management and planning is divided into three periods:

1) *Basin-wide Water Resource Development*.
Large, federally planned and funded undertakings to stimulate basinwide economic development dominated this period. Such projects combined flood control, municipal water supply, irrigation, hydroelectric power, recreation and water quality improvement functions.

2) *New Deal Era*.
Socioeconomic development through publicly owned hydropower, the establishment of the Tennessee Valley Authority, and the beginning of federal interest in water quality[12] identify this period.

[12] This new interest was marked by passage of the Federal Water Pollution Control Acts of 1948 and 1955.

3) *Nonstructural Control Era.*
This period was marked by the Water Resources Planning Act which established the interagency Water Resources Council (WRC) to implement comprehensive, coordinated joint plans of river basin commissions and the advancement of the environmental movement (Goldfarb 1994).

1900-1933: Basin-wide Water Resource Development

A comprehensive multipurpose approach to river basin planning and associated interagency coordination have been desired in our nation's water program since President Theodore Roosevelt's two reports advocated this approach at the turn of the century[13] (Doll 1994, 107). However, throughout this period, most projects were single-purpose water resource development initiatives, such as flood control levees on the Mississippi River.

After the great Mississippi flood of 1927 demonstrated the failure of segmented projects, the Rivers and Harbors Act of 1927 was passed. This Act authorized the US Army Corps of Engineers (ACOE) to create "308 reports." These

[13] The Inland Waterways Commission report of 1908 and the National Conservation Commissions report of 1909 recommended comprehensive water planning and creation of a National Waterways Commission to coordinate federal water resources activities. Two later actions focused on integrated planning were not implemented (the 1912 report by the National Waterways Commission recommending federal agency coordination and the 1917 Newlands Act authorizing development of multipurpose water planning). For the first time, navigation was discussed in the context of other uses, and as part of an entire river basin (Foster 1984, 3).

reports reflected an emphasis on whole river systems. As bioregional planning tools, they addressed hydropower, navigation, flood control, irrigation and resource development cost-benefits.

1933-1964: New Deal Era

President Franklin D. Roosevelt's New Deal ushered in an era of social and economic change throughout the country. Water activities were not excepted. In 1933, the Tennessee Valley Authority was created to manage water resources for navigation, flood control and hydropower and to provide regional economic development, mostly through dam building. The New England Regional Planning Commission, which began to chart the region's river basins, was also established during this time.

In 1938, Congress passed the Flood Control Act. This law authorized construction of flood control projects by the ACOE and US Department of Agriculture (USDA), nationalized flood control and impeded states' rights in New England regarding water resources (Foster 1984, 4). Subsequent reauthorizations of the Act expanded the purposes for which federal water resource projects could be authorized. However, projects were not created or evaluated in a comprehensive river basin planning and management framework (Doll 1994, 108).

The Hoover Commission found in 1949 that national water policies overlapped. These inefficiencies spurred institutional experimentation in water resource management (Foster 1984, 5). As a result, the New England-New York Interagency Committee (NENYIAC) was created in 1955 by joining the two regions in a federal interagency arrangement (Foster 1984, x). As states moved to perpetuate their coequal role through federal-interstate compacts, agencies such as the Delaware River Basin Commission were formed.

1965-1990: Nonstructural Control Era

The federal government attempted to implement a truly bioregional approach during the 1960s and 1970s. Project designs began to consider multiple purposes within a comprehensive river basin framework (Doll 1994, 109). Title II of the Water Resources Development Act of 1965 established regional River Basin Commissions. These commissions had authority to coordinate comprehensive planning among federal, state, interstate, local and nongovernmental entities. However, they did not own, operate, regulate or manage resulting projects. During the 1970s, political support and activity of the River Basin Commissions diminished. President Reagan eliminated the

funding for the Water Resource Councils in 1981 (Doll 1994, 110).

In 1972, amendments to the Federal Water Pollution Control Act (CWA) established the goal of restoration and maintenance of the integrity of the nation's waters. These amendments created the National Pollutant Discharge Elimination System (NPDES), a permit system limiting wastewater effluents. The amendments also created Section 303(e) which required basin plans for nonpoint source pollution and set the stage for the Comprehensive State Ground Water Protection Programs (CSWGPPs) (USEPA 1995b, 1-2).

The Safe Drinking Water Act (SDWA), passed in 1974, addressed multiple public health issues now considered within a comprehensive watershed protection framework. Issues included controlling hazardous waste and microbial contamination of ground water and protection of sole source aquifers and wellheads (USEPA 1995b, 1-3)[14].

Along with these legislative advances, several fundamental attitude shifts took place during this period:

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[14] Pollution of ground water is addressed by the EPA's Ground Water Protection Programs, CWA Section 319, the Safe Drinking Water Act (sole source aquifers), the Wellhead Protection program (protection of ground waters that supply wells and wellfields for public drinking water, and some private wells on farmsteads), and State Pesticides Management Programs under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (US Department of Commerce and USEPA 1993, Appendix E-2).

- flood management techniques began to reflect a decreased reliance on solely structural fixes;
- methods to promote water conservation were incorporated into water planning;
- economic and environmental quality objectives received more equivalent status; and
- integration of water quality objectives with water planning began (Doll 1994, 111).

Water in the 1980s and 1990s

As discussed earlier, the recent past has seen another shift in water planning. An increasing number of federal and state environmental agencies are incorporating the integrated and comprehensive approach to water planning seen previously. However, these efforts address issues of water quality rather than development (Goldfarb 1994, 489). The 1987 amendments to the CWA require expanded water quality protection, including nonpoint source pollution. Other federal examples of watershed restoration and pollution control programs are in Table 4.

Comprehensive approaches, including watershed protection (basin planning), ecosystem management and integrated coastal management are once again in the forefront of environmental management methodology. These approaches are especially relevant to coastal areas. After decades of intensive development, we are beginning to understand and appreciate the natural systems we inhabit

SELECTED WATERSHED RESTORATION AND POLLUTION CONTROL PROGRAMS

US Department of Agriculture

Water Quality Incentives Program
A watershed treatment program to protect resources threatened by NPS pollution.

Small Watershed Program (PL-566)
Addresses small agricultural watersheds with multiple resources needing protection.

River Basin Program
Assists state and local governments to identify resources problems, evaluate alternative solutions and implement protective programs.

National Forest System
Manages national forests for sustainable and multiple use.

US Department of Defense

Army Corps of Engineers
Oversees large flood control and public water supply projects; administers dredge and fill permit programs with EPA and USFWS.

US Department of the Interior

Coastal Ecosystems Program
Conserves biodiversity by promoting ecosystem-based policies and seeking project partnerships.

Bureau of Reclamation
Administers water supply facilities in western states; manages public and private lands within basins.

US Geological Survey
Long-term baseline monitoring of water resources, hydrological and geologic investigations.

Table 4. (Terrene Institute 1994, 59).

and our impact on ecosystem health (Naegel, Harvey, Podolsky and Meyer 1995, 162). The use of watershed-based planning in the 1990s as a water quality protection tool reflects this fuller understanding of the wide range of environmental stresses in a watershed.

As the complexities of whole watershed ecosystem functions become clearer, new land use models are being adopted. These models seek to control growth in alignment with environmental carrying capacity and reduce the impact of human activities across local, state, regional and national jurisdictions. Watershed-based planning encourages adoption of these models by increasing the effective use of limited staffing and funding resources. Watershed planning also improves opportunities for local agencies to take an increasingly visible leadership role in whole ecosystem protection (USEPA 1995a, 2-1). The holistic, but localized, basis of these models is especially useful to address nonpoint source pollution in estuaries, such as Buzzards Bay.

This latest trend toward watershed management has been attributed to three concerns: transboundary water management (bioregionalism), implications of federalism and the separation of powers, and the policy inconsistencies among water agencies (Goldfarb 1994, 483). The

ramifications of these concerns on efforts to control nonpoint source pollution are illustrated below:

- *Transboundary water management (bioregionalism)*: Water flows downhill, regardless of municipal, county, state, or regional boundaries. It is desirable to stop neighboring jurisdictions from blaming each other for water quality impairments generated throughout the watershed (e.g., shared resource losses due to nutrient loading).

- *Federalism and separation of powers*: For the most part, municipalities that can reduce NPS through land use lack jurisdiction over water pollution control. The proliferation of agency tasks with unique political constituencies and agendas hampers comprehensive NPS planning and control. It is desirable to maximize efficiency.

- *Water policy variety*: United States water policy is fragmented by different political jurisdictions, hydrology, and management issues. The lack of federally regulated NPS programs and Section 319's voluntary nature create strong variability in state programs. It is desirable to clarify authority (Goldfarb 1994).

Watershed management approaches of the 1990s focus on answering the challenge of these important issues by creating geographic not political boundaries, empowering local governments and states under federal direction, and integrating water policies among relevant agencies.

The Commonwealth of Massachusetts has adopted a comprehensive basin approach throughout state water programs. However, the road to this acceptance has been long and challenging.

MASSACHUSETTS' WATER HISTORY

The disastrous Connecticut Valley floods of 1927 signaled the beginning of bioregionalism in New England. This regional cooperation occurred in pursuit of solutions after the flood event[15] (Foster 1984, 7).

The three agencies responsible for water resource functions in Massachusetts[16] first actively coordinated under the auspices of the NENYIAC. This Committee set the stage for later federal-interstate agencies by producing resource inventories. These data sets are regarded as precursors to comprehensive studies. Their content stimulated awareness of water as a regional matter needing effective working relationship among state and federal water agencies. Production of the inventories demonstrated that co-equality between federal and state representatives was possible. However, the lack of political support and effort to implement its findings doomed the NENYIAC to essentially a bureaucratic exercise (Foster 1984).

As NENYIAC came to an end, New England governors wanted to continue interagency cooperation, especially after ruinous floods in 1955 (Foster 1984, x). The

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[15] Solutions under consideration included a series of multipurpose flood control structures which would provide hydroelectric power to defray costs of construction.

[16] The three agencies were the Department of Public Health, the Department of Public Works and the Metropolitan District Commission.

Northeastern Resources Committee was established in 1956 as the first serious national effort to obtain a federal-interstate natural resources compact. Although a valuable water alliance was formed, the four-year fight for ratification of the compact failed mostly due to a lack of central staff and financial support (Foster 1984).

The New England River Basins Commission

As described, past weaknesses condemned inter-agency efforts. To overcome those obstacles, the region looked to a formalized federal-interstate compact. The New England River Basins Commission (NERBC), based in large measure on the Delaware River Basin Compact, was adopted in 1967. The NERBC maximized participation by all levels of government, and combined coequality with permanence and coordination. These efforts resulted in the creation of a number of viable projects (Foster 1984, 145).

Benefiting from the national environmentalism of that era, the NERBC grew quickly. Through its water planning and energy siting activities, the NERBC created a legacy of professionally written materials (Foster 1984, x). During its fourteen year history, the NERBC was able to reawaken the region's general environmental consciousness, provide a setting for ample non-threatening information exchange

among federal, state and public participants, and encourage reasonable conflict resolution (Foster 1984, 146).

However, its organizational structure was cumbersome and the entity frequently lacked a clear role and function. Complicating these problems was the lack of a definitive constituency. The states considered the NERBC a federal initiative. The federal government questioned whether NERBC's interests in states' issues made it nationally relevant. NERBC's dwindling power hobbled its ability to implement its plans. Eventually, the NERBC was saddled with a "paper tiger" reputation both in Washington and the New England region.

The NERBC was also hindered procedurally by its unwieldy superstructure of task forces and other sub-groups. The resulting financial inefficiencies, and anarchic decision-making made its role increasingly opaque. The NERBC was left out of sensitive issues and states began to lose interest (Foster 1984, 148). When the EPA was founded and given responsibility for air and water, the river basin commissions were not assigned any responsibility. As the 1970s progressed, national attention turned to energy. The NERBC joined in the chorus about leasing lands on the Outer Continental Shelf and was criticized as engaging in matters peripheral and irrelevant

to its primary water mission. Enmity toward it increased (Foster 1984, 149).

Vague expectations, lack of oversight provisions and minimal ability to help those in power increased the NERBC's isolation and disenfranchisement. These developments eventually led to its nearly complete loss of stature. In 1981, President Reagan dismantled the river basin commissions (Foster 1984, 150).

Bioregionalism, the WPA and Future Trends

To understand Massachusetts' new direction in watershed protection, one must consider several factors present in New England's thirty-year river basin history. It appears that the inflexibility of the NERBC destined it to fail because it could not adapt to change. Part of the solution may be to balance the organization's initiative by including institutional accountability and public participation (Foster 1984, 173). This is especially relevant in New England. The principles of representation and participation are deeply imbedded in the region's culture. Adoption of the Home Rule Amendment exemplifies these principles (Foster 1984).

The Home Rule Amendment gives to local governments all regulatory authority not explicitly assigned to state government. Regarding estuarine protection, home rule

includes critical land use, site and permit review, enforcement, zoning and wetlands protection (Mei 1994, 13). The strong sense of home rule in New England dominates decision-making, as witnessed by the town meeting approach (Foster 1984, 174).

As bioregional institutions move toward a watershed approach, the role of the local government is emphasized. To be successful, such bioregional entities must be sensitive to the ramifications of this strong home rule. Therefore, it is essential that institutions respect constituents, embrace modest aspirations, remain flexible and aware of change, and address that which is timely and viable. Other principles found in successful bioregional efforts are important to efforts in New England such as the BBP:

- The program must foster a sense of "regional belonging" among citizens of the region.
- The political jurisdictions (municipalities) must be treated as whole and equal partners.
- The scale of the bioregional entity must be large enough to buffer jurisdictional differences and be economically and politically viable, yet small enough to generate focused, manageable and implementable actions.
- The bioregional institution must be appropriately scaled to offer sufficient functional support

without sapping or threatening its constituent parts[17].

- Rather than command-and-control management, it is preferable to identify compelling reasons for the existence of the bioregional institution, then build it from the bottom up through mutual interest, cooperation and regular examination[18] (Foster 1984, 175).

- The organization's program must be well-defined, specific and timely, but not rigid.

- The bioregional entity must offer its constituents something not already available, such as expertise, funding, mediation, and/or influence.

Foster identified the concepts of bioregionalism as increasingly important as the federal presence becomes reduced (Foster 1984, 176). Clearly, the 1990s have substantiated this assertion. As agencies face ever tighter budgets, they must reinvent environmental management and protection to fit the new political climate. Funding for large scale technical "fixes," such as publicly owned treatment works, has been substantially reduced. As the funding picture is changing, our understanding of, and capacity to accurately assess, whole ecosystem functioning has increased. Further, more issues, such as NPS

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[17] The NERBC was significantly flawed in its ability to appropriately define the scale of the bioregion and its institution (Foster 1984, 175).

[18] The NERBC's goals were taken over by federal goals.

pollution, call for regional tactics. These tactics place more responsibility on state and local governments for implementation of environmental programs.

All of these factors highlight the need for an innovative look at water resource planning and management. This new look must focus on lower levels of government. Further, management must consider readily available low technology and behavior change approaches which reject the fragmented management of the past and seek bioregional holism (Geller 1994, 5).

CHAPTER THREE

INTEGRATED ENVIRONMENTAL MANAGEMENT

INTRODUCTION

In response to the need for a new approach to environmental protection, agencies are looking toward integrated environmental management. Integrated environmental management (IEM) dismisses a single-resource, uni-lateral approach for a more multi-dimensional holistic approach loosely based on the ten characteristics found in Table 5.

The comprehensive perspective inherent in integrated environmental management is crucial. This is especially true for programs such as NPS control that transcend spatial, political and institutional boundaries. Pursuing anything less will not result in improvement of the environment because individual institutions will seek solutions incompatible with sustainable use of the system as a whole (Lee 1993, 112). Integrated environmental management allows us to think and act in terms of connectedness of natural systems and the impact of society's collective decisions both in the short- and long-term.

TEN CHARACTERISTICS OF INTEGRATED ENVIRONMENTAL MANAGEMENT	
1)	A clearly defined and realistic goal.
2)	A solid scientific/technical basis.
3)	A decision analysis framework that ensures best use of limited resources.
4)	Rigorous criteria for achieving established goals.
5)	Planning which tries to fully evaluate and integrate social, cultural, economic issues and concerns and environmental goals.
6)	More focus on informed planning and research than crisis management.
7)	Strong communication focused on educating the public and members of the program.
8)	Documentation of the program's success through an ecological evaluation process.
9)	Effective leadership.
10)	Use of natural boundaries rather than political or jurisdictional boundaries to implement management and restoration programs.

Table 5. (Troth and Aumen 1994).

Increased human population, demands for development, overuse and pollution threaten estuarine environments (USEPA 1989, 1). The substantially higher density in coastal areas has nearly overwhelmed the carrying capacity of estuarine environments. For example, approximately

236,000 people live in the Buzzards Bay watershed at a density of 540 people per square mile. This is more than eight times the national average of 64 people per square mile (Narragansett Bay Project 1992, 4).

The complexities of estuarine systems related to habitat protection, nonpoint source pollution and coastal land use planning demand holistic bioregional approaches. These approaches integrate immediate and extended actions across all levels of government, but focus on the role of municipal government (Imperial, Robadue and Hennessey 1992).

The watershed protection approach (WPA), ecosystem management and integrated coastal management are types of integrated environmental management used in coastal planning and management, including control of nonpoint source pollution. This paper focuses on the watershed approach since it serves as the framework of the Buzzards Bay Project.

THE WATERSHED PROTECTION APPROACH

Description of Technique

The watershed protection approach (WPA) is an excellent example of integrated environmental management. The technique shares the ten features of IEM described above. The US Environmental Protection Agency (USEPA)

began promoting the WPA as a "strategy for effectively protecting and restoring aquatic ecosystems and protecting human health" in 1991 (USEPA 1994b, 1).

As discussed in Chapter Two, watershed oriented planning is not new. Several federal agencies practice watershed management for functional areas including water quality protection (Goldfarb 1994). Nonpoint source programs, such as those under Section 319 and the National Estuary Program, are based on this approach (see Appendix 4). However, never before has watershed management been so widely adopted (USEPA 1995a, 1-4).

The USEPA developed the watershed approach in response to the increased scientific understanding of the pressures placed on estuarine systems. The WPA attempts to manage cumulative impacts to estuaries, such as nonpoint source pollution, by moving toward resource-based management in biologically defined regions (Vestal, et al. 1995, 64).

The WPA's comprehensive perspective encourages joint consideration of economic needs and restoration of the natural watershed system. Unlike fragmented approaches of the past, the WPA embraces ecosystem science focusing on community level decision-making. This approach brings ecological and socio-economic benefits by creating long-term investment in ecological health, strengthened economic viability and improved quality of life in the watershed

(Pacific Rivers Council 1993a). The watershed approach entails four interconnected features (see Figure 3): risk-based geographic targeting, stakeholder involvement, integrated solutions, and evaluation using monitoring and other data review. Within this framework:

- the watersheds where pollution poses the greatest threat to human health, ecological resources and desirable water uses receive the most immediate attention;
- analysis of problems and development of solutions involve all entities with a stake in the local situation;
- the resulting plan of action draws from the full range of methods and tools available resulting in an integrated, multi-organizational assault;
- success is measured through monitoring and other data sources(USEPA 1995b, ix); and,
- the WPA can accommodate water management at three levels: the state, the basin and the watersheds within each basin (USEPA 1995a, xi).

Advantages of WPA

The advantages of the WPA are ecological, socio-economic and institutional. These advantages include: improved environmental quality, improved organizational cooperation among relevant agencies, more effective use of limited resources, more equitable distribution of the water resource protection burden, greater participation from

FEATURES OF THE WATERSHED PROTECTION APPROACH

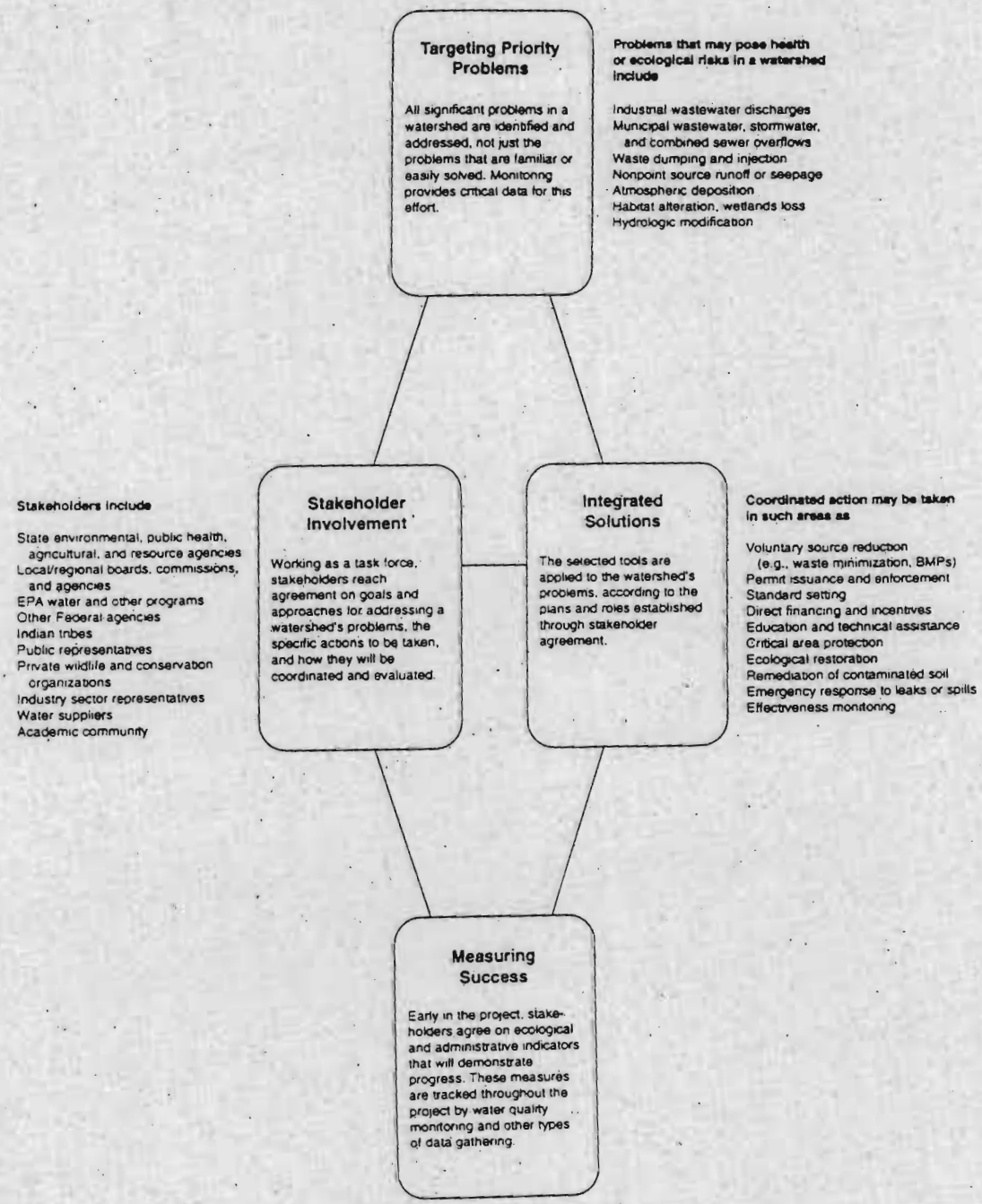

Figure 3. (USEPA 1995b, 1-2).

citizens with local knowledge, and, more complete stakeholder involvement in decision-making (USEPA 1995b, 1-5). The WPA has the flexibility and breadth to tackle complex water quality problems, coordinate overlapping functions among programs, allow new partnerships among federal, state, local agencies, citizens and the private sector, and foster a sense of ownership and stewardship of local water resources (USEPA 1995b, 1-7).

This approach can achieve objectives of protecting healthy ecosystems, restoring impaired watersheds and sustaining community development by empowering local communities within the watershed (Pacific Rivers Council 1993a). The WPA recognizes that water quality management must consider both human and ecosystem health or both may be compromised.

The WPA can also integrate surface water and ground water protection, although the specific mechanisms to ensure each resource's protection differ. Protection of ground water as part of a comprehensive water quality improvement plan is a critical element given the continual transfer of pollutants among the atmosphere, waterbodies and the subsurface (USEPA 1995b, xii).

The WPA will not compete with or replace existing water quality programs. As shown in Figure 4, the WPA provides states with a framework for integrating ongoing

permitting, planning and monitoring programs under the CWA and SDWA (USEPA 1995b, 1-3).

EMERGING FRAMEWORK FOR ACHIEVING CLEAN WATER ACT GOALS

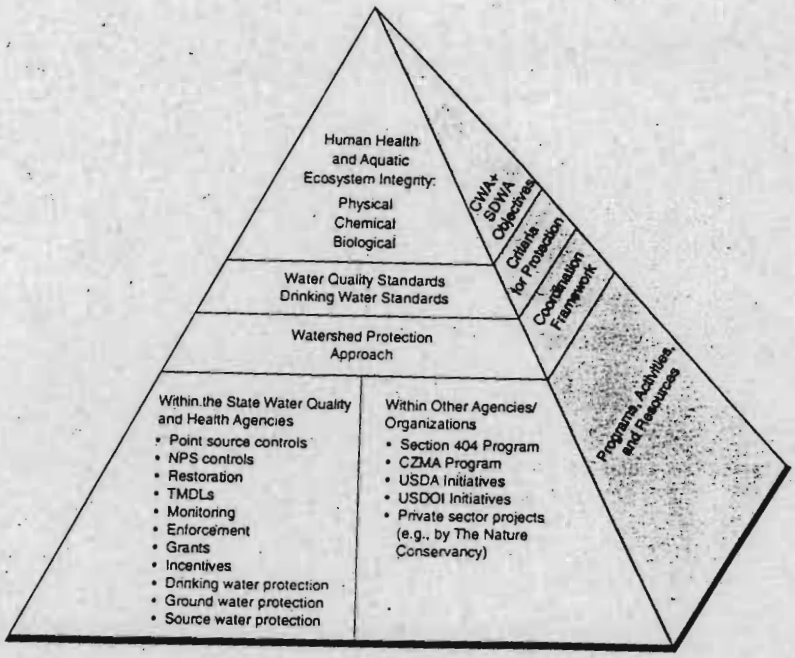

Figure 4. (USEPA 1995b, 1-6).

Watershed Protection and State Nonpoint Source Efforts

The watershed management concept is well applied to state nonpoint source programs. The comprehensive watershed approach effectively addresses the diffuse nature of NPS pollution and the significant contributory role of

land use and management to NPS pollution. Figure 5 illustrates how watershed management planning may occur statewide.

STATEWIDE WATERSHED MANAGEMENT UNDER THE WPA

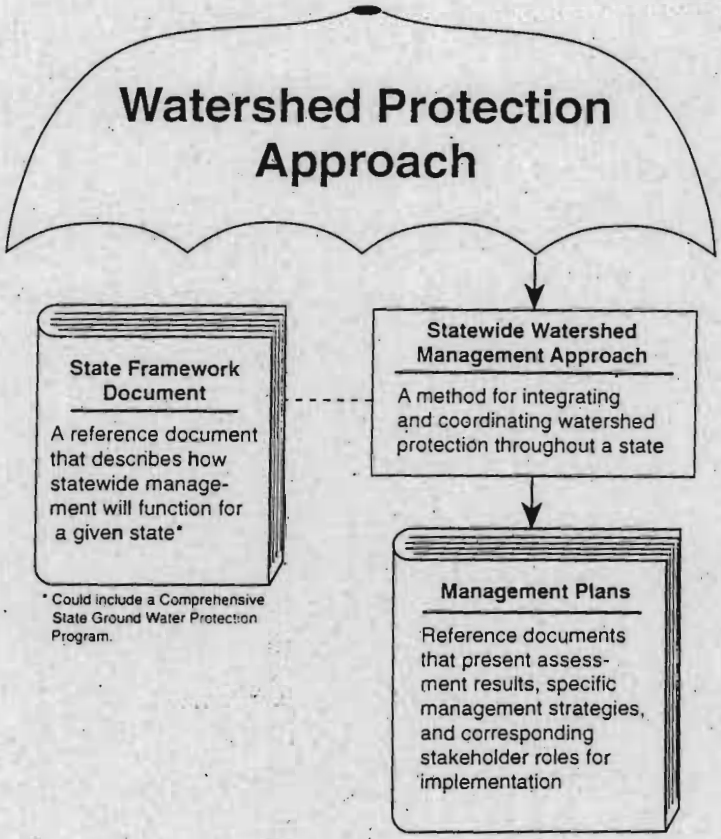

Figure 5. (USEPA 1995b, 1-9).

Such an approach allows targeting of priority watersheds and more effective use of BMPs. Massachusetts, Georgia, New Jersey and North Carolina are attempting to reorganize some or all of their state water programs along

watershed lines (Goldfarb 1994)(see Appendix 5 and Chapter Four).

Watershed Protection Project Design

Extensive discussion of specific watershed project design is beyond the scope of this paper. However, the following section provides the general outline of watershed projects in the context of NEPs and the Buzzards Bay Project (see Figure 6).

Successful watershed projects vary in design but tend to share the ten characteristics of IEM shown in Table 5 on page 34 in this chapter. More specifically, these projects tend to have effective institutional arrangements and local ownership, clear identification of the watershed problems, detailed goal setting and plan organization, secure funding and controls and effective project measurement based on adaptive management (USEPA 1995a, 3-1) (see Figure 6).

The administrative focus of a watershed project can vary from highly centralized, formal arrangements to decentralized, informally connected networks (USEPA 1995a, 4-2).

ELEMENTS OF A SUCCESSFUL WATERSHED PROJECT
SHOWING INDIVIDUAL ACTIVITIES

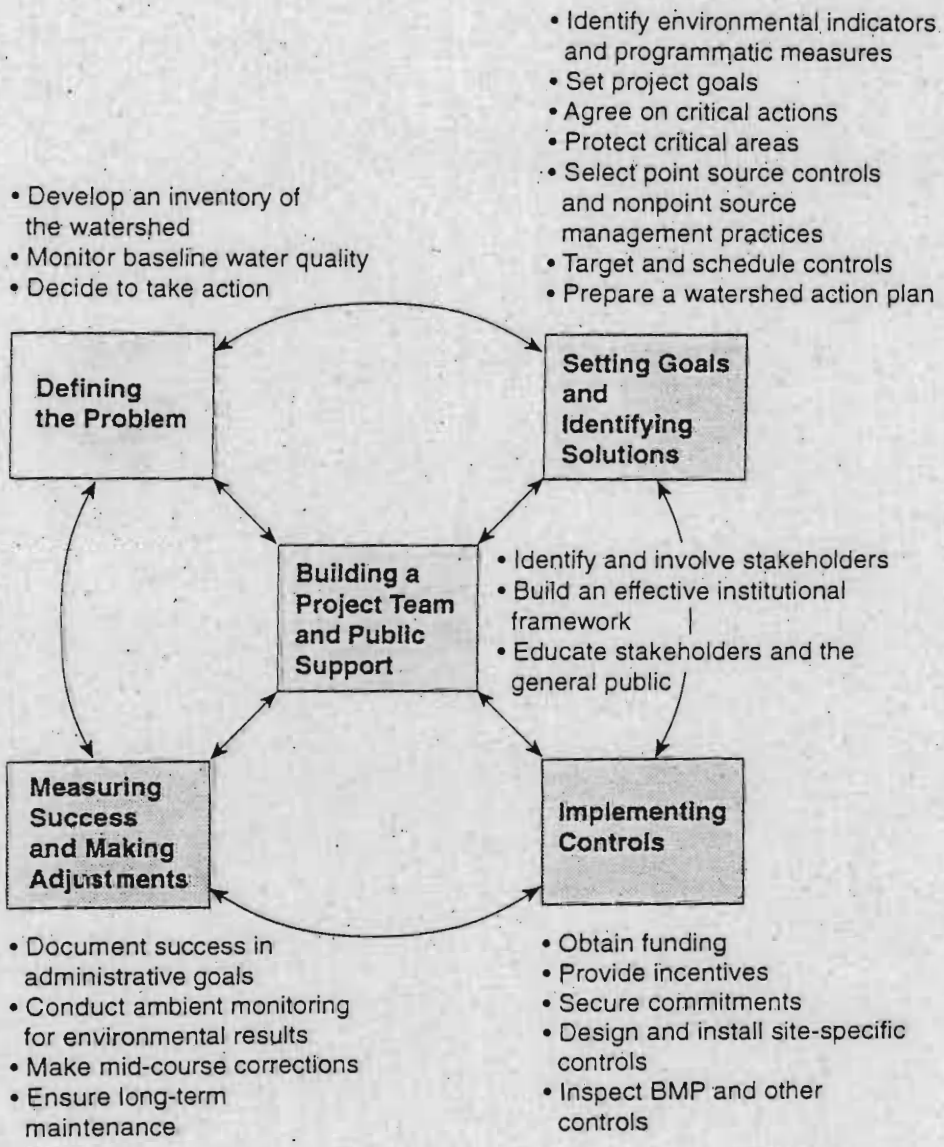

Figure 6. (USEPA 1995a, 3-3)

Figure 7 illustrates an administrative structure used in the National Estuary Program. The WPA administrative framework is based on negotiation and consensus decision-making, not an orderly "command and control" structure (USEPA 1995a, 4-6). Watershed management and planning must be flexible, responsive, participatory and uniquely tailored to each watershed's needs.

Project scale must be of sufficient size to achieve economies of scale, but small enough to effectively utilize local expertise, and be viable for long-term management (USEPA 1995a, 2-4). Criteria for targeting watersheds for attention and action vary, but most entities use some formal process (see Appendix 6). Typical criteria include the degree of impairment reported in state 305(b) reports, ecological value, public resource value, data availability, ability to resolve watershed problems, institutional capacity, and financial and staffing resources (USEPA 1995a, 2-8).

ORGANIZATION OF WATERSHED PROTECTION PROJECTS

Baseline Data

A watershed protection project is built upon a watershed assessment report that documents baseline conditions (see Table 6). The importance of baseline water

EXAMPLE ADMINISTRATIVE STRUCTURE OF A WATERSHED PROJECT

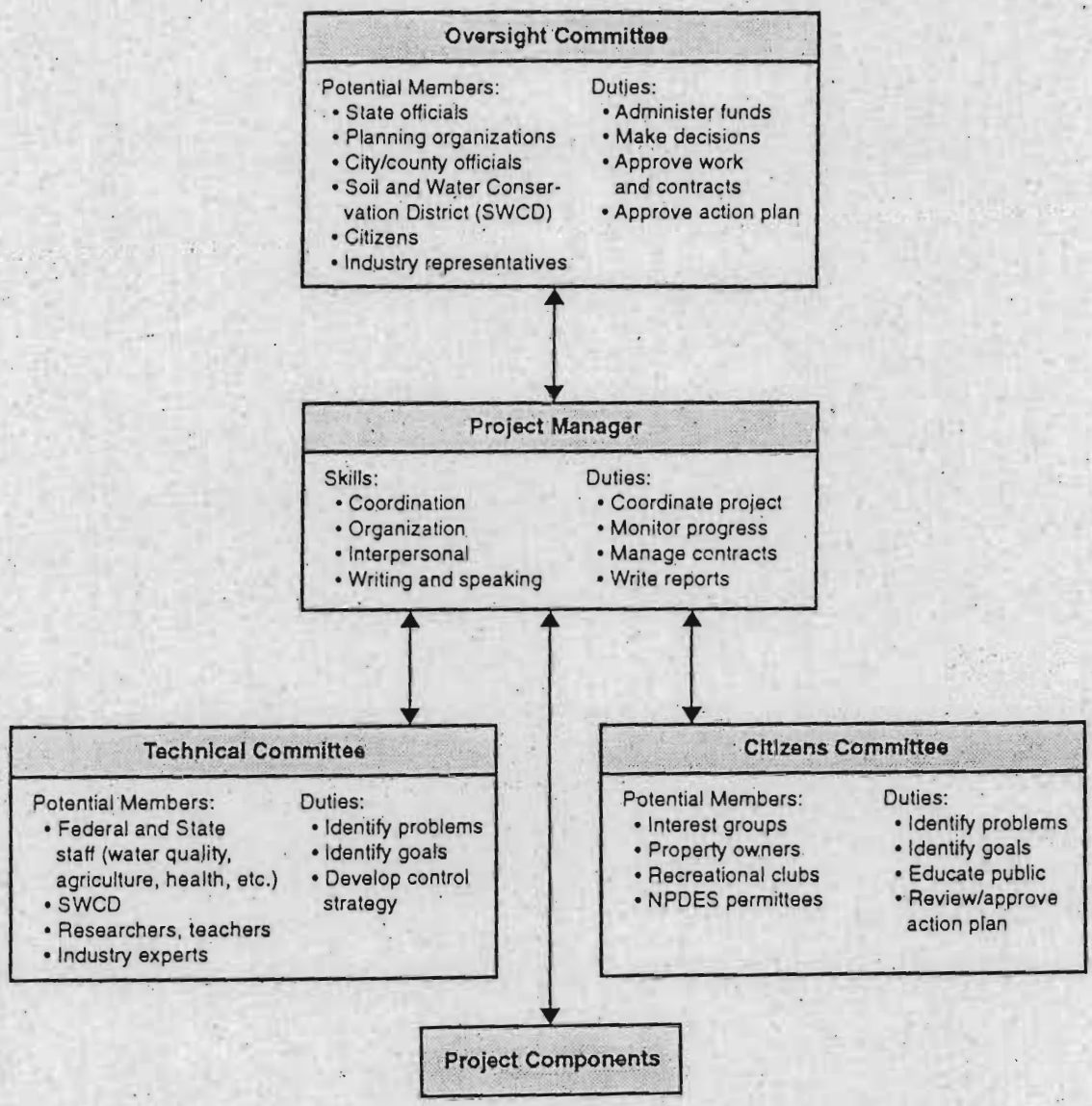

Figure 7. (USEPA 1995a, 4-3).

quality data cannot be overemphasized. The management of and planning for watersheds in the past has been severely troubled by a lack of data. This absence of data hampers comparative judgments of improvements resulting from controls or restoration efforts (USEPA 1995a, 5-5).

Six years of technical studies form the basis of the Buzzards Bay CCMP. The breadth and accuracy of these studies have helped determine the nature and extent of environmental problems in the Bay, their causes and potential solutions (USEPA 1995d, 10).

Goal Setting: The Role of Indicators

Once the watershed has been assessed and pollution sources have been identified, the project is ready to move toward the goal-setting and implementation stage (USEPA 1995a, 5-9). Setting specific goals and objectives and identifying solutions demands careful attention. Watershed planners must determine which environmental indicators[19]

[19] Indicators can be either outputs (programmatic accomplishments such as the number of BMPs put in place) or outcomes (environmental improvements such as health of fish populations). Most stakeholders are more attentive to the outcomes, which, as shown in Table 7 will become more available over the life of the project. These measures reflect changes that occur in ecological time, e.g. population health, hydrological changes. Outcomes are much more difficult to quantify than outputs, but offer a more direct indicator of ecological health and success of environmental programs (USEPA 1995c, 4).

TOPICS FOR A WATERSHED ASSESSMENT REPORT

I. Watershed Description
   - A. Name, size, administrative boundaries
   - B. Geographic locators--Federal or State identification numbers
   - C. Maps

II. Physical Characteristics
   - A. Geology, topography,
   - B. Soils
   - C. Land use/land cover
   - D. Ecoregion(s)
   - E. Hydrology

III. Critical Areas
   - A. Surface water
     - waters with endangered or threatened species
     - critical fishery areas, outstanding resource waters
     - critical riparian and instream habitat
     - water supplies
   - B. Ground water
     - water supplies
     - recharge areas
     - springs, other vulnerable areas

IV. Water Quality
   - A. Designated uses and use support
   - B. Watershed's water quality problems
     - physical/chemical
     - biological
     - habitat (including flow needs)
     - other problems or sources of stress

IV. Point and Nonpoint Sources
   - A. Point source locations, loadings (if applicable)
   - B. Nonpoint source locations, loadings (if applicable)
   - C. Control measures in place--types, locations, effectiveness

V. Information Needs
   - A. Baseline monitoring program
   - B. Other data gaps
   - C. Information management systems

Table 6. (USEPA 1995a, 5-3).

will be used to characterize the watershed condition and monitor improvement before developing goals and solutions.

Volume III of the Buzzards Bay CCMP is the Monitoring Plan. It identifies several areas for which it is more cost-effective to monitor regulatory outputs rather than water quality outcomes. These areas include planning for a shifting shoreline and evaluating utilization of boat pump-out facilities. Rather than incurring the cost of documenting site-specific improvements associated, for example, with construction and use of pump-out facilities, it is sufficient to document the amount of pollution prevented from entering the environment by these facilities. This decision allows a more concerted focus on monitoring of water quality, habitat, and living resources to evaluate environmental outcomes of specific management actions (Buzzards Bay Project 1991d, 2).

The BBP Monitoring Plan addresses both specific coastal embayments[20] such as Westport River and Buttermilk Bay, as well as the open bay[21] (see Figure 8). The objectives of monitoring include assessing the effectiveness of management actions specified by the CCMP and documenting environmental trends and the need for any

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[20] There are 28 embayments in the Buzzards Bay.

[21] The open bay is defined as that part of the bay located seaward of a line that connects the headlands at the mouths of harbors.

EXAMPLES OF ENVIRONMENTAL INDICATORS

Description of Indicator Type or Category	Examples of Indicators
Document the extent to which programmatic and regulatory actions have been taken	Number of permits reissued with new limits Number of point sources in substantial noncompliance Elapsed time from identification of serious discharge violations until correction Number of targeted facilities/properties that have implemented BMPs Amount of fertilizer sold or used Number of estuary acres monitored Number of communities enacting zoning or stormwater management ordinances Number of public water systems with source water protection Number of public outreach activities and citizens reached
Quantify the extent to which actions have led to reduction in threats to surface or ground water quality	Reduction in nutrient loadings from each type of point and nonpoint source Reduction in pollutant loadings to ground water from underground injection wells Stability and condition of riparian vegetation Percent imperviousness upstream General erosion rate upstream Amount of toxicants discharged in excess of permitted levels Amount discharged by spills; number of businesses and households that have altered behaviors or processes to reduce pollutants
Measure the extent to which ambient water quality has changed	Pollutant concentrations in water column, sediments, and ground water Frequency, extent and duration of restrictions on water uses--bathing, drinking, fishing, shellfishing Percent of stream miles or lake or estuary acres that support each designated use Percent with impaired or threatened uses Percent of citizens who rate major waterbodies as usable for various recreational activities
Measure direct effects on the health of humans, fish, other wildlife, habitat, riparian vegetation, and the economy of the region	Aquatic community metrics Reductions in waterborne disease in humans Size of wetlands or riparian habitat lost or protected Size of commercial and recreational fish harvest Increased jobs and income due to recreation

Table 7. (USEPA 1995a, 6-3).

new actions. The baseline data necessary to meet these objectives will be obtained mostly from existing information, emphasizing the importance of the data collected since 1985.

Goal Setting: Broad Goals v. Specific Objectives

The NEP must set broad goals which achieve restoration and maintenance of the nation's estuaries in balance with the will of the people in the watershed. These goals must be consistent with the CWA mandates. From these goals, the NEP can set specific, shorter-term objectives that are achievable through specific action plans. These objectives typically reflect environmental criteria (indicators), preferred uses and priority areas of impairment for the specific watershed (USEPA 1995d). It is essential that objectives are as specific as possible to prevent action plans from being inappropriately ambitious (Colt 1994).

The two goals of the nitrogen-sensitive embayment[22] action plan of the Buzzards Bay Project offer an excellent example:

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[22] Nitrogen loading is defined as the input of nitrogen to receiving waters from anthropogenic sources. Nitrogen-sensitive embayments are those that have the potential of being critically impacted by nitrogen loading from existing land use or future development (generally shallow, poorly flushed embayments). Nitrogen impacted embayments are those whose resources and ecosystem have been adversely impacted by nitrogen loading (Buzzards Bay Project 1991b, 42).

MAP OF BUZZARDS BAY SHOWING SEGMENTATION INTO STUDY UNITS FOR MONITORING

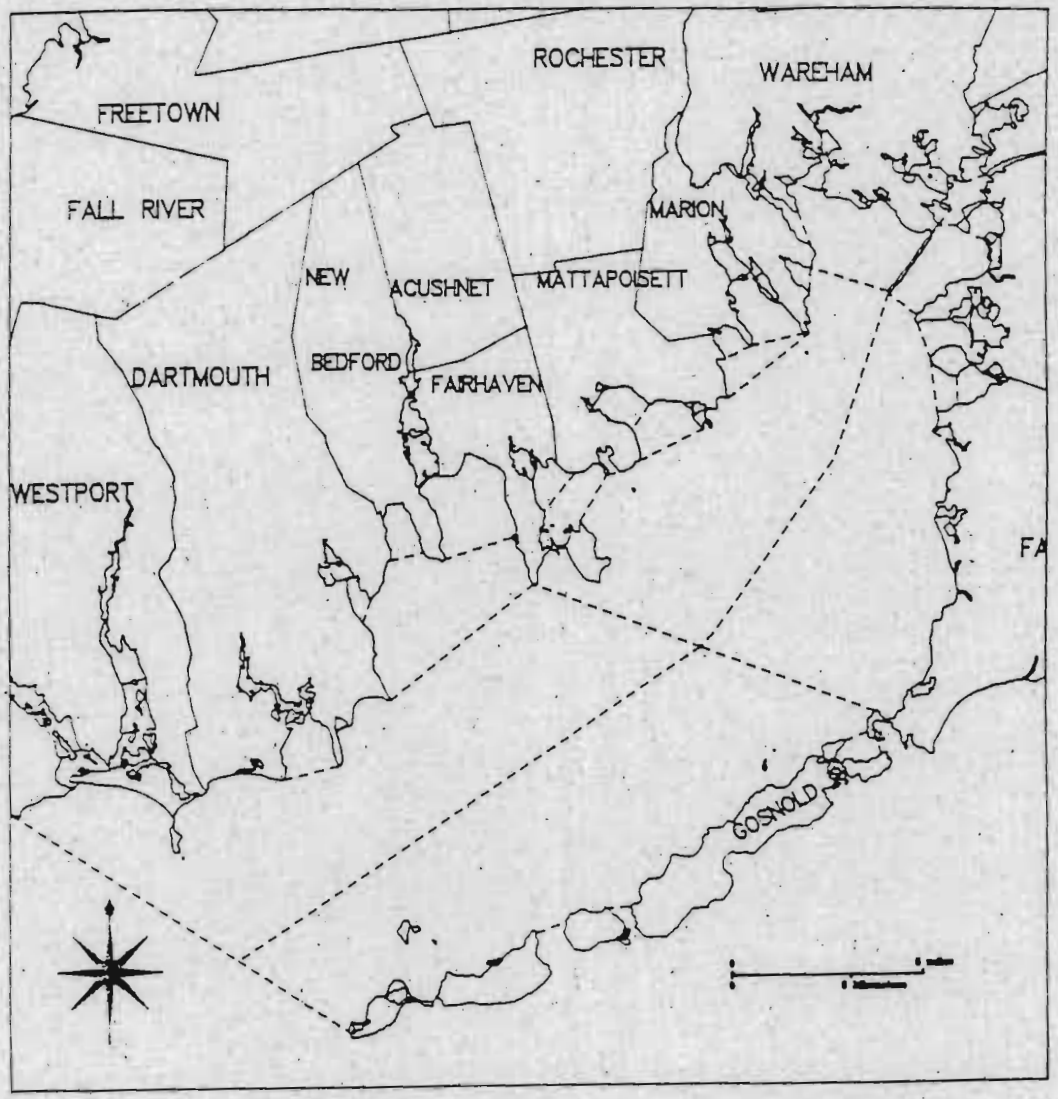

Figure 8. (Buzzards Bay Project 1991d,6).

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," and,

2) "Restore any beneficial water uses and ecosystems lost or impacted by the excessive contribution of nitrogen to any embayment within Buzzards Bay" (Buzzards Bay Project 1991b, 50).

The specific objectives to reach those goals include:

1) To control the amount of nitrogen entering Buzzards Bay as a whole.

2) To limit new additions of nitrogen entering nitrogen-sensitive embayments.

3) To reduce the amount of nitrogen entering nitrogen-impacted embayments.

4) To develop and support the use of alternative technologies that achieve denitrification of wastewater.

5) To develop a monitoring program that can assess the effectiveness of management actions taken and determine changes in water quality and health of coastal ecosystems (Buzzards Bay Project 1991b, 50).

These goals and objectives satisfy the NEP's requirements for restoration of estuaries through achievable plans based on environmental criteria and high priorities. This action plan's goals and objectives also satisfy the monitoring aspect of the WPA both in terms of outputs and outcomes.

Identifying Solutions

The next step in the watershed approach process is the identification of potential solutions to each problem. There are three questions which must be answered in developing solutions:

1. what is the solving action?,
2. who will take it and how?, and
3. in what time-frame?

It is essential that solutions to nonpoint source pollution are both structural and non-structural. These solutions can include technical controls, education, habitat restoration, economic incentives, and land-use controls such as local by-laws (USEPA 1995a, 6-2).

Continuing with the nitrogen example used above, particular stakeholders will be given explicit commitments to reach each of the objectives under the nitrogen loading reduction goals. State, federal and local governments, and nonprofit organizations share these responsibilities. Specific commitments under the nitrogen loading action plan include:

1) Revisions to state Water Quality Standards regarding nitrogen inputs to coastal embayments adopted by DEP;

2) Establishing experimental denitrifying onsite disposal systems in Buzzards Bay communities by EPA;

3) Development of an inter-municipal nitrogen overlay district;

4) Adoption of municipal by-laws regarding nitrogen loading and subdivision regulations; and

5) Implementation of a cranberry farming water quality initiative by Cape Cod Cranberry Growers' Association and the Plymouth County Conservation District (Buzzards Bay Project 1991b, 51).

When setting overall goals, the WPA encourages the inclusion of environmental indicators to communicate the degree to which pollution must be mitigated in a specific time-frame. Project developers may also want to establish a series of interim goals whose successful attainment is quantifiable in a shorter time-frame.

In the discussion of the CCMP commitments, target dates and interim actions to facilitate meeting those target dates are clearly stated. For example, the target date for commitment #1 above was December 1993. An interim action to meet that target was to adopt and field test a regulatory policy on nitrogen loading to coastal waters by December 1992. The government of the town of Marion, the Buzzards Bay Project, the Waquoit Bay National Estuary Research Reserve, and the DEP Antidegradation Task Force supported this goal. The data generated helped develop the preliminary list of Buzzards Bay nitrogen-sensitive embayments seen in Tables 8 and 9 (Buzzards Bay Project 1991b, 51).

This assessment of nitrogen loading includes existing and recommended load limit, and water classification goals. These data 1) determine whether the individual embayments need growth management, remediation or no action; and, 2) provide outcome and output indicators for evaluation and monitoring.

The Buzzards Bay Project's development of solutions is a clear adaptation of the watershed protection approach. This is seen in several ways. The BBP uses baseline data to assess and identify problems, and

RECOMMENDED NITROGEN LOADING LIMITS FOR COASTAL EMBAYMENTS

EMBAYMENT	*WATERS CLASSIFIED SB*	*WATERS CLASSIFIED SA*	*SA WATERS DESIGNATED OUTSTANDING RESOURCE WATERS*
Shallow -flushing: 4.5 days or less	350 $mg/m^3/Vr$	200 $mg/m^3/Vr$	100 $mg/m^3/Vr$
-flushing: more than 4.5 days	30 $g/m^2/y$	15 $g/m^2/y$	5 $g/m^2/y$
Deep (choose rate resulting in lesser annual loading)	500 $mg/m^3/Vr$ or 45 $g/m^2/y$	260 $mg/m^3/Vr$ or 20 $g/m^2/y$	130 $mg/m^3/Vr$ or 10 $g/m^2/y$

Note: Vr=Vollenweider flushing term, defined by the equation Vr = r / (1 + sqrt(r)), where r is residence time in years. When used above, should be read as loading during the "Vollenweider-term adjusted flushing period." Shallow is defined as 40% or more of area less than 1 m or having a mean depth of 2m or less.

Table 8. (Buzzards Bay Project 1991b, 45).

PRELIMINARY ASSESSMENT OF NITROGEN LOADING TO SOME BUZZARDS BAY EMBAYMENTS

BUZZARDS BAY EMBAYMENT	Existing N Load (kg/y)	Future N Load (kg/y)	Classif. Goal	Recommended Load limit (kg/y)	Preliminary Recommended action
Acushnet River New Bedford inner	333,000	360,000	SB	256,000	Manage Growth & Remediation
Apponagansett Bay, inner	52,000	63,000	SA	35,700	Manage Growth & Remediation
Buttermilk Bay	41,300	57,600	SA	55,200	Manage future growth
Hen Cove	9,100	10,500	SA	5,600	Manage Growth & Remediation
Marks Cove	6,100	7,500	ORA	21,800	no action
Mattapoisett upper+lower	49,000	106,000	SA	86,000	Manage future growth
Inner Nasketucket Bay	44,300	51,100	ORA	107,000	no action
Onset Bay	29,400	40,000	ORA	37,000	Manage future growth
Phinneys Harbor	17,700	25,900	ORA	127,000	no action
Pocasset River	12,700	32,700	ORA	21,500	Manage future growth
Quisset Harbor	1,500	1,900	ORA	40,000	no action
Red Brook Harbor	3,000	6,000	ORA	18,600	no action
Sippican Harbor upper harbor	12,600	15,600	SA	25,500	no action
Slocums River	97,000	178,000	SA	29,600	Manage Growth & Remediation
Squeteague Harbor	8,500	16,200	SA	31,000	no action
Wareham River	94,200	222,000	SA	37,400	Manage Growth & Remediation
West Falmouth Harbor	24,000	31,000	SA	37,200	no action
Westport River, East Branch	123,000	219,000	SA	120,300	Manage Growth & Remediation
Westport River, West Branch	27,900	56,000	ORA	26,600	Manage Growth & Remediation
Weweantic River	144,000	291,000	SA	47,600	Manage Growth & Remediation
Widows Cove	200	800	ORA	28,000	no action
Wild Harbor	8,000	9,400	ORA	30,400	no action
Wings Cove	2,001	3,700	ORA	28,000	no action

[1]This table is a preliminary assessment of nitrogen loading based on the limits recommended in Table 5.1 and embayment hydrologic features and estimated loadings calculated from landuse reported in Costa et al., 1991 and based on MassGIS landuse statistics and other sources. Because these are preliminary estimates, it is recommended that environmental managers consider more detailed assessments before implementing any specific actions or determining that no action is required, particularly where predicted loads are near recommended limits. Water quality classifications are recommended goals, not actual existing classifications. SA = high water quality areas that have excellent habitat and ecological and aesthetic values. SB =areas that have good habitat and ecological and aesthetic values, shellfish areas are restricted and require depuration, ORA = Outstanding resource areas with exceptional habitat, aesthetic, and ecological values.

Table 9. (Buzzards Bay Project 1991b, 48).

monitor actions. Specific objectives support general goals. Actions are distinctly defined and responsibilities clearly assigned. Table 10 illustrates these adaptations in the other ten goals of the BBP.

Synthesizing Solutions into Action Plans

The watershed approach offers great potential to develop management options for NPS pollution. However, these options are often technically complex and expensive. To help guide agencies dealing with NPS pollution, the EPA has developed the *Guidelines Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.* This document describes appropriate management measures[23] for each major category[24] of nonpoint source pollution.

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[23] Management measures are "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives (USEPA 1993, 1-5).

[24] The major categories of nonpoint source pollution addresses by NOAA and EPA are agricultural runoff, urban runoff (including developed and developing areas), silvicultural (forestry), marinas and recreational boating, and channelization and channel modification, dams, and streambank and shoreline erosion. EPA has also included management measures for wetlands, riparian areas, and vegetated treatment systems that apply to various categories of sources of NPS pollution (USEPA 1993, 1-7).

OVERALL GOALS OF THE BUZZARDS BAY NATIONAL ESTUARY PROGRAM

ACTION PLAN	GOALS
Protecting Shellfish Resources	Increase availability of shellfish resources for recreational and commercial uses.
Controlling Stormwater Runoff	Prevent new or increased untreated stormwater flows to Buzzards Bay that would impact water quality, shellfishing, swimming, and wetlands.
	Correct existing stormwater runoff problems that are causing or contributing to water quality degradation or shellfish-bed closures.
Managing Sewage from Boats	Eliminate the discharge of wastewater from all boats in Buzzards Bay embayments.
Managing On-Site Systems	Prevent public health threats and environmental degradation from on-site disposal systems.
Preventing Oil Pollution	Reduce the amount of petroleum hydrocarbons entering Buzzards Bay.
	Minimize the occurrence of oil spills in Buzzards Bay, both large and small.
	Minimize environmental effects from oil inputs.
Protecting Wetlands and Coastal Habitat	Long-term increase of high quality wetlands and coastal habitat in Buzzards Bay.
Planning for a Shifting Shoreline	Protect public health and safety from problems of higher waters and shifting shorelines.
	Reduce the public financial burden caused by the losses of or damage to coastal property.
	Plan for the loss of buffering wetlands and shifting sand formations.
Managing Sewage Treatment Facilities	Achieve water quality standards and protect natural resources at all POTW discharge points.
Reducing Toxic Pollution	Protect the public health and the Bay ecosystem from the effects of toxic contaminants.
Managing Dredging Activities	Establish a comprehensive framework to manage dredging and the disposal of dredged material.

Table 10. (Buzzards Bay Project 1991b).

A watershed action plan should reflect the particular watershed's resource inventory data, water quality problems and sources, environmental indicators, goals, actions, funding, and stakeholder commitments. Such a plan provides clarification and cohesion, and publicly demonstrates the project's broad-based commitment to progress (USEPA 1995a, 6-16).

Once solutions are agreed upon, the juxtaposition of the magnitude of problems that need attention and the limited funds and staffing may temporarily fatigue the project. At this stage, it is crucial that participants resist the temptation to return to solving one problem at a time. Reverting to a sectoral approach will simply transfer the problem, not only failing to clean the water but also leaving the public disillusioned and the project unsupported.

Many projects build incentives into implementation of action plans to improve compliance (Appendix 7). An ambitious educational program, together with well-enforced regulatory and broad-based voluntary programs offer the most effective incentive approach (USEPA 1995a, 7-6).

To ensure that stakeholders uphold action commitments, watershed projects must include formal agreements such as Memoranda of Understanding (MOU), and public accountability through annual reporting, public meetings and other venues.

Actual implementation of BMPs requires significant input from agencies with appropriate technical expertise and an appropriate time-period to ensure proper installation (USEPA 1995a, 7-7). Once installed, structural controls must be subject to a permanent inspection and maintenance program. Otherwise, systems could fail and lead to public disillusionment (USEPA 1995a, 7-8).

A key element of a successful watershed program is its ability to address all major sources of pollution simultaneously. This diffuses the blame for problems and focuses efforts on action. To develop effective action plans, the project team must accentuate high-risk human and ecological health problems in the context of cost effective management measures. Projected scenarios of how different measures may effect each other are also studied. Such an approach may help determine all political, social and technical challenges before committing any funds for potentially unacceptable or unsuccessful solutions (USEPA 1995a, 6-8).

The Buzzards Bay Project CCMP contains eleven action plans.[25] These plans reflect the substantial breadth that

[25] The eleven action plans address: managing nitrogen-sensitive embayments, protection and enhancing shellfish resources, controlling stormwater runoff, managing sanitary wastes from boats, managing on-site systems, preventing oil pollution, protecting wetlands and coastal habitat, planning for a shifting shoreline, managing sewage treatment facilities, reducing toxic pollution and managing dredging and dredged material disposal.

the comprehensive watershed approach promotes. Each plan is divided into the following seven sections: 1)problem, 2)background, 3)major issues, 4)goals, 5)objectives, 6)CCMP commitments and 7)other recommended CCMP actions (Buzzards Bay Project 1991b, 39).

The Action Plan is the culmination of all of the elements of the watershed protection approach. Each Action Plan includes baseline data, identification of the problem and its causes, overriding goals and specific objectives, and specific methods to meet those objectives.

Implementation of the Action Plan

Implementing the CCMP is the most important and most challenging step in the NEP process. Although existing or redirected programs are generally used for implementation, new legislation, institutional arrangements and programs will also be a part of NEP implementation. The groundwork of the Management Conference becomes crucial at this point. Its ability to build solid institutional and public support for the NEP will help gain the endorsement of the scientific community, the public, elected offices and implementing agencies (Mei 1994).

The keys to implementation are public involvement and support, political commitment, and funding (USEPA 1989, 55). The action plans embodied in the CCMP detail which steps are taken when, and by whom. The Buzzards Bay CCMP relies heavily on local government commitments. As noted previously, the legislated tradition of home rule places local governments in the most advantageous position to address NPS pollution. The Buzzards Bay Advisory Committee and the Coalition for Buzzards Bay coordinate implementation efforts (see Figure 9). One major stumbling block to implementation is funding limitations.

RELATIONSHIP OF THE THREE BUZZARDS BAY PARTNERS

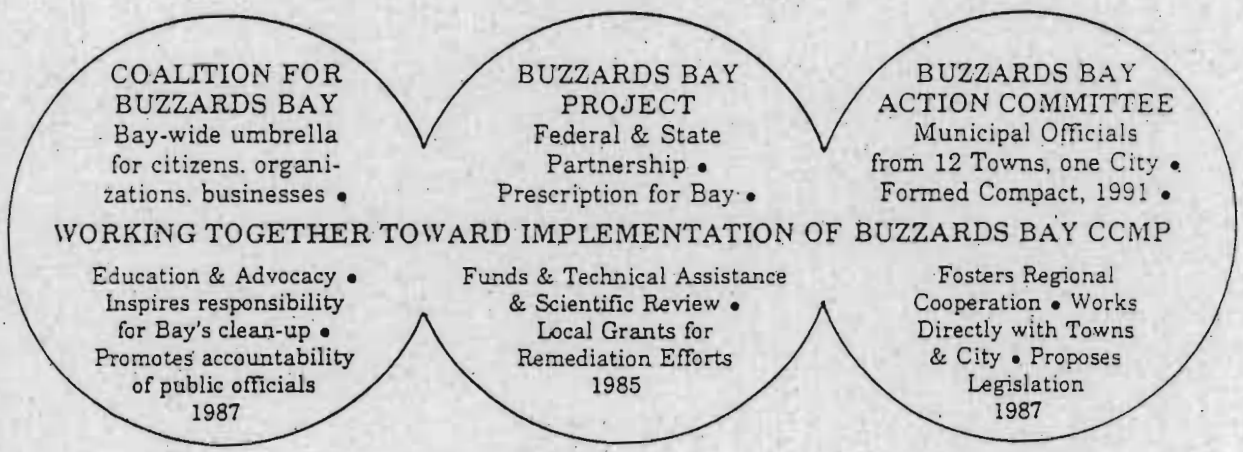

Figure 9. (Coalition for Buzzards Bay 1992).

POTENTIAL WATERSHED PROTECTION FUNDING SOURCES

EPA SOURCES

- Grants: CWA Sections 106, 604(b), 314, 319
- Wastewater Permits Program (NPDES)
- Wetlands Protection Grants
- State Revolving Funds
- NEP and Near Coastal Waters Program

STATE AND LOCAL SOURCES

- State General Assembly appropriations
- State income tax credit
- General revenue and special purpose bonds
- State income, sales and luxury taxes
- Grants and easements
- Lotteries and loans
- Hunting/fishing licenses
- NPDES permit fees (USEPA 1995a, 7-3).

Table 11. (USEPA 1991, 8).

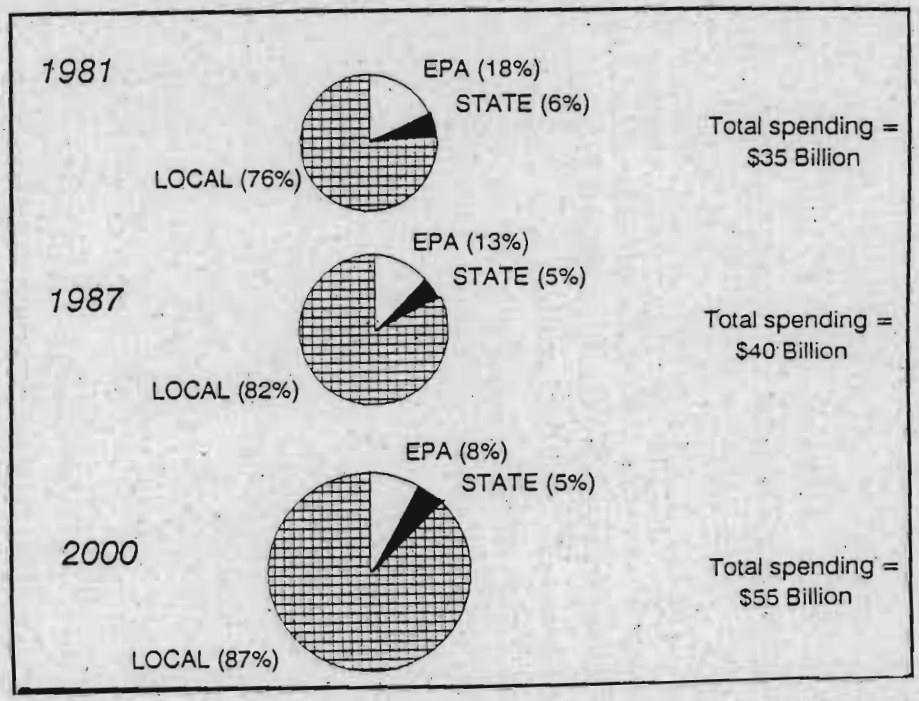

Figure 10. ENVIRONMENTAL OUTLAYS BY LEVEL OF GOVERNMENT (Buzzards Bay Project 1991c, 4).

Funding

As mentioned above, watershed projects must consider issues of project maintenance and funding as an enabling element of implementation (see Table 11 and Appendix 8). Long-term institutional and financial arrangements as well as continued management measures must be addressed in that context.

As illustrated in Figure 10, the burden of funding has increasingly fallen to local governments. By the year 2000, local governments will shoulder 87% of the total costs of environmental protection (Buzzards Bay Project 1991c, 4).

This issue is especially troubling for the Buzzards Bay Project as it has no authority to generate implementation funds. Its primary source of funding has been Section 320 of the CWA which must meet a 3:1 federal/non-federal match ratio. During completion of its CCMP, the Buzzards Bay Project received federal funds ranging from $200,000 to $607,000 for research and development of management actions. Since 1991, the Project has received approximately $200,000 per year under Section 320 toward monitoring implementation of the CCMP. This post-CCMP support funds oversight, tracking and facilitation of implementation commitments, preparation of progress reports, evaluation of monitoring data,

communication of results to the public, and modifications to the program.

The Project also receives funding from other sections of the CWA and some state transportation bond funds (USEPA 1995d). However, significant financial limitations constrict local and state financing of implementation activities (Imperial, Hennessey and Robadue 1993). Pursuit of realistic funding sources must be considered in the context of thirty years of Massachusetts' fiscal history.

Historical Perspective

The 1970s were a period of slow growth. During this period, proposition 2 1/2 was passed to encourage growth by severely limiting local property taxes and annual rate increases. These changes resulted in severe restrictions on local budgets. In response, communities sought aid at the state level. This aid was available in the early 1980s due to explosive growth in state revenues, and now represents 1/3 of all state expenditures.

However, the late 1980s and early 1990s have seen slower growth and escalating costs. Concurrent opposition to tax increases has led to operating deficits and legislative gridlock regarding balancing the budget. The implications of this bleak economic outlook is felt in every effort to implement the recommended remedial actions

in the CCMP. Potential sources of funding scrutinize each action for an apparent nexus between funding and the supported action. Thus, to improve fund-raising prospects, it is essential that funding sources fully appreciate the necessity of each action (Buzzards Bay Project 1991c).

The Buzzards Bay CCMP Action Plans contain a diverse set of recommended activities that rely on various funding sources. Regulatory actions, such as the adoption of the nitrogen loading overlay district by Bourne, Plymouth and Wareham (see #3 on page 53), impose much of the cost on the private sector. In this example, developers must comply with zoning by-laws to minimize nitrogen loading (Buzzards Bay Project 1991b, 51).

Other activities require modest sporadic expenditures. These activities include acquisitions of property, any easements, and small scale local capital projects such as stormwater detention ponds. Treatment plants and sewer connections require more significant capital expenditures.

Some of the recommended actions, mostly monitoring activities, require continuous allocations of funding (Buzzards Bay Project 1991c). Fortunately, Buzzards Bay enjoys strong support from citizens' monitoring programs which complement federal and state agencies.

Chapter Five discusses the relationship of funding to CCMP implementation further (also see Appendix 8).

Monitoring

Monitoring water quality is an important evaluative element of the watershed project because it:

- detects trends in ambient water quality;
- measures controls' ability to remove pollutants;
- demonstrates efficacy of restoration measures;
- monitors long-term controls maintenance (USEPA 1995a).

To ensure a full description of the estuary's ecological integrity, monitoring efforts should include measurements of physical, chemical, biological and habitat parameters (Yoder 1995). As mentioned above, citizen monitoring programs may help fill this gap while increasing individual involvement of the watershed project (USEPA 1995a, 8-4).

The two objectives of monitoring in the Buzzards Bay CCMP are consistent with the watershed protection approach:

- to assess the effectiveness of management actions specified by the CCMP.
- to document environmental trends and the need for new actions (Buzzards Bay Project 1991d, 7).

As discussed earlier in this chapter, baseline data is necessary to reach both objectives and to detect change in the Buzzards Bay system. This is especially important

given the difficulty of linking specific management actions with specific effects in the marine environment.

The monitoring plan includes baseline monitoring, mitigation monitoring, trend monitoring and research. Monitoring efforts seek to identify the anthropogenic impacts to the Bay, determine their effects, and conclude how management actions might remedy these impacts.

The detection of the anthropogenic impacts will be compared to baseline data on a case-by-case basis in four areas: pathogen contamination, nutrient enrichment, toxic contamination, and loss of habitat and living resources. Table 12 illustrates the nutrient enrichment monitoring plan for Buzzards Bay.

Citizen monitoring groups assist in several important ways. As shown in Figure 11, these groups help achieve the ambitious and expensive[26] task of seeking trend data in the 28 embayments around Buzzards Bay. Such efforts also contribute substantially to strong civic pride and grass-roots involvement. The citizen monitoring effort not only contributes vital scientific information, but also

[26] The total estimated annualized cost for trend and mitigation monitoring is $650,000; research tasks are nearly $300,000.

Nutrient Enrichment Monitoring					
Monitoring Code: M = Mitigation T = Trend R = Research					
Questions	Code	Observations	By	Methods	Annualized Est. Cost
1) Do management strategies affect nitrogen loads and eutrophication parameters in coastal embayments?	M,T	Tier 1: 1) DO, 2) water transparency, 3) periphyton deployments, 4) frequency of fish kills, 5) drift algae, 6) benthic infaunal indicators (Aug. only), 7) eelgrass cover, 8) fish, shellfish. See Tables 6, 7, & Fig. 6. Tier 2: Biweekly measurements of DIN, PON, & Chl from April to Nov. at DO stations (5 embayments/yr). See Tables 6, 7 & Fig. 6.	Tier 1: Citizens monitoring 1-4. Contractors 5-7. DMF 8. Tier 2: Contractors &/or DWPC.	Tier 1: Analyze water, sediments. Collect living marine resources by trawling, benthic sampling. Tier 2: Analysis of surface water samples.	Tier 1: 60K Tier 2: 125K
2) Does the STP upgrade in New Bedford Harbor affect nitrogen loads and ecological response in the open bay?	M,T	Tier 1: Monitor nitrogen in New Bedford outfall discharge weekly. Measure DIN, PON, chl a during July & August at 12 stations every 3 yrs (Fig.5; Table 8; Fig.7). Tier 2 (min. every 5 to 10 yrs): 1) benthos, 2) periphyton deployments, 3) chl a (water, sed.), 4) DIN, 5) phyto-& zooplankton, 6) sed. CHN.	Tier 1: City of New Bedford. Contractors &/or DWPC. Tier 2: Outside contractors.	Tier 1: Analysis of surface water samples. Tier 2: Analysis of water, sediments, benthos, plankton.	Tier 1: 30K Tier 2: 50K
3) What is relationship between nutrients & plankton communities?	R	Weekly measurements of nutrients, phytoplankton, & zooplankton at several stations off New Bedford and in open Bay (e.g., SMU program).	Universities &/or research institutions	Water column sampling of phytoplankton, zooplankton.	50K
4) Can areal thematic mapper data be used to synoptically characterize primary production in the Bay?	R	Weekly comparison of remote sensing data with ground truth data (#3). 1 field study + annual remote sensed images.	NOAA, EPA, Contractors	GIS overlays	20K + 50K initial cost
5) What are loads & losses of nitrogen from individual septic systems via groundwater, under different hydrologic conditions?	R	Groundwater monitoring of selected systems.	Universities &/or research institutions	Test well water samples	75K

Table 12. (Buzzards Bay Project 1991d, 13).

ENVIRONMENTAL VARIABLES MEASURED BY CITIZEN MONITORING GROUPS

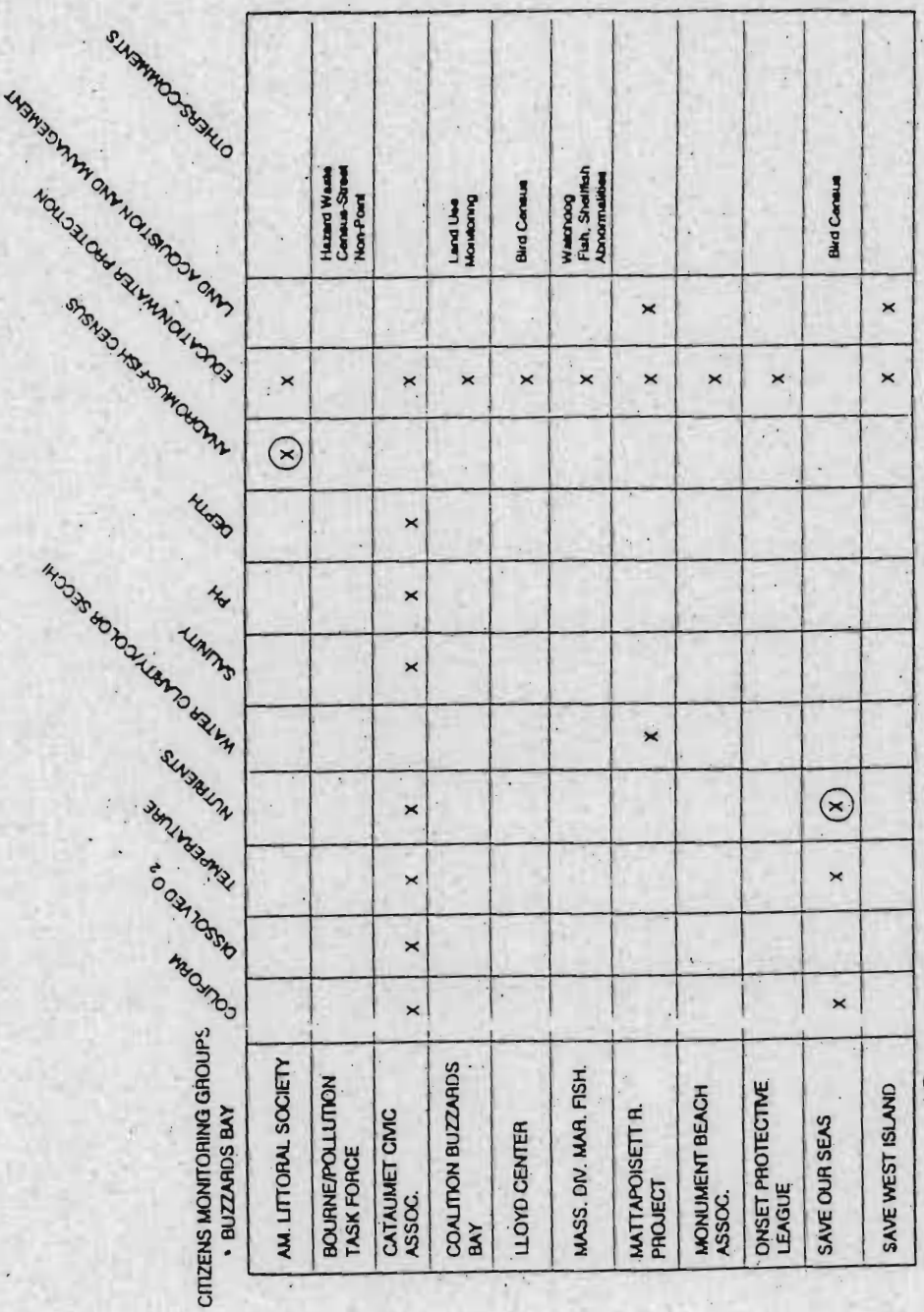

Figure 11. (Buzzards Bay Project 1991d, 47).

increases personal citizen "ownership" of the Buzzards Bay restoration effort (Buzzards Bay Project 1991d, 45). Chapter Six further discusses stimulating individual awareness and involvement.

The DMF, DEP, EPA, NOAA, FDA, local boards, universities, private research organizations, contractors and citizens will coordinate monitoring efforts (Buzzards Bay Project 1991d, 55). Periodic evaluation of the entire monitoring program will improve its efficiency and responsiveness. The review will include issues such as setting management priorities; developing "action" thresholds, hypotheses and logic flows; identifying remediation methods and resolution of communication problems, as well as new technologies. The results of these meetings will be open for public comment to maintain support for monitoring efforts and provide positive feedback to citizen participants (Buzzards Bay Project 1991d, 61). Evaluation of monitoring efforts highlights the importance of adaptive management to watershed protection.

Role of Adaptive Management

All watershed projects must be able to make necessary mid-course corrections. An undocumented problem may be

discovered, or action plan objectives may not be sufficient to reach water quality goals. Conversely, the project may be focusing on a problem that was not recognized during the planning and objective-setting sessions. In order to reduce these possibilities, the project must undertake regular consensus evaluation. This evaluation includes answers to the following:

- were correct controls installed initially?
- are controls effective?
- what does water quality and biological data demonstrate?
- are stakeholders meeting commitments? (USEPA 1995a, 8-10).

To construct the most protective and acceptable policies, policy makers should strive for idealism about science and pragmatism about politics (Lee 1993). Accomplishment of this goal requires two actions. Programs should attempt to incorporate scientific information in its purest form. Simultaneously, program managers should temper this idealism with the political realities of consensus building, funding issues and the difficulty of changing the status quo.

The principles of adaptive management[27] allow for ample consideration of ideal scientific options. Political conflict is indispensable for accenting scientific errors and reinforcing the learning of adaptive management during consideration of scientific options. Symmetry between these two forces will guide policy toward more ecologically and socially sustainable alternatives (Lee 1993).

The Buzzards Bay Project's evaluation and ranking of embayment subwatersheds provides an excellent example of adaptive management at work in watershed protection. As discussed earlier in this chapter (see Table 8 on page 55), the CCMP recommends nitrogen loading rate limits to protect Buzzards Bay from excessive inputs of nitrogen which cause water quality and living resource losses.

However, preliminary research demonstrated that to implement this management strategy, a change in scope was necessary. To manage nitrogen, research must show exactly how much nitrogen is currently being loaded from what sources, and how much nitrogen future build-out[28] will add

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[27] Adaptive management entails the application of science to policy that can change in response to experience, new information or identification of errors. Policies based on adaptive management are iterative and "learn" from inevitable errors (Lee 1993, 10). "Active adaptive management involves learning by doing" (Healey and Hennessey 1994, 188).

[28] See Appendix 11 for specific information regarding build-out in Falmouth, MA.

(Buzzards Bay Project 1994). However, the inadequate funding discussed above necessitated setting priorities for the research and limiting establishment of nitrogen controls. Further, there has been some resistance to the concept of limiting growth. These socio-economic realities have amended the need and desire for pure science. The new scenario created an interest in 1) reducing the size of the study area and 2) creating priority areas to implement nitrogen controls. Thus, the Buzzards Bay Project established the embayment subwatershed approach now in effect in Buzzards Bay.

This approach evaluates nitrogen loading to 30 Buzzards Bay embayments from existing and possible future development and provides recommended nitrogen carrying capacity data for each embayment. Based on this information, two evaluations are made: ranking of management effectiveness and the value of any threatened resources. This evaluation helps set management action priorities in the 30 embayments. The embayment method reflects how management was adapted to limited resources, and was focused on areas with the greatest potential for restoration and public benefit.

OBSTACLES OF THE WATERSHED PROTECTION APPROACH

The watershed protection approach has been described as the "ultimate in consensus-based, bottom up inside out[29], 'problem-shed' based, individualized, and targeted water resources planning and management" schemes (Goldfarb 1994, 501). However, like many environmental management methodologies, its successful implementation entails overcoming some obstacles.

Boundaries

Conflicts regarding boundaries present one obstacle to smooth WPA implementation. Watershed and aquifer boundaries do not coincide with state, county or town jurisdictions. Further, watersheds occur on a wide range of scales. These scales are not standardized and lead to subjective definition of watershed size. For the purposes of this paper, watershed scales include sub-national (Connecticut River/Long Island Sound), regional (Buzzards Bay), and local (Snell Creek, a tributary of Westport River that flows into Buzzards Bay) (see Figure 12).

The subjectivity of watershed scale allows flexible watershed management. As illustrated above, larger basins

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[29] Management from "inside out" rather than "outside in' refers to the preferred management scheme which utilizes existing institutions to the fullest extent possible.

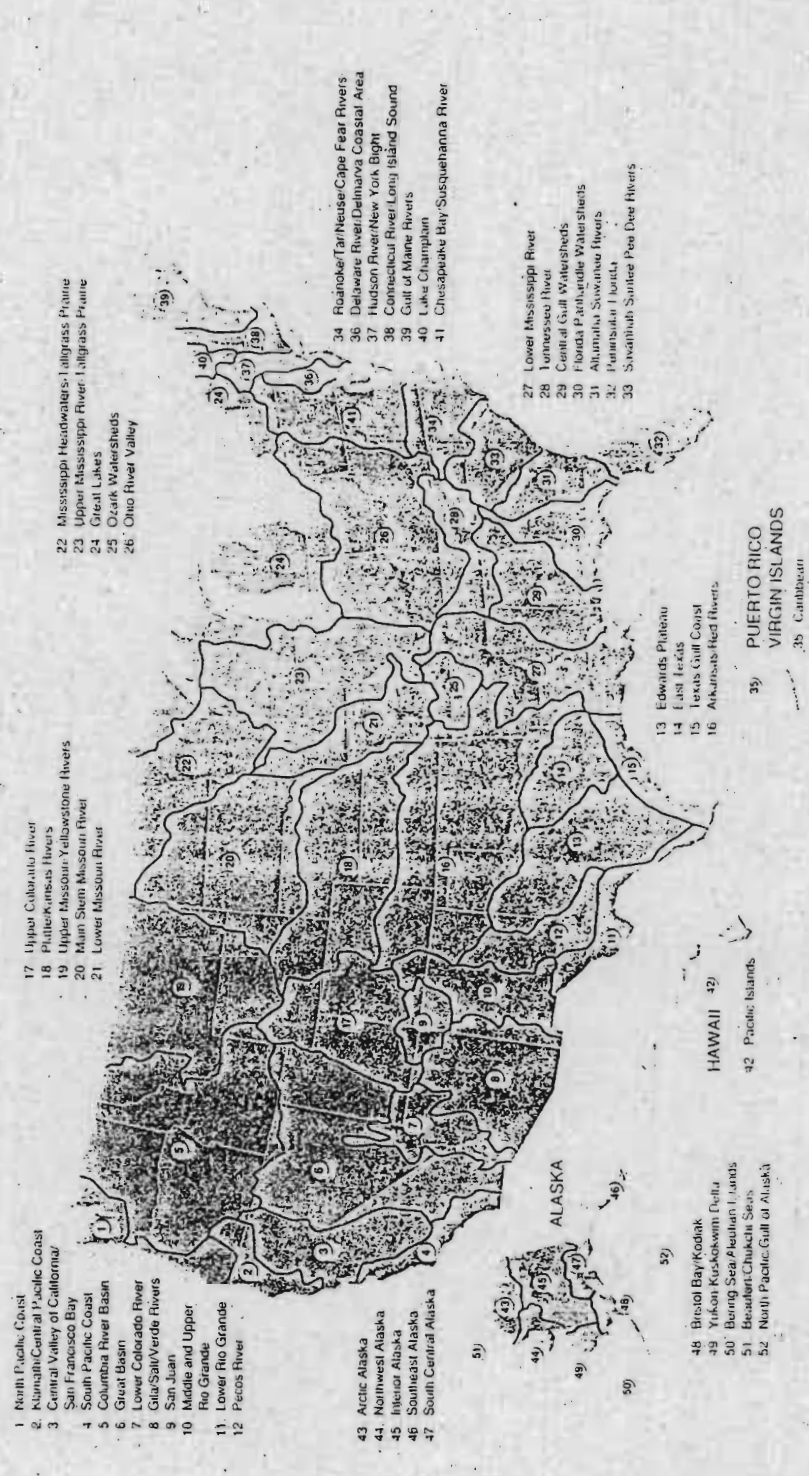

Figure 12. (National Geographic and the Conservation Foundation 1995, 21).

can provide an excellent framework for coordinating multiple watershed projects while water quality and ecosystem protection activities are best managed at the smaller watershed level. Generally, several levels of watershed programs are conducted simultaneously (Figure 13) (USEPA 1995b, 1-10). When determining scale, it is imperative to balance inclusiveness with political feasibility and provide for institutional culture (Goldfarb 1994). Involving too many players may dilute the process.

Group Dynamics

The difficulties inherent in group exercises also challenge watershed projects. These challenges include: establishing a common direction, managing institutional transitions from sectoral to bioregional orientations, documenting the development process and resolving policy conflicts. Often, the breadth of the committee approach may restrict the specificity and operational meaning of the developed plans (Goldfarb 1994). Gaining consensus can be disorderly and contentious, especially if concepts are vague. To overcome these difficulties, it is essential that the involved agencies show strong leadership, purpose and long-term commitment. Other obligations include frequent communication of goals, methods to achieve them, and a timeline to merge initiatives (USEPA 1995b, 4-1).

HIERARCHY OF NESTED WATERSHEDS

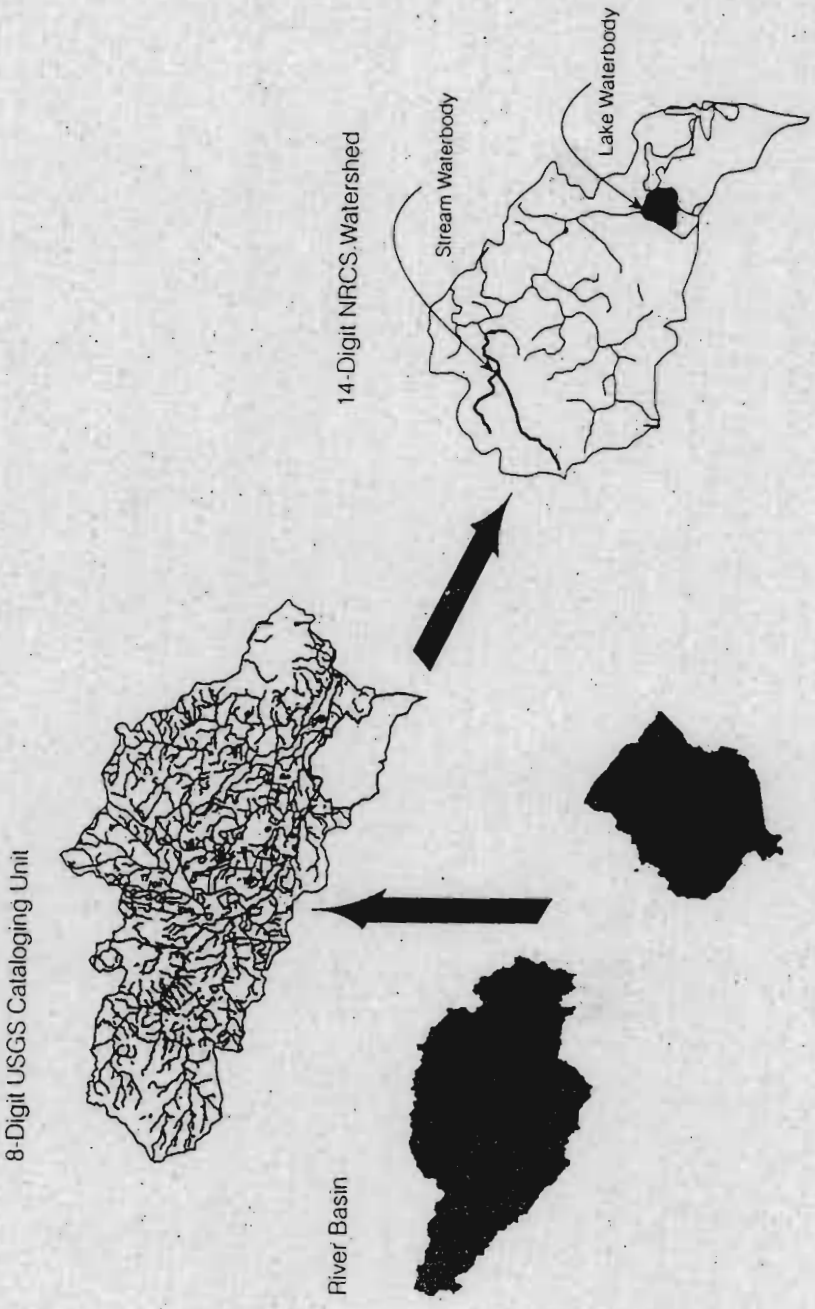

Figure 13. (USEPA 1995b, 1-8)

The Buzzards Bay Project was not particularly burdened by internal conflicts during development of the CCMP. Participants were generally enthusiastic and cooperative. All stakeholders strongly supported the overall goals of restoring estuarine water quality and reopening shellfishing (Costa 1995). The scope and design of the Buzzards Bay Project likely bolstered this cooperation.

As discussed earlier in this chapter, effective watershed projects are large enough to be economically viable, yet small enough to capitalize on local expertise and interest. Buzzards Bay is a moderately sized estuary (228 square miles) with a drainage basin of 432 square miles which includes all or sections of 17 municipalities[30]. Its ratio of land to water (1.9:1) is relatively low compared to Chesapeake Bay (14.5:1) and Delaware Bay (17.3:1). The rivers draining Buzzards Bay are considerably shorter and have smaller drainage areas than other Massachusetts rivers (Buzzards Bay Project 1991b, 13). These factors add up to relatively simple hydrology and a manageable number of political entities within the region. This setting facilitated clearer and

[30] Most of the communities in the Buzzards Bay watershed are wholly in Massachusetts. Portions of three towns in Rhode Island and two towns in Massachusetts are also part of the basin.

more purposeful goal setting, which may have minimized conflicts among stakeholders.

The nitrogen loading example discussed earlier in this chapter provides an excellent example of the difference between planning and implementation in the group setting. The CCMP identified the need to establish an inter-municipal[31] overlay district around the Buttermilk Bay sub-watershed to manage future nitrogen inputs (Buzzards Bay Project 1991b, 51). The stakeholder group readily accepted this objective during CCMP development. However, conflicts arose at the town meeting level (Costa 1995). The power of home rule discussed in Chapter Two temporarily stalled implementation. Planning boards questioned density levels recommended by the BBP, and insisted on reviewing every parcel within the subwatershed to determine the accuracy of BBP's data. Simultaneously, an outspoken developer strongly resisted the creation of any kind of nitrogen loading district. However, persistent negotiations ensued and the proponents of the overlay district prevailed. The difficulties of working in the various group settings were overcome. This example illustrates how despite occasionally allowing individual priorities to eclipse project priorities, disparate local interests in the

[31] The towns of Bourne, Plymouth and Wareham agreed to participate in this management objective.

Buzzards Bay watershed have worked successfully toward their common goal (USEPA 1995d).

Another factor contributing to the successful CCMP group exercise was the support generated during the public participation segment of the CCMP approval process. Two crucial characteristics of IEM discussed in Chapter Three are 1) planning that tries to fully evaluate and integrate social, cultural, economic issues and 2) environmental goals and communication focused on educating the public and members of the program. The thoroughness of the public participation process undertaken by the BBP enhanced communication of goals and demonstrated the long-term commitment to attainment of these goals.

The structure of the National Estuary Program itself also assisted this process. The NEP management process consists of four phases shown in Table 13. The NEP provides five years of funding to estuary projects for development of the CCMP. As shown in Figure 14, this defined funding period, combined with clear goals, precipitates careful construction of timelines incorporating all major components of the CCMP.

The actual implementation of the CCMP has elicited a more contentious response among the stakeholder group.

NATIONAL ESTUARY PROGRAM MANAGEMENT PROCESS	
• Phase 1	Planning Initiative: Building a Management Framework
• Phase 2	Characterization and Problem Definition
• Phase 3	Creation of a Comprehensive Conservation and Management Plan (CCMP)
• Phase 4	Implementation of the CCMP

Table 13. (USEPA 1989, 9).

As seen earlier in this chapter, some of the strong support discussed above, may evaporate when implementation demands specific resource commitments from the stakeholder group (Imperial, Hennessey, and Robadue).

Evaluating and Monitoring Success

Documenting outputs and outcomes presents additional difficulties. Watersheds are dynamic systems which often take years to present changes which can be measured. This is attributable to the technical difficulty and resource intensity of environmental monitoring, as well as funding limitations (USEPA 1995a, 2-9).

RELATIONSHIP AMONG THE CCMP COMPONENTS AND THE MANAGEMENT CONFERENCE PROCESS

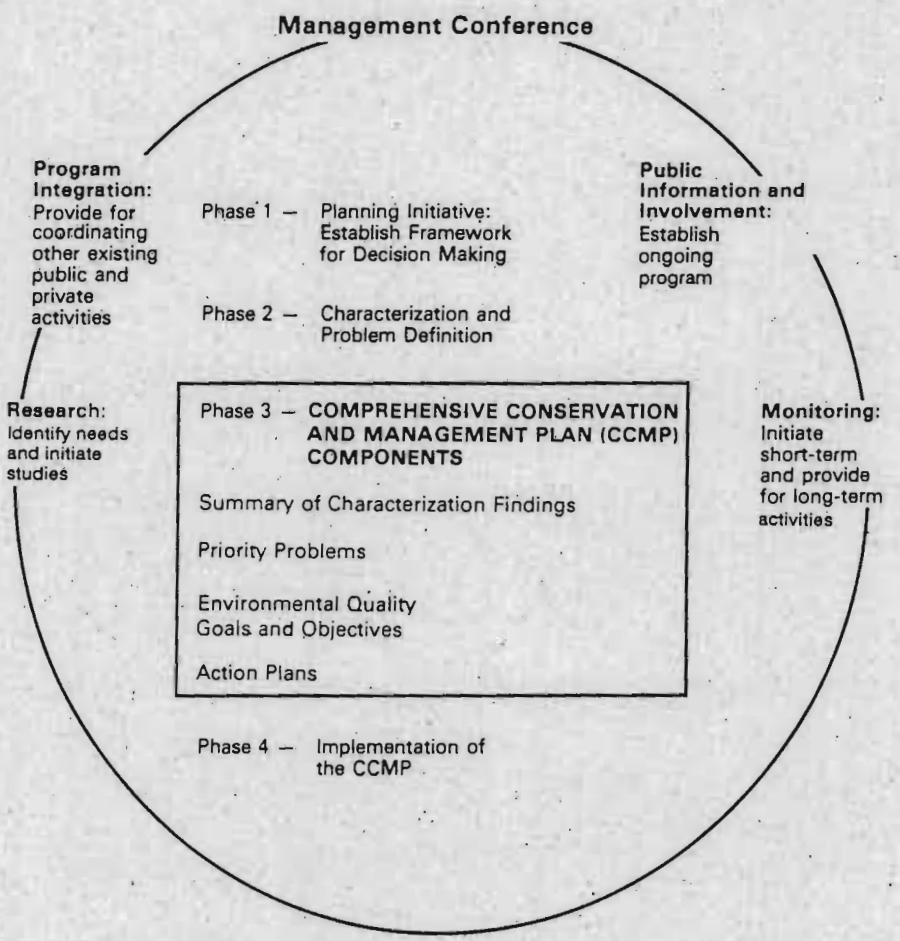

Figure 14. (USEPA 1989, 41).

To overcome these obstacles, the watershed project must report progress clearly and regularly to sponsoring organizations and the public. Since the overall goal of improving or protecting water quality may not be detectable

within a reasonable time period, interim administrative goals[32] may be an appropriate response (USEPA 1995a, 8-2).

The Coalition for Buzzards Bay adopted an innovative mechanism to track progress toward improved water quality in the Bay. Since 1989, the Coalition has issued an Environmental Report Card which essentially "grades" the watershed communities on their implementation of action plans in the CCMP (USEPA 1995d) (see Appendix 9).

Three factors are considered in evaluating progress:

- remediation of existing sources of pollution
- maintenance of current protection for natural resources
- strategic planning for future development and growth impacts.

Evaluation categories mirror the eleven CCMP Action Plans. The Coalition translates the CCMP's recommended actions for each town into community specific survey and interview questions. The information generated through these sources is then synthesized into the annual progress report presented at an annual media event. The Baywide Implementation graph (Figure 15) was developed by averaging

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[32] Such goals may include *program goals*, (documentation of shifts in resources and timing), *activity goals*, (educational presentations, septic tank inspections), *BMP goals*, (reporting of specific controls installed) and, *interim water quality goals*, (physical, chemical and/or biological documentation).

each of the town's accomplishments within each CCMP category (Coalition for Buzzards Bay 1995).

Figure 15 illustrates that achievement of the CCMP's recommended actions remains elusive. However, there are some very specific cooperative successes. Efforts regarding on-site disposal systems[33] have been fruitful. All but two towns adopted one hundred foot setback lines from septic leaching facilities to wetlands and surface waters. Septic system inspection, maintenance and siting requirements have improved overall. The establishment of twenty-eight boat pumpout facilities and "no discharge" zones in the towns of Westport and Wareham have almost achieved the action plan goals for boat wastes (Coalition for Buzzards Bay 1995, 5). However, the Bay's most critical problems received the lowest total score: nitrogen management, controlling growth and controlling stormwater runoff (Coalition for Buzzards Bay 1995).

The annual report is an indispensable tool for evaluating the success of particular Buzzards Bay

[33] Title 5, Massachusetts Sanitary Code, was amended in 1994 to make setback lines and other provisions protecting sensitive areas more stringent. The Coalition for Buzzards Bay and the Buzzards Bay Project were active in pursuing more stringent Code language.

BAYWIDE IMPLEMENTATION OF THE CCMP

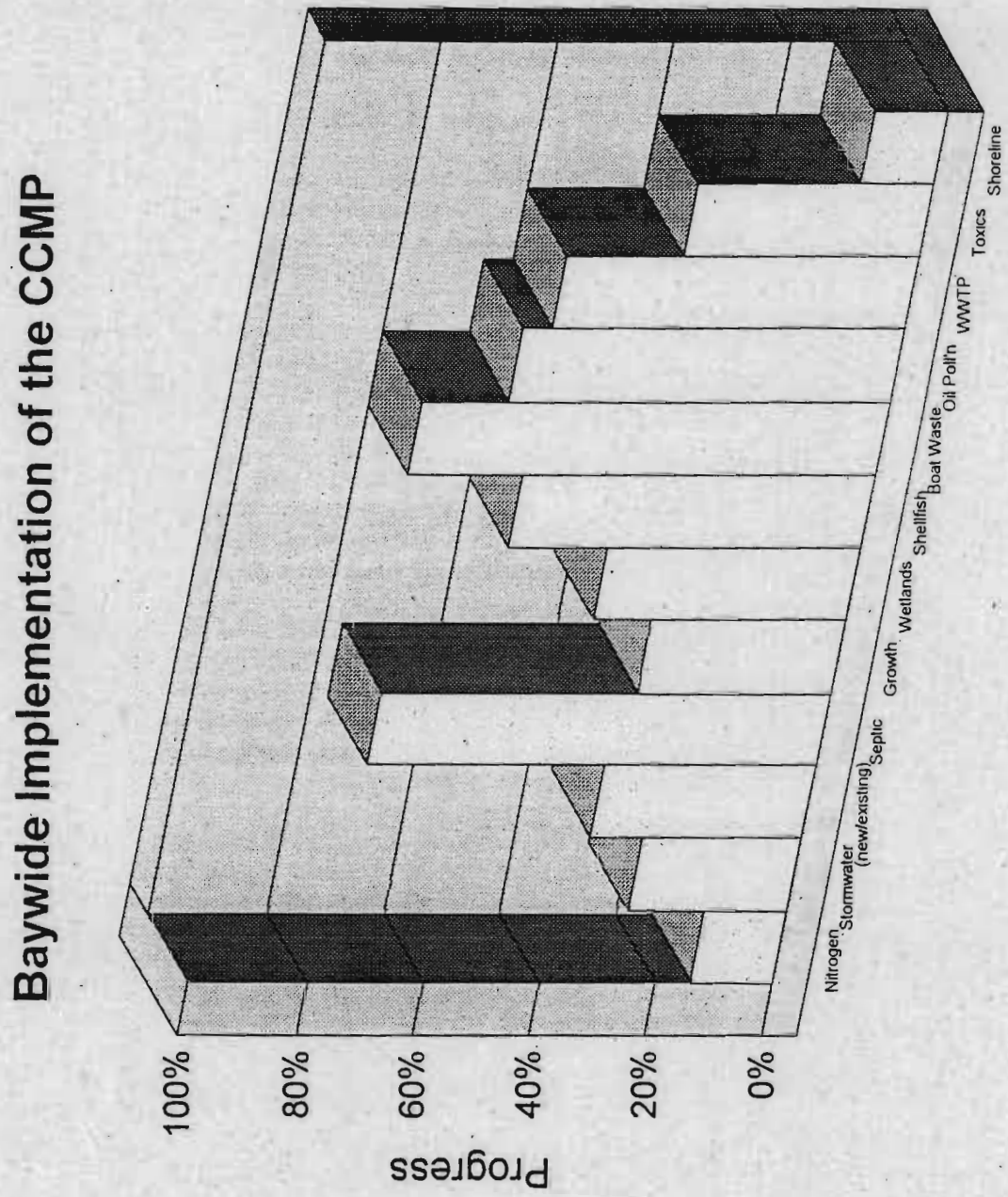

Figure 15. (Coalition for Buzzards Bay 1995, 4).

improvement actions. Its detailed and straight-forward, but tailored approach encourages the practice of adaptive management and information sharing. Visual depiction of successes and failures also helps stimulate continued involvement and renewed effort among communities.

However, the report card format has been criticized as discouraging because poor grades were issued to incomplete projects. In response, the Coalition now issues narrative analysis that recognizes projects in progress (Coalition for Buzzards Bay 1995). Overall response to this method of assessment has been positive. It provides accurate evaluation. Further, the towns' desire for a positive review encourages compliance with action plan recommendations. Finally, the general public has become more aware of the Bay, the CCMP and its implementation through availability of this publication (USEPA 1995d, 12).

Conflicts between Science and Policy

An obstacle created by the representative, consensus-building process inherent in the WPA is that the best scientific option is not always the preferred choice of action (Mlay 1992, 409).

Resource managers and scientists frequently conflict when trying to solve coastal problems because of differing perceptions and needs. Resource managers need current data

to meet statutory and regulatory deadlines. Policy decisions demand simple and quick answers from the scientific community. The scientific community may be hesitant to provide management with answers without having tested and verified initial findings (Mlay 1992, 410).

The BBP anticipated this issue and responded by developing separate science and policy stakeholder groups during certain segments of the CCMP development process. These stakeholders were encouraged to discuss all issues and options within their sub-group, but were discouraged from bringing up complex or especially controversial issues within the framework of the large group. Each sub-group worked to pare down options to those most realistically achievable. This streamlining facilitated consensus and minimized conflicts by refining the list of options then addressed by the larger stakeholder group (Costa 1995). Other mechanisms to fuse science and policy, such as setting priorities within an action plan and reducing project scale, were discussed previously.

Lack of Participation

One foundation of the WPA is the early, consistent and broad-based participation of all affected parties. However, the WPA's reliance on voluntary negotiation and consensus may not encourage appropriate stakeholder

participation. Individuals or agencies may not participate in negotiation if they believe that they can achieve their agenda through other means, such as the courts, the media, or through the political process. Some stakeholders may decide not to negotiate if they are firmly entrenched in their positions or believe they do not have adequate information or resources to achieve their agenda. These issues must be addressed in order to ensure widespread adoption of the WPA.

Because of its consensual nature, development and implementation of the CCMP is susceptible to individual prerogative. One person's objection may block adoption of particular language or implementation of a CCMP task, regardless of the soundness of the partnership. However, this same strength may be expressed in a positive way when a flawed institutional structure can be overcome by the sheer will of its participants (Wakeman 1994).

Possible methods to overcome the participation challenge are federally funded education focused on the "win-win" aspects of watershed management, professional mediation and technical assistance, and grant funding to correct stakeholder resource imbalances and encourage participation (Goldfarb 1994)[34].

[34] Another solution has been proposed in Section 302, "Comprehensive Watershed Management," of the Senate Clean Water Act reauthorization bill, S. 1114 which revises Section 208. State governors would be given the ability to

The Buzzards Bay Project did not experience a lack of participation during the creation of the CCMP. However, communities which did not implement the recommended actions have not participated as fully as needed to achieve the CCMP's goals.

To keep communities interested and communicating, the Buzzards Bay Action Committee (BBAC) was established in 1990[35]. All thirteen members of the BBAC signed an Action Compact committing them to review and update town by-laws and regulations to voluntarily facilitate implementation of the action plans. The formation of the BBAC and the signing of the compact are significant gestures of participation and cooperation given the strong home rule of the region (USEPA 1995d). Chapter Five presents additional details regarding the BBAC.

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designate waters, including groundwater and land areas as watershed management units (intra- and inter-state). This proposal also calls for eligibility for grants to create comprehensive watershed management plans. This would be limited to specific time periods and subject to the federal consistency provision. Although this bill recognizes regional variations and utilizes existing institutions, its rather "top-down" approach may create political rivalries, lack enforceability, and be plagued by funding deficiencies (Goldfarb 1994).

[35] The Buzzards Bay Action Committee is an evolution of the Buzzards Bay Advisory Committee which consisted of representatives of 12 of Buzzards Bay watershed communities and served to coordinate their activities in protecting the resource (USEPA 1995d, 12).

BIOREGIONALISM APPLIED

The National Estuary Program's effort to recognize the interdependence between land and water (Lavigne 1992, 1) is an application of the bioregional watershed protection approach. Three fundamental features of the Buzzards Bay Project illustrate bioregionalism. The BBP:

- reorders political, economic and social institutions around a place - Buzzards Bay tributaries and estuary;
- introduces a new stewardship ethic for water quality and natural resources; and,
- emphasizes regional culture and identity in decision-making (Cannon 1994, 281).

Bioregionalism, in the context of the BBP, confirms the geographic, decentralized and participatory aspects of the watershed approach and adds an ethic of awareness of the complex interrelatedness of natural systems (Cannon 1993).

This interplay stimulates a common interest among watershed citizens, and often leads to formation of watershed organizations, such as the Westport River Watershed Alliance (WRWA). Informed decision-making on the local level helps diffuse typical antagonisms by broadening the focus toward comprehensiveness (Cannon 1993).

CONCLUSIONS

The watershed protection approach evolved from the lessons of past river basin planning efforts. This approach offers a very promising environmental management tool to control NPS pollution in estuaries.

The WPA is suitable for addressing NPS pollution's diffuse origins. The geographic elements of the approach encourage establishment of bioregional programs through watersheds contributing contaminated water to estuaries. The WPA also involves social arrangements to address NPS pollution. These arrangements encourage personal and institutional investment in seeking solutions, ensure stakeholder accountability, and promote maintenance of structural and nonstructural controls.

Although this methodology represents the most logical approach to NPS pollution control, its shortcomings are considerable. Overcoming these obstacles requires, in part, tailoring each project to the unique parameters of its watershed. This refinement is facilitated by the use of adaptive management in watershed projects.

The benefits of this holistic approach are proportional to its adoption. If one town is not participating in a watershed program, the partnership aspect of the program is substantially weakened. The same is true on the state level. States that adopt the WPA more

universally will experience more of its benefits than those that adopt piecemeal WPA projects. Fortunately, for Buzzards Bay and other critical coastal areas in Massachusetts, the state has embraced the watershed protection approach.

CHAPTER FOUR

MASSACHUSETTS AND THE WATERSHED PROTECTION APPROACH

As discussed in Chapter Two, early attempts to institute watershed based management did not prevail in Massachusetts. This is true mostly because the concept was too broad, the political will was absent and the problems afflicting watersheds did not appear to need comprehensive approaches.

However, the lessons learned from basin planning helped lay the foundation for comprehensive, geographically defined efforts in the Great Lakes and Chesapeake Bay. In turn, these experiences facilitated Congress' decision in 1985 to launch an EPA led program in Buzzards Bay[36]. By 1987, Section 320 (the National Estuary Program) of the amendments to the Clean Water Act, formalized these programs.

The BBP continued its watershed focused program to improve water quality of the Buzzards Bay estuary. Development of the Buzzards Bay CCMP embodied the concepts of holism, integration, and participation. By August 1991, the plan was adopted into state policy. This policy helped

[36] Estuary programs were also launched in Narragansett Bay, Long Island Sound and Puget Sound.

shape other agencies' efforts on water issues as they sought a new framework for their activities.

In 1992 and 1993, the watershed approach was formally adopted. Watershed associations, state and federal regulatory agencies, corporations, municipalities and citizens throughout Massachusetts have hailed the WPA as an answer to polluted runoff and other watershed problems (Zimmerman 1995). The efforts of these organizations have resulted in two substantial watershed management efforts: the Clean Water Strategy and the Watershed Initiative.

CLEAN WATER STRATEGY

Overview

In 1992, the Massachusetts Department of Environmental Protection created the Office of Watershed Management as part of its Clean Water Strategy (Hill 1995, 11). This strategy is based on the watershed protection methodology reviewed in Chapter Three. It integrates water resources planning and protection through assessment and permitting of surface water discharges and water withdrawals on a five-year cycle (see Appendix 10).

The Clean Water Strategy establishes 27 river basin teams throughout the state as fundamental planning units for management of integrated activities such as resource assessment, surface water permitting and NPS control

programs. The following five functions are synchronized in a phased program under the Office of Watershed Management:

- water quality monitoring and assessment;
- water withdrawal permitting;
- nonpoint source pollution control;
- awarding of water quality related grants; and,
- wastewater permitting under the National Pollutant Discharge Elimination System (NPDES) (Scholze, Shaver, Harding and Gottlieb 1995).

The Clean Water Strategy is based on three elements: 1) river basin planning units; 2) GIS-based watershed data system; and, 3) better coordinated water programs (O'Donnell 1993). Individual watershed protection projects, like the Buzzards Bay Project, will be examined on a 5-year cycle. This cycle coincides with the renewal schedule of major withdrawal and discharge permits to allow simultaneous evaluation of water quality and quantity (see Table 14 and Figure 16) (USEPA 1995a, xi).

The Clean Water Strategy helps the DEP to focus more attention on cumulative impacts, such as NPS pollution, and more effectively involve the public. The DEP has also embarked on a series of cross coordination efforts to consolidate closely related programs and eliminate duplication (O'Donnell 1993).

EOEA BASIN SCHEDULE

1993 - 1999
Calendar Years

Basin	Assessmemt	Planning	Implementation
Connecticut	93	94	95
Chicopee	93	94	95
Nashua	93	94	95
Blackstone	93	94	95
Merrimack	94	95	96
French & Quinebaug	94	95	96
Boston Harbor	94	95	96
Cape Cod	94	95	96
Narragansett	94	95	96
Parker	94	95	96
Ipswich	95	96	97
Deerfield	95	96	97
Millers	95	96	97
Buzzards Bay	95	96	97
Islands	95	96	97
Shawsheen	95	96	97
Taunton	96	97	98
SUASCO	96	97	98
S. Coastal	96	97	98
Westfield	96	97	98
Farmington	96	97	98
Ten Mile	97	98	99
Housatonic	97	98	99
Hoosic	97	98	99
Charles	97	98	99
N. Coastal	97	98	99

Table 14. (MA DEP 1993).

According to the DEP, a high priority for all watershed efforts is the "protection of wetlands and riparian zones to enhance fisheries, shellfishing, swimming, flood control, public water supplies and wildlife habitat with special attention given to endangered species." Consideration is also given to "appropriate restoration projects for wetlands and riparian zones" (MA DEP 1993, 3).

Individual watershed restoration projects are conducted over three years. In the first year, the watershed is mapped, existing information compiled and initial community outreach conducted. The second year focuses on assessment and development of specific recommendations. The project is implemented in the third year (MA DEP 1993, Appendix B).

The Buzzards Bay Project actually predates the Clean Water Strategy, thus its research has been incorporated into the first year of the three-year EOEA Basin Schedule. Efforts are being focused on water quality assessment issues. The expansive work of the Buzzards Bay Project has enabled the DEP to address second year planning issues. The Action Plans developed in the CCMP will be used extensively by the state in development of third year implementation goals (McRoy 1995).

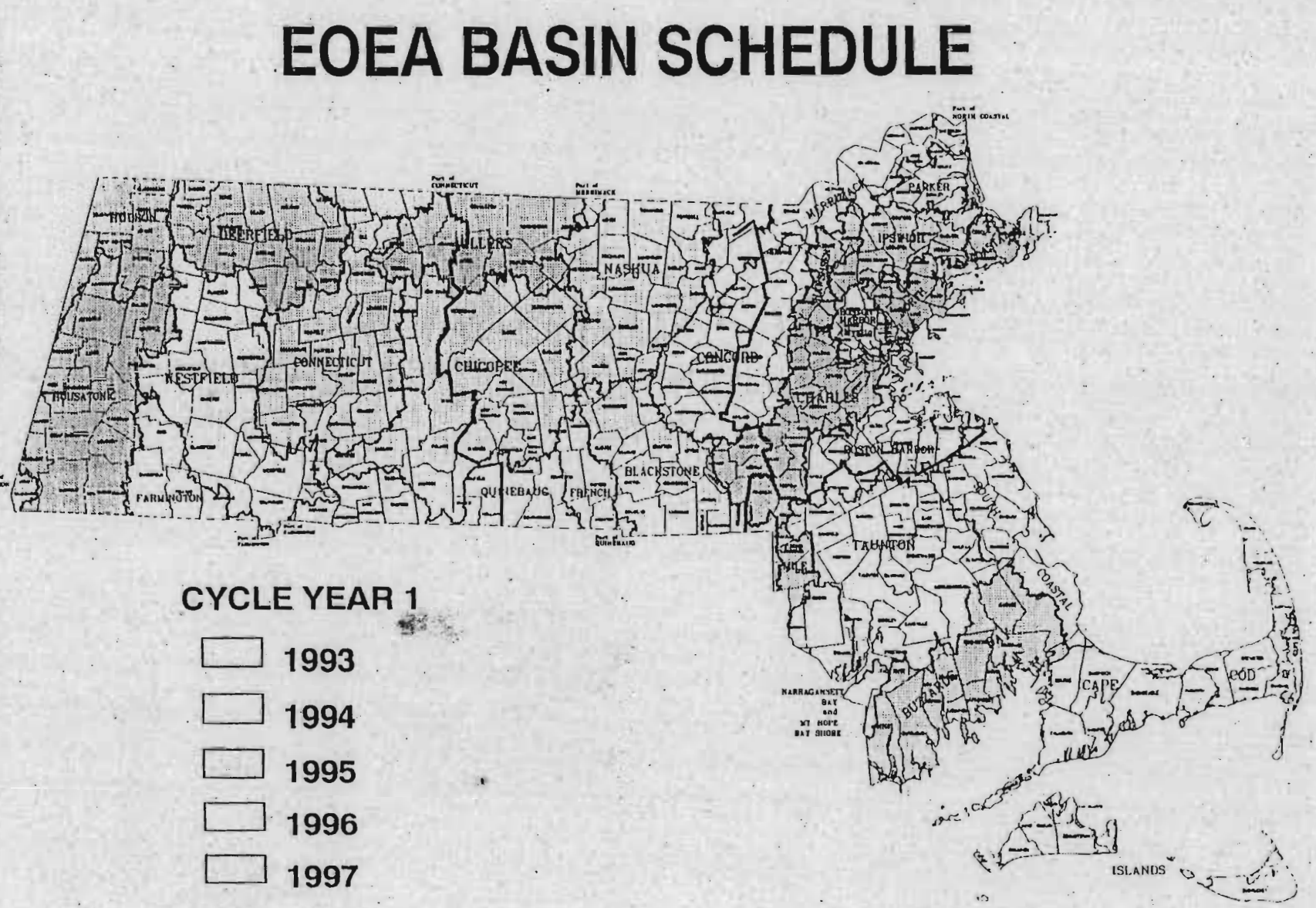

Figure 16. (MA DEP 1993).

Geographic information systems (GIS) will help identify the most risk-sensitive watersheds and set program priorities. The theme of "less process, more protection" will guide efforts to streamline, consolidate and coordinate state programs.

Program Integration

Several aspects of water resources programs under the DEP will be integrated. The DEP uses watershed-based planning to coordinate water quality assessment and water quantity analysis as well as withdrawal and surface water discharge permits (NPDES). The DEP also develops comprehensive water quality and compliance assessment data bases and computerize discharge monitoring reports (O'Donnell 1993).

Nonpoint Source Pollution Programs

State "antidegradation policies[37]" address nonpoint source pollution activities and stormwater discharges. The focus of this effort is on municipalities. Surveys of local government efforts determine local control programs, authorities for implementing state policy, and the degree

[37] All Commonwealth water quality standards include an Antidegradation Policy that requires that an alternatives analysis be conducted before allowing any new or increased discharge or activity having a significant affect on water quality (MA DEP 1993, 4).

of implementation. This information is used to modify programs and authorities to improve implementation of the state policy.

An essential component of watershed protection is wet weather assessments. Pollutant loads from these events are currently the most significant cause of nonattainment of water quality (MA DEP 1993, 5). The statewide watershed effort will focus on land uses and associated pollutants. For example, in the Buzzards Bay watershed, land uses include urban, agricultural and marina. Urban uses are associated with solids, metals, bacteria, nutrients, and pesticides; agricultural uses are associated with solids, nutrients, bacteria and pesticides; and marinas are associated with metals, bacteria, petroleum and hydrocarbons. The DEP will use this information to determine priority subwatersheds within the larger basin, identify pollution sources, and develop appropriate control measures including regulatory and nonregulatory approaches.

Control mechanisms for the wet weather pollutant sources described above may include NPDES stormwater permits, CZARA management measures, pollution prevention education and local by-laws and regulations (MA DEP 1993).

All municipalities within the priority subwatersheds with medium to high urban density will be targeted for pollution prevention and BMPs. Community programs will

include drain management, erosion and sediment control, fertilizer and pesticides control, street sweeping, stormwater treatment, salt and snow storage, as well as an education/outreach program targeting residents. The outreach program will include pollution prevention education regarding toxins, water conservation, waste disposal and other pertinent issues (MA DEP 1993).

Conclusions

The Clean Water Strategy provides an outstanding framework for water programs in Massachusetts and brings needed attention to the watershed approach. This strategy facilitates the goals of the BBP because it institutionalizes many of the CCMP's recommendations to the Department of Environmental Protection. Further, it is the intention to streamline and integrate water programs. The savings that may result may provide additional state money for important water quality protection programs, including the Buzzards Bay Project (Costa 1995).

The Clean Water Strategy also highlights the river as the center of the watershed ecosystem. Publicity around the river basin focus will likely increase public awareness and interest in rivers in their communities and enhance citizen efforts to stem NPS pollution.

THE MASSACHUSETTS WATERSHED INITIATIVE

Overview

The Massachusetts Watershed Initiative was launched in December 1993 to test a model watershed approach in one or more Massachusetts watersheds (Massachusetts Watershed Initiative Steering Committee 1995). Although the watershed approach is already instituted in the Buzzards Bay Project and others[38], the Neponset River watershed[39] was chosen to demonstrate special watershed based coordination of all agencies within the Executive Office of Environmental Affairs. Involved agencies include the DEP, DEM, Department of Fisheries, Wildlife and Environmental Law Enforcement, Food and Agriculture, the Metropolitan District Commission and the Office of CZM.

The Neponset River Watershed Project seeks to protect and enhance water resources, in close association with residents, so that the river and its subwatersheds can support multiple uses (Kennedy, O'Shea, Dunn, Jr. and LeVangie 1995).

The Watershed Initiative focuses on the structure and process by which each Massachusetts watershed can implement

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[38] Other programs based on watersheds include the Massachusetts Bays Program, Merrimack River Watershed Initiative, and the Charles River Watershed Monitoring, Modeling and Management Project.

[39] The Neponset River basin is in eastern Massachusetts, just south and west of Boston.

a watershed-based approach to assessment, planning and decision making. Participants in the December 1993 forum which launched the initiative established a Watershed Initiative Steering Committee (WISC).

The Watershed Initiative Steering Committee and Its Actions

The WISC is made up of representatives of the Massachusetts Watershed Coalition, the Executive Office of Environmental Affairs, private consulting groups, watershed associations, the Department of Fisheries, Wildlife and Environmental Law Enforcement, the EPA, DEM, DEP, the Massachusetts Bays Program, the Natural Resources Conservation Service, the Massachusetts Audubon Society, MA CZM, and others. As illustrated in Table 15, this committee was charged with twelve actions, including developing the Neponset model. The nine highlighted actions are complete, the two in italics are in progress, and the one underlined is awaiting legislative action.

The Massachusetts Watershed Initiative embraces the watershed approach. It incorporates bottom-up, locally focused management, encourages broad-based partnerships and empowers watershed citizens. The EOEA envisions that this

TWELVE ACTIONS OF THE WATERSHED INITIATIVE STEERING COMMITTEE TO FURTHER WATERSHED PROTECTION IN MASSACHUSETTS

1. **Establish a pilot project to implement the watershed approach in one or two river basins.**

2. **Audit state agencies to assess watershed functions and improve interagency coordination within watersheds.**

3. **Focus the mission of the Water Resources Commission on watershed management.**

4. **Implement a watershed data collection and processing program.**

5. *Complete the identification of critical resources statewide.*

6. Pass the Massachusetts River Protection Act.

7. **Implement a watershed based wetlands restoration and banking program.**

8. **Focus EOEA land acquisition plans on a watershed basis.**

9. *Establish broad-based education on watersheds and the watershed approach.*

10. **Urge the Governor's Task Force on the Clean Water Act to examine opportunities for amending the Act to reflect watershed objectives.**

11. **Begin to develop a comprehensive nonpoint pollution control program.**

12. **Hold a second watershed management conference.**

Table 15. (Massachusetts Watershed Initiative Steering Committee 1995).

initiative will provide more effective solutions for nonpoint source pollution and other elusive environmental problems.

Watershed Community Councils and Stream Teams

To pursue such solutions, the Steering Committee calls for the establishment of Watershed Community Councils and Stream Teams. These groups, consisting of diverse stakeholders, including municipal governments and businesses, will oversee watershed management and actively pursue watershed improvement goals. These councils may establish committees to address technical, outreach and education issues. The Community Councils and Stream Teams will use the watershed-wide water quality and habitat assessments performed by the EOEA Basin Teams[40] in watershed planning. The Watershed Initiative includes a state-wide goal for Watershed Community Councils to lead nonpoint source pollution control, with state support

[40] In an effort to reorient agencies toward the watershed approach and improve interagency cooperation, the DEP and DEM jointly developed an EOEA Basin Schedule for assessment, planning and implementation of watershed activities. This schedule is upheld by 21 Basin Teams consisting of representatives of all state and federal agencies with active watershed projects. In 1996, five of these teams will start the assessment phase of watershed management, six will start the planning phase, six will start the implementation phase, and four will be completing implementation activities begun this year (see Figure 15 and Table 15).

(Massachusetts Watershed Initiative Steering Committee 1995).

The Massachusetts Watershed Initiative is important to the Buzzards Bay Project and other coastal environmental efforts because of its emphasis on the role of local governments. As discussed in Chapter Three, the watershed approach gains much of its strength from empowerment at the local level and provides more effective implementation of environmental solutions, especially for nonpoint source pollution. The eleven Buzzards Bay Action Plans well illustrate this local emphasis. The Initiative confirms the significant contributions and benefits from municipal participation. This endeavor works specifically to ensure extensive municipal involvement by offering the incentives listed in Table 16.

Each municipality in the watershed can designate a representative to serve on the Watershed Community Council and on one or more Stream Teams within the municipal jurisdiction. These representatives will work with municipal government officials to represent their interests in the activities of the Stream Team and Community Council. Figure 17 illustrates the framework for watershed management promoted by the Watershed Initiative.

Three organizations, other than the Buzzards Bay Project, provide a regional institutional framework similar

MUNICIPAL INCENTIVES
1. The watershed approach enhances local capacity to address needs and priorities through access to funding, technical assistance and other resources.
2. The watershed approach can help communities achieve effective, consistent implementation of bylaws and regulations, by enhancing communication among local boards within a community as well as between municipalities.
3. Using the watershed approach, cities and towns participate regionally to deal with common issues, such as water supply protection, nonpoint source pollution, etc., within the watershed. This cooperation facilitates sharing of personnel, grants, equipment, access to water quality laboratory facilities and other resources for mutual benefit.
4. The watershed approach ensures local participation and authority in key environmental decisions affecting community concerns.

Table 16. (Massachusetts Watershed Initiative Steering Committee 1995, 11).

to Stream Teams and Community Councils. The Coalition for Buzzards Bay was established in 1987 as the outreach arm of the BBP. The Westport River Watershed Alliance addresses issues in the subwatersheds of both branches of the Westport River, a tributary to the Buzzards Bay. The Buzzards Bay Action Committee, made up of a representative of each of the seventeen municipalities in the Buzzards Bay watershed, promotes the political position of the municipalities (Buzzards Bay Project 1991b). The

interaction of these groups with any future Watershed Community Councils or Stream Teams developed under the Watershed Initiative remains to be seen.

FRAMEWORK FOR WATERSHED MANAGEMENT

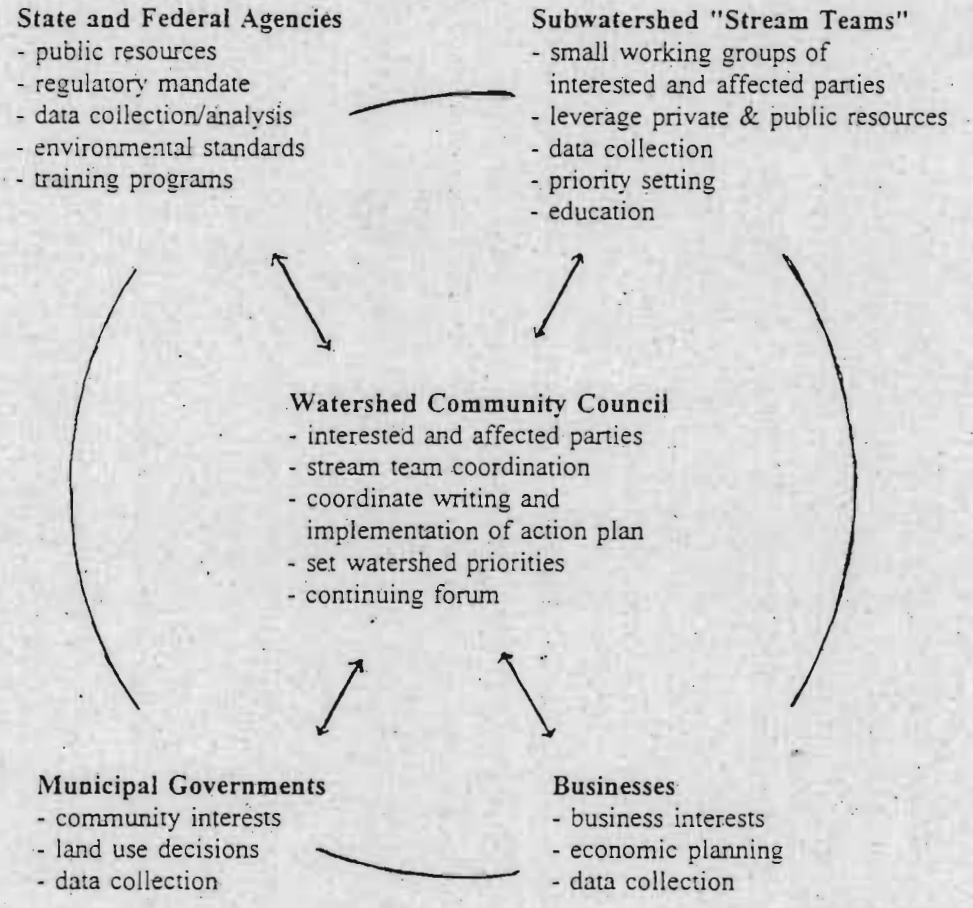

Figure 17. (Massachusetts Watershed Initiative Steering Committee 1995, 9.

FUNDING ISSUES

Both the Clean Water Strategy and the Watershed Initiative provide state water resource agencies with better tools for protection of environmental integrity, inter-agency coordination, and a more local focus. Another crucial aspect to these enterprises is their potential to improve the funding picture for water activities in the state. This aspect is especially important to the Buzzards Bay Project as discussed in Chapter Three.

The Clean Water Strategy's plan to streamline agency programs is designed to improve the cost-effectiveness of water programs (Scholze, Shaver, Harding, and Gottlieb 1995). The Watershed Initiative will seek funding from the Massachusetts Open Space Bond Bill[41] and matching funds to provide either comprehensive basin assistance or capacity building assistance. All but five watersheds will receive their standard EOEA Basin Team assistance in accordance with the Basin Schedule.

CONCLUSIONS

Both of these state initiatives are important departures from Massachusetts' past basin planning experiences. Although containing similar elements of

[41] This particular funding source was chosen because open space protection is key to watershed protection.

previous efforts, these later endeavors are much more ambitious and enjoy broader support.

The Clean Water Strategy focuses on cross-program coordination, watershed-based programming, elimination of redundancies and enhanced information sharing. Through this determined effort, the DEP can set priorities for critical resources areas and target those activities posing the greatest threat (Scholze, et al. 1995).

The Watershed Initiative focuses on increasing involvement and coordination of state agencies, local conservation commissions, planning boards, boards of health, public works departments, and private entities in the control of nonpoint source pollution. Such leadership is centered in Watershed Community Councils, with the state playing a supporting role (MA WISC 1995).

Statewide implementation of both of these watershed oriented management schemes will expand the collective ability of state and local agencies to protect and improve environmental quality. These endeavors seek strong partnerships and reinvention of the management of the environment--the bold approach taken by the Buzzards Bay Project.

CHAPTER FIVE

IMPLEMENTING THE BUZZARDS BAY PROJECT: THE ROLE OF LOCAL GOVERNMENTS AND PUBLIC OUTREACH

The preceding chapters emphasized the importance of local governments and public outreach. This chapter addresses these aspects of environmental management in greater detail through examination of the Westport River case study.

LOCAL GOVERNMENT IMPLEMENTATION

Local Authority

As illustrated in the previous chapter, Congress has recently increased state and local government's implementation of federal water pollution policies. In an effort to alleviate the unwieldy centralized approach to environmental protection, federal funds have been steadily reduced and local responsibility increased (Apogee Research, Inc. 1993, 12). States have taken a wide variety of approaches to deal with this increasing responsibility. Thirty-six states have launched regional or river basin efforts (Apogee Research, Inc. 1993, 26).

Municipalities with water responsibilities usually have some management responsibility for water supply, sewering, wellhead protection, septic system regulation, recreation, riparian buffer protection, local construction

(roads and buildings), wetlands protection and flood control (Goldfarb 1994, 497). Many municipalities endorse watershed management as a solution to NPS pollution. This is true because it provides local civic and business leaders with the ability to suitably tailor responsibilities (see Table 17) (Silverstein 1994, 28).

Nearly all watershed projects focus on increasing the role of local government. Such empowerment is essential because it enhances the ability to cooperate, understand and resolve watershed issues (Yohe and Luitweller 1994, 258). Another essential component of watershed project implementation is the support and participation of individual residents of the watershed.

Success of local approaches may be limited by the need to address a small geographic area, inadequate funding, lack of a constituency, and a perception among watershed residents and local officials that local tasks are only "patchwork" fixes (Pacific Rivers Council 1993b, 253).

Local Government Players

Nonpoint sources of pollution due to growth and development are the primary reason for habitat loss and water quality decline in Buzzards Bay. The major regulatory boards (Planning Boards, Conservation

ACTION PLAN RELEVANCE FOR PROTECTING BUZZARDS BAY WATER QUALITY AND RESOURCES

Action Plan	Community in Buzzards Bay Drainage Basin																
	Acushn[1]	Bourne	Carver	Dartmo	Fairha	FallRi[1]	Falmou	Freeto[1]	Gosnol	Marion	Mattap	Middle[1]	NewBed	Plymou[1]	Roches[1]	Wareha	Westpo
Managing N-Sensitive Embayments		•[2]	§	•[2]	•	§	•[2]	§	§	•	•	§	§	§	§	•	•[2]
Protecting Shellfish Resources		•[2]		•[2]	•[2]		•[2]		§	•	•[2]		§			•[2]	•
Controlling Stormwater Runoff		•[2]		•	•		•		•	•[2]	•		§			•[2]	•
Managing Boat Waste		•		•[2]	•		•		•	•	•		§			•[2]	•[2]
Managing On-Site Systems		•[2]	§	•	•		•[2]		§	•[2]	•	§		§	§	•[2]	•[2]
Preventing Oil Pollution	§	•[2]		•	•		•[2]		•	•[2]	•[2]		•			•[2]	•[2]
Protecting Wetlands and Marine Habitat	•	•	§	•[2]	•	§	•	§	•	•	•	§	§	§	§	•	•
Planning for Shifting Shorelines	§	•		•	•		•		•	•	•		•			•	•
Managing Sewage Treatment Facilities	§			•	•		•			•			•			•	
Reducing Toxic Pollution		§		•	•		§		§	§	§		•			•	§
Managing Dredging and Dredged Material	•	§		§	•		§			§			•			§	§

Key

• = high
§ = moderate
= little or none

[1] These municipalities have little or no coastline on Buzzards Bay, therefore marine water-based action plans to protect Buzzards Bay water quality and coastal resources do not apply. Because Plymouth and Fall River have significant coastlines not on Buzzards Bay, many water-based action plans will be of interest to these communities. Some water quality action plans apply to inland communities traversed by major streams or rivers.

[2] These municipalities have agreed to pursue CCMP recommended actions or have already taken action.

Table 17. (Buzzards Bay Project 1991b, 181).

Commissions, Boards of Health, and Boards of Appeals), and town leadership (Selectmen, Mayor, Town Council) hold joint responsibility and authority to implement the CCMP recommendations to stem these impacts (Coalition for Buzzards Bay, 1).

Initially, local government may be hesitant to embrace their new roles in CCMP implementation. Often, local governments do not have the expertise necessary to adequately address issues. As shown in Table 18, about half of Buzzards Bay communities in Massachusetts do not have professional planners, conservation agents or civil engineers on their staff. However, these municipalities have authority regarding zoning, wetlands and septic systems. Implementation of the recommended actions of the CCMP tends to be more ambitiously embraced among those municipalities with these professionals on staff. Therefore, advocates of the BBP are urging local boards to create these positions where they are lacking (Rasmussen 1995).

Joint leadership with state or federal agency staff may ameliorate this deficiency, as can clearly stated goals and objectives (Battle, Summers and Hall 1994, 265). Understanding tangible program goals and objectives and having immediate access to technical assistance will foster a sense of trust and confidence among participants and

encourage more fluid implementation of action plans (Foster 1990, 15).

PROFESSIONAL STAFF ON BUZZARDS BAY LOCAL BOARDS

	CONSERVATION AGENT (agents/towns)	PROFESSIONAL PLANNER (planners/towns)	CIVIL ENGINEER (engineers/towns)
FULL TIME	6/16 (37.5%)	6/16 (37.5%)	8/16 (50%)
PART TIME	4/16 (25%)*	0/16	0/16
NONE	6/16 (37.5%)	10/16 (62.5%)	8/16 (50%)

*Includes plans to create position.

Table 18. (Rasmussen 1995).

Municipalities make daily decisions that address nonpoint source pollution, minimize or prevent risks and secure funding for the comprehensive planning necessary to implement watershed programs (Weiss 1995). These decisions may occur on several levels, and may:

- be site-specific (e.g., septic system placement);
- address a wide range of issues in a subdivision plan (e.g., requiring "green" landscaping practices); or

- involve development of a comprehensive plan that addresses all issues, including growth.

Local governments must support and implement the full range of necessary watershed projects to reduce NPS (Smith and Coffman 1995). Some towns have organized a regional or sub-watershed approach to water quality problems, such as the inter-municipal zoning scheme adopted by Wareham, Bourne, and Plymouth to protect the nitrogen-sensitive Buttermilk Bay drainage basin. On the western end of the Bay, the Westport River Watershed Alliance has organized around that river and its tributaries. The WRWA's focuses on efforts to re-open shellfishing currently closed from fecal coliform contamination and high nutrient loading.

As shown in Table 17 on page 114, municipalities play a substantial role in all eleven action plans. However, the case study discussed below focuses on the action plan to protect shellfish resources.

CASE STUDY: SHELLFISHING RESOURCE PROTECTION

Introduction

Since the 1970s, an increasing number of shellfish-harvesting areas in Buzzards Bay have been closed due to pathogen contamination (see Figure 18). In 1970, slightly more than 4,000 acres of shellfish beds were closed; by 1991, approximately 13,200 acres were closed. Buzzards Bay

contributes approximately 25% of Massachusetts' total commercial shellfish landings. Loss of these resources represents significant economic harm and has warranted priority attention by the Buzzards Bay Project (Buzzards Bay Project 1991b, 55).

ACRES OF SHELLFISH RESOURCE AREAS CLOSED IN BUZZARDS BAY DUE TO COLIFORM CONTAMINATION

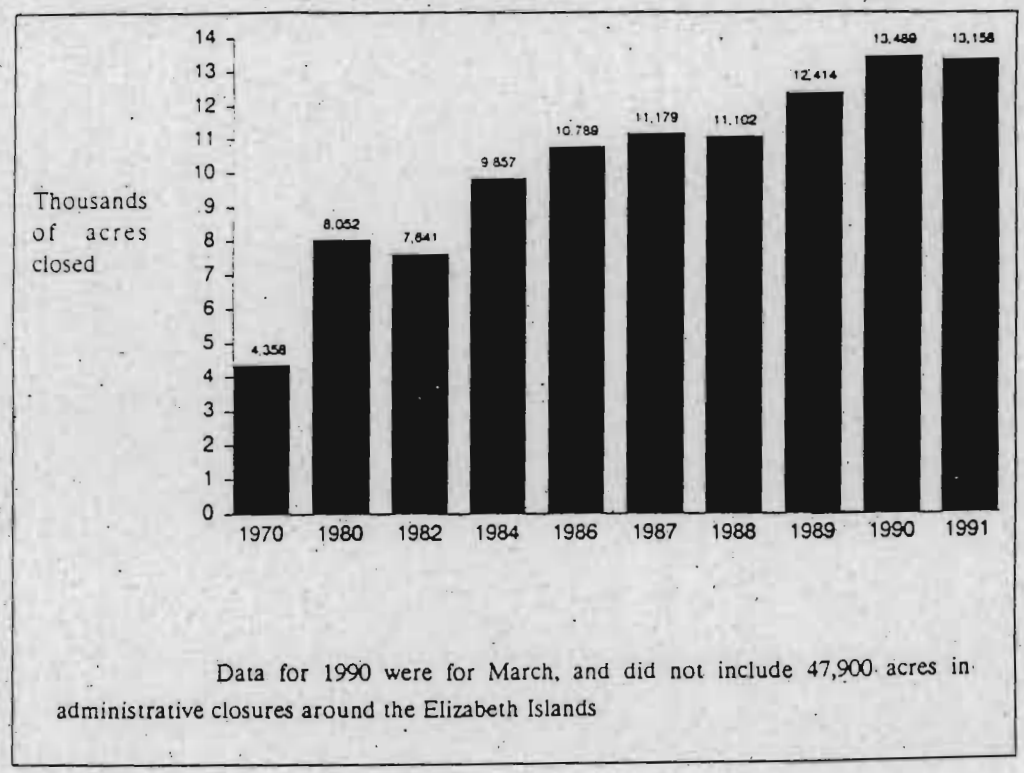

Figure 18. (Buzzards Bay Project 1991b, 55).

Under the Protecting Shellfish Resources Action Plan, the BBP has identified the following objectives:

1) to keep open all shellfish areas and open priority areas that are closed.

2) to enhance management of shellfish resources at the state and local levels.

3) to increase the capacity and commitment of towns to control identified pollution sources and help conduct the sanitary survey program.

4) to increase the ability of DMF to carry out the sanitary survey program and provide technical and financial assistance to towns.

5) to fully open the conditionally approved[42] shellfish areas (Buzzards Bay Project 1991b, 61).

The Westport River

In September 1990, volunteer fecal coliform bacteria sampling and testing began in both branches of the Westport River. The WRWA sponsored the Adopt-a-Watershed outreach program, in cooperation with the DMF, the Westport Board of Health, the Westport Fishermen's Association, and the BBP (see Figure 19). Over the years, this testing has expanded into tributary streams and other special sites funded by grants from the Massachusetts Environmental Trust (Westport River Watershed Alliance 1994a). This research has confirmed the relationship between periodic rain events and bacterial contamination in the river (WRWA 1994a, 6). In

[42] The state sanitary survey classification includes approved, conditionally approved, restricted, conditionally restricted, and prohibited categories. Conditionally approved areas are those open under certain defined conditions. Restricted areas contain moderately contaminated shellfish which can be harvested for purification. Conditionally restricted areas can be harvested when contamination is predictably low. Shellfish in prohibited areas can not be harvested.

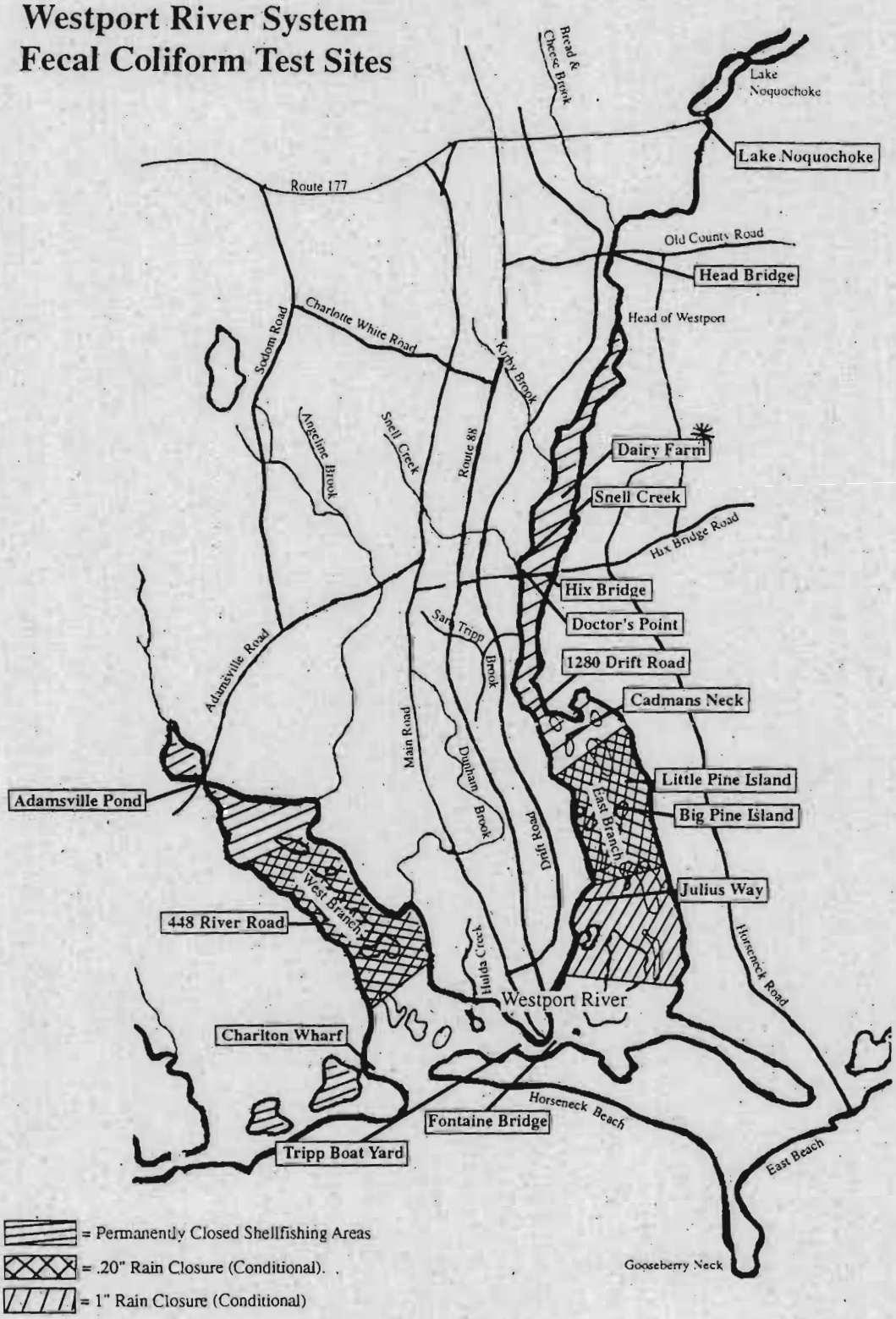

Figure 19. (Westport River Watershed Alliance 1994).

1994, almost 400 acres of shellfish beds were opened conditionally based on this wet weather finding (Coalition for Buzzards Bay 1995).

In Westport, the greatest contributors to fecal coliform pollution are runoff from cow feedlots, failed septic systems and general runoff from all land areas. Known as the "coastal agricultural resource community of New England," Westport has dairy farms adjacent to the river and wetlands. During substantial rain events, water washes over cow feed-lots before it drains into the river. The problem has intensified recently as Westport dairy farmers have increased herd sizes and/or begun raising beef cattle to compensate for decreased milk prices (WRWA 1994b, 13).

Snell Creek

One particular trouble spot is associated with the Pimental dairy farm located north of Hix Bridge Road on Snell Creek, a tributary to the East Branch of the Westport River (see Figure 19). This farmer has not installed BMPs. Livestock are not contained in feed-lots, process water from the milking barn is not treated, and manure is not stored or treated in any way.

The most important factor is that the farmland is seriously stressed by too many cows for its size. The

Westport Farmers and Westport Fishermen's Associations have assisted in establishment of a vegetative buffer strip between the farm and the creek, but this buffer is not providing appropriate protection. This is true because the vegetation is buried in a continually growing layer of manure currently three to five feet deep (Gillespie 1995). Clearly, this circumstance severely curtails the buffer's ability to slow runoff or filter wastes.

Generally, town management and boards would assist in resolution of situations of this type. Assistance may also come from state or federal agencies, from public pressure applied by nonprofit environmental organizations or civic associations, or some combination of these channels.

The Role of Local Government

The Conservation Commission has responsibility for upholding the Wetlands Protection Act (which addresses riparian areas). The Board of Health addresses sanitary issues, including shellfish health and septic system operation. The DEP assists local boards in upholding the Wetlands Protection Act and is an active player in the Buzzards Bay Project. The EPA generally does not become involved with small-scale issues, but provides guidance regarding best management practices for agriculture and urban areas.

Successful implementation of many of the Buzzards Bay Project's recommended action plans hinges on voluntary compliance with BMP regulations. Compliance with recommended BMPs, such as detention basins, reducing the dairy cow population and restoring the buffer, would solve the Snell Creek problem. However, the Town of Westport's political climate is unfavorable to such simple resolution.

A number of factors may contribute to these types of problems. Local organizations such as Conservation Commissions and Boards of Health may consist of individuals not particularly aware of, interested in or concerned about environmental protection. There may also be strong resistance to environmental controls from private property interests, developers, or business interests. Local boards may "play favorites," and administer compliance standards inconsistently. Finally, local advocacy organizations may not have strong influence on local boards or may be limited in their activities by inadequate funding and staffing.

In the Snell Creek case, the farmer cannot reduce the density of cows without suffering economic hardship. Representatives from state and local government responsible for eliminating this problem have been reluctant to enforce existing rules and regulations as these may jeopardize the farmer's ability to stay in business.

Clearly, these factors dampen the effectiveness of local boards which debilitates the efforts of local environmental organizations and civic associations to rally watershed citizens around a remedy. Another factor confounding resolution may be the unavailability of funding for state or federal agencies.

The status of this particular farm also complicates the situation. In the late 1970s, the development rights were sold to the Massachusetts Department of Agriculture through the Agriculture Preservation Restriction (APR) program. This transaction ensures that the property will remain a farm in perpetuity (Gillespie 1995). It appears that the farm's designation as an APR property has dissuaded DEP from aggressively approaching this farmer. A further complicating factor is the exemption of farms from portions of the state Wetlands Protection Act.

Three developments may help solve this problem and begin the lengthy process of shellfish restoration. In 1996, the EPA will conduct a thorough inspection of the farm property and issue recommendations to the farmer for improvement of his facilities (Gillespie 1995). Also, individuals less exposed to political pressure are beginning to urge local boards and the DEP to more appropriately address this problem. Perhaps public pressure through the media, such as a persuasive letter to

the editor, will stimulate a resolution. Finally, the Westport area's increasing notoriety for viticulture may provide the farmer with a less environmentally troubling agricultural option (Rasmussen 1995).

Public Outreach

Without active local involvement, efforts to maintain and restore watersheds will not move from the planning stage into implementation (Pacific Rivers Council 1993b, 84). This is especially important to NEP projects since this program has suffered because of the absence of a nexus between planning and implementation.

Importance of Education

Informing and involving the public about nonpoint source pollution may be the most difficult aspect of the NEP. This is particularly true in cases such as Snell Creek where local and state government response hinders efforts to solve problems. Educational programs are fundamental to watershed project success because they increase awareness and stewardship of the natural watershed system. Such programs also provide incentives for behavior change among certain groups such as developers, farmers, municipal permittees, and local officials (USEPA 1995a, 4-7).

Geographic initiatives, such as the BBP, attempt to cultivate regional responses to environmental crises and stimulate behavior alteration in that region (Reilly 1991). Educating the public about nonpoint pollution is essential because of the inherent individual contribution to, but lack of awareness about, the problem. The challenge is to promote change in human behavior in daily activities at home, at work, on farms and during construction.

BUILDING A CONSTITUENCY

Some marine environmental issues, such as control of point source pollution, have an inherent public appeal and benefit from animate citizen action efforts. Pollution pouring out of a pipe has an immediate visual impact that incites indignation among the public sectors. This reaction builds a constituency with clear objectives and strong motivations.

Nonpoint source pollution does not benefit from these attributes. The scientific issues surrounding nonpoint source pollution are more complex, its origin is diffuse, its impacts are initially invisible, and its solutions seem vague and overly broad. These factors make outreach programs regarding NPS pollution difficult to construct and sell to the public. As a result, the public remains virtually unaware of nonpoint source pollution and their

particular role in its control. Stimulating a sense of place and encouraging personal participation and involvement are crucial to successful outreach and education programs. Each is discussed below first generally, then in the context of the Westport River/Snell Creek case.

The Role of Place

Local government and citizens must feel ownership of watershed projects in order to support them (USEPA 1995a, 2-3). Humans appear to function more effectively within defined parameters, and value "belonging" somewhere (Foster 1990, 13). People define their neighborhood, town and region as where they belong. Individuals strongly value this sense of home territory. Members of the same territory, irrespective of scale, tend to perceive each other as similar and have a greater propensity to engage in similar activities (Kling and Posner 1990).

For example, as a region, New England is exceptionally self-aware, homogeneous, and interdependent socially, physiographically and economically (Foster 1990, 11). People recognize the strong home rule of the region and share pride in its history. The Buzzards Bay region and other coastal areas enjoy a strong maritime tradition which further stimulates the conscience of the public to

participate. Public outreach activities and institutional interactions must respect these cultural values to facilitate desired outcomes (DuPraw 1993).

Public Participation

Efforts to improve the estuary will affect all watershed citizens. They will be asked to change their habits (by conserving water or upgrading septic systems), share an increased tax burden, or have their property uses limited (USEPA 1989, B1). Outreach programs must generate an awareness of the ecological, social and economic benefits of restoration. Such awareness is more likely to increase acceptance of restoration projects (Pacific Rivers Council 1993b, 44). It is crucial that local citizens are involved in decisions regarding planning, developing and implementing watershed projects. An open, visible and unhampered process will encourage such participation (Pacific Rivers Council 1993b, 43).

Westport River/Snell Creek Outreach

The problems plaguing this sub-watershed have not benefited from strong public outreach efforts. This is partially due to a lack of a sense of place regarding Snell Creek. Although Westport River is appreciated as a source of shellfishing and the home of the successful Westport

Rivers winery, Snell Creek does not enjoy similar recognition or the associated stewardship. The creek is dry for substantial periods of the year and in many areas offers very restricted recreational and commercial opportunities. Sections of it are nearly invisible due to thick overhanging vegetation (Gillespie 1995). Feelings of sense of place connected with the creek and by association the river and the bay are limited to those individuals already involved in sampling and other outreach programs.

Environmentalism is not fully embraced in Westport. The town is moderately divided into two factions: those concerned about protecting ecological integrity and those advocating development and agriculture. In between these two polar positions there are many people who choose not to be involved. Thus, citizen interest regarding Snell Creek is limited to those already involved.

Efforts to educate citizens have not met the expectations of the primary watershed protection group, the Westport River Watershed Alliance. This group believes that many people are still not aware of the complexities of the issues, and that others have chosen not to become involved, despite efforts of the WRWA to reach out to all sectors of the sub-watershed (Gillespie 1995). This is not unusual in environmental remediation efforts undertaken in

the US and reflects the diminutive role that environmental ethics plays in individual lifestyle choices.

ENVIRONMENTAL ETHICS

Green Ethics Defined

The 1990s has seen some increased concern for environmental or "green" issues among the general public. Environmental concerns are triggered by interests in preservation of biodiversity, aesthetic interests or interests in protecting public health (Reich 1990a, 67). Most people are motivated to act in accordance with ideas about what is good for society (Reich 1990b). However, definitions of what is "good," are subject to individual interpretation. Further, each individual defines his contribution to "green living" differently.

The debates among entities about what is "green," and what is not have generated renewed focus on environmental ethics. Environmental ("green") ethics is loosely defined as the reconceptualization of what is appropriate human behavior toward the environment, and includes practical expressions of the relationship between humans and the environment. Practical expressions include a commitment to:

- a reduced human population,
- creating less impact by one's lifestyle, and

- improve the natural world among individuals and within families, firms and communities.

Environmental ethics recognizes that most people are locked into a consumptive lifestyle (Sylvan and Bennett 1994). A prime example of this catch is our reliance on automotive transportation. Although we may want to use our cars less, societal infrastructure makes public transportation either unavailable or so inconvenient as to be unfeasible.

In the Westport River/Snell Creek case, the "consumptive lifestyle" of concern is individual contributions to nonpoint source pollution. Residents may not want to contribute to degradation of shellfishing through nonpoint source pollution, but may not be aware of, or know how to end, their contribution. Further, residents may feel that it is too risky to change the status quo and seek alternatives. Finally, they may not understand the connection between the long-term impacts of nonpoint source pollution and lifestyle changes. These factors lead to inaction.

Environmental Inaction and Individual Responsibility

One of the fundamental challenges to establishing an environmental ethic is breaking the inaction cycle. This revolves around several premises:

- individuals can only pursue significant lifestyle changes given changes in social arrangements;
- social planners, politicians and others are able to achieve social change;
- however, these entities are often committed to the status quo;
- thus, those able to achieve social change observe individual revealed preferences and incorrectly conclude that changes are not really desired[43] (Sylvan and Bennett 1994, 207).

To overcome this cycle, individuals must pursue more substantial actions than joining an organization and/or engaging in passive environmental activities, like birdwatching. Individual and household lifestyles must reflect their commitment to ecological soundness through actions such as:

- reducing or eliminating consumption of items which cause, or whose supply and disposal cause, environmental damage;
- making environmentally sound purchases and investments;
- boycotting irresponsibly created goods;

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[43] Preferences are "revealed" in the actions or "inactions" we take, but are strongly influenced by what options are available. For example, if a consumer desires "green" household cleaning materials which are not available in the usual grocery store, the consumer cannot exercise his/her real preference by purchasing it. When this consumer purchases chemical cleaners typically available, it reinforces the manufacturer's and marketer's assumption that the preference was for all the attributes of the products, not just its convenience. They conclude that the "green" product is not really preferred and continue to market other cleaning products.

- voting for "environmental" candidates.
- encouraging and assisting environmental awareness in others;
- participating in pro-environmental activities; and,
- engaging in lifestyle alternatives such as organic gardening, composting and repairing rather than disposing of durable goods (Sylvan and Bennett 1994).

Most people currently engage in only "mainstream" green activities, such as curbside recycling and reusing grocery bags. They may belong to a national environmental organization, but most likely do not actively lobby their representatives or use their buying power as a tool to advance an environmental agenda. This important, but somewhat superficial, "greening" of America reflects our response to information overload and limitations on our time and finances.

Frequent receipt of materials from various sources demanding time, funds and attention can overwhelm innate concerns about environmental issues. Instead of making conscious choices about which issue and which cause to support when, the consumer may simply choose not to act on any of the new demands. Instead, the individual upholds their status quo and continues to recycle, reuse garbage

bags and perhaps support their favorite environmental organization.

Another element contributing to inaction is human perception and attitude toward the ocean environment and our own role in protecting water quality. Most people now recognize that the ocean cannot be used as an eternal waste dump, but still associate ocean pollution with industry or waste treatment plants. We have yet to fully realize how our individual contributions to nonpoint source pollution affect the estuarine and riverine ecosystems.

Most people do not associate water quality loss with routine activities such as: over-fertilizing lawns, ignoring maintenance of the septic system or neglecting to use or maintain best management practices on the farm or in the subdivision. In the case of the Westport River, these activities have caused the closure of shellfishing. However, many citizens continue to implicate other sources, either not knowing, or refusing, to start solving the problem by changing their own behavior.

Groups interested in addressing the individual's role in nonpoint source pollution control must recognize that the target group for their message may be part of this "mainstream." Thus, they must strive to incorporate their message into mainstream environmentalism. The most formidable challenge to such efforts is conquering the

inaction cycle. Activities such as water conservation, judicious pesticide and fertilizer use, use of non-toxic household cleaning agents and others are usually not integrated in daily lifestyles. The most logical method to begin to inculcate such daily activities is through environmental education.

ENVIRONMENTAL EDUCATION

An extensive discussion of environmental education is beyond the scope of this paper. However, it is important to understand the basic elements that contribute to effective education programs. Chapter Six contains recommendations for environmental education and public outreach regarding NPS in Buzzards Bay.

Target Audiences and Outreach Techniques

Effective education programs target the appropriate audience and utilize the most appropriate outreach techniques for that audience. Most projects attempt to cultivate a long-term environmental ethic in target audiences such as schoolchildren, teachers and among members of civic organizations (USEPA 1995a, 4-8). Teaching students focuses on future decision-makers, may recruit watershed program participants and perpetuate adoption of environmental ethics (Burk 1993). Many fewer

programs target adult decision-makers. However, focusing on affecting routine decisions of home and car owners may result in a substantial decrease in nonpoint source pollution.

Environmental outreach programs frequently rely on canvassing in person and by telephone. Most such efforts seek public support for legislative or regulatory changes (Fullmer 1993). Outreach techniques may also include involving individuals in water quality monitoring and storm drain stenciling[44] activities, conducting public surveys and conducting multi-media and mass media campaigns.

Citizens in the Westport River watershed are involved in the following projects:

- River Day, an annual educational festival;
- the River News, a newsletter discussing local, regional and national environmental issues;
- the Watershed Educational Program, a curriculum program for schools; and
- a WRWA sponsored annual beach clean up (Westport River Watershed Alliance, undated).

[44] Storm drain stenciling programs combine art, environmental education and hands-on learning. The premise is that most people are not making the connection between point and non-point sources of pollution and the impacts on coastal areas such as Buzzards Bay. Educators use stencils (cut-outs) with messages like "drains to the bay," to make that connection. Typically, participants study maps of the town highlighting storm drains, then paint the message onto the visible part of the drain. The goal is to increase awareness of the participants and all people passing that particular drain.

Water quality monitoring programs engage volunteers in surveying, monitoring and restoration activities. Concurrently, the watershed project obtains valuable data and publicity for the program (Firehock 1993). Most activities are in the field, but some involve desk-top publishing, data entry, or other skills as needed.

Although initially labor intensive for the watershed organization, the experiential learning afforded by these programs is particularly effective. This is especially true if participants are rewarded with variety, increasing responsibility, and sincere appreciation (Firehock 1993). However, these programs tend to attract "the converted"--individuals already aware of, and committed to, watershed issues and water quality protection. Non-volunteers may be those who are contributing greater volumes of NPS through routine activities.

Many communities both in and out of the Buzzards Bay region have embraced activities which focus on making the connection between stormwater runoff, NPS and individual responsibility. One such program is storm drain stenciling previously discussed (Macleod and Halperin 1993).

Another useful NPS outreach tool is the public survey. Such surveys can: measure community environmental awareness, determine the extent of residents' daily activities affecting NPS, evaluate community perception of

the project, and identify the target audience and any special communication needs (see Figure 20). This technique is not currently used anywhere in the Buzzards Bay watershed.

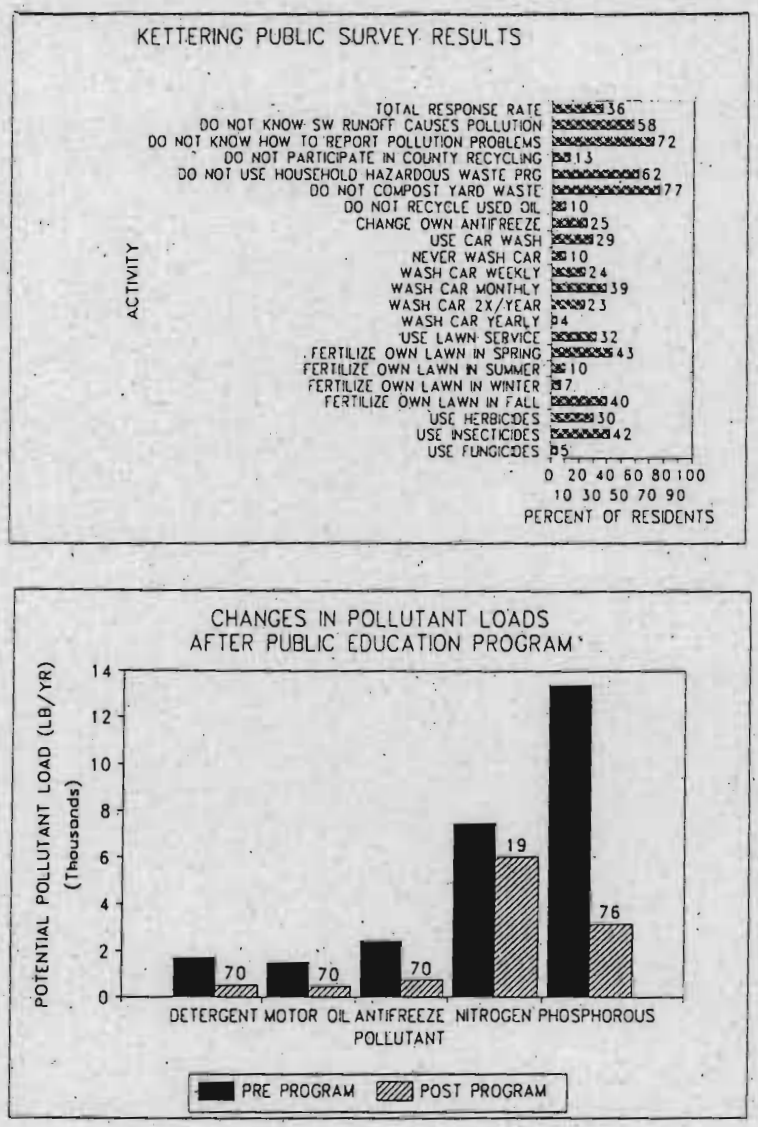


Figure 20. (Smith, Collins, Cavacas and Lahlou 1993, 460).

An innovative program for answering the challenge of NPS pollution is a multi-media campaign designed to educate community members about simple and specific ways to help restore and protect water resources. The Lake Michigan Federation conducts one such campaign, "It's All Connected." This model program includes home surveys, audio-video presentations, public service announcements, printed materials as well as curriculum material, storm sewer stenciling and local volunteer activities. It is available to other communities for adaptation to their watershed (Bero 1993).

A similar, but more extensive outreach technique is the professional mass media campaign. These campaigns include public information and education through a slogan, logo, mascot, radio tag, radio and television public service announcements (PSAs), as well as video and billboard messages regarding NPS pollution prevention. The Buzzards Bay region is currently not conducting either type of campaign mostly due to expense.

However, in Dane County, Wisconsin, one such campaign was made possible mostly due to donations. This campaign had the following goals:

- develop a public constituency around water quality protection;
- educate the public about how water quality is affected;

- connect resident actions and county water quality;
- provide guidance for individual behavioral modifications to improve water quality; and
- reduce sediment and nutrient loadings in the county services (Van Vlack 1993).

Some of the specific elements of the program are innovative and may provide a model for the Buzzards Bay Project.

The campaign's success revolves around its clever theme and design. It appealed to values central to most people: pride, self-worth, responsibility, and self-interest. Although the program addressed a broad audience, it stimulated specific actions related directly to improved water quality by appealing to the power of individuals.

The specific products of the campaign are also illustrative. The name, WaterWatch, was chosen to stimulate a focus on daily behavior regarding water consumption and disposal. The logo (a timepiece inside a water drop) emphasizes that change cannot be delayed; the slogan, "Make Your Drop Count," appeals to individual responsibility and respect for water resources without assigning blame.

To also focus attention to water quality, the campaign adopted "You're the solution to water pollution." The mascots, Papa Drop and Droplet--depicting a male and female character from two generations--are used in school

programs, parades, festivals and fairs. The television PSAs address individual actions influencing water quality, such as keeping leaves out of storm sewers; the radio spots complement the videos. Donated billboard space sends the message, "You're the solution to water pollution." Community access stations run a longer video that takes a humorous approach to NPS. Finally, widely distributed brochures inform readers about the campaign, the issues, and what they can do (Van Vlack 1993).

CONCLUSIONS

Education and outreach are seminal elements of stimulating awareness about NPS pollution control. This awareness is instrumental to bringing together all of the aspects of watershed protection discussed in this chapter.

Voluntary compliance with recommended action plans in the CCMP, especially at the local level, is indispensable to achieving the CCMP's goals. A variety of socio-economic and political quandaries often hinder local governments' ability to comply. Similar obstacles may limit the role of state and federal governments. Watershed managers must seek resolution of these matters through the influence of individual watershed citizens.

To improve constituency building around NPS pollution, managers must promote the watershed as a specific place,

encourage personal involvement toward change, and be sensitive to regional flavor and custom. Individuals must be encouraged to adopt greener attitudes toward the world around them and to go beyond their mainstream actions to benefit the environment.

CHAPTER SIX

RECOMMENDATIONS AND CONCLUSIONS

INTRODUCTION

Implementation in the Buzzards Bay, as illustrated by the Westport River/Snell Creek case, is characterized by both triumphs and defeats in estuarine protection. Education and outreach form the basis of increasing awareness about the watershed protection approach and efforts to control nonpoint source pollution through the Buzzards Bay Project. This chapter offers twelve recommendations and several applications of methods to increase the effectiveness of such programs on the local level. Most of these recommendations focus on non-governmental organizations working to educate and reach the public. A summary of all the preceding chapters follows the Recommendations and Applications.

RECOMMENDATIONS

1) *Focus children's educational materials on the relationship of NPS pollution and ecosystems.* Most educational materials targeting youth do not teach about ecosystems or NPS specifically. In an assessment of water related educational materials, only 50% addressed general ecosystem topics and 25% discussed NPS (Andrews 1993). The increasing importance of nonpoint source pollution requires broad-based environmental curricula that teach the interrelationships of air, land, and water and how activities impair natural systems (Livingston 1995).

2) *Use cost-effective multi-media/mass media approaches to NPS pollution campaigns by utilizing donated services to the fullest extent possible.* Awareness of NPS is not currently substantial enough to change daily household decision-making. However, such changes will result in improved NPS management. Education programs, such as the multi-media program discussed in Chapter Five, that engage several techniques and focus on practical habit changes are the most effective at increasing public awareness and affecting water quality (Badics 1995). As shown previously, donations can finance part or all of such programs.

3) *Education and outreach efforts must promote a fundamental change of attitude toward holism and consideration of all aspects of ecosystem functioning.* Beliefs that the ocean can handle as much waste as we produce must be replaced with a fuller understanding of the relationships along the land/sea interface. Individuals must understand that each choice concerning water use, maintenance of septic systems and BMPs, use of toxins, automobile purchases and use, and disposal of wastes, affects the watershed.

4) *Consumers must demand better choices of green products.* Green products must be more available and more economical to become more consumable. Individuals should ask both retailers and manufacturers for products that are: less toxic, use more recycled materials, and require less packaging. If individuals do not speak up, the inaction cycle continues.

5) *Improve individuals' understanding of their role in NPS control by simplifying written materials.* Simplifying the information about NPS pollution into smaller segments may help resolve the problem of information overload and apathy (see Application #1).

6) *Improve individuals' response to their role in NPS control by reducing the number of changes asked of them and providing hands-on guidance.* Lists of more than a few actions tend to overwhelm people resulting in no action. Thus, organizations may do better by promoting one or two activities for some specified period of time (see Application #2).

7) *Use a tiered approach in written literature.* Rather than asking individuals to make changes that may seem drastic to them, ask them to try one change at a time. This approach alleviates the feeling that individuals are being asked to do too much at once, and gives them an opportunity to test out actions that they may have once dismissed. People are more likely to embrace and repeat actions that seem simple, reflect no substantial inconvenience or cost, and feel good to complete. Once one simple step is taken, more complex actions may follow (see Application #3).

8) *Run campaigns that incorporate sponsors.* Funding is frequently the limiting factor in nonprofit organizations' ability to run campaigns. Thus, it is essential to capitalize on any opportunity which appears to benefit manufacturers or marketers. Bear in mind that sponsorship is good for both the NGO and the sponsor, and is not limited to retailers. Sponsors can include other NGOs, universities and private businesses such as banks, accounting and insurance companies, and travel-related businesses (see Application #4).

9) *Run campaigns that combine visible NPS controls with educational messages and sponsorships.* Nonpoint source pollution is a "hard sell," because people do not necessarily understand what it is and how to control it. Further, most people resist changing their habits, especially if such changes result in inconveniences or additional expense. Thus, it is beneficial to run campaigns that illustrate how nonpoint source pollution is controlled through structural fixes and how individuals can play a part in its control at home. This is particularly beneficial if a sponsor assists with costs (see Application #5).

10) *Make people understand that nonpoint source pollution is everyone's problem and encourage personal involvement toward its mitigation.* In all literature and public appearances, reiterate the role that each of us plays in the watershed (see Application #6).

11) *Be publicly thankful to all of your volunteers.* Keep volunteers engaged through written thank you's, volunteer appreciation events and gifts. Be sure

that these venues reinforce the "green" message (see Application #7).

12) *Capitalize on opportunities presented by electronic media.* Establish an E-mail address, electronic home page and/or bulletin board (see Application #8).

APPLICATIONS

1) SIMPLIFY MATERIALS: In addition to, or rather than, including all aspects of nonpoint source pollution in one written document, split the issue up into more "bite-size" sections. This may be best achieved in a series of simple primer fact sheets. Each fact sheet could address one aspect of NPS with specific information on how to improve its control.

   For example, create one fact sheet that includes the specific "green" remedy for clogged drains. Perhaps increase its appeal and duration by designing it like a recipe or rolodex card.

2) TARGET BEHAVIOR CHANGES: An example of such a targeted campaign is the "Baking Soda Break." This campaign would entail using volunteers such as scout troops, interns, 4-H clubs and others, perhaps as part of earning a "badge" or other program. An arrangement would be made for the volunteer and a guardian to enter homes of the watershed resident to "Clean Your Sink Without Dirtying Your Sea" during a special month's promotion. The volunteer would clean the sink using only baking soda, a soft brush and elbow grease. "Payment" in exchange for a clean sink could include: leaving literature and the baking soda, receipt of a small donation, and/or signing a pledge to take the "Baking Soda Break" for the rest of the month.

3) A TIERED APPROACH: In November run a "Sand for Salt" campaign, asking people to use sand instead of salt for one snowstorm. To encourage participation, it may be appropriate to include a sand sample. Another example would be to ask people to refrain from laundering clothes during one Spring wet weather event. Once it is evident that this change is not particularly invasive, other changes may be more easily instituted.

4) INCORPORATE SPONSORS. For example, for the "Baking Soda Break," arrangements could be made with Arm & Hammer to give away boxes of their baking soda at no cost to the organization. Perhaps the local hardware store could be a part of the "Sand for Salt" campaign.

5) COMBINE SPONSORSHIP, PUBLIC OUTREACH AND FUNDRAISING: One possible application is a "green" car wish. This "EnviroWash" could be sponsored by Seventh Generation or another "green" retailer. The retailer supplies the sponges, soap, and towels in exchange for publicity while volunteers wash the cars. A detention basin and grassed swales or other appropriate control can be displayed as a best management practice. Participants in the car wash will learn more about the hydrology of watersheds, the benefits of open space retention, and the importance of vegetated buffers. A nonprofit watershed organization could erect a display and literature booth for perusal while participants wait for their cars. The hosting organization can keep profits made from the activity. To gain publicity and additional customers, perhaps a volunteer could wear a fish costume or other related "attention grabber."

6) ENCOURAGE PERSONAL INVOLVEMENT: Refer to citizens' "watershed addresses." Ease interested watershed citizens into responsibilities to avoid burn-out. At events, publicly request volunteers for simple, straightforward actions, such as one phone-call, one letter, or one hour of envelope stuffing. Plant a willing "volunteer" to encourage others to follow suit.

7) APPRECIATE VOLUNTEERS: If budgets allow, provide certificates, T-shirts or other tokens, such as gift vouchers for "green" retailers or baskets of "green" products, tree seedlings or other tokens of appreciation.

8) GET ON-LINE: Utilize the Internet for research and to connect with other organizations working on similar issues. Subscribe to appropriate mailing lists. Link up with other organizations if maintaining operations alone is unfeasible. Seek donated computing services and equipment from universities, electronics manufacturers and software companies.

CONCLUSIONS

"To protect our water, we must control the pollution that drains off our land" (Browner 1994, 7).

The Buzzards Bay NEP demonstrates that comprehensive watershed-based planning and program implementation is desirable to protect coastal water quality from nonpoint source pollution. Chapter One illustrates that nonpoint source pollution is the most serious threat to coastal water bodies. The chapter concludes that local geographically oriented strategies, such as the watershed protection approach, are particularly effective in nonpoint source pollution control. The Buzzards Bay NEP Project is the first estuarine application of this integrated environmental management technique on the east coast.

The watershed protection approach reflects the most recent interpretation of integrated river basin planning in this country. Chapter Two demonstrates that the fertile history of river basin planning substantially contributed to this interpretation.

The USEPA has focused on creating the watershed protection approach as an adaptable management framework. As discussed in Chapter Three, this approach is based on four interconnected features: 1) risk-based geographic targeting, 2) stakeholder involvement, 3) integrated

solutions, and 4) evaluation using monitoring and other data review. In addition, the WPA transfers substantial responsibility for managing water quality to local governments.

These features work together to improve organizational cooperation, provide more effective use of resources and ensure more complete stakeholder involvement in decision-making--all adding up to overall institutional cooperation and ecosystem health. As a model of the WPA, the Buzzards Bay Project rests on two principles: a bioregional focus, and an adoption of comprehensive planning and persistent public involvement.

The Commonwealth of Massachusetts adopted these principles in the comprehensive basin approach of its Clean Water Strategy and Watershed Initiative. Chapter Four discusses the increasing importance of these programs in light of decreased federal funding, the pressing need to address NPS, and the increasing importance of adaptive management. Statewide implementation of both of these watershed oriented management schemes will expand the collective ability of state and local agencies to protect and improve environmental quality. Predated by the Buzzards Bay Project, these endeavors institutionalize strong partnerships and streamline management of the environment.

Formidable challenges, especially regarding funding limitations, arise when planning progresses into action. Implementation of Buzzards Bay action plan recommendations tests all aspects of estuarine management. The Westport River case study evaluated in Chapter Five demonstrates that implementation often unsettles cooperative relationships among institutions and emphasizes any weaknesses in action plans. The Buzzards Bay Project's heavy reliance on local implementation and voluntary compliance received strong support on paper. However, when implemented, some local boards were reluctant to cooperate, some private interests became recalcitrant and many actions were limited by funding and inter-governmental friction.

It is suggested that education and outreach are the solutions to the difficulties of implementing NPS pollution abatement. Such efforts must create a sense of place, stimulate individual participation, reflect an environmental ethic, and carefully consider the regional setting.

The integration and collaborative partnerships of the watershed approach offer a new perspective and promise for solving estuarine nonpoint source pollution problems (Coastal America 1994). These partnerships can overcome the diversity of communities, improve understanding of

watershed hydrology, and bring watershed consciousness into the public mind.

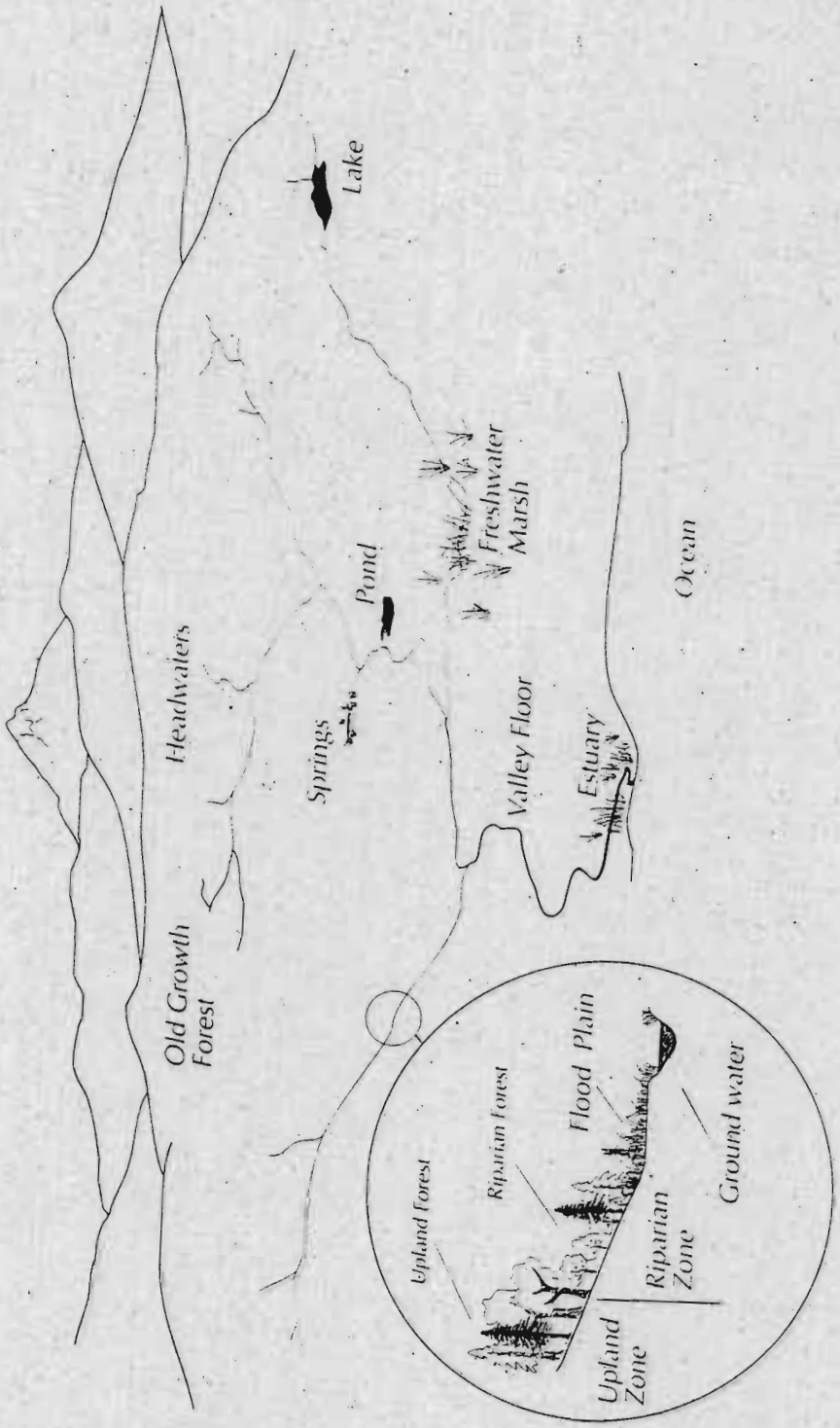
We are all ultimately citizens of a watershed--an ecosystem of air, land and water--and our collective action determines the quality of these ecosystems. To preserve our common fate, environmental managers must meet the challenges inherent in changing attitudes, and engage all citizens in maintaining healthy and productive aquatic and marine ecosystems.

APPENDIX 1: SOURCES AND CAUSES OF WATER QUALITY IMPAIRMENT (USEPA 1995a, 5-6).

POLLUTANT OR STRESSOR	POSSIBLE SOURCES
SEDIMENT	Cropland Forestry activities Pasture Streambanks Construction activities Roads Mining operations Gullies Livestock operations Other land-disturbances
NUTRIENTS	Erosion, runoff from fertilized areas Urban runoff Wastewater treatment plants Industrial discharges Septic systems Animal production operations Cropland or pastures where manure is spread
BACTERIA	Animal operations Cropland or pastures where manure is spread Wastewater treatment plants Septic systems Urban runoff Wildlife
PESTICIDES	All land where pesticides are used (forest, pastures, urban areas, golf courses, waste disposal sites) Sites of historical usage Urban runoff Irrigation return flows
ALTERED FLOW REGIME OR HABITAT MODIFICATION	Impoundments Urban runoff Artificial drainage Bank destruction Riparian corridor destruction

APPENDIX 2

THE WATERSHED ECOSYSTEM (Pacific Rivers Council 1993a)



APPENDIX 3

SCOPE OF MANAGEMENT CONFERENCE RESPONSIBILITIES UNDER SECTION 320 OF THE CLEAN WATER ACT

1. Assessing trends in the estuary's water quality, natural resources and uses;

2. Identify causes of environmental problems by collecting and analyzing data;

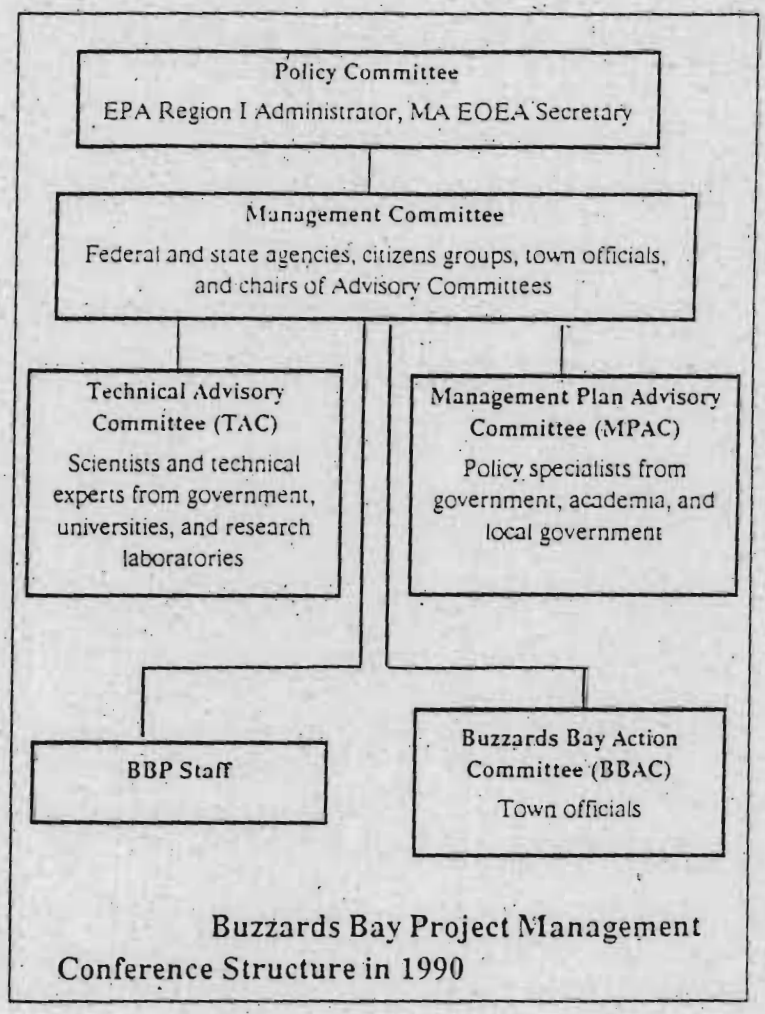
3. Assess pollutant loadings in the estuary and relate them to observed changes in water quality, natural resources, and uses;

4. Recommend and schedule priority actions to restore and maintain the estuary, and identify the means to carry out these actions.

5. Develop plans for the coordinated implementation of priority actions among federal, state, and local agencies involved in the Conference;

6. Monitor the effectiveness of actions taken under the CCMP; and,

7. Review Federal assistance and development programs to determine whether they are consistent with the goals of the CCMP.



Buzzards Bay Project Management Conference Structure in 1990

Category of Project	Legislation or Other Authorization	Focus
Nonpoint Source Targeted Watershed Projects	CWA Section 319	Grants for small watershed demonstrations provided through Section 319(h) grants, with states encouraged to take advantage of U.S. Department of Agriculture Hydrologic Unit Area (HUA) projects or other large watershed-scale initiatives.
Clean Lakes Protection/Restoration Projects	CWA Section 314	Lake protection and restoration. Source of many techniques relevant to holistic watershed management emphasizing grassroots stakeholder involvement. Most projects focus on small lakes and reservoirs.
Great Lakes Remedial Action Plans	Treaty agreements with Canada, 1987 CWA and Amendments in Omnibus Water Resources Act of 1990.	Development of water quality-based restoration programs for Areas of Concern, usually to address toxicant problems on riverine estuaries.
U.S. Department of Agriculture (USDA) Hydrologic Unit Area (HUA) Projects	President's Water Quality Initiative and the Farm Bill Conservation Title	Provides for water quality-oriented USDA technical assistance and cost-sharing in selected special watershed units with documented surface or groundwater concerns related to agricultural practices.
USDA Forest Stewardship Incentives Program (SIP)	1992 Farm Bill, Title XII (dealing with nonindustrial private forestry)	Encourages partnership between USDA Forest Service with state forestry programs to improve management of up to 25 million acres of private woodlands and forests. Improvement can be targeted for riparian zones or wetlands.
Natural Resources Conservation Service (NRCS) Small Watershed Projects	PL-566, Upstream Flood Control and Critical Area Treatment	Encourages watershed planning to identify land treatment practices to reduce soil erosion and coastal flooding and to address other conservation needs.
USDA Demonstration Projects	President's Water Quality Initiative	Demonstrates practical technology which can be used as part of integrated resource management for water resource protection.

(continued)

Category of Project	Legislation or Other Authorization	Focus
National Estuary Program	CWA Section 320	Promotes development of integrated management planning based on flexible regional stakeholder involvement and public outreach for 21 major estuaries and their associated watersheds.
U.S. Department of Interior (DOI) Bureau of Land Management (BLM) Fish and Wildlife 2000 Plan	An initiative under the BLM's riparian policies that places fish and wildlife values on an equal footing with other multiple uses of BLM leases	Starting in 1987, has led to numerous projects in western states to restore or protect riparian habitats. The recent Riparian-Wetlands initiative for the 1990s and the Bring Back the Natives Initiative are especially targeted at restoring ecological functions and protecting native fish stocks.
Corps of Engineers (COE) Environmental Enhancement Initiatives	Water Resources Development Acts of 1986 and 1990	In 1986, the Corps became a partner with the 8 States on the Upper Mississippi River in mitigating adverse ecological impacts from navigation works. Expanded in 1990 to cover all Corps projects. Examples include the Kissimmee River and the Everglades (Florida) and the Anacostia River (Maryland and the District of Columbia).
Incremental Flows Evaluations	Required by at least 15 States and relevant to Federal dam permit renewals, environmental impact work for COE and Bureau of Reclamation, and National Park Service assistance	Studies of instream flow needs in watersheds. Common in western states for operation of major dams. Also of importance elsewhere where rivers dammed for hydro-power or where issues with anadromous fisheries involved.
River Corridor Conservation Programs	Wild and Scenic Rivers Act, National Trails System Act, and Outdoor Recreation Act	In addition to the system for Wild and Scenic River designation, the National Park Service provides technical assistance to states for statewide river conservation programs or corridor protection projects on specific streams. Also many states or local governments have river greenbelt programs.

APPENDIX 5: Watershed Protection Processes EPA Region IV (USEPA 1991, 6-7)

1. Designate a Coordinator for the project. The Coordinator is the project's "champion" and day-to-day facilitator.

2. Write a brief description of the watershed, including its environmental problems, based on available information.

3. Delineate the project's preliminary scope and goals clearly.

4. Form an EPA watershed team containing a representative from each program with an active role in watershed management. This team will coordinate EPA programs during the project.

5. Assemble and evaluate available information on the extent and causes of water body use impairment and the risks to human health and the environment.

6. Form an interagency watershed coordinating committee containing appropriate technical and management representatives from key government agencies (State, regional, and local), industries, and citizens groups. This committee will facilitate communication among groups involved in watershed management and will help develop and implement the watershed protection plan.

7. Hold regular meetings of the EPA watershed team and the interagency coordinating committee to identify issues, discuss solutions, build consensus, and obtain commitments for action.

8. Identify all EPA and non-EPA activities and key participants that are involved with environmental problems in the watershed. Identify major milestones in each of these existing activities.

9. Develop a Watershed Management Plan that:
   - Identifies the highest-priority problems, as determined by consensus of the participants
   - Specifies total maximum daily loads and other water quality-based control approaches
   - Describes specific actions to address problems and identifies who will take these actions
   - Specifies problems or issues that require additional data gathering and analysis
   - Identifies opportunities for cooperative efforts
   - Delineates ways to leverage resources
   - Sets priorities for the EPA programs with regard to the watershed.

10. Support further characterization of the watershed's problems or the potential solutions, as resources allow.

11. Implement the corrective actions identified in the strategy.

12. Develop environmental indicators that, through monitoring, will be used to measure the success of the corrective actions.

APPENDIX 5
NORTH CAROLINA'S WHOLE-BASIN PROTECTION PROCESS
(Bowman and Creager 1995)

1. Compile all existing relevant information on basin characteristics and water quality.

2. Define the water quality goals and objectives for water bodies within the basin. (Revise as necessary as more data are gathered and analyzed.)

3. Identify the critical issues (e.g., water supply protection) and current water quality problems within the basin and the major actors (point and nonpoint sources) that contribute to these problems or concerns.

4. Prioritize the basin's water quality concerns and critical issues, in consultation with other government agencies and appropriate nongovernment organizations.

5. Define the subbasin management units, considering basin hydrology, physiographic boundaries, problem areas, and critical issues.

6. Identify needs for additional data.

7. Collect additional data as appropriate.

8. Analyze, integrate, and interpret the data collected. Revisit Step 2 through 5 in light of the new information.

9. Determine and evaluate the management options for each management unit in the basin.

10. Select final management approaches for the basin and targeted subbasins.

11. Complete the draft Whole-Basin Management Plan. Perform additional modeling analyses if necessary to finalize the wasteload allocations.

12. Distribute the draft plan for review and comment from the Environmental Management Commission and arrange for a public hearing.

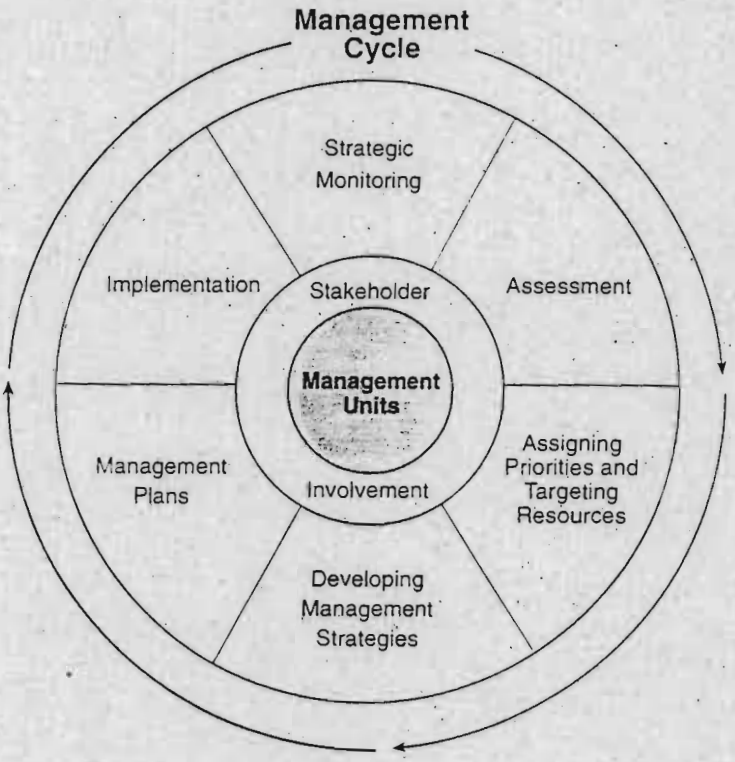
13. Revise the plan as appropriate in response to comments and obtain final EMC approval.

14. Implement the management approaches, including point and NPS control strategies.

15. Monitor the program's success and update the plan every five years.

APPENDIX 5
COMMON ELEMENTS OF STATEWIDE WATERSHED MANAGEMENT
(USEPA 1995A, 2-2)

(Page 3)



APPENDIX 6
WATERSHED MANAGEMENT: A STEP-BY-STEP GUIDE (USDC and USEPA 1993, 4-43)

1. **Delineate and map watershed boundary and sub-basins within the watershed.**

2. **Inventory and map natural storm water conveyance and storage systems.**

3. **Inventory and map man-made storm water conveyance and storage system.**
   This includes all ditches, swales, storm sewers, detention ponds, and retention areas and includes information such as size, storage capacity, and age.

4. **Inventory and map land use by sub-basin.**

5. **Inventory and map detailed soils by sub-basin.**

6. **Establish a clear understanding of water resources in the watershed.**
   Analyze water quality, sediment, and biological data. Analyze subjective information on problems (such as citizen complaints). Evaluate waterbody use impairment—frequency, timing, seasonality of problem. Conduct water quantity assessment—low flows, seasonality.

7. **Inventory pollution sources in the watershed.**
   Point sources—location, pollutants, loadings, flow, capacity, etc. Nonpoint sources—type, location, pollutants, loading, etc.
   - land use/loading rate analysis for storm water;
   - sanitary survey for septic tanks;
   - dry flow monitoring to locate illicit discharges

8. **Identify and map future land use by sub-basin.**
   Conduct land use loading rate analyses to assess potential effects of various land use scenarios.

9. **Identify planned infrastructure improvements—5-year, 20-year.**
   Stormwater management deficiencies should be coordinated and scheduled with other infrastructure or development projects.

10. **Analysis.**
    Determine infrastructure and natural resources management needs within each watershed.

11. **Set resource management goals and objectives.**
    Before corrective actions can be taken, a resource management target must be set. The target can be defined in terms of water quality standards; attainment and preservation of beneficial uses; or other local resource management objectives.

12. **Determine pollutant reduction (for existing and future land uses) needed to achieve water quality goals.**

13. **Select appropriate management practices (point source, nonpoint source) that can be used to achieve the goal.**
    Evaluate pollutant removal effectiveness, land owner acceptance, financial incentives and costs, availability of land operation and maintenance needs, feasibility, and availability of technical assistance.

14. **Develop watershed management Plan.**
    Since the problems in each watershed will be unique, each watershed management plan will be specific. However, all watershed plans will include elements such as:
    - existing and future land use plan;
    - master storm water management plan that addresses existing and future needs;
    - wastewater management plan including septic tank maintenance programs;
    - infrastructure and capital improvements plan

APPENDIX 7

TYPES OF INCENTIVES FOR INSTALLATION OF CONTROLS IN WATERSHED PROJECTS (USEPA 1995a, 7-4).

Type of Incentive or Motivational Factor	Description of Key Factors
Education	Programs that target key audiences and tailor the message to the audience are most effective in eliciting a behavior change. Can include technical education about operation and benefits of controls.
Technical assistance	One-on-one interaction between the professional water quality staff and the affected citizen, with recommendations about BMPs appropriate for the specific site in question. Includes on-site engineering or agronomic work during the installation of BMPs.
Tax advantages	Can be provided through state and local taxing authorities or by a change in the federal taxing system that rewards those producers who install BMPs.
Cost-share to individuals	Direct payment to individuals for installation of specific BMPs (e.g., terraces) has been effective where the cost-share rate is high enough to elicit widespread participation
Cross-compliance among existing programs	Generally a type of quasi-regulatory incentive/disincentive that conditions benefits received on meeting certain requirements or performing in a certain way. Currently in effect through the 1985 and 1990 Farm Bills.
Direct purchase of riparian corridors or of lands causing the greatest problems	Direct purchase of special areas for preservation has been used extensively by groups such as the Nature Conservancy; community-owned greenbelts in urban areas are another variation. Costs of direct purchase are generally high but effectiveness can also be exceptional. Sometimes used to obtain control of critical areas whose owners are unwilling to install BMPs.
Nonregulatory site inspections	A site visit by staff of local or state agencies can be a powerful incentive for voluntary installation of BMPs.
Peer pressure	Social acceptance by one's peers can be a motivational factor for installation of BMPs by some individuals. For example, if a community values the use of certain agricultural BMPs, producers in those communities are more likely to install them.
Direct regulation of land use and production activities	Regulatory programs that are simple, direct, and easy to enforce are quite effective. Such programs can regulate land use (through zoning ordinances) or the kind and extent of activity allowed (e.g., pesticide application rates), or can set performance standards for a land activity (such as retention of the first inch of runoff from urban property).
Incentives from private enterprises	Watersheds with successful nonpoint source projects often are backed by private enterprises that support the implementation and operation of the recommended BMPs. These companies supply services and equipment that individuals cannot afford to own or acquire. Without these services or equipment there is a tendency to neglect BMP maintenance once the financial incentive expires. Some examples include: firms specializing in animal waste lagoon pumpout and land application, companies that specialize in prescribed burning for brush control and range management, and professional associations skilled in integrated pest management techniques.

APPENDIX 8
A SUMMARY OF REVENUE OPTIONS
(Buzzards Bay Project 1991c, 112)

A SUMMARY OF REVENUE OPTIONS

	Approval by Local Governing Body	Approval by the General Court	Voluntary Participation	Equity Issues	Continuity of Revenue	Financial Management Mechanisms
General Revenues	Yes	No	No	General Taxpayer	Subject to Annual Appropriations	None
Taxes	Depends	Depends	No	Can Charge Selectively	Continuous	Special Districts
Boat Excise						
a) Change Collection Method	No	No	No	No Change in Relative Burden	Annually Collected	None
b) Raise Rate Using Current Schedule	No	Yes	No	No Change in Relative Burden	Annually Collected	None
c) Change Structure	No	Yes	No	Can be Progressive	Annually Collected	None
Fees						
Betterments	Yes	No	No	Beneficiary Pays	Lump Sum or Continuous	Special Districts
System or User Fees	Yes	No	Yes	Fee-for-Service	Continuous	Enterprise Funds
Impact Fees	No (1)	Yes	No	Charged to Developer	Lump Sum	No History of Any Used
Special Permits	No	No	No	Charged to Developer	Lump Sum	None
Capacity Credits	Yes	No	No	Charged to Users -- Indirectly	Lump Sum	None

1/ If Commonwealth passes as local option, local approval required, if passed as new fee, no local approval required.

A SUMMARY OF REVENUE OPTIONS						
	Approval by Local Governing Body	Approval by the General Court	Voluntary Participation	Equity Issues	Continuity of Revenue	Financial Management Mechanisms
Fines & Penalties	No	Local - No State & Federal - Yes If Sent to Mass. Bay Trust Fund	No	Polluter Pays	Erratic -- Not Dependable	None
Bonds						
General Obligation Bonds (1)	Yes	No	No	General Taxpayer	Lump Sum	MBIA & AMBAC
Revenue Bonds (1)	Yes	No	No	Beneficiary Pays	Lump Sum	MBIA & AMBAC
Grants & Loans	Yes (2)	No	No	Depends on Repayment of Loans	Depends	N/A

1/ Note, these options are also limited under the state imposed debt ceilings for local governments.
2/ Exceptions to this are Tax Anticipation Notes and Revenue Anticipation Notes. Massachusetts General Laws Chapter 44 section 17.

APPENDIX 9
COALITION FOR BUZZARDS BAY REPORT CARD - TOWN OF WESTPORT

Westport

Achievements in 1994

Following the completion of a Growth Management Plan last year, the Planning Board got to work on revising their regulations and considering new bylaw changes to better guide the future development of Westport's rural landscape and watershed to the Westport Rivers to protect farmland, open space, and water resources. To improve stormwater runoff control in new subdivisions, new regulations are in the process of being drafted. In addition, new road standards reducing the width of new roads and allowing for greater use of gravel drives to reduce paving, preserve rural character, and reduce stormwater runoff were written and will soon be adopted.

To preserve open space and farmland in new subdivisions, the Planning Board has drafted a Flexible Residential Development bylaw which encourages developers to retain open space by providing a bonus dwelling for every 10 acres preserved. This development option will provide greater protection for Westport's rural landscape as well as natural resources. In addition, a requirement that at least 50% of new lots created in town be comprised of upland to limit encroachment on nearby wetlands and allow for adequate siting of septic systems and wells is being considered. These important changes will go before Town Meeting for approval in 1995.

The Planning Board also began a build-out study of the Westport River watershed to determine to what extent future development will increase inputs of nitrogen to the rivers. Nitrogen from septic systems added to the river increases algae growth, decreases oxygen levels, and subsequently degrades water quality and habitat for shellfish and finfish. By determining what future nitrogen loading will be, the town can act now to protect the river for future generations. Completion of this study is scheduled for June 1995.

It truly was a year of planning for the Westport Planning Board and we look forward to the adoption of many of these changes in 1995.

The tidal waters of Westport were officially designated a "No-Discharge Area" for boat wastes in 1994 by the U.S. Environmental Protection Agency. Westport is the second Buzzards Bay community to achieve this status and one of only three in Massachusetts. This designation came largely due to the hard work of the town Harbormaster and Board of Health to provide adequate and accessible boat pumpout facilities.

An Oil Spill Contingency Plan for the town prepared in cooperation with the state Coastal Zone Management Office and U.S. Coast Guard remains the only clean local plan Baywide.. This plan will provide guidance for town response actions in the event of a spill. An oil spill response drill was held in town in December.

The Board of Health continued to seek out and remediate sources of bacterial pollution to the river with an aim to reopening shellfish beds. Six sites listed in the Division of Marine Fisheries Sanitary Survey for the river were cleaned up. Other actions to control runoff pollution from dairy farms in particular included the design and preliminary testing of a peat filter stormwater system. The Board of Health is currently seeking funding for testing of this system on one farm in town. Finally, town and volunteer fecal coliform testing of the river continued under the direction of the Director of Public Health to identify 'hot spots" of contamination in the river. Reductions in fecal coliform counts in the river and new ways of managing shellfish bed closures on a "Conditional" basis produced a part-time opening of 380 acres of shellfish beds in 1994.

The Board of Health held a Household Hazardous Waste collection in 1994.

Recommendations for 1995

Open Space and Growth Management

1. Adopt Flexible Residential Development proposal at Annual Town Meeting to provide for future development options that protect farmland, open space, and natural resources. (Town Meeting)

2. Complete Nitrogen Build-Out study of Westport Rivers and explore options for management to protect river water quality and habitat. (Planning Board)

3. Become more active in the acquisition of important open space and farmland. Expand past efforts to include more farms in state Agricultural Preservation Program (APR). (Conservation Commission)

Wetlands Protection

1. Improve wetlands protection through the adoption of a local Wetlands Protection Bylaw which includes provisions for the maintenance of vegetated buffer strips between developed areas and adjacent wetlands. (Conservation Commission)

2. Make greater effort to attend wetland workshops and trainings to learn more about conservation tools, delineation, and enforcement. (Conservation Commission)

3. Follow through with plans to require a minimum upland area on new lots created in town under the zoning bylaw to limit encroachment on wetland areas. (Town Meeting, Planning Board)

4. Develop an inventory of coastal resources and a comprehensive Harbor Management Plan. (Conservation Commission, Planning Board)

Stormwater Management

1. Adopt Stormwater Regulations and new road standards to reduce and treat runoff pollution in new subdivisions and commercial developments. (Planning Board)

Septic Systems

1. Adopt and appropriate funding for Betterment Bill to provide homeowners with low interest loans to repair failing septic systems contributing to ground and surface water pollution. (Board of Health, Town Meeting)

Input on town actions to protect Buzzards Bay in 1994 was provided by the Westport Board of Selectmen, Planning Board, and Board of Health

APPENDIX 10
WHY STATES PREFER TO MANAGE BY WATERSHEDS

1. *Water quality programs can focus more directly on the resources*: rather than measuring success in terms of program activities, the focus is on environmental results.

2. *The basis for management decisions is improved*: all significant stressors are examined, pooling of resources increases data availability, and basin-oriented monitoring produces more detailed information.

3. *Program efficiency is enhanced*: staff effort is coordinated, modeling studies are consolidated, permitting redundancies are eliminated, public meetings are consolidated, TMDL reporting is enhanced.

4. *Coordination among agencies in the state can be improved*: roles are clarified and tasks assigned more appropriately, local program consistency is enhanced, and redundant responsibilities reduced.

5. *Resources are better directed to priority issues*: risk-based procedures can become dominant because water quality impairments are most easily identified, comprehensive review and comparison is possible and improved coordination produces common priorities.

6. *Coordination with EPA can be improved*: EPA and state agencies have coordinated through programs like NEPs and TMDLs. The WPA can ensure better long-term planning, coordinated state-federal commitments, information transfer among states, prioritize basin planning through Section 104(b)(3) and 319 programs, and facilitate regional and state cooperation.

7. *Consistency and continuity are encouraged*: the tendency to be reactive is minimized because goals are achieved over fixed cycles and subject to broad scrutiny during planning processes.

8. *Opportunities for data sharing are enhanced*: Data housed among several agencies can be shared via computer technologies, including GIS.

9. *Public involvement is enhanced*: Citizens become aware of, rally around and interact during development and activities regarding their watershed resulting in increased support for associated programs.

10. *Innovative solutions are encouraged*: The wide variety of expertise involved in watershed planning creates an excellent climate for nontraditional solutions to be considered and implemented including ecological restoration, protection of critical areas, wetlands mitigation banking and market-based solutions (USEPA 1995b).

APPENDIX 10
COMPREHENSIVE SOURCE WATER PROTECTION IN MASSACHUSETTS
(USEPA 1995b, 4-8)

Comprehensive Source Water Protection in Massachusetts

EPA is actively promoting development of CSGWPPs. Massachusetts is currently working to develop a CSGWPP aimed at integrating protection of both surface water and ground water sources of drinking water using EPA's CSGWPP Guidance as a model. Through this process, the state has begun to identify inconsistencies and gaps in the protection programs for both ground and surface water-based drinking water supplies and to develop recommendations and actions necessary to address those deficiencies.

A critical part of Massachusetts' current effort is the integration of the state's drinking water protection program with its river basin approach to resource management. With development of its Clean Water Strategy in 1993, the state started synchronizing functions within each basin that had previously been carried out in isolation within discreet water protection programs: water quality monitoring; water withdrawal permitting (new wells); mitigation and remediation of nonpoint sources of pollution; and permitting under NPDES. Each of these activities impacts drinking water supplies as well as other waters of the state in some way, and drinking water supplies are critical resources to be protected in each basin. The state's strategy is ultimately to combine ground water and surface water protection program efforts into a unified Source Water Protection Program which will provide protection for all sources of drinking water throughout Massachusetts.

Specific issues to be addressed during development of its Source Water Protection Program include: (a) defining surface water protection areas for reservoirs and river intakes of varying sizes and types and identifying appropriate land use restrictions in those protection areas; (b) alleviating problems resulting from highway runoff to surface water supplies; and (c) developing a policy for disposal of water supply-generated sludge in drinking water protection areas. Additional opportunities for integration of drinking water protection into the state's basin approach will be identified as the program is developed further.

APPENDIX 11
(Buzzards Bay Project 1991b, 147)

Buildout Analysis in Falmouth

Description

Falmouth was the first town in Buzzards Bay to complete a buildout analysis. The assessment was conducted in 1984, at a time when the town was experiencing steady growth and the year-round population was approximately 20,000. Town residents knew that the town was growing rapidly and might develop problems in the future, but the results of the buildout analysis were sobering. They indicated that, based on allowable growth under existing zoning regulations, the population of Falmouth could more than triple, to an ultimate population of 68,000 people. With this information, town leaders can make better informed decisions to limit or control growth and its impacts on the environment.

Use

One result of the buildout study in Falmouth was the establishment of a nutrient-loading program (the portion of that program that covers nitrogen loading to coastal ponds inspired the nitrogen-sensitive-embayment concept developed by the Buzzards Bay Project). Because the program uses a mass loading formula that is principally based upon population increase, it is one of the best land-use management tools available in coastal areas. Falmouth's program goes beyond federal and state laws and increases the opportunity to protect sensitive coastal areas from the cumulative impacts of growth.

Operation of Coastal Pond Nutrient-Loading Bylaws

Developers proposing projects within the drainage basins of Falmouth's coastal ponds must determine the probable impact of the proposed development (in addition to already developed properties) on the receiving waters. To ensure that all developments are treated equally, the town has set standards for calculating the level of nitrogen loading. The developer must implement mitigating measures to reduce the nitrogen output generated by the development if analysis indicates it will cause the receiving waters to exceed their critical concentrations.

Outcome

The greatest advantage of this program is that it allows the town's regulatory boards to identify areas in which the density allowed under zoning is inappropriate. The program has also established a means by which the town can determine the developments that will contribute more than their "fair share" of nitrogen. This enables the town to objectively and equitably scale down the density. The program is designed so that the private sector shoulders the major implementation costs. The town is not forced to conduct exhaustive townwide land-use studies to allocate and regulate growth. Instead, the program is triggered on a project-by-project basis, and the developers are responsible for determining the impact of additional development. The Project is recommending a slightly different approach to address the nitrogen-pollution problem as outlined in the Managing Nitrogen-Sensitive Embayments Action Plan.

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