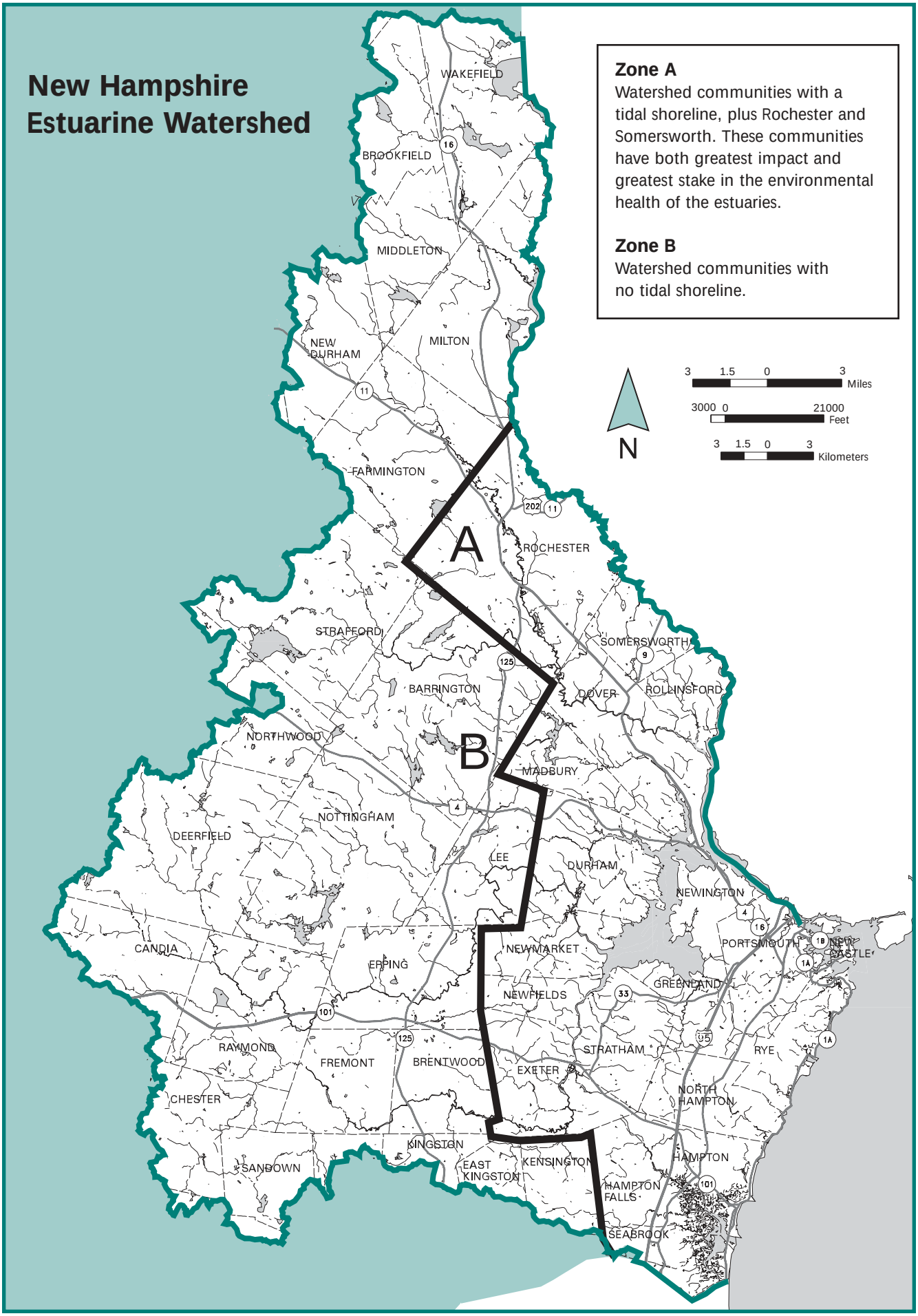
NEW HAMPSHIRE
ESTUARIES PROJECT

MANAGEMENT PLAN

2000

New Hampshire Estuarine Watershed



NEW HAMPSHIRE
ESTUARIES PROJECT

MANAGEMENT PLAN

New Hampshire
Estuaries Project

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2000

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Regulation and Management, A Base Program Analysis authored by Carl Paulsen, 1999, is the source of policy and management information found in this Management Plan.

This Management Plan and more information about the estuaries is available on the New Hampshire Estuaries Project website: www.state.nh.us/nhep

For copies of the *Management Plan, Technical Characterization, Base Programs Analysis, State of the Estuaries Report,* and the *Executive Summary for the Management Plan,* contact the N.H. Estuaries Project office in Portsmouth.

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PREFACE

This Comprehensive Conservation and Management Plan of the New Hampshire Estuaries Project presents a broad framework and specific list of actions to protect and enhance the environmental quality of the estuaries of the State of New Hampshire. It is intended to be a guide for all who use, enjoy, or care about the state's estuarine resources.

The NHEP Management Plan addresses the environmental quality of the entire watershed draining to New Hampshire coastal waters, but focuses action efforts on the lands surrounding the Great Bay and Hampton-Seabrook Estuaries. Due to the national significance of their natural resources, the New Hampshire estuaries were selected for assistance and support from the National Estuaries Program. Although these estuaries are by no means pristine, much progress has already been made in correcting problems. Upgrades to sewage treatment plants, reopened shellfish beds, restoration of degraded salt marshes, increased acreage of permanently protected habitat, and improved planning for future development all indicate the power of partnerships forged at the local level. This Management Plan builds on these improvements and partnerships and focuses on this positive direction.

From its start, the New Hampshire Estuaries Project has aimed for real improvements to the environment. The idea that the only legitimate reason for planning is to prepare for implementation was often mentioned at NHEP meetings. Thus, the planning phase of the project was guided by the principle that enthusiasm for implementation would not be generated by volumes of scientific studies on every environmental issue, but by clear demonstrations of problems and solutions at the local level. The common theme of NHEP work was improvement and protection of estuarine water quality – the foundation of the estuaries' value as wildlife habitat, as a recreational resource, and as a key element to the Seacoast economy. Shellfish were chosen as a tangible, easily understood indicator to measure improvements to water quality.

A diverse group participated in the development of the Plan, with considerable input from the public along the way. The Plan is the result of a three-year, collaborative process that required countless meetings, long discussions, creative thinking,, and hard-won compromises. The Action Plans crafted by these volunteers are practical, realistic, and ready for implementation. This document could not have been produced without their patience and dedication.

The Management Plan outlines actions formulated around five themes:

1. Water Quality
2. Land Use, Development, and Habitat Protection
3. Shellfish
4. Habitat Restoration
5. Public Outreach and Education

Actions are largely intended to either prevent problems, identify and correct problems, or educate and involve specific target audiences. The actions are not presented as activities to be implemented solely by the NHEP; rather, they are intended as a guide for government agencies, recreational users, businesses, educators, and members of the public who have worked, and will continue to work, toward the over-arching goal of a clean, healthy estuarine environment. The Plan includes suggested funding and provisions for monitoring progress over the long term.

This is an ambitious plan. While some actions can be implemented immediately, others require more time. Over the next several years, we will continually evaluate the state of the estuaries, measure progress, and adjust the actions to accommodate current realities. With the enthusiasm and stewardship of all who live near, work on, or simply enjoy the estuaries and their bountiful resources, we will achieve our goal of protecting these priceless resources for generations to come.

The following is a summary of actions that will help us achieve our goal.

ACTION PLANS

WATER QUALITY ACTION PLANS

Wastewater Treatment Facilities 4-17

WQ-1 Evaluate Wastewater Treatment Facility impacts on estuarine water quality, and seek practical options at the state level for secondary and tertiary or alternative treatment where appropriate.

WQ-2 Evaluate the suitability of UV alternatives to chlorine in wastewater post- treatment for the Seacoast communities.

WQ-3 Prioritize and then upgrade facilities to reduce bacterial pollution from hydraulic overloading of Seacoast wastewater treatment facilities (WWTFs).

Illicit Connections in Urban Areas 4-26

WQ-4A Establish on-going training and support for municipal personnel in monitoring storm drainage systems for illicit connections.

WQ-4B Assist Seacoast communities in completing and maintaining maps of sewer and stormwater drainage infrastructure systems.

WQ-4C Eliminate illicit connections in Seacoast communities.

Illegal Direct Discharges 4-33

WQ-5 Conduct shoreline surveys for pollution sources.

WQ-6 Promote collaboration of state and local officials (conservation commissions, health officers, building inspectors, et al.) to locate and eliminate illegal discharges into surface waters.

WQ-7 Provide incentives to fix or eliminate illegal direct discharges such as grey water pipes, failing septic systems, and agricultural runoff.

Stormwater 4-40

WQ-8 Research the effectiveness of innovative stormwater treatment technologies for existing urban areas in New Hampshire, and communicate the results.

WQ-9 Ensure that water quality and quantity impacts from new development or redevelopment are minimized to the maximum extent practical at the planning board stage of development.

WQ-10 Research the use and effectiveness of the Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire. Revise, publish, and promote the Handbook.

Permitted Discharges **4-47**

WQ-11 Revise state industrial discharge permit criteria in response to new processing technology, and re-evaluate existing permits.

Oil Spills **4-49**

WQ-12A Acknowledge and support the oil spill prevention and response activities of the Piscataqua River Cooperative.

WQ-12B Enhance oil spill clean up efforts through pre-deployment infrastructure and development of high-speed current barriers.

Septic Systems **4-53**

WQ-13 Provide septic system maintenance information directly to shoreline property owners, and to other citizens of the Great Bay and coastal watersheds to help improve water quality.

WQ-14 Encourage the use of innovative alternative technologies for failing septic systems to help improve water quality.

Air Quality **4-57**

WQ-15 Support efforts to reduce deposition of atmospheric pollutants through eliminating loopholes in current laws, encouraging the construction of more efficient power plants, and encouraging energy conservation.

Water Quality Funding **4-59**

WQ-16 Find funding sources for key strategies.

Water Quality Outreach **4-61**

WQ-17 Coordinate public tours of wastewater treatment facilities

WQ-18 Support and coordinate stormwater technical workshops.

WQ-19 Stormwater Awareness: Support and expand stormdrain stenciling programs.

WQ-20 Conduct estuarine field day for municipal officials.

LAND USE AND HABITAT PROTECTION ACTION PLANS

Future Development/Impervious Cover **5-19**

LND-1 Prepare a report of current and future levels of imperviousness for the subwatersheds of the New Hampshire coastal watershed.

LND-2 Implement steps to limit impervious cover and protect streams at the municipal level.

LND-3 Conduct research in coastal NH watersheds to examine the relationship between percent impervious cover and environmental degradation.

LND-4 Prevent the introduction of untreated stormwater to wetlands by supporting the development of NH Minimum Impact Development Guidelines.

LND-5 Support the Natural Resource Outreach Coalition (NROC), a municipal decision-maker land-use planning outreach method modeled after the successful University of Connecticut Cooperative Extension "Non-point Education for Municipal Officials" (NEMO) program.

Sprawl 5-31

LND-6 Minimize urban sprawl in coastal watersheds.

LND-6A Develop a regional pilot partnership to create a smart growth vision among Towns and Regional Planning Commissions in a single estuarine watershed.

LND-6B Conduct a comprehensive review of the 43 towns within the estuaries and coastal watershed area to determine land-use polices that affect sprawl.

LND-6C Develop and maintain a comprehensive database or library of new smart growth funding programs.

LND-6D Develop a science-based handbook and video on the nature, causes, and remedies of sprawl for audiences in the coastal New Hampshire watershed area.

LND-6E Actively participate and contribute to the development of new smart growth planning tools with particular emphasis on provisions that protect estuarine water quality.

LND-6F Aggressively assist communities that embrace a strong smart growth philosophy to conduct comprehensive reviews, identify sources of funding, provide public education, and implement new land-use tools.

Tidal Wetlands 5-46

LND-7 Complete rulemaking and begin implementation of the Recommended New Hampshire Wetland Mitigation Policy for NH DES, prepared by the Audubon Society of NH and the Steering Committee on Wetlands Mitigation.

LND-8A Strengthen enforcement and effectiveness of the state tidal buffer zone (TBZ) through outreach to local officials and tidal shoreland property-owners.

LND-8B Amend state tidal buffer zone (TBZ) regulations to include regulation of deck construction.

LND-9A Reduce the quantity, improve the quality, and regulate the timing of stormwater flow into tidal wetlands through policy changes at the NH DES Wetlands Bureau.

LND-9B Reduce the quantity, improve the quality, and regulate the timing of stormwater flow into tidal wetlands through changes to the NH DES Site Specific Program.

LND-10 Using the Coastal Method and other techniques, identify and restore additional restorable tidal wetlands.

LND-11 Create a list of potential wetland restoration projects that could be used for wetland mitigation projects, and distribute the list to state agencies and Seacoast municipalities.

LND-12 Pursue restoration funding from the NH DOT, USDA/NRCS, US F&WS and other sources.

Shorelands 5-57

LND-13 Provide a framework specific and appropriate to the New Hampshire Seacoast for defining and delineating urban and non-urban shoreland areas.

LND-14 Develop and implement an outreach program to encourage and assist communities in developing and adopting land use regulations to protect undisturbed shoreland buffers.

LND-15 Support land conservation efforts in shoreland areas.

LND-16 Improve enforcement of the state Comprehensive Shoreland Protection Act and other applicable shoreland protection policies through outreach efforts to local officials and shoreland property-owners.

LND-17 Provide incentives for the relocation of grandfathered shoreland uses.

Groundwater 5-68

LND-18 Locate and quantify quantity and quality of groundwater inflow to the estuaries.

LND-19 Locate, reduce or eliminate, and also prevent groundwater contaminants.

Freshwater Wetlands 5-72

LND-20 Develop and implement a Wetlands Buffer Outreach Program for planning boards.

LND-21 Prevent the introduction of untreated stormwater to freshwater wetlands by enacting legislation giving NH DES authority to regulate stormwater discharge to wetlands.

LND-22 Prevent the introduction of untreated stormwater to wetlands by strengthening municipal site plan review regulations.

LND-23 Prevent the introduction of untreated stormwater to wetlands through an increased understanding of stormwater impacts on wetland ecology.

LND-24 Work with NH DES to encourage adoption of a state wetlands mitigation policy.

LND-25 Encourage municipal designation of Prime Wetlands and 100-foot buffers (or equivalent protection).

LND-25A Create a traveling Prime Wetlands Display.

LND-25B Provide training and project assistance for towns interested in utilizing the Method for the Comparative Evaluation of Non-tidal Wetlands in New Hampshire.

LND-25C Work with local planning boards and conservation commissions on regulatory approaches to wetlands conservation.

LND-25D Create and/or enhance local land conservation programs with emphasis on high value wetlands and buffers.

Habitat Protection 5-86

LND-26 Support implementation of state and federal land protection programs (e.g., Conservation and Reinvestment Act, Land and Community Heritage, Teaming With Wildlife, Land and Water Conservation Fund, Coastal Initiative Program, Farmland Preservation Program).

LND-27 Support the efforts of the Great Bay Resource Protection Partnership.

LND-28 Encourage towns to dedicate current-use change tax penalties to conservation commissions for the purpose of natural resource acquisition, easements, restoration, and conservation land management.

LND-29 Provide technical assistance in land protection and management to regional land trusts and municipal conservation commissions.

LND-30 Develop and encourage use of biomonitoring standards to evaluate water quality.

LND-31 Use results of biomonitoring and water quality monitoring to prioritize watershed areas for protection and remediation.

LND-32 Encourage municipalities to incorporate wildlife habitat protection into local master plans by promoting NH Fish and Game's *Identifying and Protecting Significant Wildlife Habitat: A Guide for Towns* and other activities.

LND-33 Develop a model local planning approach to encourage the identification and maintenance of contiguous habitat blocks.

LND-34 Encourage appropriate buffers around important wildlife areas and rare or exemplary natural communities.

LND-35 Maintain current-use program.

LND-36 Encourage conservation easements.

SHELLFISH RESOURCES ACTION PLANS

Shellfish Sanitation Management 6-11

SHL-1 Implement National Shellfish Sanitation Program guidance to develop an FDA-certified shellfish program.

SHL-2 Identify sources of and reduce or eliminate contaminants in the New Hampshire estuaries watersheds.

SHL-3 Institute land-use practices in estuarine watersheds that improve water quality and shellfish habitat.

SHL-4 Enhance funding to maintain a comprehensive shellfish program.

SHL-5 Regularly collect and monitor water quality to identify sources and reduce or eliminate contaminants.

SHL-6 Periodically collect and monitor shellfish tissue samples as appropriate for toxins and biotoxins.

Shellfish Resource Management 6-22

SHL-7 Maintain an ongoing shellfish resource assessment program.

SHL-8 Develop and implement a plan for shellfish resource enhancement and habitat restoration.

SHL-9A Decrease shellfish resource depletion and increase productivity with stricter state penalties for illegal harvesting.

SHL-9B Increase outreach and education about methods to control shellfish predators.

SHL-9C Explore alternative recreational shellfish harvest methods.

SHL-9D Increase productivity by discouraging the harvest of immature shellfish.

Shellfish Outreach 6-36

SHL-10 Provide information regarding public access to shellfish beds through distribution of maps/booklets.

SHL-11 Establish Bounty of the Bay shellfishing field education program.

SHL-12 Develop and maintain a shellfisher license information database for use in outreach activities.

SHL-13 Update materials and improve distribution of shellfish- related information.

SHL-14 Provide for direct citizen involvement in NH shellfish management decisions.

Shellfish Aquaculture 6-48

SHL-15 Evaluate and address barriers to aquaculture and promote environmentally sound aquaculture practices.

HABITAT RESTORATION ACTION PLANS

Shellfish Restoration 7-13

RST-1 Develop and implement a plan for shellfish resource enhancement and habitat restoration activities to achieve a sustainable resource contributing to a healthy environment.

Wetland Restoration (Tidal) 7-14

RST-2 Using the coastal method and other techniques, identify and restore additional restorable tidal wetlands.

RST-3 Continue to restore the restorable tidal wetlands listed in the natural resources conservation service report, *Method for the Evaluation and Inventory of Vegetated Tidal Marshes in New Hampshire.*

Habitat Restoration 7-19

RST-4 Identify and implement habitat restoration projects in other important non-tidal habitat areas, such as uplands and freshwater wetlands.

Wetland Restoration 7-21

RST-5 Create a list of potential wetland restoration projects that could be used for wetland mitigation projects, and distribute the list to state agencies and seacoast municipalities.

RST-6 Pursue restoration funding from the NH DOT, USDA/NRCS, US F&WS, and other sources.

PUBLIC OUTREACH AND EDUCATION ACTION PLANS

General Outreach 8-11

EDU-1 Utilize the media to enhance educational efforts.

EDU-2 Work with the seacoast newspapers to establish a monthly newspaper column devoted to coastal natural resource issues.

EDU-2a Develop an agreement with Strafford County UNH Cooperative Extension to enable the NHEP outreach project team to contribute coastal natural resource information to the UNH Cooperative Extension column in Foster's Daily Democrat.

EDU-3 Establish and fund a technical assistance grant program to promote and fund projects that support the NHEP management plan.

EDU-4 Maintain and expand the New Hampshire estuaries project's shoreline property-owner database.

Volunteer Involvement 8-21

EDU-5 Support volunteer organizations active in water quality, habitat, or other estuarine watershed natural resource issues.

INTRODUCTION TO THE PLAN

1

The cultural and natural history of New Hampshire's Seacoast has long been shaped by the bountiful resources of its estuaries. The Seacoast's natural beauty and resource wealth, and access to markets, education, and recreation make the region a magnet for people and businesses. Continuing population growth is the greatest threat to the environmental health of the state's estuaries including Great Bay, Little Bay , and Hampton/Seabrook Harbor (hereafter referred to as the "estuaries"). The *New Hampshire Estuaries Project Comprehensive Conservation and Management Plan* is a working document designed to help Seacoast communities protect, manage, and use their natural resource legacy responsibly, for the benefit of present and future generations.

NHCP

Gundalow on Great Bay

THE TEAM

The planning phase of the NHEP has been guided by a 30-member Management Committee, chaired by the Director of the Office of State Planning, with assistance from four Project Teams: Water Quality, Land Use, Shellfish and Living Resources, and Outreach and Education. All the members of the Management Committee and the four Project Teams together make up the NHEP Management Conference – a group of approximately 75 individuals representing the interests of area citizens; recreational resource-users; the business, academic and scientific communities; local, state, and federal agencies and governments; and environmental organizations. The release of the draft *Management Plan* in December 1999 marked the conclusion of the primary planning phase of the project. This final Management Plan was revised following public comment and review. After approval, the final *Management Plan* will move into the implementation phase. The Management Committee will work to initiate, oversee, track, evaluate, and update implementation of the Action Plans.

DOCUMENT ORGANIZATION

This *Plan* reflects the work of many individuals, agencies, and organizations.

Chapter 2: State of the Estuaries is a thumbnail summary of the current status and trends of the environmental condition of the estuaries, based on a detailed analysis of current scientific research and knowledge of the estuaries completed for the NHEP.

Chapter 3: A Vision for New Hampshire's Estuaries outlines a consensus vision of people working together to protect and enhance the natural resources of the estuaries and the Seacoast region. This common vision was developed by the NHEP with the participation of citizens, local officials, University of New Hampshire scientists and educators, representatives of environmental organizations, businesses, and state and federal agencies. All aspects of the NHEP planning process involved this same broad representation. *Chapter 3* presents a view of the possible – a realistic, reachable state of the estuaries for 2005 and beyond.

The key to understanding and implementing the *Plan* is recognizing that everything in the estuarine ecosystem is connected to everything else. The *NHEP Plan* focuses on water quality because it is related to nearly all the priority problems identified for the estuaries, and because progress can be measured and accounted for. However, all five of the priority concerns – water quality, land use and habitat, shellfish resources, habitat restoration, and public outreach and education – are related to each other. All are essential aspects of the whole ecosystem and of the *Plan*.

These priorities are discussed in *Chapter 4: Water Quality; Chapter 5: Land Use, Development, and Habitat Protection; Chapter 6: Shellfish Resources; Chapter 7: Habitat Restoration; and Chapter 8: Public Outreach and Involvement*. These chapters provide more detailed background on estuarine environmental conditions, the most serious threats to the ecological health of the estuaries, and what can be done to protect and improve the estuarine environment. Each chapter contains an introduction, a statement of why the issue is important, the problems or challenges to be resolved, a summary of pertinent existing regulatory and management programs, and a series of detailed Action Plans.

Chapter 9: Regulation and Management reviews the institutional framework for managing estuaries at the local, regional, state and federal level.

Chapter 10: Implementation and Financing outlines strategies and funding sources, and *Chapter 11: Summary of Recommended Actions* ranks the Action Plans by priority.

Chapter 11: Monitoring Plan includes research and technical development needs and a monitoring plan to track progress and help ensure that efforts to protect New Hampshire's estuaries are responsive, dynamic, and effective.

ACTION PLANS

The Action Plans in this document were drafted by the NHEP Project Teams, refined based on suggestions from the public gathered at a series of open forums, and reviewed and revised by the NHEP Management Committee following the comment period on the Draft *Plan*.

Each Action Plan begins with a background statement and a list of actions or activities to achieve the desired outcome. Each Action Plan also includes a list of responsible parties, an estimate of costs and funding sources, a review of any anticipated regulatory needs, the expected benefits, monitoring and/or enforcement requirements, and a priority ranking in relation to the overall *Management Plan*.

The total estimated costs for all the Action Plans proposed in the *Plan* far exceed the financial resources at hand. The NHEP Management Committee has reviewed all the Action Plans and assigned priority rankings for implementation.

THE NATIONAL ESTUARY PROGRAM

The New Hampshire Estuaries Project is part of the National Estuaries Program (NEP), established by Congress in 1987 to recognize and protect "estuaries of national significance." The National Estuary Program is administered by the U.S. Environmental Protection Agency (EPA). Each estuary program completes four basic steps:

1. Identify the major threats to the estuary through a review of scientific information and management structure, by sponsoring new research as needed, and enlisting citizens, business groups, and other stakeholders in creating a common vision for the estuary's future.
2. Develop a Comprehensive Conservation and Management Plan (CCMP) that sets specific goals and allocates responsibility for achieving the goals among the NEP partners, regulatory agencies, local governments, and citizen or interest groups. This *Management Plan* is the New Hampshire Estuaries Project's CCMP.
3. Implement the Plan, working with all the various partners. Flexibility is emphasized to allow local governments and citizens to choose the most cost-effective and environmentally beneficial solutions for their communities to meet the Plan's goals.
4. Monitor progress made toward the Plan goals to determine the effectiveness of actions taken, and to focus on areas where problems are greatest.

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The NHEP project area covers the entire watershed for the estuaries. Towns as far west as Candia and as far north as Wakefield are within the drainage basin. Although approximately one third of the watershed lies in the state of Maine, the NHEP is focused on the New Hampshire portion. In recognition of the importance of proximity to the estuaries, the project was divided into two areas: Zone A and Zone B. Zone A municipalities are those towns that border on tidal waters, plus Rochester and Somersworth. Zone B municipalities are those in the drainage area but with no tidal shoreline. The BPA review of the local management framework focuses primarily on Zone A municipalities (see inside cover).

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The New Hampshire Estuaries Project invites everyone who is interested to review the *Plan* and find ways to get involved in the many efforts to protect and improve the environmental quality and quality of life in the region.

INTRODUCTION TO THE PLAN

1

The cultural and natural history of New Hampshire's Seacoast has long been shaped by the bountiful resources of its estuaries. The Seacoast's natural beauty and resource wealth, and access to markets, education, and recreation make the region a magnet for people and businesses. Continuing population growth is the greatest threat to the environmental health of the state's estuaries including Great Bay, Little Bay , and Hampton/Seabrook Harbor (hereafter referred to as the "estuaries"). The *New Hampshire Estuaries Project Comprehensive Conservation and Management Plan* is a working document designed to help Seacoast communities protect, manage, and use their natural resource legacy responsibly, for the benefit of present and future generations.

NHCP

Gundalow on Great Bay

THE TEAM

The planning phase of the NHEP has been guided by a 30-member Management Committee, chaired by the Director of the Office of State Planning, with assistance from four Project Teams: Water Quality, Land Use, Shellfish and Living Resources, and Outreach and Education. All the members of the Management Committee and the four Project Teams together make up the NHEP Management Conference – a group of approximately 75 individuals representing the interests of area citizens; recreational resource-users; the business, academic and scientific communities; local, state, and federal agencies and governments; and environmental organizations. The release of the draft *Management Plan* in December 1999 marked the conclusion of the primary planning phase of the project. This final Management Plan was revised following public comment and review. After approval, the final *Management Plan* will move into the implementation phase. The Management Committee will work to initiate, oversee, track, evaluate, and update implementation of the Action Plans.

DOCUMENT ORGANIZATION

This *Plan* reflects the work of many individuals, agencies, and organizations.

Chapter 2: State of the Estuaries is a thumbnail summary of the current status and trends of the environmental condition of the estuaries, based on a detailed analysis of current scientific research and knowledge of the estuaries completed for the NHEP.

Chapter 3: A Vision for New Hampshire's Estuaries outlines a consensus vision of people working together to protect and enhance the natural resources of the estuaries and the Seacoast region. This common vision was developed by the NHEP with the participation of citizens, local officials, University of New Hampshire scientists and educators, representatives of environmental organizations, businesses, and state and federal agencies. All aspects of the NHEP planning process involved this same broad representation. *Chapter 3* presents a view of the possible – a realistic, reachable state of the estuaries for 2005 and beyond.

The key to understanding and implementing the *Plan* is recognizing that everything in the estuarine ecosystem is connected to everything else. The *NHEP Plan* focuses on water quality because it is related to nearly all the priority problems identified for the estuaries, and because progress can be measured and accounted for. However, all five of the priority concerns – water quality, land use and habitat, shellfish resources, habitat restoration, and public outreach and education – are related to each other. All are essential aspects of the whole ecosystem and of the *Plan*.

These priorities are discussed in *Chapter 4: Water Quality; Chapter 5: Land Use, Development, and Habitat Protection; Chapter 6: Shellfish Resources; Chapter 7: Habitat Restoration; and Chapter 8: Public Outreach and Involvement*. These chapters provide more detailed background on estuarine environmental conditions, the most serious threats to the ecological health of the estuaries, and what can be done to protect and improve the estuarine environment. Each chapter contains an introduction, a statement of why the issue is important, the problems or challenges to be resolved, a summary of pertinent existing regulatory and management programs, and a series of detailed Action Plans.

Chapter 9: Regulation and Management reviews the institutional framework for managing estuaries at the local, regional, state and federal level.

Chapter 10: Implementation and Financing outlines strategies and funding sources, and *Chapter 11: Summary of Recommended Actions* ranks the Action Plans by priority.

Chapter 11: Monitoring Plan includes research and technical development needs and a monitoring plan to track progress and help ensure that efforts to protect New Hampshire's estuaries are responsive, dynamic, and effective.

ACTION PLANS

The Action Plans in this document were drafted by the NHEP Project Teams, refined based on suggestions from the public gathered at a series of open forums, and reviewed and revised by the NHEP Management Committee following the comment period on the Draft *Plan*.

Each Action Plan begins with a background statement and a list of actions or activities to achieve the desired outcome. Each Action Plan also includes a list of responsible parties, an estimate of costs and funding sources, a review of any anticipated regulatory needs, the expected benefits, monitoring and/or enforcement requirements, and a priority ranking in relation to the overall *Management Plan*.

The total estimated costs for all the Action Plans proposed in the *Plan* far exceed the financial resources at hand. The NHEP Management Committee has reviewed all the Action Plans and assigned priority rankings for implementation.

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THE NATIONAL ESTUARY PROGRAM

The New Hampshire Estuaries Project is part of the National Estuaries Program (NEP), established by Congress in 1987 to recognize and protect "estuaries of national significance." The National Estuary Program is administered by the U.S. Environmental Protection Agency (EPA). Each estuary program completes four basic steps:

1. Identify the major threats to the estuary through a review of scientific information and management structure, by sponsoring new research as needed, and enlisting citizens, business groups, and other stakeholders in creating a common vision for the estuary's future.
2. Develop a Comprehensive Conservation and Management Plan (CCMP) that sets specific goals and allocates responsibility for achieving the goals among the NEP partners, regulatory agencies, local governments, and citizen or interest groups. This *Management Plan* is the New Hampshire Estuaries Project's CCMP.
3. Implement the Plan, working with all the various partners. Flexibility is emphasized to allow local governments and citizens to choose the most cost-effective and environmentally beneficial solutions for their communities to meet the Plan's goals.
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STATE OF THE ESTUARIES

2

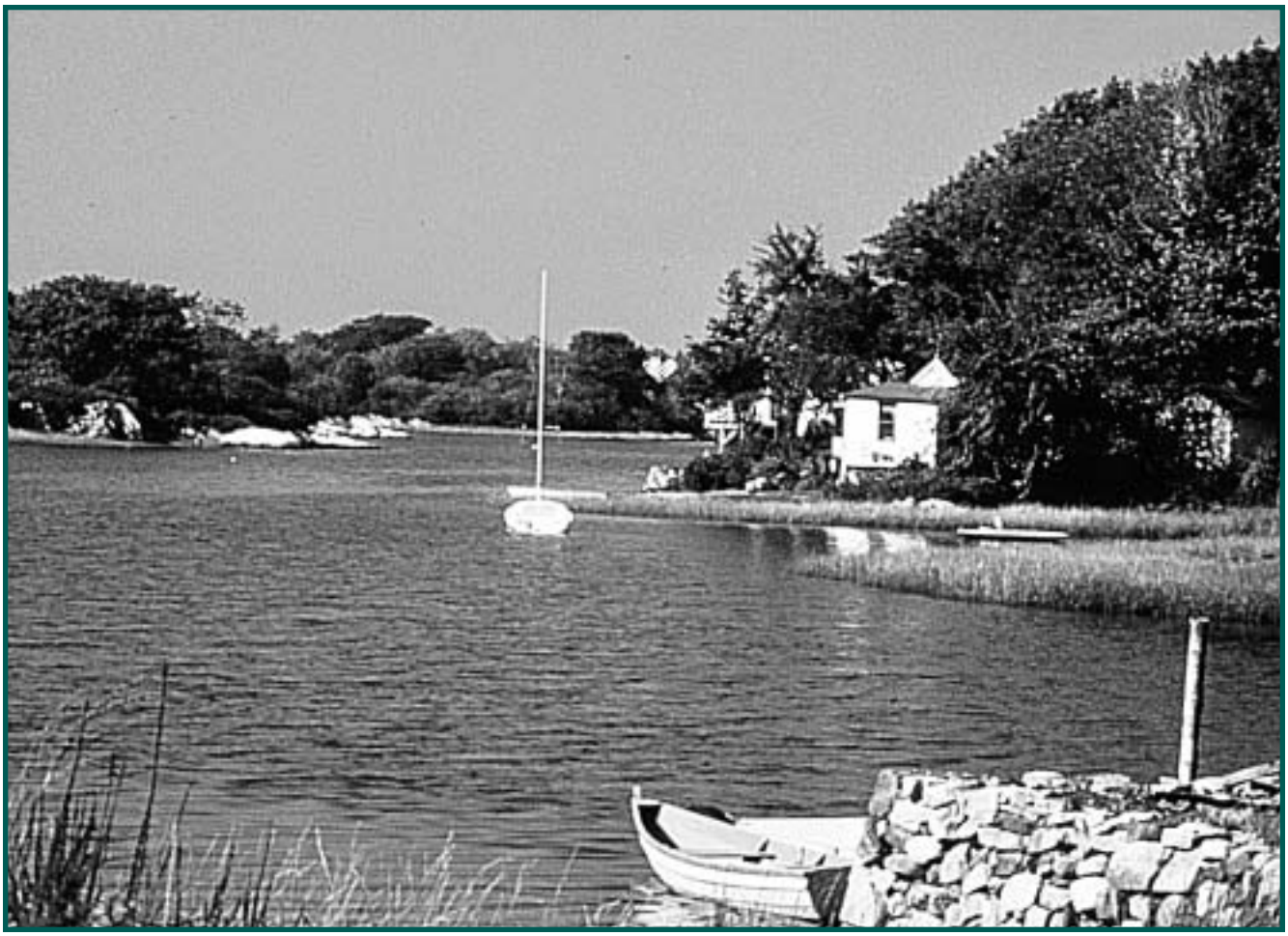
Estuaries are a vital component of the natural, aesthetic, and economic character of coastal New Hampshire. The cultural and natural history of the region has long been shaped by the abundant resources of New Hampshire's estuaries. Archaeological evidence shows that long before European colonization, people were drawn to New Hampshire's estuaries for the bountiful fish, shellfish, and game; to grow crops on the rich soils along the rivers; and to navigate the waterways.

GBNERR

Crommet Creek, Great Bay

The first European settlements in New Hampshire were located at the waters' edge to take advantage of the extraordinary fisheries of the rich estuaries and the nearby Gulf of Maine. Cod, lobster, alewives, sturgeon, menhaden, clams, and oysters sustained the first Europeans and formed the foundation of the early colonial economy. Coastal New Hampshire's link to the estuaries was further strengthened when the forests of the Great Bay watershed were harvested to supply the growing needs of colonial shipbuilding as new boatyards sprang up along the tidewaters. Soon after, enterprising industrialists looked to the tidal rivers and creeks of coastal New Hampshire for waterpower to drive mills and factories. Industry prospered with the combination of abundant waterpower, plentiful natural resources, and access to worldwide markets afforded by tidewater locations.

Today New Hampshire's estuaries still contribute to the economic, aesthetic, and environmental character of our state. However, the very attractions of the coastal location and resources pose a threat due to the affects of population growth and development on the environmental condition of the estuaries that supports the region's prosperity and appeal.



GBNERR

Little Harbor

New Hampshire's estuaries face threats that imperil Seacoast traditions of fishing, shellfishing, and other water-dependent activities. Polluted stormwater runoff, overburdened septic systems, and wastewater treatment facility and industrial discharges, all threaten the environmental quality of our estuaries. These threats represent dangers to regional water quality, as well as to the host of living things that depend on New Hampshire's estuaries for their well-being, and make the estuaries so resource-rich.

The activities of area residents and visitors have profound impacts on the estuarine system. Boats put oil and other pollutants in the water, disturb plant and animal life, and erode banks. Shoreline development removes protective plant cover, disturbs soils, increases runoff, and disrupts wildlife habitat and corridors and scenic views. Population growth and development throughout the region add to stormwater problems and burden wastewater treatment systems.

New Hampshire's estuaries provide a coveted coastal atmosphere and setting for life along the coast, as they have throughout history. Located within an hour of Boston, Manchester, and Portland, this unique and beautiful land- and seascape attracts residents, businesses, and tourists, making the New Hampshire Seacoast one of the fastest-growing areas in New England – and compounding the pressures of development on the estuaries. We must use these resources responsibly, to safeguard this legacy for future generations.

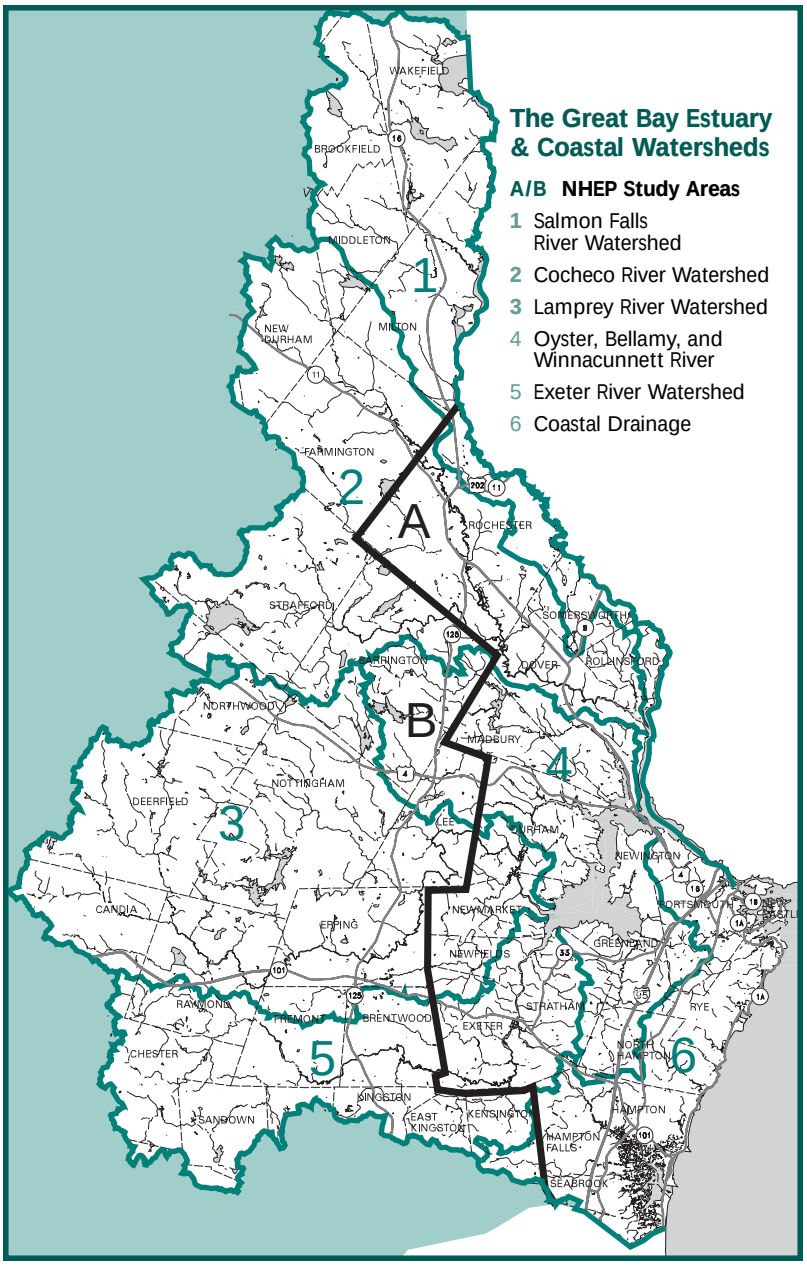
WHAT IS AN ESTUARY?

An estuary is a semi-enclosed embayment where freshwaters from rivers and streams mix with saltwater from the ocean. Estuaries are extraordinarily productive and diverse environments because of a unique set of conditions that create unusually nutrient-rich, protected waters. Many biologists consider estuaries among the most productive environments on earth.

JEL/UNH

Above: the Hampton-Seabrook Estuary

Left: South and North Mill Ponds, Portsmouth



Tidal Tributaries: Salmon Falls/Piscataqua River, Cocheco River, Bellamy River, Oyster River, Lamprey River, Squamscott River, Winnicut River.

NEW HAMPSHIRE'S ESTUARIES

With its Old Man of the Mountains icon, New Hampshire is more often associated with the White Mountains than with marine or estuarine habitat. However, New Hampshire has over 230 miles of sensitive tidal shoreline in addition to 18 miles of open-ocean coastline on the Gulf of Maine.

New Hampshire's estuaries are a varied collection of bays, tidal rivers, and salt marsh systems. The Great Bay and Hampton-Seabrook estuaries are the largest distinct estuaries in New Hampshire. Great Bay, Little Bay, the Squamscott River, and the tidal portions of the Lamprey, Oyster, Bellamy, Cocheco, and Salmon Falls Rivers, the Piscataqua River, Little Harbor, Rye Harbor, Hampton-Seabrook Harbor, and many smaller tidal tributaries are all part of New Hampshire's diverse estuarine systems.

Project Area

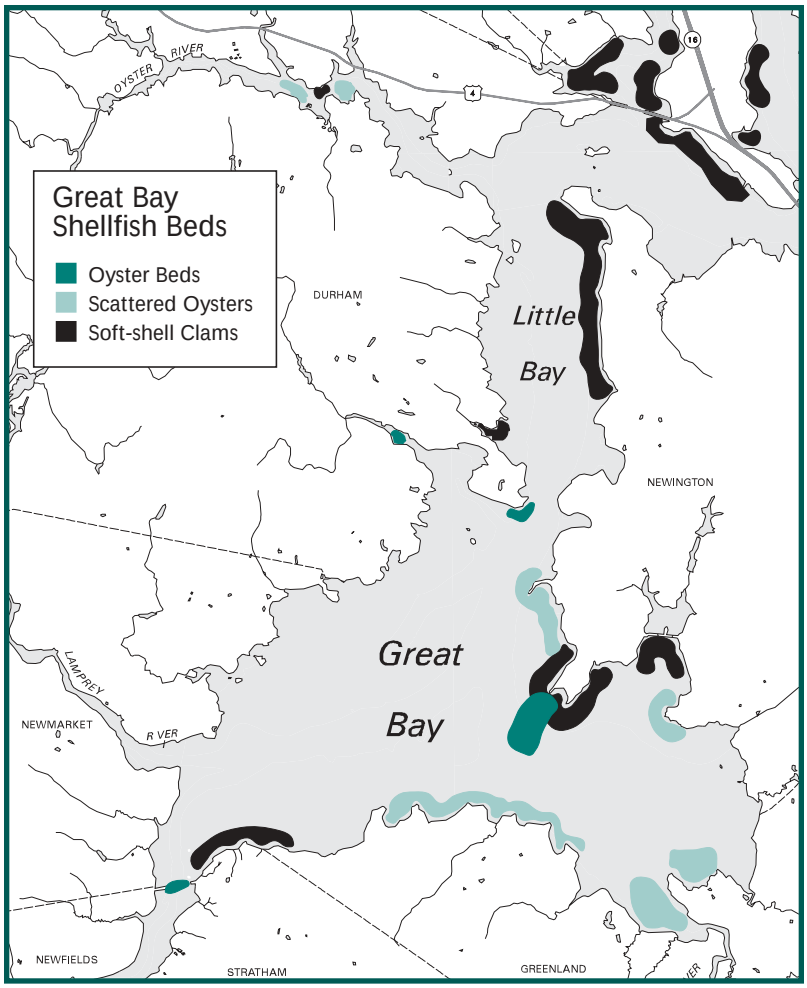
These watershed areas encompass the New Hampshire Estuaries Project study area which includes 43 municipalities, and are the focus of the actions included in the *Management Plan*. (See map of the New Hampshire estuaries watersheds on the inside cover of this *Plan*.)

The entire NHEP area of 43 towns is divided into Zone A and Zone B. The 19 communities of Zone A include all municipalities with tidal shoreline, plus Rochester and Somersworth. Many NHEP Action Plans focus on Zone A cities and towns since they have both the greatest impact and the greatest stake in the environmental health of the estuaries.

Great Bay

The Great Bay Estuary covers 17 square miles with nearly 150 miles of tidal shoreline. Great Bay is unusual because of its inland location, more than five miles up the Piscataqua River from the ocean. Due to its inland location, Great Bay's tidal exchange with the ocean is slow, requiring up to 18 days or 36 tide cycles for water entering the head of the estuary to move to the ocean. With much of Great Bay's shorelines still largely undeveloped, it has

been called “the unknown treasure of the New Hampshire Seacoast.”



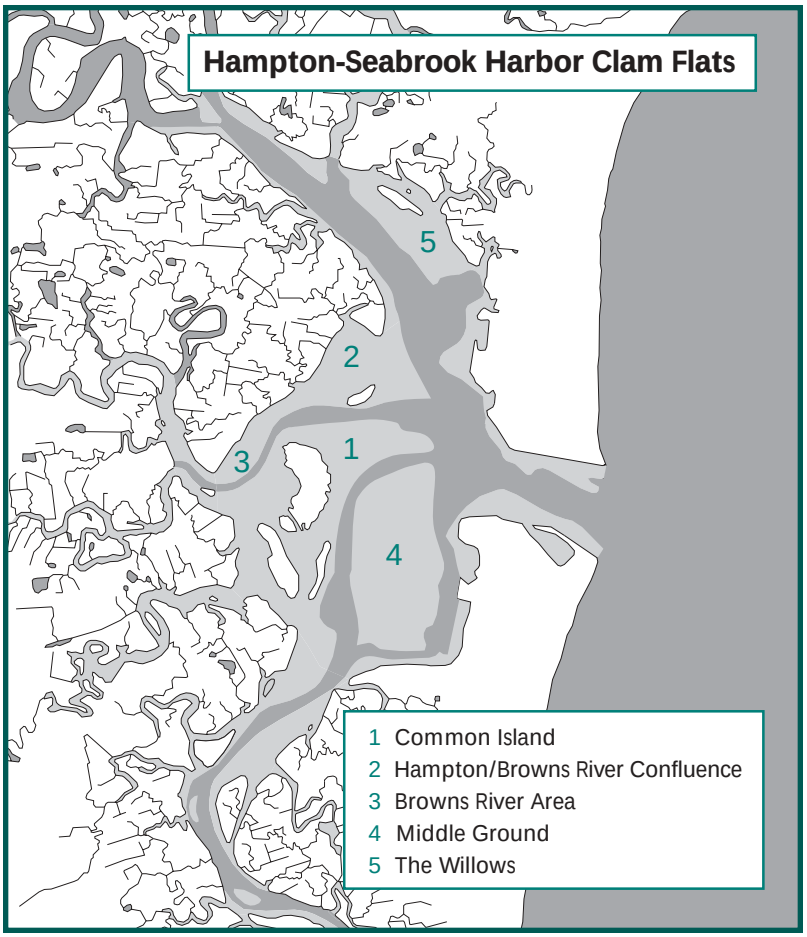
Recreational shellfishers harvest oysters and clams; fishing enthusiasts pursue striped bass, bluefish, herring, or smelt; lobstering is a commercial and recreational activity, and eels are trapped for bait and for export. Birders from all over the country and the world come to view migratory birds against this picturesque backdrop. Great Bay is the state’s principal waterfowl overwintering site, and a focus area for the North American Waterfowl Management Plan. The Great Bay National Wildlife Refuge was established on just over 1,000 acres of the former Pease Air Force Base.

Great Bay’s relatively undisturbed natural setting attracts scientists, researchers, and teachers interested in estuarine and marine processes, or salt marsh, mudflat, eelgrass, and other habitats. The University of New Hampshire, a land-grant, sea-grant, and space-grant university, is located in Durham within the Oyster River watershed of the Great Bay estuarine system. The University of New Hampshire and New Hampshire’s Seacoast have become a nationally and internationally recognized center for research, teaching, and development of practical applications of marine and estuarine science and technology.

Recognized as an estuarine system of national significance, Great Bay is the site of the Great Bay National Estuarine Research Reserve and the University of New Hampshire’s Jackson Estuarine Laboratory. The National Oceanic and Atmospheric Administration recently joined with the University of New Hampshire to establish the Cooperative Institute for Coastal and Estuarine Environmental Technology at UNH. The new Joint Hydrographic Center and the Center for Coastal and Ocean Mapping at UNH have drawn the top researchers in this emerging field.

Hampton-Seabrook Harbor

Hampton-Seabrook Harbor encompasses 475 acres of water at high tide. Characterized by extensive salt marshes and separated from the ocean by a series of barrier beaches, this estuary represents a more typical estuarine system. This estuary’s 5,000 acres of contiguous salt marsh make it by far the largest salt marsh in the state. Hampton-Seabrook Harbor provides the backdrop for Hampton Beach, one of the busiest tourist attractions and vacation spots in the state. It is also the site of the North Atlantic Energy Service Corporation’s Seabrook Station, a nuclear-powered electric generation facility.



Although surrounded by the busy seacoast communities of Seabrook, Hampton, Hampton Falls, and North Hampton, the Hampton-Seabrook Estuary hosts the best clamming in the state. Several thousand New Hampshire residents purchase shellfish licenses each year, most to dig the softshell or steamer clams of the Hampton-Seabrook Estuary.

Estuarine Watersheds

New Hampshire's estuaries are linked to the surrounding upland areas by the freshwater that drains through the Great Bay and coastal watersheds. On its course to the ocean, water collects a variety of materials of both natural and human origin, with profound impacts on the estuaries.

The 43 cities and towns in the 980 square-mile Great Bay and coastal watersheds are linked by water. From rainwater to groundwater, puddles to tidal rivers, across municipal and political boundaries, water moves unerringly through these watersheds along its course to the ocean. Each watershed resident is responsible for safeguarding our mutual interest in the water and natural character of the area, and for leaving a positive environmental legacy of improving the environmental condition of New Hampshire's estuaries.

New Hampshire has benefitted from its close association with the estuaries, but the estuaries themselves have paid a dear price for this association. Rivers that once supported substantial runs of anadromous fish (species that live in saltwater but spawn in freshwater), such as Atlantic salmon, American shad, and alewives and other river herring, now host minimal returns or none at all. Over-harvest and poor estuarine water quality have contributed to declines of seasonal fish populations that depend on estuaries as spawning and nursery grounds.

For many years, our estuaries were used as convenient dumping grounds for sewage and industrial wastes. The industrial history of the Great Bay and coastal watersheds are chronicled in the toxic materials trapped in sediments throughout the estuaries. Dams that once ran mills and factories now restrict freshwater flow and collect sediments. Much of New Hampshire's valuable salt marsh habitat has been lost or degraded to some degree by filling and constriction of tidal flows for roads and development, and by historic ditching and draining for harvesting salt marsh hay and to control mosquitoes. Today we are responsible for dealing with both historic and present-day sources of estuarine contamination.

A REPORT CARD ON NEW HAMPSHIRE'S ESTUARIES

The good news is that our estuaries remain among New Hampshire's crown jewels. The estuaries are a natural and cultural resource treasure. After a long history of sewage and industrial pollution, water quality has improved significantly over the last two decades. The estuaries contain valuable and productive habitats that support diverse species, some rare or endangered.

The bad news is that work remains to be done. Cleaning up the water of the estuaries is critical to the health of resources such as shellfish, and for people to use and enjoy estuarine resources.

The priority water quality problems include:

- Bacterial contamination from runoff from impervious areas, waste water treatment facilities (WWTFs) overloading and malfunctions, illegal direct discharges and cross-connections, and faulty septic systems;
- Nutrient contamination from WWTFs and non-point sources such as tributaries, surface runoff, septic systems, etc.;
- Toxic contaminants from historic industrial sites, oil spills, industrial and municipal wastewater, and stormwater runoff;
- Sediments from upland watersheds or rivers from runoff.

The priority living resource problems include:

- Oyster population declines
- Clam density declines
- Loss or fragmentation of wildlife habitat
- Degraded salt marshes

The management approaches for addressing these problems include:

- Stormwater management
- Elimination or reduction of pollution from WWTFs, cross-connections, and illegal discharges
- Outreach to local and regional planners
- Shellfish resource and sanitation management
- Land conservation
- Shoreland protection
- Limiting sprawl development

Habitat Protection

Improving water quality, and improving and restoring habitats and resource management will help address most of these problems. Growth and development present the greatest environmental challenges to the estuaries. In addition to solving existing problems, planning and preventive actions in the estuarine watersheds are needed to protect the estuaries from the increasing pressures of growth and development.

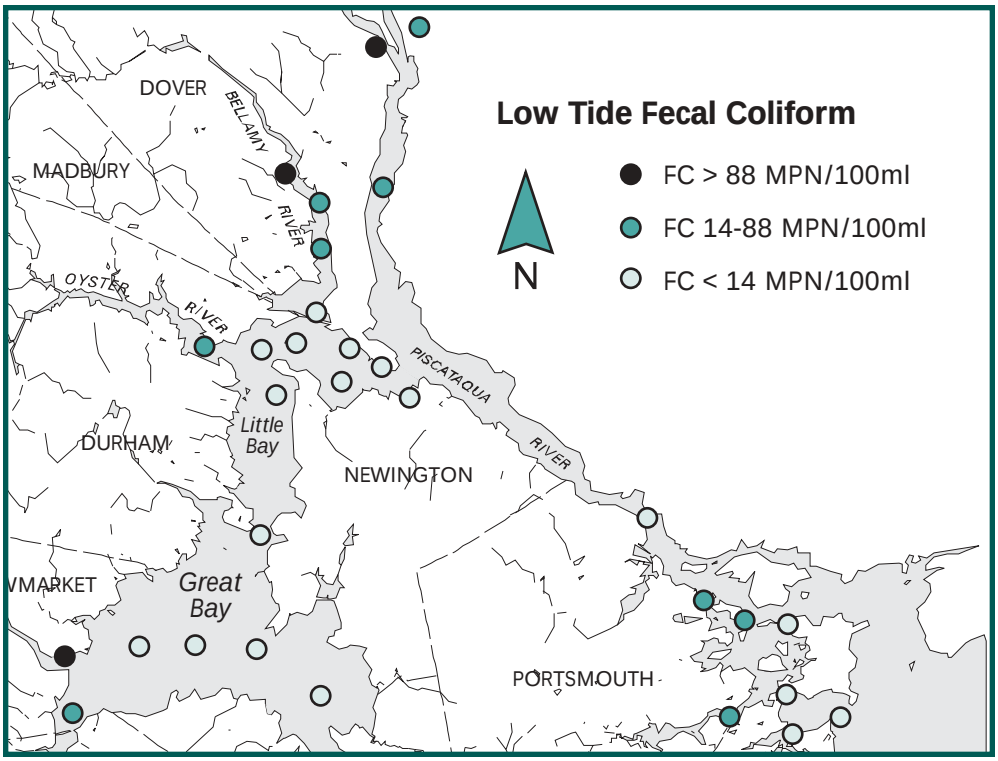
Water Quality

Water quality, an important indicator of environmental health, has a profound influence on the condition of nearly all estuarine habitats, plants, and animals. Water transports and redistributes harmful bacteria, excess nutrients, and toxic materials. Stormwater runoff contributes to degraded water quality and threatens many natural resources throughout the coastal watersheds.

Stormwater contaminates New Hampshire's estuarine waters with pathogenic bacteria and viruses, nutrients, sediment, trace metals and other toxins from roadways, parking lots, roofs, and residential and agricultural areas. Runoff from impervious surfaces carries bacteria and sediments, and is a significant source of trace metal and toxic organic contaminants. Storm runoff from disturbed areas carries sediments and associated nutrients. Runoff resulting from rainfall and snowmelt events in urban and urbanizing areas is the most common source of bacterial contamination in New Hampshire estuaries. This is due to a combination of inflow and infiltration to sewer pipes, overloaded wastewater treatment plants and combined sewer overflows (CSOs), and non-point source runoff. Bacterial contamination is the chief cause of shellfish bed closures.

Non-point source pollution (NPS) is water pollution that comes from diffuse sources and is carried to surface water by rainfall, snowmelt, or groundwater movement. NH DES estimates that over 90% of impairments to lakes, ponds,

Average levels, 1988-98. Levels greater than 14MPN/100ml lead to shellfish harvesting closures.



rivers, and streams statewide are due to non-point sources. Water quality monitoring studies show that non-point sources are a significant problem in New Hampshire coastal waters and tributaries, especially for bacterial contamination. Stormwater runoff can collect, transport, and deposit fecal bacteria, excess nutrients, oils and greases, toxic contaminants from pesticide and herbicide applications, toxic metals, and sediments eroded from shorelines and construction sites. Stormwater runoff, which can include storm sewer cross-connections, is considered the number one water quality problem facing the Seacoast region, and is a factor in keeping some shellfish beds closed.

Point source pollution, typified by both permitted and illegal direct discharges, is a continuing challenge to the environmental character of the coastal watersheds. Wastewater treatment facilities, industrial discharges, and power plants are the most common point sources. While these discharges are closely monitored and regulated through state and federal permitting processes, the demands of regional economic and residential growth challenge wastewater treatment plant capacities, spur demand for electric power, and accelerate the production of industrial waste products. Point source pollution, often characterized by continual low level contaminant loading, tends to increase proportionally with regional growth.

New Hampshire's estuaries are also subject to contamination from the air. **Atmospheric deposition** from both outside and within the state's borders is now recognized as an important source of pollutants to surface waters across the state. Lead, mercury, and nitrogen compounds are deposited directly into surface waters or onto upland watershed areas and delivered to the estuaries in stormwater runoff.

COASTAL AIR QUALITY

An ozone monitoring station at Rye Harbor no longer records levels of ozone that exceed the standards set by the US EPA. Earlier in the 1990s, ozone levels regularly violated EPA's one-hour ozone standard, indicating that the New Hampshire Seacoast, including Great Bay Estuary, had high tropospheric ozone levels. All of Rockingham County was within the ozone non-attainment region, therefore the estuary was in ozone non-attainment. New Hampshire no longer has any areas in violation of this standard.

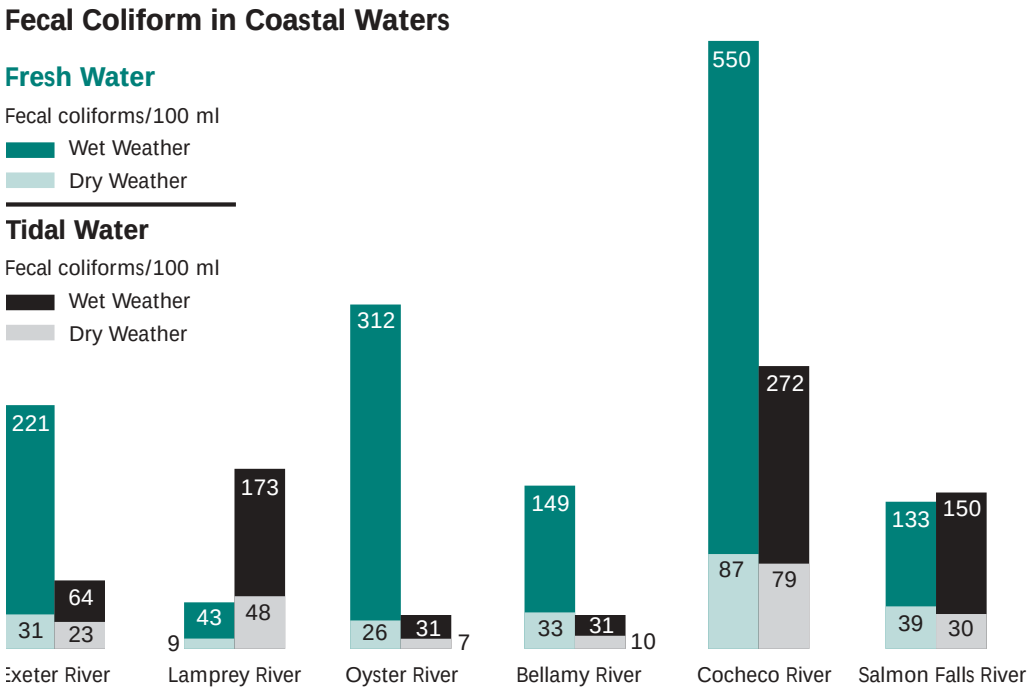
However, EPA recently created a more stringent ozone standard, based on an eight-hour average. Once EPA designates areas of attainment and non-attainment New Hampshire may have some areas that do not meet the eight-hour ozone standard. Air pollution presents health hazards to people and to wildlife, and pollutes surface water as atmospheric deposition. Still, citizens attending NHEP public meetings ranked air quality low in priority, probably because most Seacoast air pollution is beyond the reach of local control.

New Hampshire and other East Coast states affected by ozone pollution carried by air currents from other regions have joined together to form the Ozone Transport Assessment Group (OTAG) to study the problem and seek appropriate actions. Nitrogen oxides (NOx) and volatile organic compounds (VOCs) react together in sunlight to produce low level, or tropospheric, ozone. OTAG studies indicate that NOx is the limiting factor in the photoreaction of NOx and VOC. Of all the NOx generated in New Hampshire, 63% is from mobile sources (motor vehicles) while 24% is from point sources and 13% is from area sources. OTAG data also indicate that the majority of New Hampshire's ozone results from NOx emissions that occur to the south and west, or "upwind." The NH DES has petitioned EPA to mitigate the upwind emissions of NOx by requiring upwind sources to reduce their Nox emissions, in an attempt to reduce New Hampshire's ambient tropospheric ozone concentrations.

The Ozone Transport Assessment Group (OTAG) has completed their policy recommendations and submitted them to EPA for their action. Based on OTAG's data, EPA has proposed new NOx emissions figures that are directed at sources upwind of New Hampshire.

NH DES has also convened a Global Climate Change Workgroup representing a wide range of interests from virtually every sector throughout the state. Their charge is to suggest measures to NH DES to reduce emissions of greenhouse gases cost effectively and without detriment to the economy. There are currently no regulations at the state or federal level aimed specifically at controlling greenhouse gases.

Geometric mean fecal coliforms (colonies/100 ml) in water collected during dry weather and storm events for three consecutive years in tributaries to the Great Bay Estuary: 1993-96.



Bacteria

Fecal coliform bacteria in water is a warning of sewage contamination and may indicate the presence of disease-causing organisms. Found throughout New Hampshire's estuaries, fecal bacteria come from a variety of sources: faulty septic systems, overboard-marine toilet discharges, wastewater treatment facility overflows, and sanitary sewer-stormwater system cross connections. Cross connections occur when sanitary sewers leak – or are illegally connected – into stormwater systems, causing discharge of sewage-contaminated stormwater directly into surface waters. Waterfowl, pet, and livestock waste can also contribute to bacterial contamination. Because of the public health risks associated with these bacteria, fecal coliform levels are routinely monitored throughout coastal New Hampshire in both wet and dry weather. Shellfish beds are closed to harvesting when fecal coliform levels in water exceed 14 per 100 ml.

Although coliform counts in tidal rivers have been reduced dramatically since 1960, water quality sampling throughout the Great Bay Estuary tracks a pattern of elevated counts coming from urban runoff and wastewater treatment plants. Despite significant improvements in recent decades, wastewater treatment facilities (WWTF) in the Seacoast do not meet their required treatment standards 100% of the time. Factors affecting WWTF performance include equipment problems, operational changes, operator errors, storm events, and changes in waste stream. The most severe incidences of bacterial contamination from WWTFs follow rain events that cause systems to overflow.

Bacterial concentrations in New Hampshire estuaries are highest during or immediately after rainfall, indicating that much of the bacterial pollution comes from contaminated stormwater runoff. Storm-associated bacterial pollution has been found in all the primary rivers in the Great Bay watershed, with the highest levels found in the Cocheco River.

High background concentrations of bacteria in the Cocheco River under dry-weather conditions suggest ongoing sewage pollution. Cross-connections that add untreated waste to stormwater systems through cracked pipes and illegal connections are the most likely sources of dry-weather bacterial pollution. Stormwater systems then deliver contaminated water directly to the Cocheco River and streams flowing into Great Bay.

Nutrients

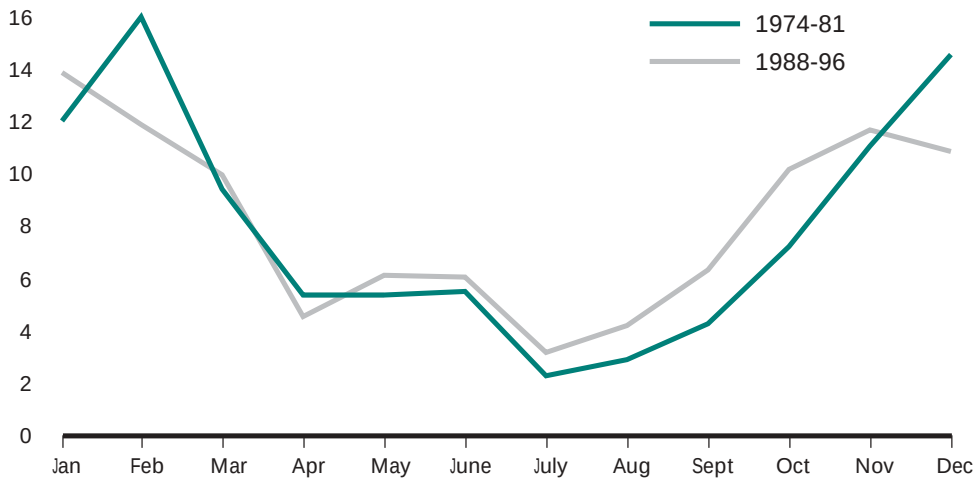
Estuarine systems are especially sensitive to excess nitrogen. Nitrogen is a naturally occurring nutrient essential for plants and algae. But too much nitrogen can promote unrestrained growth of nuisance algae. As these algae blooms die and decompose, they rob the water of oxygen, harming or killing estuarine and marine life.

Nutrient loading is the continual addition of nutrients from natural and human sources. The nutrient load to Great Bay from its tributary rivers comes from both point and non-point sources, and from atmospheric deposition. Nutrient loading occurs in all New Hampshire estuaries and their tributaries. Evidence suggests that nutrient concentrations within the main area of Great Bay have not changed significantly over the past twenty years. No widespread eutrophication effects have been observed. However, local isolated incidents of reduced oxygen levels and intense phytoplankton blooms have been observed in some freshwater tributaries of the Great Bay Estuary. Documented effects of phytoplankton blooms in other areas are rare. Thus, eutrophication and related impacts do not appear to be an imminent widespread problem.

No data is available on nutrient loading in Hampton-Seabrook, Rye, and Little harbors. But given the 80% tidal exchange twice a day, excess nutrients are not believed to be a problem.

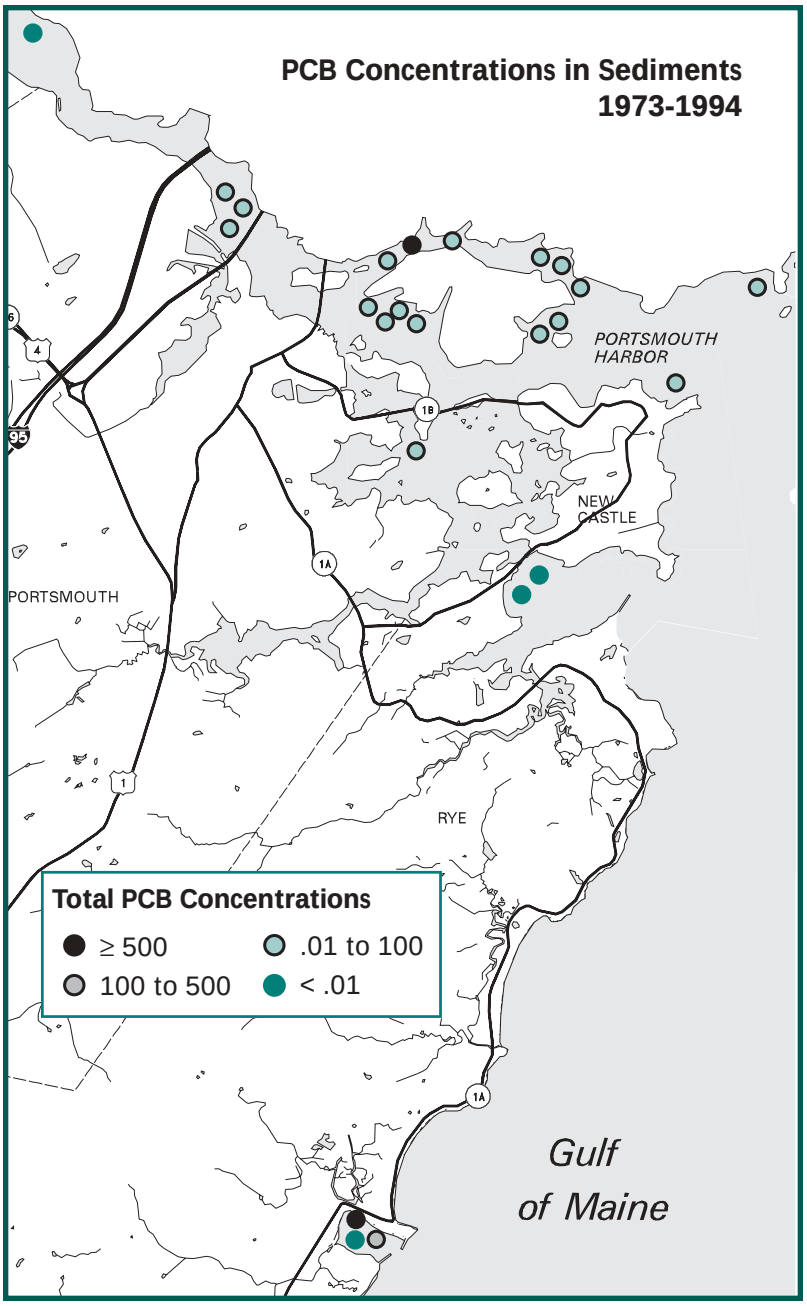
However, sources of nutrient contaminants such as wastewater treatment facility effluent, lawn fertilizer residue, septic systems, and runoff from impervious surfaces, will increase with human population growth and development pressures. For this reason, it is important to continue to monitor nutrient levels in New Hampshire's estuaries as a safeguard against gross nutrient contamination.

Dissolved Inorganic Nitrogen



Monthly mean dissolved inorganic nitrogen at Adams Point in Great Bay for the years 1973-81 and 1988-96.

Nutrient concentrations within the main area of Great Bay have not changed significantly over the past 20 years.



Spatial distribution of PCB concentrations showing hot spots in Hampton Harbor and near the Portsmouth Naval Shipyard.

Toxic Materials

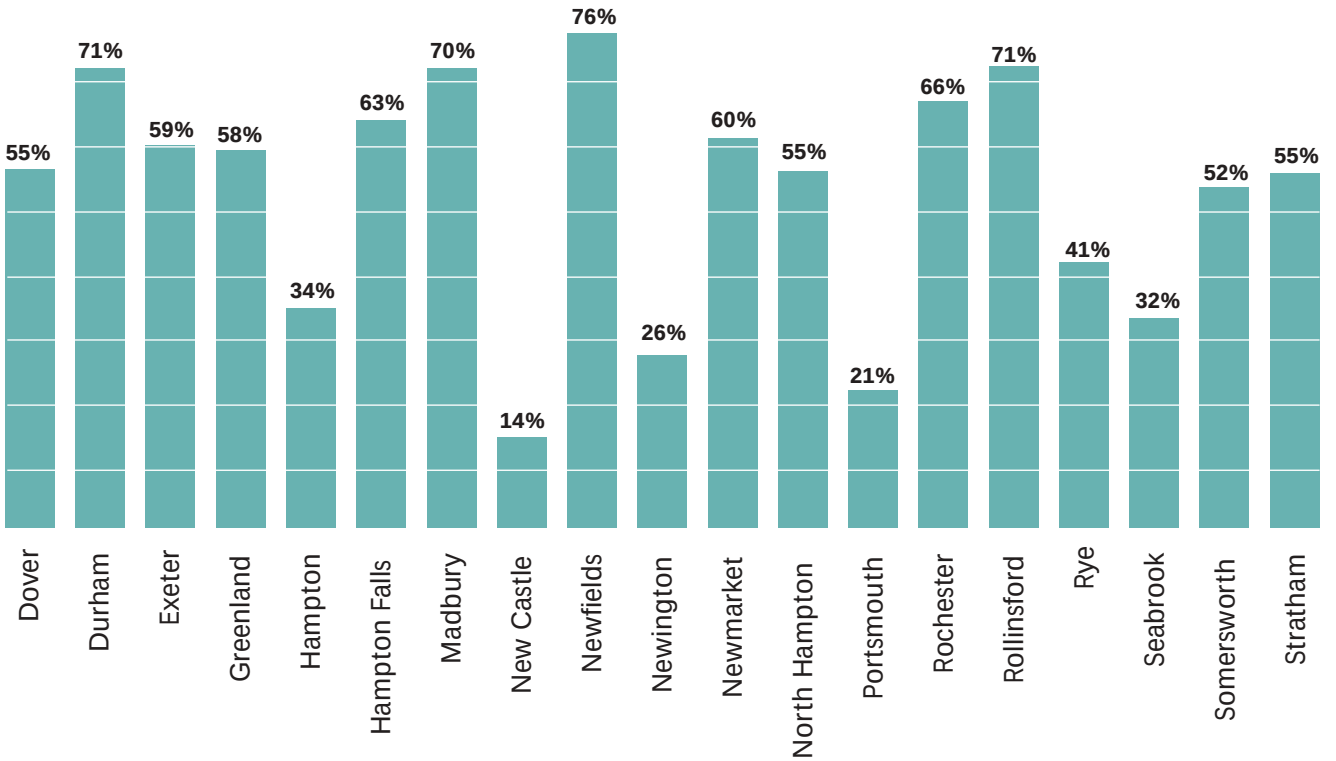
Heavy metal and toxic organic compounds are found throughout New Hampshire's estuaries. The Portsmouth Naval Shipyard, the former Pease Air Force Base, and a few other locations exhibit particularly elevated concentrations of some toxic contaminants. The most common toxic contaminants are chromium, lead, mercury, copper, zinc, and PCBs. A warning has been issued against consuming lobster tomalley due to PCB levels. DDT and other organic pollutants are present at elevated levels at some sites, but not at concentrations of concern to humans and other living things in most cases. Concentrations may warrant limited, localized concern, but remediation is complicated, with issues of stirring up and redistributing contaminants, disposing of dredgespoil, etc.

From colonial times mills, tanneries, and factories were built on the banks of our coastal rivers for their waterpower, shipping access, and easy waste disposal. A legacy of toxic contamination remains stored in the fine-grained sediments dispersed throughout the estuaries. Currently small doses of toxins enter the estuaries from permitted and monitored discharges, pesticides, atmospheric deposition, and occasional oil spills. Other suspected sources include municipal discharges, stormwater runoff, and groundwater contaminated with leachate from hazardous waste disposal sites.

Land Use and Regional Growth

Many of the threats to the environmental character of our estuaries are the direct result of human activities, including development of land for residential, commercial, industrial, and other uses. Continued population growth and development in the coastal region will add more impervious surfaces – paved areas, buildings, etc. – and add to the potential for increased stormwater-related, non-point source pollution. Negative impacts on both water quality and living resources can be managed through careful planning of development. New Hampshire communities – especially those with urbanized areas near surface waters – need technologies that effectively treat runoff.

Potentially Developable Land in the 19 Coastal New Hampshire Municipalities, 1998



The greatest threats to water quality, habitat, and quality of life from land use and development are:

See p. 5-2 for a map of potentially developable land described above.

Impervious surfaces created in the built environment add to the volume and velocity of stormwater, sending more pollutants and sediments through drains and tributaries or directly into the estuaries.

Shoreland development can destroy the natural buffering of vegetated and wooded soils against erosion and runoff, destroys wildlife habitat and travel corridors, and alters scenic vistas from both shore and water.

Sprawl development fragments wildlife habitat and corridors and reduces open space.

In the 19 New Hampshire towns with tidal shoreline (NHEP Zone A), approximately 30% of the land is currently developed. Studies indicate an additional remaining 15% is undevelopable due to permanent conservation and wetlands restrictions. Up to 55% of the total land area within these towns could potentially be developed, i.e., land with no legal restrictions or physical constraints that would prevent development. Future development will magnify runoff-associated problems and create new natural resource management issues by increasing impervious surfaces and destroying or degrading riparian and wetland habitats.

Shorelands are under particularly intense residential development pressure because many people desire to live by water in a coastal area. Shoreland development can impair a riparian area's ability to protect water quality and

provide habitat to several important wildlife species. Recent analyses indicate 35% of New Hampshire's tidal shoreland – defined as a strip of land extending 300 feet from the water's edge – is already developed. Just 16% of tidal shoreland is permanently protected, with an additional 21% likely to remain undeveloped because of natural resource constraints. But approximately 28% of the state's tidal shorelands remain open and developable. Both shoreland preservation and conscientious development of shorelands require careful planning and attention.

Natural Resources

The rich diversity of habitats found in New Hampshire's estuaries support a great variety of plants, animals, and fish, including rare and endangered species. Botanists have identified 67 rare plant species within the Great Bay and coastal watersheds, a dozen associated with estuarine environments.

These estuarine habitats include salt marshes, eelgrass beds, algal beds, rocky intertidal areas, barrier beaches, dunes, mud and sandflats, clam and oyster beds, and subtidal bottom habitats with substrate ranging from mud to cobble and boulders. The NH Coastal Program and the UNH Complex Systems Research Center are developing geographic information system (GIS) data to map the location and extent of these various habitat areas.

Protecting and buffering the variety of habitats found throughout the Great Bay and coastal watersheds safeguards the area's unique natural character, and supports the survival of the species that use and depend on these habitats. Preserving and protecting these important habitats demands careful planning as development pressures grow and human uses within the watershed increase.

Land Use Regulations for 19 Estuarine Communities in Coastal New Hampshire

Regulation	Number of Towns with Regulations	% Towns with Regulations
Master Plan	19	100%
Erosion Control	18	95%
Stormwater Control	17	89%
Wetland Protection	17	89%
Septic Control	15	79%
Gravel Extraction	14	74%
Open Space	13	68%
Floodplain Ordinances	13	68%
Aquifer Protection	12	63%
Shoreland Protection	12	63%
Chemicals/Toxics	8	42%
Growth Management	8	42%
Water Resource Management Protection Plan	5	26%
Marinas	4	21%
Impact Studies	3	16%
Biosolids	2	11%
Review Committees	2	11%

THE NHEP BASE PROGRAM ANALYSIS AND TECHNICAL CHARACTERIZATION

See Chapter 9 for more detailed recommendations from the Base Programs Analysis.

The National Estuaries Program requires a *Base Program Analysis* (BPA) of existing local and state regulatory and management programs for protecting estuarine resources. Gathering this background information was an essential step for the NHEP in designing a realistic and workable *Management Plan*. The NHEP Base Program Analysis, *Regulation and Management of New Hampshire's Estuaries*, evaluated the effectiveness of the existing framework, and provided valuable insight for identifying priority issues and management road-blocks.

The Water Quality; Land Use, Development, and Habitat Protection; Shellfish Resources; and Habitat Restoration chapters of the NHEP *Management Plan* and the Action Plans each have a technical or scientific component taken from *A Technical Characterization of Estuarine and Coastal New Hampshire*, and a regulatory and management section derived from the BPA. The *Technical Characterization* is a detailed review and analysis of current scientific research and knowledge of New Hampshire's estuaries, and is the source for most of the scientific and technical information contained in this *Management Plan*. Both the *Base Program Analysis* and the *Technical Characterization* are available from the NHEP.

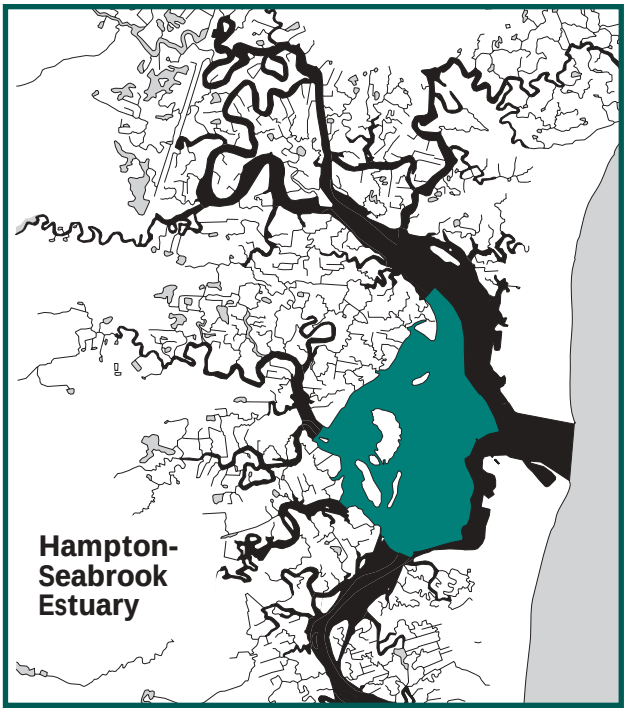
The *BPA* found a reasonably strong regulatory framework for natural resource protection of the estuaries. Programs for shoreland and wetland protection are sound, as are the point source permit program and septic regulations. While regulations for living resource conservation are adequate, follow through is limited in some cases.

Most other regulatory programs rely on voluntary efforts and Best Management Practices (BMPs) to protect water quality. The effectiveness of this approach depends on BMPs keeping up with constant progress in treatment technologies and scientific understanding. Non-point source and stormwater control BMPs are currently being reviewed and updated.

The BPA identified several additional regulatory and management shortcomings. State stormwater and erosion control regulations apply only when areas of 100,000 square feet or more are disturbed (50,000 square feet in protected shoreland). Shoreland regulations are complicated. Wetlands mitigation practices lack clarity. Protection for vernal pools and wetland drainages is limited. NH Department of Transportation policy on site disturbances and stormwater runoff is unclear. A limited number of communities have used local regulations to address some of the state-level gaps, such as shoreland protection and stormwater and erosion controls.

Regulatory enforcement and site-specific monitoring are also important estuarine management issues. For example, current septic system maintenance and performance requirements are often unenforceable due to the large numbers of systems in each community. Enforcement of local regulations and adequate on-site monitoring can be an administrative burden for volunteer, part-time municipal officials.

1998 Shellfish Water Classifications



Open Closed

Open Closed

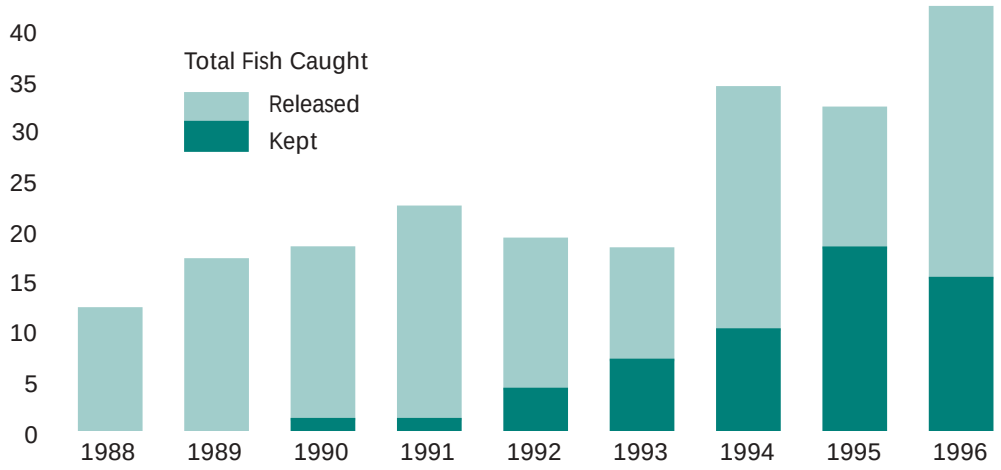
Shellfish Resources

Shellfish in New Hampshire are limited to recreational harvest only, because the state does not have a US Food & Drug Administration approved program for commercial harvesting. Shellfish harvest is a popular recreational pursuit in New Hampshire. However, oyster resources in the Great Bay Estuary have declined in recent years. From 1991 to 1996 oyster density reductions in three beds of recreational importance ranged from 42% to 69%. Other oyster beds have lost significant bed acreage, especially in the Oyster and Bellamy rivers. Oyster harvests reflect these declines: a 1991 study estimated a total harvest of 5,000 bushels of oysters by 1,000 license holders, but by 1997 the estimated harvest had declined to 2,700 bushels by 661 harvesters. Predation, limited availability of suitable larvae-attachment substrate, disease, harvest pressure, and a variety of management issues are likely factors in these declines.

Softshell clam resources in the Hampton-Seabrook Estuary are well documented. Adult populations on three particular flats of the estuary peaked in abundance in the early-to-mid 1980s, then declined sharply through the late 1980s. This decline was most likely due to intense recreational and illegal harvest pressure.

After the flats were closed to harvesting in the late 1980s, adult clam densities began to recover. Conditional reopening of the flats to harvest in 1994 appears not to have significantly affected the resource. From 1990 to 1995 adult clam densities quadrupled on the Middle Ground flat, while Common Island densities remained essentially unchanged. Clam densities in the Hampton River decreased by 50%. One suspected cause of this decrease is a lethal form of leukemia in clams. Little information is available on the softshell clam resources of the Great Bay Estuary and the Little Harbor-Back Channel area.

Tagged Striped Bass Catches



Striped bass caught in New Hampshire with U.S. Fish and Wildlife Service tags: 1988-96.

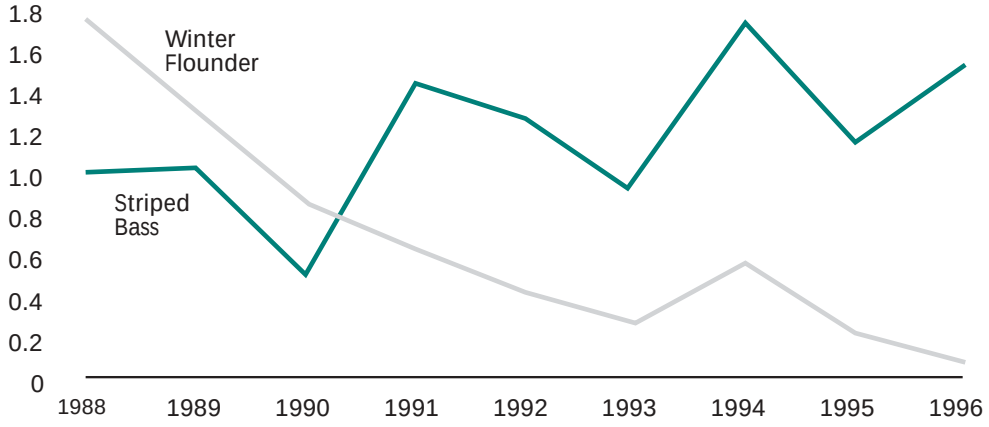
Finfish

A region-wide moratorium and subsequent harvest restrictions on striped bass in the 1980s and 1990s have resulted in dramatic gains in the seasonal occurrence of stripers in New Hampshire waters. Catches of both legal and undersized striped bass tagged by the U.S. Fish and Wildlife Service have increased steadily since 1988. Biologists and anglers generally confirm that fish of all sizes have increased in abundance.

Recreational anglers have not enjoyed this same abundance with winter flounder. Catch per unit effort declined steadily from 1988 to 1993, rose briefly in 1994 and 1995, and then decreased again in 1996. Although juvenile fish appear abundant in the estuaries, adult populations have declined due to commercial harvest pressure in the Gulf of Maine. Commercial landings of winter flounder show a similar, steady decline.

Rainbow smelt catches have varied greatly at several locations in the Great Bay Estuary – peaking in the late 1980s, declining sharply in the early 1990s, and increasing in the mid 1990s. From 1975 to 1996 spring returns of river herring (alewife and blueback) declined in the Exeter, Lamprey, and Taylor rivers, but increased in the Oyster and Cocheco rivers.

Finfish Catches



Catch per trip of striped bass and winter flounder. Based on survey information.

Whimbrel

Waterfowl and Shorebirds

The Seacoast is the principal wintering location for waterfowl in New Hampshire, with 75% of the state's overwintering waterfowl found on Great Bay. State, federal, and locally controlled reserves and sanctuaries in the Great Bay area provide over 6,300 acres of wetlands salt marsh and upland habitat. As a result, Great Bay is an important destination for birders interested in a variety of waterfowl and shorebirds. Great Bay is also a focus area for the North American Waterfowl Management Plan. The Great Bay National Estuarine Research Reserve lists over 170 species by season and abundance on its checklist of the birds of Great Bay. A recent mid-winter survey recorded mallards, black ducks, greater and lesser scaup, goldeneye, bufflehead, red-breasted mergansers, and Canada geese as the predominant waterfowl.

Salt Marsh

The 5,000-acre salt marsh of the Hampton-Seabrook Estuary is the largest contiguous salt marsh in the state. Tidal marshes of the Great Bay Estuary total 2,230 acres, with the most extensive salt marshes found along the lower Piscataqua River, the Squamscott River, and Great Bay itself. The fringing marshes of the Great Bay Estuary wind along tidal shorelines between the low tide line and adjacent upland areas, wherever the soils, elevations, and tidal action are favorable.

The Hampton-Seabrook Estuary

GBNERR

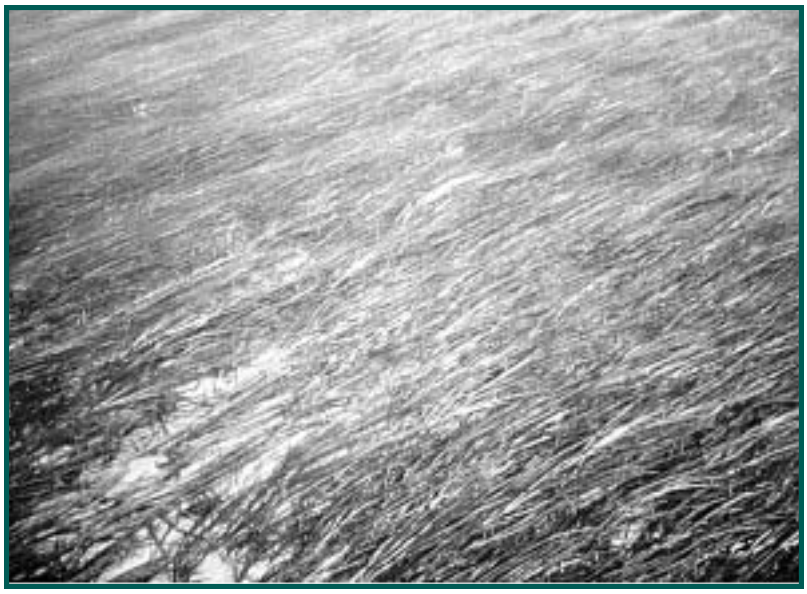
MORRISON

Nearly all salt marshes in New Hampshire were subjected to ditching and draining at one time or another into the first half of this century, in attempts to control mosquitoes or increase harvest of salt marsh hay. Present salt marsh acreage in the state is half of what it once was, with most of the lost acreage filled for residential and industrial development and road or rail construction. Total salt marsh acreage has remained the same over the past decade. However, past development of salt marshes and road and railroad crossings have restricted water circulation and tidal flow within the remaining marshes. These changes in the natural tidal flow have degraded salt marsh function, with impacts including growth of invasive species such as purple loosestrife and *Phragmites australis* or common reed.

Recently a number of salt marshes in New Hampshire have been successfully restored by re-establishing tidal flow and freshwater exchange. Most of these projects have re-established tidal flow and exchange to marshes where tides were restricted by undersized or damaged culverts, water control structures, and/or berms of debris or dredge spoil. Recovery of marsh functions and habitat has been rapid and successful. By 1999 the collaborative efforts of many different agencies and landowners had restored or enhanced over 430 acres of salt marsh in New Hampshire.

Eelgrass

Eelgrass beds or meadows form subtidal and intertidal seagrass habitats which cover the greatest area of all habitat types in the Great Bay Estuary. Eelgrass habitats are important as breeding and nursery grounds for finfish, shellfish, and other invertebrates, and as feeding grounds for many fish, invertebrates, and birds. Eelgrass stabilizes bottom sediments, and may also filter nutrients, suspended sediments, and contaminants from estuarine waters.



Eelgrass

Eelgrass wasting disease (caused by the myxomycete *laburinthula sp.)* was first recognized in Great Bay in the 1940s. In the late 1980s wasting disease caused dramatic eelgrass declines in the Great Bay Estuary, arousing great concern into the early 1990s. However, historical eelgrass beds have made an impressive recovery of acreage and densities, and new beds have been observed in areas previously devoid of eelgrass. While overall the resource is improving, recovery of lost eelgrass areas has been significantly slower in Little Bay.

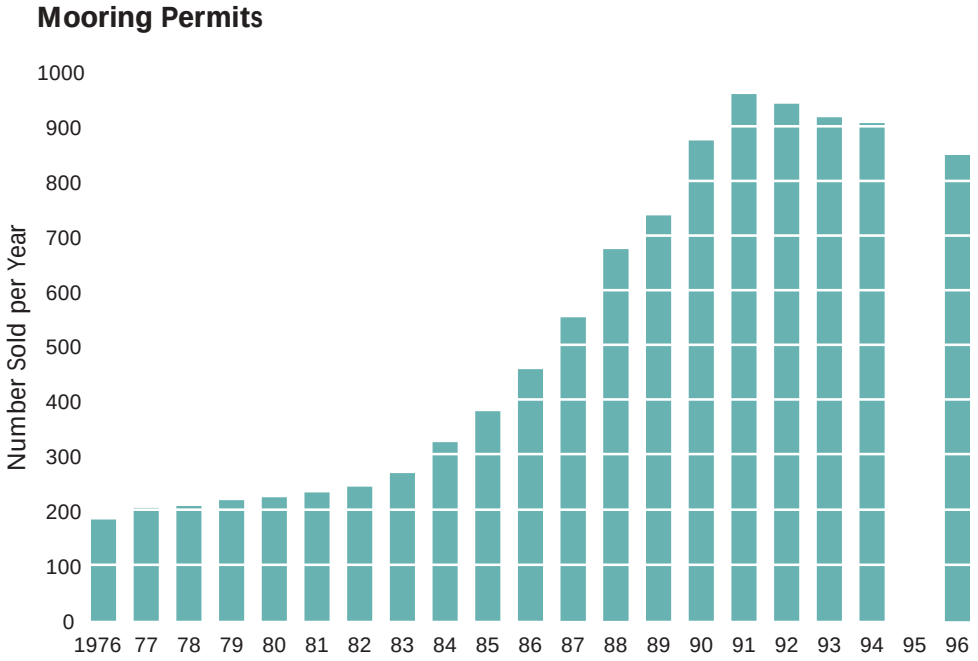
Eelgrass restoration efforts have been conducted at several sites in the Great Bay Estuary, including Little Bay where beds killed by the wasting disease have not recovered in over 10 years. Eelgrass restoration projects have also been undertaken in Rye Harbor and the Piscataqua River adjacent to the State Port Facility expansion.

Recreational and Commercial Uses

Recreational Tourism and Boating

Tourism and recreation are important to the Seacoast economy. Tourism is the region's second-largest industry, with over 15% of jobs tourism-related. Important recreational activities include boating, fishing and shellfishing, sailing, day cruises, and tours. Boating has grown in popularity since the 1980s, with over 8,500 boats registered for tidal waters in 1992. Annual mooring permit sales grew dramatically in the 1980s and into early 1990s, but have leveled off since the NH Port Authority implemented a harbor management plan. Canoeing, rowing, kayaking, and windsurfing are also popular activities in the estuaries.

Annual mooring permit sales by the New Hampshire Port Authority: 1976-1996



Commercial Fishing

The American lobster is the most important commercially harvested species in New Hampshire, yielding about $16 million annually. Lobsters migrate into the estuaries during late spring, with some moving well into Great Bay during the summer. Despite fishing pressure in estuarine and ocean areas from 300 lobster fishers, landings remained relatively stable during the 1990s, averaging almost 1.6 million pounds annually from 1992 to 1997. In 1996 a summer oil spill and an October salinity drop caused by a particularly heavy rainfall event (greater than 12 inches of rain in two days in some areas) had negative impacts on lobsters, particularly those in traps at the time of the events. Mortality estimates are not available, but slightly lower 1997 lobster catches may be partly due to these events.

Landings of cod and winter flounder, also important to New Hampshire's commercial fishing fleet, consistently declined from 1992 to 1997. Spiny dogfish, shrimp, sea urchin, and other species have gained importance to the state's fishing industry. Recent catch records suggest that these species may also be succumbing to increased fishing pressure.

Recreational Fishing

Recreational fishermen pursue a variety of species, including striped bass, bluefish, salmon, mackerel, tomcod, flounder, shad, and smelt. In addition to boat access, numerous shore and bridge locations are used for fishing. Several charter boat companies in the Great Bay and Hampton-Seabrook estuaries take fishermen to inshore and offshore locations. Almost 150 recreational lobstermen set traps throughout the Great Bay and Hampton-Seabrook estuaries. A 1990 NH Fish & Game study estimated 88,000 saltwater anglers spent over $52 million dollars on fishing-related expenses.

NHEP

Striped bass fisherman

Recreational Shellfishing

Recreational shellfishing is an important part of the history and tradition of coastal New Hampshire, with its almost 250 miles of tidal shoreline. Softshell (steamer) clams and oysters are the principal quarries of recreational harvesters, but other shellfish species are also sought. Oysters are primarily harvested from the Great Bay Estuary, while softshell clams are primarily dug from the Hampton-Seabrook Estuary. In 1994 almost 3,000 clamming licenses were sold to New Hampshire residents, while oyster harvesters numbered nearly 1,000. A UNH study in 1992 estimated that recreational clamming in the Hampton-Seabrook Estuary contributed nearly $3 million to the state and local economy.

However, over half the shellfish-growing waters in New Hampshire's estuaries remain closed to harvesting. Shellfish beds are closed due to bacterial contamination, and due to insufficient monitoring to declare areas open and shellfish safe for human consumption. The impacts of wastewater treatment plant overflows, stormwater/sewer cross connections, and stormwater runoff require closure of beds after even small amounts of rain. This demonstrates the links between human activity in the watershed, water quality, and shellfish sanitation.

The NHEP is using shellfish in a number of ways to achieve its water quality goals. First, shellfish are used to directly measure water quality improvements. As estuarine water quality improves, more shellfish beds reopen. Second, shellfish are recognized as a tangible, understandable, and reliable indicator of overall environmental health. Thriving populations of shellfish typically indicate that other estuarine species are also healthy, and help to improve water quality by filtering estuarine water. Finally, the NHEP seeks to reopen as many of the state's closed beds as possible for citizens who enjoy harvesting this public resource.

A VISION FOR NEW HAMPSHIRE'S ESTUARIES

3

The mission of the New Hampshire Estuaries Project is to promote, protect, and enhance the environmental quality of the state's estuaries. Continuing growth and development in the region makes realizing this mission all the more challenging. Participants in the three-year planning process mapped out a vision for the estuaries in 2005 and beyond. This future includes:

GBNERR

Sailing on Great Bay

- Cleaner water;
- Regional development patterns that protect water quality, maintain open space and important habitat areas, and preserve the beauty and views of the estuaries;
- More healthy shellfish beds open to recreational harvest; and
- Restoration and enhancement of important habitat areas that have been altered or degraded.

Teams of citizens, resource professionals, and state and local officials have developed a detailed series of steps, or Action Plans, to make this vision a reality. These Action Plans are the heart of this *Plan*.

New Hampshire's Great Bay and coastal estuaries are dynamic, complex systems. Their location and wealth of resources have drawn human activity since pre-colonial times. Their beauty, diversity, and productivity make New Hampshire's estuaries treasure troves of natural and cultural heritage. The people who live, work, and visit within the watersheds of the estuaries are part of this sensitive ecosystem, and the health and future of these unique resources are in our hands.

The greatest environmental risks to the estuaries are from population growth and development, which can have significant impacts on water quality and living resources, and can result in loss and fragmentation of habitat and open space. The health of the estuaries, in turn, affects human health and well-being, as well as the economic, recreational, and cultural opportunities of people in the Seacoast region and the state. Recreation and tourism,

S. MIRICK

Adams Point, Great Bay

important economic activities for the New Hampshire Seacoast, depend on clean water and healthy estuaries. The New Hampshire Estuaries Project aims to provide the support and tools for this generation of residents to be careful stewards of the estuaries.

The Office of State Planning projects Rockingham County will grow by nearly 140,000 people by 2020, or 35% of all statewide growth. Rockingham and Strafford Counties are part of a four-county area that makes up less than 33% of the state's land area, but will host 85% of the state's population growth from 1997-2020. These two counties are home to New Hampshire's estuaries and their watersheds, which are the focus of this *Plan*.

The *Plan* uses water quality to chart a practical course for achieving NHEP goals for the estuaries. Clean water is the critical element for healthy estuaries and is the focus of the Action Plans developed to address those threats. Protecting and improving water quality requires both correcting existing problems that degrade water quality, and preventing future problems. NHEP has chosen to focus on improving water quality as the most effective way to attain broad measurable results, and to communicate the need to protect all aspects of environmental quality.

Environmental quality encompasses a broad and interrelated range of issues and problems. All healthy organisms – including humans – and their habitats require clean water. People need clean water to enjoy the estuary and its abundant living resources, whether as a source of food, of earning a living, or for quality of life and recreation. NHEP's focus on water quality requires addressing the full range of issues affecting environmental quality of the estuaries, including pollution, land use, habitat protection and restoration, shellfish sanitation and resource management, and more.

PRIORITY CONCERNS

ANMP

Sediment sampling: North Mill Pond, Portsmouth

Reducing current pollution sources is not enough to ensure the protection and improvement of water quality. Prevention of future pollution is essential, and requires a discussion of how we use land, and how we can protect and restore habitats like freshwater and tidal wetlands, shorelands, and upland buffers and corridors. To address the priority problems outlined in Chapter 2, the New Hampshire Estuaries Project goals and actions focus on five areas of concern, all of which are interrelated:

1. **Water Quality:** Identify and eliminate or reduce pollution sources that degrade water quality;
2. **Land Use, Development, and Habitat Protection:** Work with municipalities within the estuarine watershed to ensure that land use policies and new development consider impacts on estuarine water quality and habitats;
3. **Shellfish Resources:** Open shellfish beds that have been closed due to pollution or lack of testing to certify shellfish safety for human consumption;
4. **Habitat Restoration:** Protect and restore viable and diverse habitats in the estuarine region;
5. **Outreach and Education:** Raise awareness and engage communities, government agencies, organizations, and individuals in responsible use and stewardship of the estuaries.

The NHEP visions of the future were formulated around the topics of water quality, land use, shellfish, habitat, and education. NHEP participants were then asked to identify steps needed to take us from where we are today to where we want to be in the future. These steps were developed into the individual action plans outlined in the *Plan*. The highest priority action plans will be implemented first, with high priority and priority action plans implemented as funding becomes available. To assess the success of the Action Plans, measureable objectives were developed and are presented on pages 3-7 to 3-17. *Appendix 3: Results of the NHEP Planning Process* details the development of the goals, objectives, and strategies of the *NHEP Management Plan*.

L. CHASE

Water quality sampling on the Cocheco River

Goals for Water Quality

To achieve **cleaner water**, the NHEP established a set of specific goals with measurable, science-based standards. Actions to achieve these goals are detailed in *Chapter 4: Water Quality*.

- Ensure that New Hampshire's estuarine waters and tributaries will meet standards for pathogenic bacteria, including fecal coliform, *E. coli*, and *Enterococci* bacteria.
- Ensure that New Hampshire's estuarine waters, tributaries, sediments, and edible portions of fish, shellfish, other aquatic life, and wildlife will meet standards for metals, PCBs, oil and grease, PAHs, and other toxic contaminants.
- Ensure that New Hampshire's estuarine waters and tributaries will meet standards for organic and inorganic nutrients, specifically nitrogen, phosphorus, chlorophyll a (freshwater), dissolved oxygen, and biological oxygen demand (BOD).

Goals for Land Use, Development, and Habitat Protection

The goals for **land use** and **habitat protection** in the watersheds of the estuaries are critical to future environmental quality of the estuaries. See *Chapter 5: Land Use, Development, and Habitat Protection* for complete action plans.

- Ensure that the New Hampshire estuarine watersheds will have development patterns that protect estuarine water quality and preserve the rural quality of the waershed.
- Maximize the acreage and health of tidal wetlands in the coastal New Hampshire watershed.
- Protect freshwater and tidal shorelands by using buffers or setbacks along tidal and freshwater shorelands to safeguard estuarine water quality and other estuarine values such as habitat and scenic views.
- Protect estuarine water quality by ensuring that groundwater impacts are minimized.
- Maintain habitats of sufficient size and quality to support populations of naturally occurring plants, animals, and communities.
- Allow no net loss of freshwater wetland functions in the New Hampshire coastal watershed.

Goals for Shellfish Resources

The goals for shellfish resources are specific and measurable. See *Chapter 6: Shellfish Resources* for complete action plans.

- Achieve sustainable shellfish resources by tripling the area of shellfish beds that are classified open for harvesting to 75% of all beds, and tripling the quantity of harvestable clams and oysters in New Hampshire's estuaries.

R. LANGAN

Adult oysters with juvenile settlement

- Assure that shellfish are fit for human consumption and support a healthy marine ecosystem.
- Provide opportunities and strategies for restoration of shellfish communities and habitat.
- Support coordination to achieve environmentally sound shellfish aquaculture activities.

Goals for Habitat Restoration

Habitat restoration goals are linked to those for water quality, shellfish, and land use and habitat protection. Action plans are detailed in *Chapter 7: Habitat Restoration*.

- Maintain habitats of sufficient size and quality to support populations of naturally occurring plants, animals, and communities.

Goals for Education and Outreach

Public education and outreach is another key component of the *Plan* and its future success in meeting these ambitious environmental goals. Outreach efforts and goals are linked to and reinforce all other parts of the *Plan*. Civic leadership and public knowledge, stewardship, cooperation, participation, and demand for accountability will inform and guide the work of realizing these goals and objectives. Local governments, businesses, and organizations are key players in protecting New Hampshire's estuaries. Some goals depend on direct actions of citizens and landowners. Public participation and local knowledge contributed greatly to the *Plan's* development and are essential to its implementation.

Chapter 8: Public Outreach and Education outlines action plans for the first general outreach goal below. The chapters on water quality, land use, and shellfish include action plans for outreach goals dedicated to those topics.

- Raise awareness and engage participation of communities, government agencies, organizations, and individuals in the responsible use and stewardship of New Hampshire's estuaries.
- Engage the active participation of communities, government agencies, organizations, and individuals in achieving the goals for water quality; land use, habitat protection, and restoration; and shellfish for New Hampshire's estuaries.

Storm drain stencilling

J. PETERSON

WATER QUALITY OBJECTIVES

Goal #1: Ensure the New Hampshire's estuarine waters and tributaries will meet standards for pathogenic bacteria including fecal coliform, *E. coli,* and Enterocci.

MANAGEMENT OBJECTIVES

Objective 1

Achieve water quality in Great Bay and Hampton Harbor that meets shellfish harvest standards (14 counts of fecal coliform/100 ml) by 2010.

Objective 2

Minimize beach closures due to failure to meet water quality standards for tidal waters (Enterococci levels not exceeding 104 counts/ 100 ml. in any one sample).

Objective 3

Increase water bodies in the NH coastal watershed designated 'swimmable' by achieving state water quality standards (*E. coli* levels not exceeding 406 counts/100 ml in any one sample. For designated beaches, *E. coli* should not exceed 88 counts/100 ml.)

Objective 4

Reduce the number of known illicit connections in the NH coastal watershed by 50% by 2010.

Objective 5

Achieve 50% reduction of known illegal discharges into Great Bay, Hampton Harbor and the tributaries by 2010.

ACTION PLANS

WQ-3 Prioritize and upgrade facilities to reduce bacterial pollution from hydraulic overloading of wastewater treatment facilities. (High)

WQ-4A Establish ongoing training and support for municipal personnel in monitoring storm drainage systems for illicit connections. (Highest)

WQ-4B Assist seacoast communities in completing and maintaining maps of sewer and stormwater drainage infrastructure. (Highest)

SHL-2 Identify sources of and reduce or eliminate contaminants in NH's estuarine watersheds. (Priority)

SHL 5 Regularly collect and monitor water quality to identify sources and reduce or eliminate contaminants. (Highest)

WQ-4C Eliminate illicit connections in seacoast communties. (Highest)

WQ-5 Conduct shoreline surveys for pollution sources. (Highest)

WQ-6 Promote collaboration of state and local officials to locate and eliminate illegal discharges into surface waters. (High)

WQ-7 Provide incentives to fix or elimiate illegal direct discharges such as grey water pipes, failing septic systems, and agricultural runoff. (Highest)

WQ-8 Research the effectiveness of innovative stormwater treatment technologies. (Highest)

WQ-13 Provide septic system maintenance information directly to shoreline property owners. (Highest)

WQ-14 Encourage the use of alternative technologies for failing septic systems. (High)

Goal #2: Ensure the New Hampshire's estuarine waters, tributaries, sediments, and edible portions of fish, shellfish, other aquatic life, and wildlife will meet standards for priority contaminants such as, metals, PCBs, PAHs, and oil and grease.

MANAGEMENT OBJECTIVES

Objective 1

Develop baseline of toxic impacts on ecological and human health by tracking toxic contaminants in water, sediment, and indicator species: blue mussels (Gulfwatch); tomcod, lobsters and winter flounder (Coastal 2000).

Long-term: Reduce toxic contaminants levels in water, sediment and indicator species so that no levels persist or accumulate according to:

- FDA guideline levels
- State water standards in Ws 1700
- Sediment levels below ER-M levels

(References for standards found in Appendix 3.)

ACTION PLANS

WQ-2 Evaluate the suitability of UV alternatives to chlorine in wastewater post-treatment. (High)

WQ-4B Assist seacoast communities in completing and maintaining maps of sewer and stormwater drainage infrastructure. (Highest)

WQ-7 Provide incentives to fix or eliminate illegal direct discharges such as grey water pipes, failing septic systems, and agricultural runoff. (Highest)

SHL-6 Periodically collect and monitor shellfish tissue samples as appropriate for toxins and biotoxins. (Highest)

WQ-11 Revise state industrial discharge permit criteria in response to new processing technology and re-evaluate existing permits. (Priority)

WQ-12A Acknowledge and support the oil spill prevention and response activities of the Piscataqua River Cooperative. (Priority)

WQ-12B Enhance oil spill clean up efforts through pre-deployment infrastructure and development of high-speed current barriers. (High)

WQ-15 Support efforts to reduce deposition of atmospheric pollutants. (Priority)

Goal #3: Ensure the New Hampshire's estuarine waters and tributaries will meet standards for organic and inorganic nutrients, specifically nitrogen, phosphorous, chlorophyll A (freshwater), dissolved oxygen, and biological oxygen demand (BOD).

MANAGEMENT OBJECTIVES

Objective 1

Maintain inorganic nutrients, nitrogen, phosphorous and chlorophyll a in Great Bay, Hampton Harbor and their tributaries at 1998-2000 NERR baseline levels.

Objective 2

Maintain organic nutrients in Great Bay, Hampton Harbor and their tributaries at 1994-1996 NERR baseline levels.

Objective 3

Maintain dissolved oxygen levels at:

>4 mg/L for tidal rivers

>6 mg/L for embayments

(Great Bay and Little Bay)

> 7 mg/L for oceanic areas

(Hampton Harbor and Atlantic Coast)

Objective 4

Maintain NPDES permit levels for BOD at wastewater facilities in the NH coastal watershed.

ACTION PLANS

WQ-1 Evaluate Wastewater Treatment Facility impacts on estuarine water quality and seek practical options at the state level for secondary and tertiary or alternative treatments. (High)

WQ-5 Conduct shoreline surveys for pollution sources. (Highest)

WQ-6 Promote collaboration of state and local officials to locate and eliminate illegal discharges into surface waters. (High)

WQ-7 Provide incentives to fix or eliminate illegal direct discharges such as grey water pipes, failing septic systems, and agricultural runoff. (Highest)

WQ-8 Research the effectiveness of innovative stormwater treatment technologies. (Highest)

WQ-9 Ensure water quality and quantity impacts from new development and redevelopment are minimized at the planning board stage. (High)

WQ-10 Research, revise, publish and promote the Stormwater Management and Erosion and Sediment Control Handbooks for Urban and Developing Areas. (Highest)

WQ-11 Revise industrial discharge permit criteria in response to new processing technology and re-evaluate existing permits. (Priority)

WQ-15 Support efforts to reduce deposition of atmospheric pollutants. (Priority)

LAND USE OBJECTIVES

Goal #1: The New Hampshire coastal watershed has development patterns that ensure the protection of estuarine water quality and preserve the rural quality of the watershed.

MANAGEMENT OBJECTIVES	ACTION PLANS
Objective 1 Minimize the amount of impervious surfaces and assess the impacts to water quality by: 1) Keeping the total impervious surface in each subwatershed below 10% of the total land area, and 2) Reducing stormwater runoff from future development in all sub-watersheds, especially where impervious surfaces already exceed 10%.	**LND-1** Prepare a report of current and future levels imperviousness for the subwatersheds of the NH coastal watershed. (Highest) **LND-2** Implement steps to limit impervious cover and protect streams at the municipal level. (Highest) **LND-3** Conduct research in coastal NH watersheds to examine the relationship between percent impervious cover and environmental degradation. (High) **LND-4** Prevent the introduction of untreated stormwater to wetlands by supporting the development of NH Minimum Impact Development guidelines. (High) **LND-5** Support the Natural Resource Out-reach Coalition programs. (Highest)

MANAGEMENT OBJECTIVES	ACTION PLANS
Objective 2 Minimize the total rate of land consumption in the NH coastal watershed (as measured by acres of developed land per capita). **Objective 3** Encourage 43 coastal watershed municipalities to actively participate in addressing sprawl.	**LND-6** Minimize urban sprawl in coastal watersheds. (Highest) **LND-6A** Develop a regional pilot partnership to create a smart growth vision among towns and Regional Planning Commissions in a single estuarine watershed. (Highest) **LND-6B** Conduct a comprehensive review of the 43 towns within the estuaries and coastal watershed area to determine land use policies that affect sprawl. (High) **LND-6C** Develop and maintain a comprehensive database or library of new smart growth funding programs. (High) **LND-6D** Develop a science-based handbook and video on the nature, causes, and remedies of sprawl for audiences in coastal NH watershed. (Priority) **LND-6E** Actively participate and contribute to the develop of new smart growth planning tools with emphasis on protecting estuarine water quality. (High) **LND-6F** Assist communities that embrace a strong smart growth philosophy to conduct comprehensive reviews, identify sources of funding, provide public education, and implement new land use tools. (Highest)

Goal #2: Maximize the acreage and health of tidal wetlands in the New Hampshire coastal watershed.

MANAGEMENT OBJECTIVES

Objective 1

Allow no loss or degradation of 6200 acres of tidal wetlands in the NH coastal watershed and restore 300 acres of tidal wetlands degraded by tidal restrictions by 2010.

ACTION PLANS

LND-7 Complete rule-making and begin implementation of Recommended NH Wetland Mitigation Policy (High)

LND-8a Strengthen enforcement and effectiveness of the state tidal buffer zone through outreach to local officials and tidal shoreland property owners. (Priority)

LND-8b Amend state tidal buffer zone regulations to include regulation of deck construction. (Priority)

LND-9a Reduce the quantity, improve the quality, and regulate the timing of stormwater flow into tidal wetlands through policy changes at the NH DES Wetlands Bureau. (Highest)

LND-9b Reduce the quantity, improve the quality, and regulate the timing of stormwater flow into tidal wetlands through policy changes at the NH DES Site Specific Program. (Highest)

LND-10/RST-2
Using the Coastal Method and other techniques, identify and restore additional restorable tidal wetlands. (High)

LND-11/RST-5
Create a list of potential wetland restoration projects that could be used for wetland mitigation projects, and distribute the list to state agencies and Seacoast municipalities. (High)

LND-12/RST-6
Pursue restoration funding from the NH DOT, USDA/NRCS, US F&WS and other sources. (Highest)

RST-3 Continue to restore the restorable tidal wetlands listed in the NRCS report, Method for the Evaluation and Inventory of Vegetated Tidal Marshes in New Hampshire.

Goal #3: Protect freshwater and tidal shorelands to ensure estuarine water quality.

MANAGEMENT OBJECTIVES	ACTION PLANS
Objective 1 Allow no new impervious surfaces or major disturbances of existing vegetation (except for water-dependent uses) in NH coastal watershed. In addition to state Shoreland Protection Act regulations, encourage additional reductions of shoreland impacts by 2010.	**LND-13** Provide a framework specific and appropriate to the NH seacoast for defining and delineating urban and non-urban shoreland areas. (High) **LND-14** Develop and implement an outreach program to encourage and assist communities in developing and adopting land use regulations to protect undisturbed shoreland buffers. (Highest)
Objective 2 Allow no new establishment or expansion of existing contamination sources (such as salt storage, junk yards, solid waste, hazardous waste, etc.) within the shoreland protection area as tracked by the Department of Environmental Services.	**LND-15** Support land conservation efforts in shoreland areas. (Highest) **LND-17** Provide incentives for the relocation of grandfathered shoreland uses. (High) **LND-16** Improve enforcement of the state Comprehensive Shoreland Protection Act and other applicable shoreland protection policies through outreach to local officials and shoreland property owners. (Highest)

Goal #4: Protect estuarine water quality by ensuring that groundwater impacts are minimized.

MANAGEMENT OBJECTIVES	ACTION PLANS
Initial Objective Determine the extent of groundwater resources and their contaminant load to Great Bay and Hampton Harbor by 2005.	**LND-18** Locate and quantify quantity and quality of groundwater inflow to the estuaries. (Highest)
Objective 2 Reduce and eliminate groundwater contaminants based on outcome of Objective 1 by 2010.	**LND-19** Locate, reduce or eliminate, and also prevent groundwater contaminants. (Highest)

Goal #5: Allow no net loss of freshwater wetlands functions in the NH coastal watershed.

MANAGEMENT OBJECTIVES

Objective 1
Determine indicators for freshwater wetland functions.

Objective 2
Establish state and municipal regulatory framework necessary to prevent introduction of untreated stormwater into tidal and freshwater wetlands by 2010.

Objective 3
Increase use of buffers around wetlands in NH coastal watershed

ACTION PLANS

LND-4 Prevent the introduction of untreated stormwater to wetlands by supporting the development of NH Minimum Impact Development Guidelines. (High)

LND-20 Develop and implement a Wetlands Buffer Outreach Program for planning boards. (High)

LND-21 Prevent the introduction of untreated stormwater to freshwater wetlands by enacting legislation giving NHDES authority to regulate stormwater discharge to wetlands. (High)

LND-22 Prevent the introduction of untreated stormwater to wetlands by strengthening municipal site plan review regulations. (High)

LND-23 Prevent the introduction of untreated stormwater to wetlands through an increased understanding of stormwater impacts on wetland ecology. (Priority)

LND-24 Work with NHDES to encourage adoption of state wetlands mitigation policy. (High)

LND-25 Encourage municipal designation of Prime Wetlands and 100-foot buffers (or equivalent protection). (High)

LND-25a Create a traveling Prime Wetlands display. (Priority)

LND-25b Provide training for towns interested in utilizing the NH Method for Comparative Evaluation of Non-tidal Wetlands. (Highest)

LND-25c Work with local planning boards and conservation commissions on regulatory approaches to wetlands conservation. (High)

LND-25d Create and/or enhance local land conservation programs with emphasis on high value wetlands and buffers. (High)

Goal #6: Maintain habitats of sufficient size and quality to support populations of naturally occurring plants, animals, and communities.

MANAGEMENT OBJECTIVES	ACTION PLANS
Objective 1 Determine existing acres of permanently protected land in the NH coastal watershed in the following categories: tidal shoreland, large contiguous forest blocks, wetlands with high habitat values, freshwater shorelands, rare and exemplary natural communities, by 2005. **Objective 2** Increase acreage of protected land containing significant habitats in the NH coastal watershed, through fee acquisition or conservation easements by 2010.	**LND-26** Support implementation of state and federal land protection programs. (Highest) **LND-27** Support the Great Bay Resource Protection Partnership. (Highest) **LND-28** Encourage towns to dedicate current-use change tax penalties to land protection. (Highest) **LND-29** Provide technical assistance in land protection and management to regional land trusts and conservation commissions. (High) **LND-35** Maintain current-use program. (Highest) **LND-36** Encourage conservation easements. (Highest)

MANAGEMENT OBJECTIVES	ACTION PLANS
Objective 3 Support completion of state biomonitoring standards and increase the miles of rivers and streams meeting those standards by 2010.	**LND-30** Develop and encourage use of biomonitoring standards to evaluate water quality.(High) **LND-31** Use biomonitoring and water quality monitoring to prioritize watershed areas for protection and remediation. (High)

MANAGEMENT OBJECTIVES	ACTION PLANS
Objective 4 Increase use of buffers around wildlife areas and maintaining contiguous habitat blocks in the NH coastal watershed by 2010.	**LND-32** Encourage municipalities to incorporate wildlife habitat protection into master plans by supporting NH F&G manual on Identifying and Protecting Significant Wildlife Habitat. (Highest) **LND-33** Develop a model local planning approach to encourage identification and maintenance of contiguous habitat blocks. (Highest) **LND-34** Encourage appropriate buffers around important wildlife areas and rare or exemplary natural communities. (High)

SHELLFISH OBJECTIVES

Goal #1: Achieve sustainable shellfish resources by tripling the area of shellfish beds that are classified open for harvesting to 75% of all beds, and tripling the quantity of harvestable clams and oysters in NH's estuaries

MANAGEMENT OBJECTIVES

Objective 1

Maintain an approved National Shellfish Sanitation Program supported by the State.

Objective 2

Increase soft shell clam beds in Great Bay, Little Bay, and Hampton Harbor that are open for harvest to 2500 acres by 2010.

Objective 3

Shellfish Acreage: No net decrease in acreage of oyster beds from 1997 amounts for Nannie Island, Woodman Point, Piscataqua River, Adams Point, Oyster Squamscott and Bellamy Rivers.

Objective 4

Shellfish density

A) Oysters: No net decrease in oysters (>80 mm) / square meter from 1997 amounts at Nannie Island, Woodman Point, Piscataqua River, Adams Point, and Oyster River.

B) Clams: No net decrease in adult clams (>50 mm) / square meter from the 1989-99 10-year average at Common Island, Hampton River, and Middle Ground.

Objective 5

Shellfish Assessment: Survey each major oyster and soft-shell clam bed at a minimum of every 3 years for dimensions, density and population structure.

ACTION PLANS

SHL-1 Implement National Shellfish Sanitation Program guidance to develop an FDA-certified shellfish program. (Highest)

SHL-2 Identify sources of and reduce or eliminate contaminants in NH's estuaries watersheds. (Priority)

SHL-3 Institute land use practices in estuarine watersheds that improve water quality and shellfish habitat. (Priority)

SHL-4 Enhance funding to maintain a comprehensive shellfish program (Highest)

SHL-5 Regularly collect and monitor water quality to identify sources and reduce or eliminate contaminants. (Highest)

SHL-6 Periodically collect and monitor shellfish tissue samples as appropriate for toxins and biotoxins. (Highest)

SHL-7 Maintain an ongoing shellfish resource assessment program. (Highest)

SHL-8 Develop and implement a plan for shellfish resource enhancement and habitat restoration. (Highest)

SHL-9A Decrease shellfish resource depletion and increase productivity with stricter state penalties for illegal harvesting. (Priority)

SHL-9B Increase outreach and education about methods to control shellfish predators. (Priority)

SHL-9C Explore alternative recreational shellfish harvest methods. (Priority)

SHL-9D Increase productivity by discouraging the harvest of immature shellfish. (Priority)

Goal #2: Assure that shellfish are fit for human consumption and support a healthy marine ecosystem.

MANAGEMENT OBJECTIVES	ACTION PLANS
Objective 1 Achieve water quality in Great Bay and Hampton Harbor that will meet shellfish harvest standards by 2010.	**SHL-1** Implement National Shellfish Sanitation Program guidance to develop an FDA-certified shellfish program. (Highest) **SHL-2** Identify sources of and reduce or eliminate contaminants in NH's estuaries watersheds. (Priority) **SHL-3** Institute land use practices in estuarine watersheds that improve water quality and shellfish habitat. (Priority) **SHL-5** Regularly collect and monitor water quality to identify sources and reduce or eliminate contaminants. (Highest) **SHL-6** Periodically collect and monitor shellfish tissue samples as appropriate for toxins and biotoxins. (Highest)

Goal #3: Provide opportunities and strategies for restoration of shellfish communities and habitat.

MANAGEMENT OBJECTIVES	ACTION PLANS
Objective 1 Restore 20 acres of oyster habitat in Great Bay and its tidal tributaries.	**SHL-8** Develop and implement a plan for shellfish resource enhancement and habitat restoration. (Highest)

Goal #4: Support coordination to achieve environmentally sound shellfish aquaculture activities.

MANAGEMENT OBJECTIVES	ACTION PLANS
Objective 1 Ensure that aquaculture practices do not adversely impact water quality or ecological health of NH's estuaries.	**SHL-1** Implement National Shellfish Sanitation Program guidance to develop and maintain an FDA-certified shellfish program. (Highest) **SHL-15** Evaluate and address barriers to aquaculture and promote environmentally sound practices. (Highest)

HABITAT RESTORATION OBJECTIVES

Goal #1: Maintain habitats of sufficient size and quality to support populations of naturally occurring plants, animals, and communities.

MANAGEMENT OBJECTIVES

Objective 1

Increase the acreage of restored estuarine habitats by 2010.

Salt marsh: Restore 300 acres of salt marsh with tidal restrictions.

Eelgrass: Restore 50 acres of eelgrass in Portsmouth Harbor, Little Bay, and the Piscataqua, Bellamy and Oyster rivers.

Shellfish habitat: Restore 20 acres of oyster habitat in Great Bay and the tidal tributaries.

ACTION PLANS

RST-1 Develop and implement a plan for shellfish resource enhancement and habitat restoration. (Highest)

RST-2 Using the coastal method and other techniques, identify and restore additional restorable tidal wetlands. (High)

RST-3 Continue to restore the restorable tidal wetlands listed in the NRCS report. (Highest)

RST-4 Identify and implement habitat restoration in important non-tidal habitats. (High)

RST-5 Create a list of potential wetland restoration projects that could be used for mitigation, and distribute to state agencies and municipalities. (High)

RST-6 Pursue restoration funding from NH DOT, USDA/NRCS, US F&WS and others. (Highest)

Seabrook Middle Ground Re-opened for Shellfishing as Water Quality Improves

Early in the morning of November 6, 1998, the Seabrook Middle Ground was reopened to clamming for the first time in nearly ten years. Hundreds of shellfishers huddled against the pre-dawn chill at the Hampton State Boat Launch, waiting their turns in the small outboard launches that would run them across the harbor to the best clamming in New Hampshire.

NHCP

Clamdiggers at the Middle Ground, Hampton-Seabrook Harbor

Those that turned out for the early morning low tide were rewarded with their 10-quart limit of softshell – or steamer – clams with just a few minutes of digging. NH Fish and Game officials estimated 800 clammers dug their limits of clams in the first two days of the season, harvesting 2% of the Middle Ground's standing stock of two-inch clams.

Reclassification of the Middle Ground resulted from marked water quality improvements in Hampton-Seabrook Harbor due largely to increased municipal sewerage coverage in the town of Seabrook, and other smaller scale pollution control measures around the Harbor. The NH Estuaries Project, NH Department of Health and Human Services, NH Fish and Game Department, NH Office of State Planning, NH Department of Environmental Services; the towns of Seabrook, Hampton, and Hampton Falls; North Atlantic Energy Service Corporation (Seabrook Station); and volunteers from Great Bay/Coast Watch and area towns all cooperated in these efforts to test water, and identify sources, and reduce pollution.

Reclassification of the 40 acres of the Seabrook Middle Ground significantly increased the harvest area and number of shellfish available for recreational harvest by New Hampshire residents. However, safety zones near wastewater treatment plants and as yet unclassified areas of the Harbor's tributaries within the Harbor area remain closed.

THE WORK HAS BEGUN

From the beginning of the New Hampshire Estuaries Project, the Management Committee has solicited and listened to concerns, priorities, and suggestions from the public. Work was begun even during the three-year planning process on the highest-priority goals and objectives to address priority problems. Progress has been made on water quality surveys, identification and correction of water pollution sources, development and implementation of a new shellfish resource management program, work with local officials on land use issues, salt marsh restoration efforts, and more.

In the first three years the NHEP awarded 27 technical assistance grants for projects addressing water quality and habitat improvements, and planning and outreach efforts throughout the region. Municipalities, citizen groups, environmental organizations, the academic and research communities, and state agencies working for environmental improvements have all benefitted from the NHEP grants program.

Municipal officials in the Seacoast gained a new tool for land and habitat conservation and water resource management through the NHEP Critical Lands Analysis project. Each of the 19 NHEP Zone A towns (those with tidal frontage) received local and regional scale maps identifying high-value natural resource areas that might be especially vulnerable to development pressures.

The NHEP has taken an active role in water pollution identification and clean-up work throughout the Seacoast. NHEP has helped the NH DES step up their non-point source investigations, resulting in the identification of numerous cross connections and illegal discharges to the estuaries. With NHEP support, NH DES, NH DHHS, and NH OSP have increased their shoreline and sanitary survey activities.

Over 500 acres of shellfish waters in the Hampton-Seabrook Estuary and Lower Little Bay were opened to recreational harvesting as a result of this increased monitoring, investigation, and identification and clean up of pollution sources.

A new, coordinated state shellfish sanitation program is being implemented. The NHEP identified the health of shellfish populations and habitat as a high priority, and as a unifying outreach focus to advance the cause of clean water. Increasing the acreage of classified and open softshell clam and oyster beds is central to the vision for New Hampshire's estuaries. The NHEP and its shellfish team determined a restructured and more coordinated state shellfish sanitation program was needed to achieve this goal. All state agencies involved in various aspects of shellfish and water quality monitoring and management were represented on the shellfish project team, along with scientists from the University of New Hampshire's Jackson Estuarine Laboratory and citizens interested in shellfishing. From these discussions, the NH Department of Environmental Services spearheaded a collaborative, inter-agency effort to develop and obtain resources for a restructured shellfish sanitation program, which is outlined in Action SHL-1. Implementation of the seven-year plan began in 1999 when the Legislature reassigned authority for shellfish sanitation to NH DES.

WATER QUALITY

4

Clean water is essential for healthy estuaries. Water is the basic life-sustaining element linking all the characteristic features of New Hampshire's estuarine environment. Efforts to improve water quality drive the Action Plans developed to address the priority problems threatening the estuary. The NHEP focuses on improving water quality as the most effective way to attain measurable environmental improvements, and to communicate to citizens and decision-makers the need to protect all aspects of our region's natural resources. Improving and protecting estuarine water quality calls for correcting current problems and pollution sources, and for preventing future problems as New Hampshire's Seacoast region continues to grow.

NHEP

Upper Cocheco River, New Hampshire

The mixing of ocean saltwater with inland and coastal freshwaters creates the unique and highly productive conditions of the estuaries. These special environmental conditions are reflected in the richness of estuarine habitats. Estuaries play a unique role as nurseries for living resources of not only the estuarine, but also marine and upland ecosystems.

Pollutants in New Hampshire's estuaries include bacterial, toxic, and nutrient contaminants from municipal and industrial wastewater treatment facilities, septic systems, sediments, fertilizers, other runoff, plus oil spills and contaminated sites in the watersheds. Current and future sources of contamination must be reduced and prevented. Most of these water quality problems are directly related to human activities.

WHY IT MATTERS

Clean water is essential to the rich variety of unique habitats and diverse plant and animal communities found in New Hampshire's estuaries. Clean water is also vital for many human activities at the heart of the Seacoast economy and cultural traditions. Groundwater, precipitation, wetlands, and surface waters of the rivers, lakes, streams, and the Gulf of Maine of the Atlantic Ocean all affect water quality in the estuaries, reflecting the complexity and interconnected nature of estuarine systems. Human activities and natural processes influencing any of these water sources ultimately influence the water quality of the estuaries.

The priority water quality contaminants in New Hampshire's estuaries are:

- Pathogenic microorganisms (fecal-borne bacteria and viruses) from improperly treated sewage, urban stormwater runoff, and other non-point sources;
- Nutrients from sewage treatment plants and non-point sources such as tributaries, surface runoff, septic systems, atmospheric deposition, etc.;
- Toxic contaminants (organic chemicals and heavy metals, from oil, solvents, pesticides) from historic industrial sources and from current industrial and municipal wastewater and atmospheric deposits;
- Sediments from upland watersheds or rivers carried into the estuaries by runoff.

THE CHALLENGE

Pollution abatement efforts in New Hampshire's estuaries began in the 1940s, and continue today. Much progress was made through the 1970s and 1980s and into the 1990s, with the installation and upgrading of municipal wastewater treatment systems. Water quality and habitat areas have recovered significantly. Bacterial contamination has been decreasing in the last decade in most of the state's coastal areas, largely due to upgraded wastewater treatment facilities (WWTFs).

But pollution problems remain and continuing vigilance and planning is needed to protect estuarine water quality from the pressures of population growth and development. Treatment plant hydraulic overloading including pump station overflows and bypasses, combined sewer overflows (CSOs), and illicit connections to storm sewers all contribute human sanitary waste to estuarine waters. The shellfish beds are closed when treatment plants fail, pump stations overflow, and CSOs discharge. Non-point sources of pollutants also increase with added development. *Chapter 5: Land Use, Development, and Habitat Protection* addresses non-point source pollution through actions to limit impervious cover and sprawl, and to protect tidal and freshwater wetlands, groundwater, and shorelands.

While there are no grossly contaminated areas, all New Hampshire estuarine waters are subject to **bacterial contamination** for some time each year. Fecal coliform bacteria are measured as indicators of sewage contamination,

to warn of threats to public health and safety. People can become ill from eating contaminated shellfish or from contact with water polluted with pathogenic microorganisms. Concentrations of these indicator bacteria are generally quite low throughout the estuaries, and estuarine water quality supports most uses in most areas. Still, contaminants persist in all estuarine waters and at levels – especially during or after rainfall or snowmelt runoff events – that require limiting uses such as shellfish harvesting to protect human health. Stormwater runoff carries pollutants into estuarine waters from combined sewer overflows, impervious areas like roadways, parking lots and roofs, ineffective septic systems, vessel discharge, pet waste, and possibly waterfowl.

Heavy metals and toxic compounds are also found throughout the estuaries, with higher levels concentrated around Seavey Island and the Portsmouth Naval Shipyard and other hot spots including Rye Harbor. Much of the toxic contamination in New Hampshire's estuaries is the legacy of historic industrial activities in the

BACTERIAL CONTAMINATION

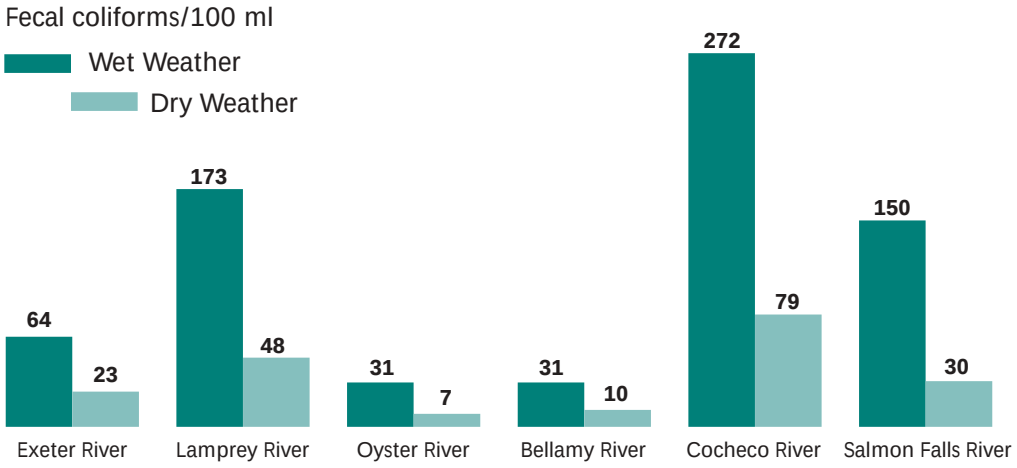
A three-year study of how storm events affect water quality in the tributaries of the Great Bay Estuary confirmed urban runoff as a source of contamination. Fecal coliform bacteria are monitored as an indicator of pathogenic microorganisms. Concentrations are generally quite low in many areas, at a level of water quality that supports most uses. However, elevated concentrations of fecal coliforms were detected in all areas following rainfall events. Stormwater bacterial contamination of the Great Bay Estuary is well documented, and efforts continue to identify the sources. Recent studies found many sources of stormwater contamination in coastal New Hampshire towns – including stormwater drains, sewer pipes, stormwater treatment systems, and animal feces.

Evidence suggests these sources are prime suspects:

- Runoff from impervious areas
- Illicit connections
- Wastewater treatment system overflows
- Faulty septic systems
- Vessel discharges
- Waterfowl and large bird populations such as pigeons and starlings

Rainfall-related contamination causes closure of shellfish beds to harvesting, as discussed in *Chapter 6: Shellfish Resources*. Potential sources of bacterial contamination near and within New Hampshire's shellfish waters include wastewater treatment facilities effluent, stormdrains, parking lots, roadways, snow dump sites, etc.

Fecal Coliform in Tidal Water



Geometric mean fecal coliforms in tidal water, collected during dry weather and storm events in tributaries to the Great Bay Estuary: 1993-96.

Suspected sources of high wet weather counts in the Cocheco RIver are illicit connections and leaking sewer pipes.

EXCESS NUTRIENTS

Nitrogen is a naturally occurring nutrient essential for plant and algae growth. However, too much nitrogen can ultimately reduce water oxygen levels, with potentially catastrophic consequences for many estuarine creatures. Nutrients in the estuaries come from natural sources such as watershed sediments, wildlife, organic debris (leaves and other vegetation), and groundwater, as well as from point and non-point sources caused by human activity, including atmospheric deposition from power plants, etc. Nitrogen and phosphorus are the two most important nutrients in terms of pollution since they usually have the most impact in aquatic ecosystems. Nitrogen is generally believed to be the nutrient of greatest concern in estuarine and marine waters, although phosphorus has been identified as primary nutrient concern in some situations.

Point sources – primarily municipal and industrial wastewater treatment plants – contribute 41% of nutrient pollutants to the estuaries. Nearly half (48%) of the nutrient loading to Great Bay comes from non-point sources, including urban runoff, stormwater conduits, on-site wastewater treatment (septic) systems, lawn fertilizers, agricultural runoff, and waterfowl and other natural processes. Atmospheric deposition of nitrogenous compounds from the burning of fossil fuels accounts for the remaining 11%. Water contamination from atmospheric deposition is not easily managed. But while non-point sources include nutrients from natural sources, all point source pollution is caused by human activity, and can be managed. Loading from point sources becomes more important for planning for future development and nutrient reduction.

Less is known about nutrient loading in the Hampton-Seabrook Estuary. While point sources and non-point sources of nutrients exist around the Hampton-Seabrook Estuary, the problems associated with nutrient loading are minimized because 80% of the water in the estuary is exchanged with the ocean with each tide cycle.

Excess nitrogen in water can stimulate rapid, unchecked growth of algae and plants, potentially resulting in eutrophication. When such blooms die, their decomposition depletes oxygen in the water, suffocating shellfish and other marine life. All New Hampshire estuaries and their tributaries are subject to nutrient loading, but nutrient concentrations in Great Bay have been largely stable over the last 20 years. No widespread eutrophication has been observed. Isolated incidents of reduced oxygen and phytoplankton (tiny plants that float in water) blooms have occurred in some of the freshwater tributaries of Great Bay – in the impoundments behind the dams at the head of the tide on the Salmon Falls, Cocheco, Oyster, and Lamprey Rivers – and in Portsmouth's North Mill and South Mill Ponds.

EPA-New England, local watershed groups such as the Lamprey River Watershed Association, and the states of Maine and New Hampshire have documented evidence of eutrophication, particularly from point sources, in certain river segments. Total maximum daily load (TMDL) studies of the Salmon Falls River, the Lamprey River below the Epping treatment plant, and the Cocheco River below the Rochester treatment plant have resulted in upgrades to tertiary treatment for the Epping and Rochester WWTFs. Five Salmon Falls River point sources will likely have tighter nutrient limits in their reissued NPDES permits.

While eutrophication and related impacts do not appear to be imminent problems, sources of nutrient contaminants (wastewater treatment effluent, lawn fertilizers, septic systems, and runoff from impervious surfaces) will increase with further population growth and development.

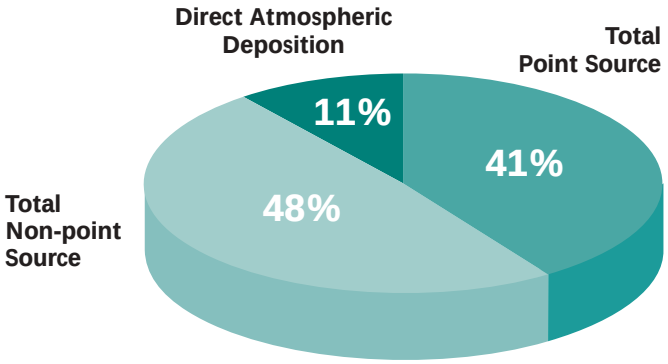
watershed. Other documented sources include oil spills, municipal waste discharges, defense facilities and Superfund sites, stormwater runoff, and groundwater contaminated by hazardous wastes. Numerous oil spills have, to varying extents, adversely affected estuarine life and habitats. Elevated tissue concentrations of toxic contaminants in lobster tomalley, bluefish, and other living resources have caused human consumption advisories, and raise a warning for the whole estuarine system. Toxic levels in sediments are a continuing concern requiring monitoring and risk assessment for activities such as dredging or construction.

Nutrients are continually added to New Hampshire's coastal waters from both natural and human sources. Although nutrient loading occurs in all New Hampshire estuaries and tributaries, no significant change in the nutrient levels of Great Bay has occurred over the last 20 years. No widespread eutrophication–the process by which excess nutrients stimulate excessive algae and plant growth that can deplete oxygen and kill marine life when it decomposes – has been observed. However, intense phytoplankton blooms and reduced oxygen concentrations have occurred as isolated local events in the Great Bay Estuary.

Eutrophication and related impacts do not appear to be imminent threats, but as population and development increase so will sources of nutrient contamination from wastewater treatment facilities, septic systems, lawn fertilizer runoff, runoff from impervious surfaces, and air deposition. The cumulative impacts of these sources could eventually cause nutrient-related problems in the estuaries if current waste treatment technologies and land use plans and regulations continue unchanged. WWTFs are the major source of nitrogen and phosphorus. Strategies to reduce nutrient loading and bacterial contamination from WWTFs are needed to protect water quality in the estuaries, but these will be expensive.

Water quality problems are often the result of large numbers of people in and around the estuaries. People have been and must continue to be part of the solution as well. Outreach and education efforts are the key to many of the actions planned to improve water quality in New Hampshire's estuaries. Many opportunities exist for Seacoast residents to participate in this *Plan* – as homeowners, landowners, business owners and managers, as citizens and taxpayers, as community leaders, municipal and state agency staffers, and volunteers.

Sources of Nitrogen Loading to the Great Bay Estuary

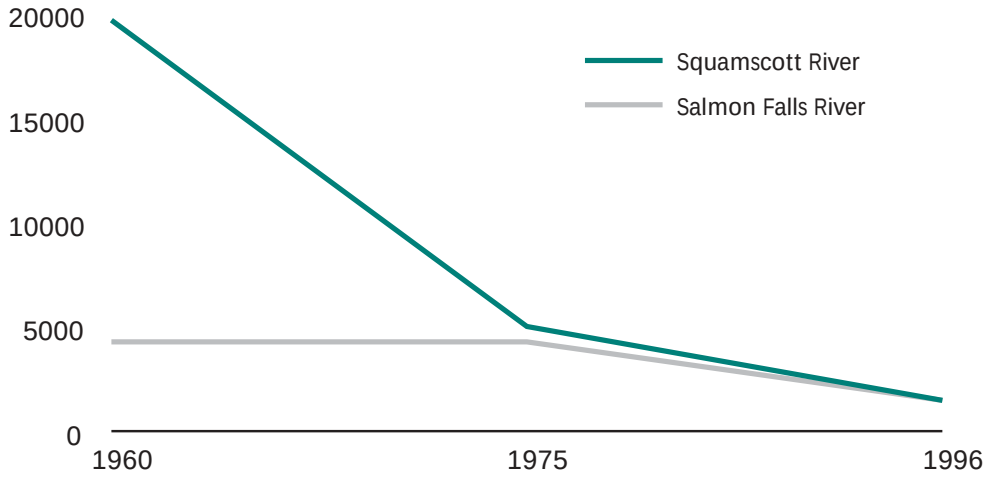


Wastewater Treatment Systems

Despite significant improvements in recent decades, Seacoast WWTFs still do not meet their required treatment standards 100% of the time. Factors affecting plant performance include storm events, waste stream changes, equipment breakdowns, and operator error. The most severe incidences of bacterial contamination follow rainfall runoff events and treatment process upsets at WWTFs. While dramatic reduction in fecal coliform counts has occurred in tidal rivers like the Squamscott since 1960 due to upgrades required by federal legislation, water quality sampling throughout the Great Bay Estuary tracks a pattern of elevated counts coming from urban runoff and WWTFs. Both routine and storm-related effluent nutrient contribution varies with individual WWTFs. Based on total nitrogen concentrations measured in effluent and

Total coliforms (colonies/100 ml) in the Exeter/Squamscott and Salmon Falls rivers

Total Coliforms 1960-1996



average effluent volume reported by the plants, the largest nitrogen contributions to the Great Bay Estuary are, in descending order, the Portsmouth, Rochester, Dover, Exeter, Berwick, and Kittery WWTFs.

WWTFs are not the only part of municipal treatment systems that can cause pollution problems. The Seacoast region was the first area of settlement in New Hampshire, and some of the infrastructure in the older cities and towns is old and difficult to replace or maintain. Leaking sewer pipes are suspected in most urban communities. Sewer system maintenance and keeping stormwater and sewage separated are critical to water quality. In addition, projected growth in the region will require increased capacity at some facilities.

Stormwater poses difficulties for several municipal sewage treatment systems in the region. When overburdened by stormwater, facilities bypass pumping stations and discharge inadequately treated sewage directly into tidal waters. Combined sewer overflows (CSOs) have been gradually eliminated from several Seacoast communities. The two remaining CSOs in Portsmouth are significant sources of bacterial contamination to Little and Portsmouth Harbors. Exeter's one remaining CSO is responsible for contaminated water draining into the Squamscott River. Eliminating these last CSOs will be expensive, but would end their storm-related major releases of bacteria

and nutrients into tidal waters. In 1999, Exeter appropriated $1.7 million to address their CSO problem by 2000.

Stormwater drain systems in several Seacoast towns contain high concentrations of fecal contaminants, even in dry weather, suggesting leaks from sewer pipes or illicit connections of sewage discharging into the storm drains. Many illicit connections have recently been identified and eliminated in Dover and Newmarket.

Stormwater

Stormwater runoff is water from rainfall and snowmelt that runs along the surface of the ground. In an undisturbed natural setting, plant cover slows the movement of stormwater, allowing more time for the water to soak in. Plant roots and organic matter also help absorb and hold water. Thus vegetation allows the soil to act as a natural filter for contaminants, and for plants to take up and use nutrients carried in the water. Slowing the passage of stormwater also reduces its ability to erode soils and deposit them as sediments in surface waters.

Stormwater runoff carries a variety of pollutants. Amounts and types depend on the nature of the precipitation and the surfaces over which the water flows. Building and development replaces naturally vegetated land with hard, impervious surfaces – roads, pavement, roofs, etc. – that cause stormwater from large areas to flow and collect swiftly, accumulating contaminants before it discharges into storm drains and surface waters. This results in increased erosion, flooding, and water pollution. The faster water moves, the more soil is eroded and carried into surface waters as sediment. As more impervious surface covers the landscape, less rainfall is absorbed. Loss of open land reduces buffering of wetlands and surface waters, increasing flooding problems. Stormwater picks up and carries contaminants from vehicles, fertilizers and pesticides, sewers, atmospheric deposition, pets, and industrial and commercial sites, often delivering them directly to nearby surface waters.

Stormwater runoff contaminates New Hampshire's estuarine waters with pathogenic bacteria and viruses, nutrients, sediment, trace metals and other toxins. Runoff from impervious surfaces is a significant source of both trace metal and toxic organic contaminants. Runoff resulting from rainfall and snowmelt events in urban and urbanizing areas is the most common source of bacterial contamination in New Hampshire estuaries. This is due to a combination of inflow and infiltration to sewer pipes, overloaded wastewater treatment plants and combined sewer overflows (CSOs), and non-point source runoff.

Water from rains or melting snow washes contaminants from roadways, parking lots and other paved surfaces, rooftops, construction sites, fertilized lawns, farms, and faulty septic systems into drains, ditches, and tributaries of the estuaries. Contamination from these kinds of diffuse sources is called non-point source pollution. While the U.S. EPA estimates 60% of surface water pollution nationally is non-point related, non-point sources are estimated to contribute 48% of the annual nutrient load to Great Bay. Point sources – primarily municipal wastewater treatment plants – contribute 41%. Continued population growth and development in the coastal region will add more impervious surfaces – paved areas, buildings, etc. – potentially

causing more stormwater-related pollution, as well as adding pressure to WWTFs and sanitary sewer systems.

Stormwater also poses significant problems for municipal sanitary sewer systems. Often stormwater infiltrates old sanitary sewer systems, overburdening pipes, pumping stations, and wastewater treatment facilities. To avoid damage to the system, operators discharge the excess raw sewage and stormwater volume without treatment. These discharges are referred to as Combined Sewer Overflows or CSOs.

ANMP

North Mill Pond, Portsmouth

Other Direct Discharges

In addition to the 18 New Hampshire and three Maine WWTFs, a number of industrial and other plants hold National Pollutant Discharge Elimination System (NPDES) permits for discharges into New Hampshire's tidal waters. Industrial discharge permits include 11 facilities in New Hampshire and three in Maine, two power plants that discharge into the Piscataqua River and Seabrook Station (a nuclear power plant) which discharges into the Atlantic Ocean, and three water treatment plants in the Great Bay Estuary.

Shoreline surveys continue to reveal illegal direct sewage discharges in many areas. Remaining small illegal sewage discharges may be contributing to the high bacterial counts found in many tributaries of the tidal rivers and bays.

Septic Systems

Many shoreline areas in the more rural and suburban areas around the estuaries and their tributaries are still served by septic systems. Studies in Seabrook show that septic systems have the potential to contaminate tidal waters when the systems are located close to shore, especially in more densely populated areas with high water tables and coarse, excessively well-drained soils. Seabrook has nearly finished connecting all homes and businesses to their new sewer system. But septic systems are still common along much of the state's tidal shorelines, and failing, poorly maintained, or inadequate systems are a problem.

REGULATORY AND MANAGEMENT PROGRAMS

Non-point Source Pollution

Non-point source pollution is all pollution that does not come from a single source or pipe and may be difficult to locate. Much non-point source pollution results from stormwater runoff. **Federal** control of non-point source pollution stems from the Clean Water Act and Coastal Zone Management Act, and focuses on non-regulatory approaches. Amendments to the Clean Water Act in 1987 required states to develop non-point source management programs in order to receive Clean Water Act Section 319 funds.

The 1990 reauthorization of the Coastal Zone Management Act (CZMA) required states receiving CZMA funds to develop coastal non-point source programs. The federal government has approved New Hampshire's program with certain conditions.

Clean Water Act Section 303 (d) and its implementing regulations require states to list water segments that are impaired – defined as out of compliance with a water quality goal or designated use such as swimming or fishing, even after targeted pollution control practices have been implemented to address the problem. The 303 (d) listed waters affecting the New Hampshire estuaries are part of the Cocheco River and the Salmon Falls River downstream of Somersworth. Water bodies on the 303 (d) list are given priority for Section 319 funding to address non-point sources. In December 1999 EPA proposed to apply total maximum daily load (TMDL) reduction targets to non-point sources in 303 (d) listed water segments. This approach is already in effect for point sources in 303 (d) waters.

New Hampshire's **state** non-point source programs are coordinated by a steering committee that includes all state, federal, and local agencies with responsibilities related to non-point sources. NH Department of Environmental Services Water Division is the lead agency, with additional programs under the NH Department of Agriculture, Markets and Food and the NH Department of Resource and Economic Development's Division of Forests and Lands. The NH Office of State Planning, Regional Planning Commissions, and Conservation Districts all help municipalities plan for protection against development-related runoff problems.

New Hampshire's non-point source programs have recently been revised to focus on priority watersheds, including the coastal watershed (the NHEP's study area). New Hampshire's Coastal Non-point Pollution Control Program is coordinated with the state's Clean Water Act Non-point Source Program. NH DES provides financial and technical assistance in addressing the impacts of urban development, septic systems, agriculture, forestry, roads, marinas and boating, hydromodification, and wetlands. The *NHEP Management Plan* is closely linked with the Non-point Souce Program because both programs share objectives.

Local governments have authority to establish zoning ordinances and development regulations that can give them substantial control over non-point source pollution. Zoning, subdivision regulations, and site plan review may include requirements for stormwater and erosion control, septic design, siting,

and installation. These planning tools may address prohibited land uses, open space requirements, and more. Many towns in the estuarine area use the site plan review process to address post-construction stormwater management.

Zoning overlays may help protect shoreline habitats, wetlands, and other important natural resources from development. Municipalities can also acquire open space lands or conservation easements to protect estuaries and other surface waters or habitats.

The effectiveness of implementation and enforcement of local regulations varies from town to town in the estuarine watersheds. Alone or in combination, these municipal measures contribute to the control and abatement of non-point source pollution provided they are effectively implemented and enforced. All municipalities within NHEP Zone A have established zoning, subdivision, and site plan review processes. The NHEP *Base Program Analysis* found that local natural resource protection regulations and the implementation and enforcement of local regulations vary widely among the towns, often due to community size and staffing differences. Local land use control and its enforcement was found to be a vital link in the protection of New Hampshire's estuaries.

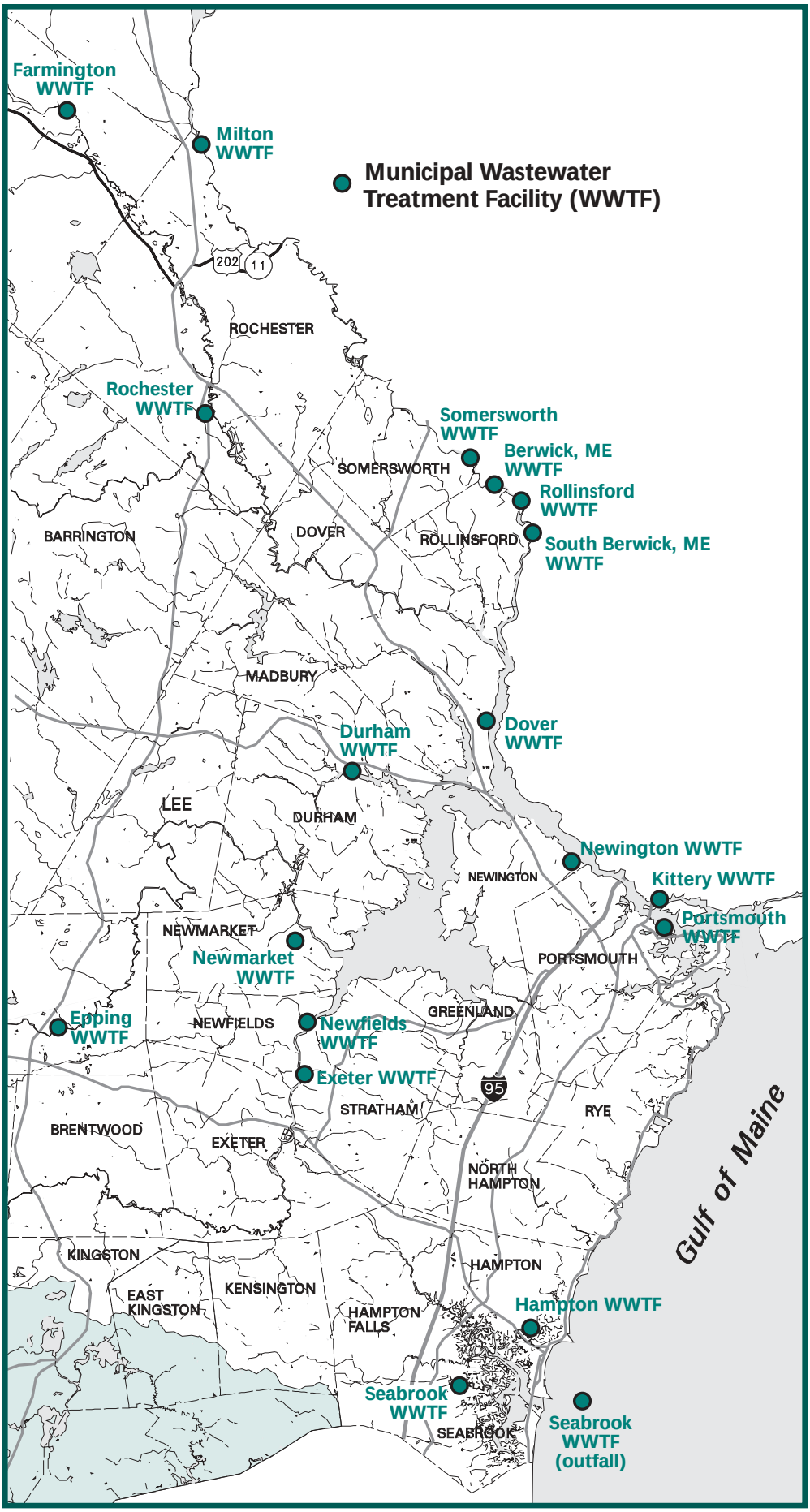
Point Source Pollution

Pollution that is discharged from the end of a pipe or a single readily identifiable source is called point source pollution. This type of pollution includes discharges from industrial and municipal wastewater treatment facilities (WWTFs), and other sources such as drainage ditches. These highly visible sources were the first ones addressed by the Clean Water Act, with dramatic results. However, point source problems persist.

At the **Federal** level, the U.S. Environmental Protection Agency (EPA) regulates point source discharges through the National Pollutant Discharge Elimination System (NPDES) established under the Clean Water Act. Wastewater discharges from all sources require a NPDES permit. The NPDES permit limits the quantity and concentration of pollutants

Rochester Wastewater Treatment Facility Discharge

NHEP


Municipal Wastewater Treatment Facility (WWTF)
Farmington WWTF
Milton WWTF
202
11
ROCHESTER
Rochester WWTF
Somersworth WWTF
Berwick, ME WWTF
SOMERSWORTH
Rollinsford WWTF
South Berwick, ME WWTF
BARRINGTON
DOVER
ROLLINSFORD
MADBURY
Dover WWTF
Durham WWTF
LEE
DURHAM
Newington WWTF
NEWINGTON
Kittery WWTF
Portsmouth WWTF
NEWMARKET
Newmarket WWTF
PORTSMOUTH
Epping WWTF
NEWFIELDS
Newfields WWTF
GREENLAND
Exeter WWTF
95
STRATHAM
RYE
BRENTWOOD
EXETER
NORTH HAMPTON
Gulf of Maine
KINGSTON
HAMPTON
EAST KINGSTON
KENSINGTON
HAMPTON FALLS
Hampton WWTF
Seabrook WWTF
SEABROOK
Seabrook WWTF (outfall)

discharged. Specific requirements depend on the water receiving the effluent, the type of discharge, and may involve best available technology and economic feasibility considerations.

Certain municipal stormwater systems and industrial and construction sites currently require NPDES permits. Under Phase II of EPA's NPDES stormwater management regulations, certain additional stormwater systems that drain into, or are collected by ditches, pipes, or other conveyances before discharging into surface waters, will require NPDES permits by March 2003. Under the current Phase I regulations, construction sites that disturb five or more acres require a NPDES permit, but that threshold drops to one acre under Phase II.

In Phase I, EPA required medium and large municipal separate storm sewer system (MS4) operators – generally those serving areas with populations of 100,000 or more – to obtain permits. While no such MS4s are located in New Hampshire, dischargers of stormwater discharges associated with industrial activity were also required to apply for permits in Phase I. These industrial sources generally include heavy and light manufacturing facilities, hazardous/solid waste processing, recycling facilities including junkyards, mining, timber processing, power plants, vehicle maintenance, sewage/sludge treatment plants, and construction activities that disturb more than 5 acres.

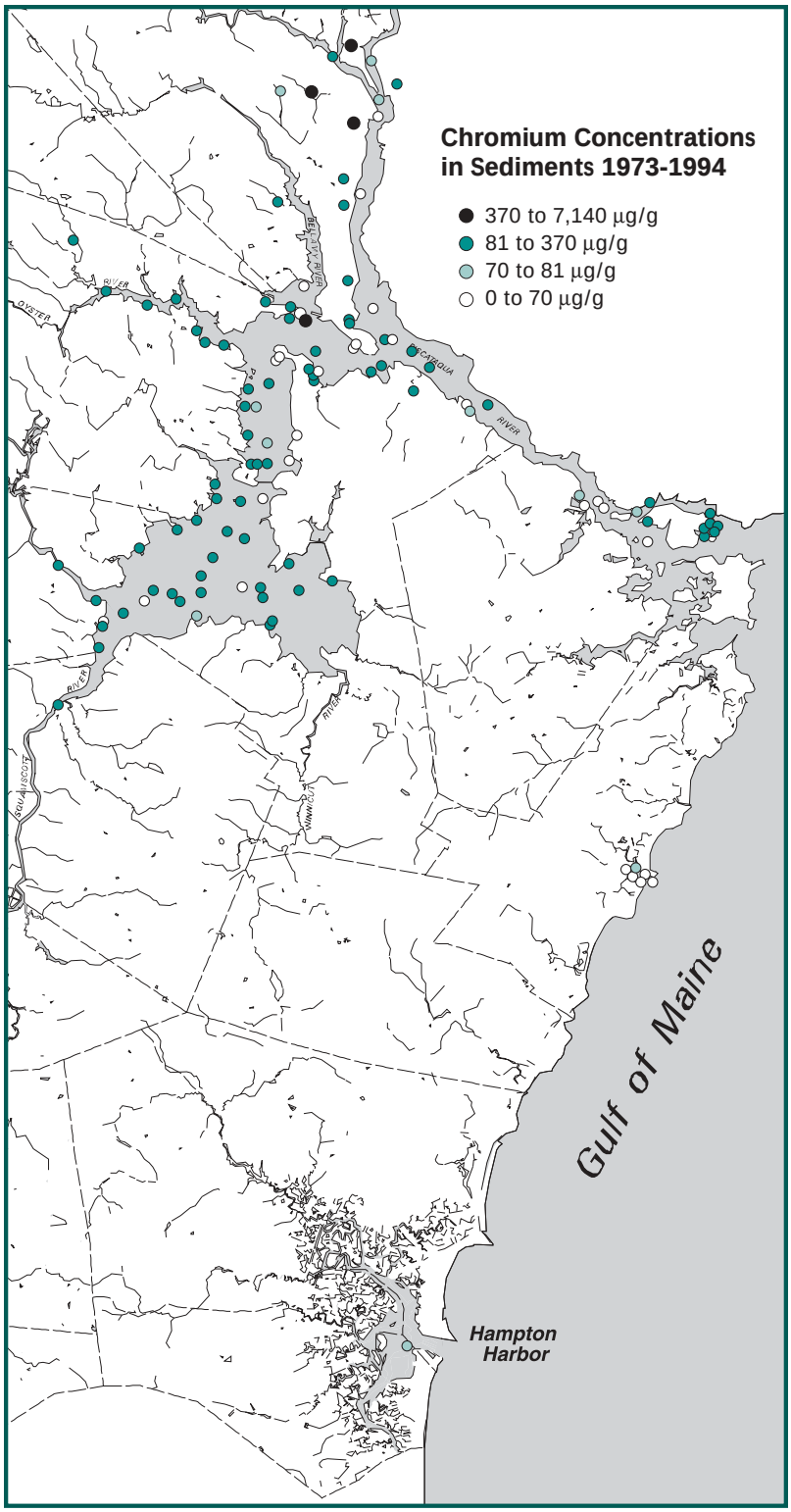
Phase II will regulate small MS4 discharges in urban areas located in 26 municipalities in New Hampshire, stormwater discharge associated with smaller-area construction activity, and the municipally owned industrial activities that were exempted from regulation during Phase I. Small municipal separate storm sewer system (Small MS4) owners and operators in the following New Hampshire Seacoast municipalities will be required to apply for NPDES permit coverage under Phase II: Dover, Durham, Madbury, New Castle, Newington, Portsmouth, Rochester, Rollinsford, Rye, and Somersworth.

As with all NPDES permits in New Hampshire, NH DES will review and certify Phase II NPDES permit applications. The NH OSP is lead agency of a working group recently formed to prepare for the technical assistance communities will need when they begin to address Phase II compliance. Participants include some of the Phase II communities, NH OSP/Coastal Program, NH DES, and NH DOT.

Each NPDES permit requires periodic monitoring and reporting of discharges to EPA and the state. Most Seacoast NPDES permit-holders are on a monthly reporting schedule. NH Department of Environmental Services inspects permitted sites in the Seacoast area at least annually. In the Seacoast, whenever sewage that has not been treated or disinfected is released the operator must notify EPA, NH DES, and all public or privately-owned water systems drawing water from the same receiving water and located within 20 miles downstream of the point of discharge. EPA can enforce NPDES requirements with a range of compliance orders and civil and criminal penalties up to $25,000 a day and imprisonment. Enforcement actions in response to significant non-compliance and certain by-pass or overflow situations are coordinated between EPA and NH DES.

Clean Water Act Section 303 (d) and its implementing regulations require states to list water segments that are impaired – defined as out of compliance

with a water quality goal or designated use such as swimming or fishing, even after targeted pollution control practices have been implemented to address the problem. The Clean Water Act requires that the list include priority ranking of segments most in need of total maximum daily load (TMDL) analysis. The TMDL defines the maximum amount of a specific pollutant that can be discharged into a body of water without violating the water quality goals for that water. NPDES permits and state wastewater discharge licenses are written in accordance with TMDL allocations for the specific water body and source. Permits for five dischargers into the Salmon Falls/Piscataqua rivers in New Hampshire and Maine are currently being developed in accordance with the TMDL for that water. TMDLs are also being developed or implemented for the Cocheco River in Rochester.



Effects Range-Median (ER-M) is the concentration at which biological effects are likely to occur. ER-M = 145µg/g for chromium.

The Clean Water Act requires each **state** to establish water quality standards based on water uses and criteria for specific contaminants that are necessary to protect those uses. New Hampshire has established these standards under the state's Water Pollution and Waste Disposal Act (RSA 485-A). NPDES permits establish limits to protect these standards, and require consideration of U.S. Fish & Wildlife Service comments, in accord with the Fish and Wildlife Coordination Act. The Coastal Zone Management Act also requires that federal actions be consistent with state Coastal Zone Management Plans. Under this provision, New Hampshire requirements were incorporated into several federal projects including a hydroelectric facility in South Berwick, Maine and the new interstate gas pipeline which runs through the New Hampshire Seacoast.

NH RSA 485-A makes it unlawful to discharge sewage, industrial, or other wastes in a way that degrades water quality below classification criteria. NH DES can require any person who causes a body of water to be degraded

below the standards of its classification to correct the problem. New Hampshire's standards for bacteria are consistent with the stringent guidelines of the US Food and Drug Administration's National Shellfish Sanitation Program for permitted discharges to tidal waters from wastewater treatment facilities.

Discharge permits must go through both state and federal review. In practice, permittees have two permits, one federal and one state, with EPA incorporating any additional New Hampshire conditions into its permits, and New Hampshire adopting the federal NPDES permits as its own.

Local governments have no direct involvement in the NPDES regulatory control for point source discharges. They may comment on NPDES permit applications as part of the public comment process. The local role in pollution discharges is primarily the management of wastewater treatment facilities and stormwater collection systems, and regulations and ordinances to reduce non-point sources that impact stormwater runoff. Municipalities also have some control over industries that discharge into municipal wastewater treatment systems, through their pretreatment programs.

GOALS FOR CLEANER WATER

To achieve cleaner water in the estuaries, the NHEP established specific goals and objectives with measurable, science-based standards. Refer to *Appendix 3* of the *Plan* for the specific standards for the water quality goals and objectives. Action Plans for water quality detail how specific sources of pollution will be identified and eliminated or reduced to meet these goals:

- Ensure that New Hampshire's estuarine waters and tributaries will meet standards for pathogenic bacteria including fecal coliform, *E. coli*, *Enterococci*, and total coliforms.
- Ensure that New Hampshire's estuarine waters, tributaries, sediments, and edible portions of fish, shellfish, other aquatic life, and wildlife will meet standards for metals, PCBs, oil and grease, PAHs, and other toxic contaminants.
- Ensure that New Hampshire's estuarine waters and tributaries will meet standards for organic and inorganic nutrients, specifically nitrogen, phosphorus, chlorophyll A (freshwater), dissolved oxygen, and biological oxygen demand (BOD).
- Engage the active participation of communities, government agencies, organizations, and individuals in achieving the goals for water quality.

WATER QUALITY
ACTION PLANS

Wastewater Treatment Facilities

WQ-1 Evaluate how Wastewater Treatment Facility effluent affects estuarine water quality, and seek practical options at the state level for secondary and tertiary or alternative treatment where appropriate. 4-17

WQ-2 Evaluate the suitability of UV alternatives to chlorine in wastewater post-treatment for the Seacoast communities. 4-20

WQ-3 Prioritize and then upgrade Seacoast wastewater treatment facilities to reduce bacterial pollution from hydraulic overloading. 4-23

Illicit Connections in Urban Areas

WQ-4A Establish on-going training and support for municipal personnel in monitoring storm drainage systems for illicit connections. 4-26

WQ-4B Assist Seacoast communities in completing and maintaining maps of sewer and stormwater drainage infrastructure systems. 4-28

WQ-4C Eliminate illicit connections in Seacoast communities. 4-31

Illegal Direct Discharges

WQ-5 Conduct shoreline surveys for pollution sources. 4-33

WQ-6 Promote collaboration of state and local officials (conservation commissions, health officers, building inspectors, et al.) to locate and eliminate illegal discharges into surface waters. 4-36

WQ-7 Provide incentives to fix or eliminate illegal direct discharges such as grey water pipes, failing septic systems, and agricultural runoff. 4-38

Stormwater

WQ-8 Research the effectiveness of innovative stormwater treatment technologies for existing urban areas in New Hampshire, and communicate the results. 4-40

WQ-9 Ensure that water quality and quantity impacts from new development or redevelopment are minimized to the maximum extent practical at the planning board stage of development. 4-43

WQ-10 Research the use and effectiveness of the Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire. Revise, publish, and promote the Handbook. 4-45

Permitted Discharges

WQ-11 Revise industrial discharge permit criteria in response to new state processing technology, and re-evaluate existing permits. 4-47

Oil Spills

WQ-12A Acknowledge and support the oil spill prevention and response activities of the Piscataqua River Cooperative. 4-49

WQ-12B Enhance oil spill clean up efforts through pre-deployment infrastructure and development of high-speed current barriers. 4-51

Septic Systems

WQ-13 Provide septic system maintenance information directly to shoreline property owners, and to other citizens of the Great Bay and coastal watersheds to help improve water quality. 4-53

WQ-14 Encourage the use of innovative alternative technologies for failing septic systems to help improve water quality. 4-55

Air Quality

WQ-15 Support efforts to reduce deposition of atmospheric pollutants through eliminating loopholes in current laws, encouraging the construction of more efficient power plants, and encouraging energy conservation. 4-57

Water Quality Funding

WQ-16 Find funding sources for key strategies. 4-59

Water Quality Outreach

WQ-17 Coordinate public tours of wastewater treatment facilities. 4-61

WQ-18 Support and Coordinate Stormwater Technical Workshops. 4-64

WQ-19 Stormwater Awareness: Support and expand stormdrain stenciling programs. 4-66

WQ-20 Conduct estuarine field day for municipal officials. 4-68

PRIORITY

+++ **Highest**

++ **High**

+ **Priority**

ACTION WQ-1

Evaluate how Wastewater Treatment Facility effluent affects estuarine water quality, and seek practical options at the state level for secondary and tertiary or alternative treatment where appropriate.

PRIORITY

++

WASTEWATER TREATMENT FACILITY

BACKGROUND

Direct discharges from Wastewater Treatment Facilities (WWTFs) are in some cases contributing or major sources of suspended solids and nutrients into surface waters of the state. These pollutants can lead to aquatic nuisance plant infestation and increased incidence of reduced-oxygen concentrations, which can result in habitat degradation, aquatic fauna mortality, algae blooms and eutrophication, and changes to plant and animal communities. These environmental impacts warrant consideration and examination of advanced or alternative wastewater-treatment technologies.

Currently coastal communities evaluate wastewater treatment facilities and infrastructure through the 201 Facility Plans, as required by the EPA. Local officials and operators use these plans in long-term planning for upgrading facilities. Compliance with permit limits varies, but generally coastal wastewater plants meet most or all of their wastewater effluent limits most of the time. Hydraulic overloading is a common occurrence that results in untreated wastewater discharges. Except for Portsmouth, all Seacoast wastewater treatment facilities employ secondary treatment. The Portsmouth facility uses advanced primary treatment, a technology using sand filters to treat effluent.

Although the limited available nutrient data show that nutrients are not at critical levels in most areas of the estuarine systems, EPA, the states of Maine and New Hampshire, and local watershed groups such as the Lamprey River Watershed Association have documented evidence of eutrophication, especially from point sources, particularly at the heads of the tides in the Salmon Falls and Cocheco Rivers. Careful survey of the present effects on flora and fauna is an important part of planning for facility upgrades.

ACTIONS/ACTIVITIES

1. NH DES will hire a contractor to identify WWTF discharges that are probable or potential causes of nutrients and suspended solids impacts throughout New Hampshire's estuaries and tributary rivers. Municipal wastewater plants discharging to tidal waters include: Dover, Durham, Exeter, Hampton, Newfields, Newington, Newmarket, Portsmouth, and Seabrook. Review National Pollutant Discharge Elimination System (NPDES) permits and analyses, and the New Hampshire Estuaries Technical Characterization report.

2. The Contractor will conduct biological assessments and look for data gaps in the chemical analyses and biological assessments of surface waters in the potential impact zone. After finding data gaps, conduct follow up wet-weather and dry-weather sampling and analyses. WWTF effluent should be isolated to the extent possible from other point and non-point sources.

3 Each wastewater treatment plant determined to be negatively affecting water quality or biological communities will be evaluated by the contractor for design constraints and capacities. This will be the best point to evaluate appropriate upgrade needs for secondary, tertiary, and/or alternative treatment.

Secondary treatment should achieve removal of 85% suspended solids and 85% Biological Oxygen Demand (BOD). Secondary treatment methods may include activated sludge aeration, trickling filters, sequencing batch reactors, and rotating biological contactors.

Tertiary treatment usually aims to remove nutrients such as phosphorus and nitrogen. Phosphorus removal options are ion exchange, sorption, or coprecipitation. Nitrogen removal processes include ammonia stripping and nitrification/denitrification. A new and promising approach is biological nutrient removal.

Constructed wetlands are an alternative treatment for reducing nutrients and common contaminants; however, state regulations discourage use of constructed wetlands to treat wastewater. Commonly cited statistics indicate constructed wetlands can be expected to remove 75% of total suspended solids, 45% of total phosphorus, and 25-35% of total nitrogen.

4 NH DES will conduct cost-benefit analyses to evaluate upgrade needs for secondary, tertiary, and alternative treatment. The report of this study would include: review of wastewater treatment plant design with recommendations for changes; review of options, structural constraints, land constraints, engineering and legal planning issues, construction (depends on options), operations and maintenance, and monitoring schedules.

5 NH DES will continue to work with municipalities by evaluating the cost-benefit analyses with municipal officials and facility managers.

6 NH DES will evaluate monitoring criteria, criteria values, and monitoring frequency required in the permits for any wastewater treatment facilities that install upgrades or other adaptations as a result of this study.

RESPONSIBLE PARTIES

NH DES would hire a contractor to review available data from permit information and other sources (Step 1). The contractor would proceed with supplemental monitoring, if needed data gaps are identified (Steps 2 and 3). NH DES would use the resulting information to work with municipalities in an effort to upgrade facilities that are having impacts on water quality and biological communities (Steps 4-6).

IMPLEMENTATION LOCATION

This Action Plan will be implemented in the following communities with wastewater treatment facilities: Farmington, Milton, Rochester, Somersworth, Rollinsford, Dover, Durham, Newington, Protsmouth, Newmarket, Newfields, Epping, Exeter, Seabrook , and Hampton.

COSTS

Data and information review by contractor in Step 1	$20,000
Supplemental monitoring in Steps 2 and 3 (field work, analytical testing, and report)	$50,000
Cost/benefit analysis in Step 4	$30,000
Information transfer to municipalities in Step 5	$5,000
Evaluation of permit monitoring criteria in Step 6	$0
Research and final report in Step 4	$0
Total	**$105,000**

FUNDING

Possible funding sources would include: State and Federal Revolving Loan Fund under Clean Water Act P3 options, NHEP Implementation Funding, and the Cooperative Institute for Coastal and Estuarine Environmental Technology, or through other Federal programs identified in Tables 10.1 to 10.6 of this document.

REGULATORY NEEDS

Legislative changes may be needed to clarify the use of artificial constructed wetlands created specifically for pollutant removal, as distinct from naturally occurring wetlands. Wetlands are considered "waters of the state" and as such are entitled to strict water quality protection. Such waters may receive pollutant discharges by permit only and are subject to water quality considerations. They cannot constitute part of the treatment process. All minor permits in the Seacoast have recently been reissued.

EXPECTED BENEFITS

Upgrades of wastewater treatment plants found to be sources of suspended solids and nutrients will directly improve water quality, flora, and fauna in the zone of effluent impact. Removal of nutrients from the continuous waste stream will reduce the likelihood of internal recycling of nutrients within the estuary.

MONITORING AND ENFORCEMENT

Additional monitoring may be worked into the NPDES permits to verify the effectiveness of the upgrades.

TIMETABLE

Initiated by 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

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PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

WASTEWATER TREATMENT FACILITY

PRIORITY

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ACTION WQ-2

Evaluate the suitability of UV alternatives to chlorine in wastewater post-treatment for Seacoast communities.

BACKGROUND

Chlorine is commonly used to disinfect wastewater before final discharge, but chlorine's general toxicity harms aquatic organisms, including shellfish larvae. Dechlorination agents are generally added after disinfection to convert the chlorine to the inert chloride. This further increases the chemical burden in the waste stream, and although less toxic than chlorine, chloride is generally undesirable. Since chemical dechlorination requires little or no infrastructure beyond the existing treatment plant, chemicals are essentially the only cost. The cost (defined as production cost - calculated on the basis of the amortized capital costs, plus the annual operation and maintenance costs, divided by the annual wastewater volume treated by the plant) of chlorination averages $0.02/1000 gallons, adding dechlorination averages $0.005/1000. A chlorine plus dechlorination facility for new plant construction averages $0.03/ 1000. The advantages of chlorine are its low cost and effectiveness on most wastewater, regardless of contents.

The only currently available and practical alternative to chlorine is UV(ultraviolet) disinfection. The waste stream is split into multiple shallow channels and exposed to modest levels of ultra-violet light for just a few seconds. For water that is clear, UV is highly effective, leaves no chemical residue, and effectively kills both bacteria and viruses. UV is also inexpensive, since it requires little space. Energy requirements are low compared to existing WWTF power usage. Long-term costs for UV disinfection are the same as for a retrofitted chlorine plus dechlorination system, $0.03/1000. Cost in new plant construction is slightly less, $0.025/1000. While a UV facility takes little space, urban plants with no expansion room may have difficulty adding a UV facility.

The principle disadvantage of UV disinfection is the process's sensitivity to turbidity, the cloudy condition of water with suspended sediments or foreign particles. Turbidity is measured differently from total suspended solids (TSS), and is not always well correlated with measures of suspended solids. There is no plant standard for turbidity, but allowable levels of total suspended solids (TSS) can easily produce turbidity that renders UV disinfection ineffective. Filtration may be required to ensure sufficient clarity. But filtration can have high operation and maintenance costs if, for example, effluent is turbid enough to cause clogging.

The Dover wastewater treatment facility constructed in 1992 has a conventional UV facility. The Environmental Research Group at UNH is studying, with NOAA-CICEET funding, an innovative UV technology called pulsed-UV. This will be piloted in Dover and Durham in 1999 and in 2000. Pulsed-UV holds promise for wastes that are more difficult to treat, e.g. CSOs (combined sewer overflows).

ACTIONS/ACTIVITIES

The situations under which UV disinfection works are well understood, as are the costs. The following steps are needed to determine if this technique is a suitable alternative to the traditional use of chlorine disinfection.

1. Meet with all NHEP study area wastewater treatment plant operators and municipal decision-makers to discuss the detrimental effects of chlorination, and evaluate their interest in post-treatment disinfection alternatives.
2. Assess the chlorination/dechlorination products in the post-treatment stream of the major wastewater treatment plants discharging into the estuaries. Review WET (wastewater effluent toxicity) data.
3. For plants producing problematic chemical levels, determine if the wastewater turbidity levels will require filtration. For plants that cannot use UV, consider increasing the chlorine detention time as an alternative.
4. Determine the cost and benefit for each plant retrofit.
5. Present findings to the operators and decision-makers. Work with each municipality to secure funds for construction along with transfer of technical information.

RESPONSIBLE PARTIES

The lead implementors should be the University of New Hampshire and UNH Cooperative Extension (Steps 1-5). A UNH engineering or marine studies student will perform the assessment of each discharge, evaluate turbidity levels, and do the cost/benefit analysis for each retrofit (Steps 1-4). WWTFs throughout the NHEP study area will be assessed, and NH DES will partner with UNH at each step and work with the municipalities on technical support and to secure funds to implement the recommendations based on priority assignments.

IMPLEMENTATION LOCATION

This Action Plan will be implemented in those communities with wastewater treatment facilities estuarine watershed selected as appropriate research locations (See list on pages 4-18). Findings and recommendations will be presented across the NHEP study area.

COSTS

Stipend and expenses for student (conduct assessment, evaluation, and analyses) in Steps 1-4	$10,000
NH DES involvement (incorporated into existing job tasks) in Steps 1-5	$0
Total	**$10,000**

FUNDING

This action may be funded through CICEET, US EPA NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.5 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP could also support this action. Cash or in kind contributions from Seacoast communities toward the project may also be appropriate.

REGULATORY NEEDS

Potential changes to NPDES permits.

EXPECTED BENEFITS

Removal of chlorine from WWTF effluent, with resulting reduction of toxicity to flora and fauna in the receiving waters. An added benefit is the education about and/or elimination of accidental chlorine dumps into the estuary at the facilities switching from chlorine to UV-disinfection. Chlorine is known to kill or harm shellfish and migratory fish, especially the larval forms.

MONITORING AND ENFORCEMENT

Water samples will be collected by the UNH student during dry and storm conditions following the construction of the retrofits to document the effects on water quality. Selected biomonitoring methods might also be employed to track impacts to aquatic communities.

TIMETABLE

Initiate by 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

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PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION WQ-3

Prioritize and then upgrade Seacoast wastewater treatment facilities to reduce bacterial pollution from hydraulic overloading.

PRIORITY

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WASTEWATER TREATMENT FACILITY

BACKGROUND

Shellfish beds are frequently closed to harvest due to bacterial contamination when wastewater treatment facilities (WWTFs) experience overflows, bypasses and pump problems at the plant or in the distribution system. Both mechanical problems and excess flowage during storm events cause these closures. In addition, Exeter and Portsmouth have combined sewage overflows (CSOs) that discharge untreated sewage and stormwater into surface waters, because of inadequate treatment plant capacity to handle the increased flow during storms. EPA has given both towns administrative orders to fix the CSOs, which are likely to be more stringently enforced in the next couple of years. A multitude of enforcement actions are now being carried out on Seacoast WWTFs. This should make the planning and tracking activities envisioned below appealing to communities.

The key premise of this Action is that each facility has different issues and each community has different WWTF needs. There is no single solution to wastewater issues. Some plants will soon be subject to additional permit requirements, such as limits on phosphorus. All facilities do not contribute equally to wastewater ecological problems. Impacts vary with the frequency and amount of discharge, the affected receiving waters, plant location in the watershed, and treatment process. One option is a pollution tracking system similar to the toxic release inventory, but this may not make sense given the particulars of permit requirements. Plants with more recent permits will have lower pollution limits than older permits. Plants with more recent permits may have violations even when their discharge is significantly cleaner than a facility that is in compliance with an older permit.

This Action is intended to assist NH DES and communities to achieve better treatment of wastewater with a plan that is facility-specific and commensurate with the plants' impacts on the estuaries. The communities and NH DES are working hard to improve WWTF performance, but a regional and long-term planning perspective is needed. This project needs the participation of plant operators and their knowledge of the WWTF systems to succeed.

This Action Plan sets the stage for understanding the "big picture" of wastewater treatment in the estuarine watersheds, prioritizes the problems caused by WWTFs, and recommends how to ameliorate those problems. This project considers future impacts of long-term growth on estuarine water quality. The WWTFs in these watersheds require very large investments to meet performance goals. Most are aging, and operation and maintenance budgets will not be sufficient to upgrade the plants. Carrying out this Action Plan should help communities choose the best way to allocate resources to make upgrades, and build the case for federal or state funding assistance.

ACTIONS/ACTIVITIES

1. Understand the impacts on estuarine water quality of each WWTF that discharges into tidal rivers in the Study Area using the NHEP Technical Characterization report, shellfish program, data from WQ-1, and consultations with the affected communities. (DES, RPCs)

2. WWTF Needs Assessment: In collaboration with the affected communities, compile and prioritize the real problems at each plant. Implement upstream and downstream water monitoring if additional data are needed to characterize the receiving waters under various conditions, and to determine the impact of the discharge. Look at all aspects of the plant – inflow/infiltration, pump stations, pipe age, treatment process, plant capacity, CSOs, frequency and amounts of untreated discharge, etc. Examine any plans the town has for improvements or system upgrades. Discuss the problems with the town government and plant operators. Encourage the municipalities to develop contingency plans for mechanical failures. (Consultant)

3. Develop a long-term regional plan that includes: plant size and capacity, age of pipes and plants, and contingency planning (e.g., double pumps to avoid bypasses). (DES, RPCs)

4. Develop WWTF recommendations and tracking procedure. Communicate plant-specific recommendations to each town. The communities, NH DES, and EPA will develop agreements to fix the problems that result in bacterial loading to the estuary first, then work on other improvements. NH DES and EPA will also work with the communities by providing guidance and technical assistance and tracking successes. Involve the plant operators at every step. (DES, RPCs)

5. Prioritize funding for plants based on the recommendations. Assist communities to secure funds to modernize facilities, e.g., State Revolving Fund. (DES, RPCs)

RESPONSIBLE PARTIES

NH DES is the lead implementer; EPA, Seacoast communities, and Regional Planning Commissions may also assist with this Action. These activities will be undertaken for all facilities identified as important (see Step 1) throughout the NHEP study area. The work will be supported with funding for a coordinator position at NH DES to assist the communities with the planning (Steps 1-5). The coordinator will analyze the *NHEP Technical Characterization* and shellfish program water quality data, and conduct additional water quality analysis as needed. Consultants will be brought in as needed to assist in system analysis (Step 2). The NH DES position should last two years with a mechanism for NHEP or NHCP staff to track progress. Information on the impacts of each WWTF in the ecosystem and the recommendations for each plant should be publicized to increase public support for the necessary improvements.

IMPLEMENTATION LOCATION

This Action Plan will be implemented in communities with municipal sewage and stormwater infrastructure throughout New Hampshire's estuarine watershed. These include over, Durham, Exeter, Hampton, Newfields, Newington, Newmarket, Partsmouth, and Seabrook.

COSTS

Project coordinator/principal investigator in Steps 1-5	
One Full Time Equivalent for two years	
(Grade 22 to 24, approx. $40,000 per year plus benefits)	$110,000
Consulting and engineers in Step 2	$150,000
Water quality monitoring and equipment in Step 2	$30,000
Total	**$290,000**

FUNDING

This action may be funded in part through US EPA NHEP implementation funds or through other appropriate federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through the State Revolving Loan fund and natural resource management agencies such as NH DES or NH OSP. Communities also have the ability to raise funds for infrastructure improvements by securing municipal bonds authorized at town meeting through the adoption of project specific warrant articles.

REGULATORY NEEDS

While the initial effort requires no regulatory changes, the implementation phase might. For example, if one part of a WWTF is found to be more of a problem than another, administrative orders may need to be changed to make sure the worst problems are fixed first. More state and federal money may also be needed for upgrades.

The scale, variety and complexity of estuary impacts from municipal wastewater treatment plants in two states (NH and ME, or NH and MA) may warrant the formation of a regional water pollution authority like the Winnipesaukee River Basin Program.

EXPECTED BENEFITS

This Action will result in a regional plan for improving water quality from WWTFs, with realistic cost estimates to fix WWTF problems, prioritization of problems to help allocate funds, and a time line to make improvements. Despite the high costs of this Action Plan, the potential gains in water quality improvement are significant.

MONITORING AND ENFORCEMENT

NH DES will conduct additional upstream and downstream monitoring if necessary.

TIMETABLE

Initiate by 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

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PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ILLICIT CONNECTIONS

PRIORITY +++

ACTION WQ-4A

Establish on-going training and support for municipal personnel in monitoring storm drainage systems for illicit connections.

BACKGROUND

Illicit connections – where non-stormwater pollution discharges into the storm drain systems – are prevalent in New Hampshire urban communities. Illicit connections often result in untreated sanitary sewage flowing through storm drain systems, and discharging untreated into surface waters.

NH Department of Environmental Services is implementing a plan [Coastal Watershed Status Report, December 1995] to identify and eliminate illicit connections in all coastal urban centers. Action WQ-4A will build on information found during investigations by the Department of Environmental Services (NH DES), and will assist municipalities in long-term monitoring of storm drainage systems for illicit connections.

NH DES identified the nine communities targeted for NPDES Phase II regulations (Dover, Durham, Madbury, New Castle, Newington, Portsmouth, Rochester, Rollinsford, and Rye) as well as Hampton and Seabrook as key communities for this activity. Monitoring in the smaller communities of Hampton, Seabrook, Durham, and others may also be desirable.

ACTIONS/ACTIVITIES

1. Form a review board with members from the NHEP, NH DES, NHCP, and municipal officials from the key communities listed above, to review the results of the investigations and discuss their challenges in finding and eliminating illicit connections. Review the completed and on-going investigations by NH DES to determine where major problems are located.
2. NH DES and OSP/NHCP will train municipal staff in investigatory techniques for identifying illicit connections and enforcement options for ongoing investigations.
3. Municipalities will work with NH DES to develop and maintain an illicit connections database of the storm drainage system, and include this in the operations budget.
4. The review board will create local monitoring plans based on the NH DES investigative techniques (e.g. bacterial monitoring, smoke and dye testing). Identify funding sources including loans and grants such as the State Revolving Fund, Clean Water Action Plan, Non-point Source Program (NPS), and the Community Development Block Grant (CDBG) as incentives for the communities.
5. NH DES and NH OSP/NHCP will work with municipalities to identify resource needs for water quality monitoring of storm drain outfalls.
6. Assist communities with securing funds to monitor storm drainage systems as an additional incentive to participate in this training program.

RESPONSIBLE PARTIES

The New Hampshire Department of Environmental Services may be the lead implementer of this action with assistance from the New Hampshire Office of State Planning and the New Hampshire Coastal Program and coastal community public works departments.

IMPLEMENTATION LOCATION

This Action Plan will be implemented in key communities such as Portsmouth, Dover, Rochester, Newmarket, Somersworth, and Exeter. Scaled-back monitoring in the smaller communities of Hampton, Seabrook, Durham, and others may be desirable locations for implementation of this Action Plan.

COSTS

Review of current status and training:	
Coordinate review board in Step 1	$0
Meetings with communities (supplies, copies, etc.) in Step 1	$500
Training in Steps 2-6 (development, materials, AV equipment, etc.)	$10,000
Total	**$10,500**
Monitoring program for 11 communities: water quality monitoring of storm drainage outfall pipes in Step5 and smoke and dye testing (as needed) in Steps 2-4	(per town) $5,000
Total	**$55,000**

Note: Costs for fixing illicit connections are shown in Action WQ-4C.

FUNDING

This action will be funded through US EPA NHEP implementation funds in 2001 and 2002. Future work may be funded through federal programs identified in Tables 10.1-5 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP could also support this action. Possible funding sources include loans and grants such as the State Revolving Fund, Clean Water Action Plan, Non-point Source Program (NPS), and the Community Development Block Grant (CDBG).

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Implementation of this action will result in increased awareness of illicit connections and improvement of surface water quality.

MONITORING AND ENFORCEMENT

NH DES will oversee the development of local monitoring plans. This action should result in increased local enforcement of illegal sewer hook-up laws and ordinances.

TIMETABLE

Initiate in 2001. Complete for Phase II communities, Hampton, and Seabrook by 2002. This Highest Priority action is expected to be implemented in the first four years of *NHEP Management Plan* implementation.

+++

PRIORITY

Highest Priority. Implementing Action WQ-4B before or concurrently with this action may be desirable.

ILLICIT CONNECTIONS

PRIORITY +++

ACTION WQ-4B

Assist Seacoast communities in completing and maintaining maps of sewer and stormwater drainage infrastructure systems.

BACKGROUND

While some communities have adequate infrastructure maps, many have incomplete maps or none at all. Investigations into illicit connections to storm drains have demonstrated the importance of accurate sewer and storm drain systems maps. Maps are also valuable for emergency response to events such as oil spills on roadways. In larger communities such as Dover, Exeter, Newmarket, Portsmouth, Rochester, and Somersworth, maps also play a key role in long-term infrastructure planning. These communities and NH Department of Transportation can serve as partners in this action.

Most of the urbanized areas of the Seacoast region, including Dover, Durham, Madbury, New Castle, Newington, Portsmouth, Rochester, Rollinsford, Rye, and Somersworth, will be required to map all their stormwater conveyances as part of their development and implementation of stormwater management programs required under Phase II of EPA's NPDES stormwater management program.

While wastewater treatment plants and pump stations are important to the protection of water quality, the sewerage infrastructure that carries waste to these destinations must also be maintained. Recent repair work in one coastal community revealed old pipes made from bored logs. Infrastructure maps would assist communities in long-term planning for replacement and maintenance of underground pipes, as well as with master plan development. This Action Plan will help communities prepare for Phase II stormwater management NPDES permit regulations, which will require permits for small municipal separate stormwater system discharges by March 2003.

ACTIONS/ACTIVITIES

1. Regional planning commissions (RPCs) will hire staff (funded by NH DES) to determine the availability and completeness of infrastructure maps for all municipalities with sewer and storm drain infrastructure. Review of completeness will include map type, accuracy, and additional needs. Other information should be obtained from utilities (GIS layers).
2. RFCs will verify existing infrastructure and map the systems in areas where information gaps exist. Investigate the possibility of using geomagnetic survey equipment to locate underground pipes.
3. RPCs will digitize the gathered information and create data layers on a GIS system, along with natural drainage features, roadway, and utility data layers.
4. Municipalities perform field checks of the final maps, and RPCs make any necessary corrections.

5 Once the data layers are completed, the RPCs could provide a workstation for municipalities as needed to access the data, or pass the information on to communities that have appropriate hardware and software.

6 Train municipal staff to access the information and create data layers through the University of New Hampshire's Community Mapping: A GIS Course for Educators, Community Leaders, and Other Interested Persons, provided by UNH Cooperative Extension.

RESPONSIBLE PARTIES

NH DES and the Regional Planning Commissions would partner as lead coordinators for this action (Steps 1-5). The affected coastal communities, and perhaps also the NH Department of Transportation, should be included in this effort. UNH Cooperative Extension will provide GIS Course (Step 6).

IMPLEMENTATION LOCATION

This Action Plan will be implemented in communities with municipal sewage and stormwater infrastructure such as Dover, Durham, Madbury, New Castle, Newington, Portsmouth, Rochester, Rollinsford, and Rye. Mapping will be completed in all those communities identified as needing maps.

COSTS

Costs per municipality:	
0.5 staff time for three years in Steps 1-4	$30,000
Meeting with municipalities	
Researching and obtaining additional data layers	
Digitizing and creating data layer	
Field supplies and equipment in Steps 1-4	$ 5,000
Geomagnetic survey equipment and training in Step 2	$ 5,000
Surveys of sewer and storm drainage systems in Step 2	$120,000
Total	**$160,000**
Other costs for RPCs over 3 years	
Transferring information to municipalities in Step 5	$ 1,000
Training municipal staff/Participation in GIS course in Step 6	$ 5,000
Setting up a workstation at each RPC office in Step 5	$12,000
Total	**$18,000**

FUNDING

This action may be funded through US EPA NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.5 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP will also support this action. Costs per town may vary substantially.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Maps will provide much needed information to municipalities and NH DES for investigations of illicit connections, saving staff time and equipment costs. Use of the maps for emergency response planning and long-term infrastructure planning and maintenance will help protect water quality.

MONITORING AND ENFORCEMENT

Not applicable.

TIMETABLE

This Highest Priority action is expected to be implemented by 2004.

PRIORITY

+++

Highest Priority. Completion of this action before or concurrently with implementation of Action WQ-4A is desirable.

ACTION WQ-4C

Eliminate sewer and storm drain illicit connections in Seacoast communities.

PRIORITY
+++ ILLICIT CONNECTIONS

BACKGROUND

Illegal direct discharges represent the majority of the remaining point sources of pollution contaminating surface waters in the NHEP study area. These are significant – but preventable – sources of bacteria and nutrient loading throughout the estuaries and coast. Immediate improvements in water quality have resulted from eliminating sanitary wastewater discharges connected to the storm drainage system instead of the municipal sewer system. These discharges are commonly referred to as illicit connections.

Action WQ-4C will build on work to identify sources conducted in WQ-4A (training to monitor storm drain systems for illicit connections). Action WQ-7 (incentives to fix or eliminate illegal discharges) provides tools to work with owners of direct discharges and municipalities by assisting them with funding to fix illicit connections. Significant incentives are needed to reach compliance. The State Revolving Fund is one possible funding source. Key communities for this activity include Portsmouth, Dover, Rochester, Newmarket, and possibly Somersworth.

This Action Plan will help communities prepare for Phase II stormwater management NPDES permit regulations, which will require permits for small municipal separate stormwater system discharges by March 2003.

ACTIONS/ACTIVITIES

1. Create a database template for municipalities to collate information obtained in the storm drainage system investigations (NH DES). Municipalities need to purchase software to use the template. Where possible, useful, and financially feasible, regional planning commissions can assist communities in exporting data to a mapping program to create an additional layer to track progress in eliminating direct discharges (see Action WQ-4B).
2. The NH Department of Environmental Services will assist municipalities in prioritizing and scheduling the removal of illicit connections identified by NH DES investigations and through WQ-4A.
3. Help municipalities obtain loan and grant funds to eliminate illicit connections (See WQ-7 for further information).
4. Municipalities and business and home owners remove illicit connections from the storm drainage system, and connect to the municipal sewer system.
5. Use background data obtained from Action WQ-4A to continue monitoring and documenting water quality improvement after eliminating illicit connections. Local watershed associations, such as Great Bay Coast Watch and the Cocheco River Watershed Coalition, will assist in follow-up monitoring.

RESPONSIBLE PARTIES

Coastal municipalities and NH DES will partner as lead implementers with assistance from the Regional Planning Commissions.

IMPLEMENTATION LOCATION

This Action Plan will be implemented in communities with municipal sewage and stormwater infrastructure such as Dover, Durham, Madbury, New Castle, Newington, Portsmouth, Rochester, Rollinsford, and Rye.

COSTS

Per community:	
Purchase of database software in Step 1	$400
RPC personnel time to assist with data layer of illicit connections in Step 1	$2,000
Annual maintenance budget for illicit connections fixes in Steps 2-4 (assumes 10 fixes per year @ $6,000 per fix)	$60,000
Long-term water quality monitoring of storm drainage system (annual cost) in Step 5	$ 2,000
Total	**$64,400**

FUNDING

This action may be funded through US EPA NHEP implementation funds or through other federal programs identified in Tables 10.1 to 10.5 in the *NHEP Management Plan*. The State Revolving Fund is one possible funding source. State funds available through natural resource management agencies such as NH DES and NH OSP will also support this action. Local match for fixes will help support removal of illicit connections (Steps 2-4).

REGULATORY NEEDS

Not applicable.

EXPECTED BENEFITS

Eliminating raw sewage discharges from storm drainage systems will yield nearly immediate improvements in water quality, as these pipes flow directly into estuarine and coastal surface waters.

MONITORING AND ENFORCEMENT

The state of New Hampshire has regulations governing illicit connections, and NH DES uses a strategy of working with municipalities to identify and correct such connections. Post-fix monitoring will be conducted to document improvement in water quality and monitor storm drainage systems for illicit connections.

TIMETABLE

This Highest Priority action will be inititated in 2001. Twenty fixes will be funded in 2001 and 2002..

+++

PRIORITY

Highest Priority. This action most effectively follows implementation of WQ-4A, WQ-4B, and WQ-7.

ACTION WQ-5

Conduct shoreline surveys for pollution sources.

PRIORITY
+++ ILLEGAL DIRECT DISCHARGES

BACKGROUND

Most industrial point source discharges have been eliminated or are closely monitored through state and federal permitting programs. But many older, non-industrial, illegal discharges continue to pollute sensitive estuarine waters. This Action outlines steps for cost-effective surveys to identify such discharges, using traditional sanitary surveys for shellfish growing areas and using similar methods in areas not designated as shellfish growing areas.

The goal of this long-term, dynamic action is protecting human and ecological health. These surveys are an educational and service opportunity for students and other volunteers, with training. Shoreline surveys will aid in eliminating illegal discharges, and in raising public awareness of pollution issues and solutions. This Action Plan will help communities prepare for Phase II stormwater management NPDES permit regulations, which will require permits for small municipal separate stormwater system discharges by March 2003.

Many shellfish growing areas in the NHEP study area have been surveyed and classified by the Department of Health and Human Services. The remaining unclassified areas are scheduled for sanitary surveys over the next five years by the NH DES shellfish sanitation management program. (NH DES has completed storm drain investigations in all urban coastal communities except Portsmouth and Rye, which are scheduled for 1999 and 2000.) The National Shellfish Sanitation Program (NSSP) requires routine shoreline surveys every three years for all shellfish growing waters, but once an initial shoreline survey for pollution sources is completed, subsequent surveys review only new development. The FDA requires a full sanitary survey every 12 years for shellfish waters, with a less intensive survey every three years.

ACTIONS/ACTIVITIES

1. NH DES and volunteers conducts surveys using existing protocols published by the Food and Drug Administration with the Interstate Shellfish Sanitation Conference.
2. Gather existing survey information collected by watershed associations, conservation commissions, conservation districts, community health officers, and other groups. (NH DES)
3. Use existing shoreline survey/sanitary survey database to manage survey results and coordinate with mapping programs. Explore opportunities for involving UNH students, docents, and watershed organization volunteers to enter data. (NH DES)
4. Seek volunteers from such groups as students, conservation commissions, watershed associations and other organizations to assist with surveys. (NH DES)

5. Use the volunteer training program developed by the Great Bay Coast Watch to train teams and/or team leaders to conduct surveys. Great Bay Coast Watch has successfully assisted the NH Coastal Program and the Department of Health and Human Services in several shoreline surveys, and their program should be the model for other organizations that join this effort. Survey leaders should participate in FDA training opportunities.
6. Delineate the entire area to be surveyed (as directed by the Sanitary Survey schedule) and divide the project into zones or other sub-units. (NH DES)
7. Train and assign volunteer groups to geographic units to conduct surveys. (NH DES and Great Bay Coast Watch)
8. Notify shorefront property owners, town conservation commissions, and health officers of impending surveys. (NH DES)
9. Conduct surveys. (NH DES, NHCP, NHEP, volunteers)
10. Enter survey results in the NH DES database and coordinate with mapping programs. (NH DES)

RESPONSIBLE PARTIES

NH DES will be responsible for completing the sanitary surveys, including shoreline surveys of shellfish growing areas in tidal waters and entering results in the DES database (Steps 1-10) (see Action SHL-1). The New Hampshire Coastal Program and the New Hampshire Estuaries Project outreach coordinator will assist with the shoreline surveys (Step 9). The NH DHHS will continue to provide technical assistance on human health-related shellfish questions. Great Bay Coast Watch and other volunteer organizations may also assist with conducting surveys. (Steps 4, 5, 7, and 9).

IMPLEMENTATION LOCATION

See shoreline survey schedule on pages 6-14 for locations and dates.

COSTS

Per Season:

Training for survey leaders in Step 5	$200
Volunteer training in Step 7	$1,000
Volunteer organization support in Step 5	$7,500
Printing for forms, postage, and telephone follow-up in Steps 1-10	$200
Data entry (if not performed by students/volunteers) in Step 3	$200
Reporting to NH DES in Step 10	$500
Total	**$9,600**

FUNDING

This action will be funded in 2001 and 2002 with US EPA NHEP implementation funds. Ongoing support for this action will be re-evaluated after 2002. State funds available through natural resource management agencies such as NH DES and NH OSP may also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Expected benefits include: identification of pollution sources, especially those with direct impacts on water quality; collection of current data in a format usable with mapping programs; program design and data management that can be easily updated; and increased public awareness and participation.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

This Highest Priority action will be implemented in 2001 and 2002.

PRIORITY

+++ Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*. It is related to the implementation of the NH Shellfish Sanitation Program outlined in Action Plan SHL-1.

ILLEGAL DIRECT DISCHARGES

PRIORITY

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ACTION WQ-6

Promote collaboration of state and local officials (conservation commissions, health officers, building inspectors, and others) to locate and eliminate illegal discharges into surface waters.

BACKGROUND

While WQ-5 addresses identification of illegal discharges into shellfish growing waters of the estuaries, WQ-6 addresses all other shoreline areas of the NHEP study area, primarily those in Zone B and non-tidal portions of Zone A.

Efforts to identify and resolve pollution problems are most effective when state and local officials (building inspectors, health officers, conservation commission members, public works staff, and others) collaborate. This Action Plan aims to encourage local officials to share their knowledge with NH DES and others conducting pollution source surveys. This Action Plan will help communities prepare for Phase II stormwater management NPDES permit regulations, which will require permits for small municipal separate stormwater system discharges by March 2003.

ACTIONS/ACTIVITIES

1. NH DES and NHEP develop a public awareness campaign including posters, training programs/workshops, direct mail, and other communication tools to explain procedures for reporting suspected pollution sources. Offer the option of holding workshops for individual communities during regularly scheduled meetings.
2. NH DES staff will respond promptly to new and increased reporting, and provide follow-up communication to reporting groups.
3. NH DES will investigate and address the reported illegal discharges.
4. NH DES and NHEP create and distribute a community-by-community status report to inform all parties of the actions and results.

RESPONSIBLE PARTIES

The New Hampshire Department of Environmental Services would be the lead implementer of this action with outreach assistance from NH Coastal Program and NHEP. (Step 1-4)

IMPLEMENTATION LOCATION

This Action Plan will be implemented in all 43 communities in New Hampshire's estuarine watershed. Emphasis may be placed on the 19 NHEP Zone A communities (17 towns with tidal shoreline plus Rochester and Somersworth).

COSTS

0.5 NH DES staff for program development and follow-through of complaints in Steps 1-4	$20,000
Promotional materials and mailings in Step 1	$5,000
Inspection budget in Steps 2 and 3	$5,000
Status report production and mailing in Step 4	$2,000
Total	**$32,000**

FUNDING

This action may be funded through US EPA NHEP implementation funds or through other federal programs identified in tables 10.1 to 10.5 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP could also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Cooperation and communication between NH DES and municipalities will lead to identification of sites unknown to regulatory government agencies, thus reducing illegal discharges and improving estuarine water quality.

Building good relationships with the local communities will establish trust between local officials and NH DES.

MONITORING AND ENFORCEMENT

Water quality monitoring, enforcement, and development of a town-by-town status report are all integral to this action.

TIMETABLE

Initiate by 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

++

PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

BACKGROUND

ILLEGAL DIRECT DISCHARGES

PRIORITY

+++

ACTION WQ-7

Provide incentives to fix or eliminate illegal direct discharges such as grey water pipes, failing septic systems, and agricultural runoff.

After illegal discharges are identified through action WQ-6, a multi-level strategy to fix or eliminate them should begin to remove the threat to water quality and public health. This action should identify funding sources and other incentives, including loans and cost-share programs, for property owners to fix or eliminate their discharges. This action is intended to help property owners with illegal direct discharges achieve compliance with water protection laws. This action will help communities prepare for the Phase II stormwater management NPDES permit program, which will require permits for small municipal separate stormwater system discharges by March 2003.

ACTIONS/ACTIVITIES

1. Identify sources of financial and technical assistance, and review information on pertinent regulations and related policies in the NHEP Base Program Analysis. Provide this information as an incentive for owners or responsible parties to remedy illegal direct discharges. The NH Department of Environmental Services, the University of New Hampshire, USDA/NRCS, and the Office of State Planning/Coastal Program will collaborate with NHEP, using existing information and directories where possible.
2. The Department of Environmental Services should be encouraged to market State Revolving Fund loans to municipalities, for the purpose of making incentive loans to property owners with failing septic systems. US Department of Agriculture funds may be available for agricultural sites to eliminate direct discharges.
3. NHEP will create and regularly update a printed and online directory listing current financial assistance opportunity information targeted to fixing direct discharges. The directory should be easily updated in both print and online formats, and be included with all notices to property owners of illegal discharges.
4. NHEP will create a database listing owners of direct discharges using information from sanitary surveys, shoreline surveys, and other reported discharges (including data generated through Action WQ-5).
5. NHEP will send the funding directory to owners of direct discharges, and offer technical assistance and referrals for the application and design process to remedy the problem.
6. NHEP will, concurrently with Step 5, develop case studies of success stories, with referrals from successful projects, to encourage cooperation. Use success stories for press releases and to maintain good media relationships.

RESPONSIBLE PARTIES

NHEP is the lead implementer (Steps 1-6) with assistance from NH DES, NRCS and NHCP, develops the directory for distribution by NH DES, county conservation districts, UNH Cooperative Extension, NRCS, and others.

IMPLEMENTATION LOCATION

This Action Plan will be implemented in all 43 communities in New Hampshire's estuarine watershed. Emphasis may be placed on the 19 NHEP Zone A communities (17 towns with tidal shoreline plus Rochester and Somersworth).

COSTS

NHEP staff in Steps 1-6	$0
Printed and on-line directory development in Step 3	$3,000
Production, printing, and mailing costs in Steps 3, 5, and 6	$7,000
Development of discharge database in Step 4	$2,000
Mailing costs in Step 5	$500
Total	**$12,500**

FUNDING

This action may be funded through US EPA NHEP implementation funds, or through other federal programs identified in Tables 10.1 to 10.5 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES, and NH OSP could also support this action.

REGULATORY NEEDS

None anticipated when the efforts resulting from this action are successful. In cases where the landowner has been uncooperative or refused to make appropriate changes, the appropriate existing environmental enforcement procedures should be initiated.

EXPECTED BENEFITS

This action should not only result in the elimination of illegal discharges, it should also build an awareness of this threat to water quality, not only to owners, but to the general public.

An additional benefit would be generation of success stories to publicize, and case studies to assist with public relations and additional projects.

MONITORING AND ENFORCEMENT

- Work with the property owner or oversight agency to assure that any grant funding contractual obligations are met.
- Assure that action has been taken and properly implemented. Water quality monitoring should be undertaken to determine impaired and recovery conditions.

TIMETABLE

This Highest Priority action will be implemented in 2001 and 2002.

+++

PRIORITY

Highest Priority. Implementation of this action will greatly enhance implementation of many other Action Plans.

STORMWATER

PRIORITY

+++

ACTION WQ-8

Research the effectiveness of innovative stormwater treatment technologies for existing urban areas in New Hampshire, and communicate the results to developers and communities.

BACKGROUND

Urban stormwater carries pathogens, sediment, nutrients, heavy metals, and other contaminants. Pro-active planning goals to reduce stormwater impacts include minimizing impervious surfaces and maximizing vegetated areas. Stormwater from paved surfaces in developed urban centers can degrade downstream waters with both contaminants and increased volumes of water. Various technologies have been used to reduce the large peak flows, with mixed success. Innovative stormwater treatment technologies designed specifically for large impervious areas are now available. Mostly designed for subsurface installation, these urban retrofits take less space than conventional methods to treat stormwater before it drains to surface waters.

CICEET-sponsored researchers at the University of New Hampshire are testing the effectiveness of traditional technologies for managing both the quantity and quality of stormwater. Research results will be available in 2000 to corroborate continued use of effective stormwater treatment and control methods, and to help discontinue the use of methods that are not effective, or even worse, contribute pollutants.

Traditional techniques may be preferable, but are not always practical for treating stormwater. Lack of space for natural solutions is often a problem in urban centers, making innovative retrofits a potentially attractive alternative. Confirming treatment effectiveness of retrofits in New Hampshire urban areas is most important, and must be closely examined relative to the cost of installation and maintenance requirements. By March 2003 EPA will require Phase II NPDES stormwater management permits for discharges from small municipal separate storm sewer systems, and from construction sites disturbing between one and five acres. Post-construction stormwater management in new development and redevelopment must also meet Phase II requirements.

ACTIONS/ACTIVITIES

1. The NHEP outreach coordinator and/or NH Department of Environmental Services will spearhead a partnership among the University of New Hampshire, NH DES, the Office of State Planning/Coastal Program, the NH Estuaries Project, conservation districts, the UNH/NOAA Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) and USDA/NRCS to find and collate existing research and manufacturer information on innovative stormwater technologies (retrofits for water quality and quantity management).

2. This ad hoc group will use the published third-party information gathered and provide this to developers and communities to assist them in selecting the best available treatment retrofits.

3 NH DES will monitor the effectiveness of the two stormwater treatment facilities that will be constructed in Hampton and Seabrook in 2000. Each facility will have a retrofit unit within the treatment system.

4 Ad hoc group from Step 1 will organize and schedule workshops and demonstrations to show the successes and challenges of these two facilities. One of these events could be held in conjunction with industry trade shows.

5 Ad hoc group will develop a 'driving tour booklet' of stormwater facility sites in Zone A and B, including design specifications and water quality data for each site. Distribute the booklet to local governments, trade organizations, and to stormwater trade show attendees.

RESPONSIBLE PARTIES

NH DES (Steps 1-5), NHEP, OSP/NHCP, UNH, USDA Natural Resource Conservation Service, county conservation districts, UNH/CICEET (research and outreach programs) and RPCs for creation and distribution of the information (Steps 1, 2, 4, 5).

IMPLEMENTATION LOCATION

This Action Plan will be implemented in the 43 communities in New Hampshire's estuarine watershed. Findings and recommendations will be presented across the NHEP study area.

COSTS

Research third party water quality data that pertains to the retrofits in urban communities in Step 1	$5,000
Collation of materials in Step 2	$2,000
Water quality monitoring at two retrofit sites in Step 3	$55,000
Workshops and demonstration events in Step 4	$10,000
Development of the driving tour booklet in Step 5	$5,000
Distribution and promotion of driving tour book in Step 5	$5,000
Total	**$77,000**

FUNDING

Step 3 (monitoring) will be funded with US EPA NHEP implementation funds in 2001. Other steps may be funded with US EPA implementation funds, or through other appropriate federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES or NH OSP could also support this action. Scientific research may be funded by these sources or through other academic research awards.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Tools and information to assist local decision-makers and developers in their efforts to improve stormwater management.

MONITORING AND ENFORCEMENT

Pre- and post-construction monitoring to determine effectiveness of stormwater technology at the Hampton and Seabrook facilities.

TIMETABLE

This Highest Priority action will be initiated in 2001.

+++

PRIORITY

Highest Priority. Implementation of this action does not depend on the implementation of other Action Plans in the *NHEP Management Plan*, however the information gained from this action should be used in WQ-10.

ACTION WQ-9

Ensure that water quality and quantity impacts from new development or redevelopment are minimized to the maximum extent practical at the planning board stage of development.

PRIORITY

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STORMWATER

BACKGROUND

As development increases so does runoff to storm-drainage systems. These drainage systems are often not upgraded to handle the additional load. The resulting stormwater discharges ultimately add increased water volume during storm events to streams, rivers, and estuaries. Base flow often decreases as impervious surfaces are laid over undeveloped land. Careless development can result in impacts to surface waters and groundwater, including receiving increasing amounts of sediment and contaminants without buffering capacity to filter, dilute, and absorb the pollutants. Many towns in the NHEP study area use the site-plan review process to address post-construction stormwater management. Action WQ-9 assists municipalities in their local stormwater management control efforts.

Under the site-specific law all projects disturbing 100,000 sq. ft. or more require a permit from the NH Department of Environmental Services. For lands under the jurisdiction of the state Comprehensive Shoreland Protection Act (CSPA) the threshold requiring a permit drops to 50,000 sq. ft. NH DES engineers review development plans to ensure that water quality is protected both during and after construction, through the use of temporary and permanent stormwater controls, and other best management practices. Smaller projects often pose similar risks to water resources, but are often not reviewed for potential impacts by the local community.

By March 2003 EPA will require Phase II NPDES stormwater management permits for discharges from small municipal separate storm sewer systems, and from construction sites disturbing between one and five acres.

ACTIONS/ACTIVITIES

1. Update and amend the documentation of NHEP study area ordinances produced in the NHEP Base Program Analysis, if necessary.
2. Review stormwater management strategies and innovative model ordinances from other states, e.g., Massachusetts Department of Environmental Protection Stormwater Management Strategy.
3. Refer to the NHEP Base Program Analysis to determine which communities lack erosion and sediment control ordinances for projects below the 100,000 sq. ft. or 50,000 sq. ft. state thresholds. Using model ordinances and technical manuals, regional planning commissions will work with municipalities to create local ordinances to minimize impacts to water resources, such as requiring that development proposals include on-site stormwater treatment.
4. Coordinate local ordinance requirements with relevant state agencies such as the Department of Transportation, Department of Environmental Services, and the Office of State Planning to ensure consistency with state regulations.
5. Encourage adoption of protective ordinances for projects greater than 20,000 sq. ft.

RESPONSIBLE PARTIES

Regional Planning Commissions as lead agency (Steps 3-5) with assistance from communities, Department of Transportation, Department of Environmental Services, and Office of State Planning. A consultant will complete Steps 1-2.

IMPLEMENTATION LOCATION

This Action Plan can be implemented in all 43 communities in New Hampshire's estuarine watershed.

COSTS

Researcher in Steps 1-2	$7,000
RPC Circuit rider in Steps 3-5	$10,000
Coordination activities (e.g. meetings, conference calls) in Steps 1-5	$3,000
Total	**$20,000**

FUNDING

This action may be funded in part through US EPA NHEP implementation funds (except for coordination costs), or through other appropriate federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES or NH OSP could also support this action.

REGULATORY NEEDS

- Changes to local ordinances and building codes.
- Possible municipal regulation related to access to existing town- or city-owned storm drainage infrastructure.
- Possible state regulation related to access to existing state-owned storm drainage infrastructure.

EXPECTED BENEFITS

Reduction and prevention of sedimentation and contaminant load to coastal region surface waters.

MONITORING AND ENFORCEMENT

Municipal enforcement of local building codes and plan specifications. Possible state enforcement where appropriate in cases of use of state-owned and/or maintained storm drain systems.

TIMETABLE

Initiate by 2005. Opportunities to implement this High Priority action will be pursued in the next four years.

PRIORITY

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High Priority. Implementation of this action does not depend on implementation of other Action Plans in the *NHEP Management Plan*.

ACTION WQ-10

PRIORITY +++ STORMWATER

Research the use and effectiveness of the Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire. Revise, publish, and promote the Handbook.

BACKGROUND

In 1992 the United States Department of Agriculture Natural Resource Conservation Services (formerly Soil Conservation Service), the Rockingham County Conservation District, and NH DES published a handbook for developers entitled Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire, commonly referred to as the "Green Book." The Green Book provides technical guidance on preventing soil erosion and controlling sediment loss on lands being developed for residential, commercial, industrial, and recreational use.

The Green Book is widely used in developing plans, but occasional noncompliance and incorrect implementation of Best Management Practices (BMPs) continues to be a problem at construction sites. This Action will help communities and developers comply with Phase II stormwater management NPDES permit regulation of discharges from construction sites disturbing between one and five acres.

ACTIONS/ACTIVITIES

1. Compile a list of the current education activities by a variety of organizations including DES, OSP, and the Conservation District, that promote the use of the Green Book.
2. Concurrent with Step 1, research developments under construction and completed construction projects that were permitted through the Alteration of Terrain Program to determine what BMPs were implemented incorrectly, and if there is resistance to using BMPs. Identify areas of compliance and noncompliance for the designed BMPs (completed in 2000).
3. Rewrite the Green Book to reflect the knowledge gained from the Step 2 research (completed in 2000).
4. Develop education programs, or coordinate with existing efforts identified in Step 1, that include positive incentives for contractors and local officials to implement BMPs correctly. Use information gathered from Steps 1 and 2 to educate target audiences.

RESPONSIBLE PARTIES

NH DES will be the lead agency and coauthor of the revised Green Book (Steps 1-3) with assistance from NRCS, County Conservation Districts. These groups plus NHEP outreach, and the OSP/NHCP will complete Step 4.

IMPLEMENTATION LOCATION

This Action Plan will be implemented in all 43 communities in New Hampshire's estuarine watershed.

COSTS

Research and field study in Step 2 (complete)	$0
Rewrite Green Book in Step 3 (complete)	$0
Publish and distribute Green Book in Coastal watershed in Step 3	$30,000
Program development and implementation of education and outreach activities in Steps 1 and 4	$10,000
Total	**$40,000**

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other appropriate federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES or NH OSP will also support this action.

REGULATORY NEEDS

Study findings may indicate need for possible rule changes.

EXPECTED BENEFITS

- Reassessment and update of currently recommended erosion and sediment control BMPs.
- Increased compliance with erosion and sediment control practices.
- Information gathered through the evaluation of BMP compliance will strengthen the technical assistance efforts of NH DES, NRCS, and Conservation Districts
- Understanding of the reasons for noncompliance should result in more useful BMPs and greater compliance with erosion and sediment controls.
- All the above improvements should result in less erosion from construction and development sites and less sedimentation of estuarine waters.

MONITORING AND ENFORCEMENT

Municipal building inspectors should ensure that BMPs are correctly implemented. Direct NH DES enforcement if local efforts fail or are inadequate.

TIMETABLE

This Highest Priority action will be completed by 2004.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION WQ-11

Revise state industrial discharge permit criteria in response to new processing technology, and re-evaluate existing permits.

PRIORITY

+

PERMITTED DISCHARGES

BACKGROUND

Throughout New Hampshire's estuaries some toxic contaminants are found, mostly as the legacy of historic industries trapped in sediments. Although these contaminants are generally below federal alert levels, the continuing existence of acute low-level inputs demands vigilance. NPDES permits for point sources discharging into the state's estuarine and coastal waters thus monitor for these contaminants.

New technology is available for reducing chemical waste. In many cases alternative chemicals or processes can be used that avoid the generation of toxic wastes. In other cases, toxic chemicals can be recycled and recovered at the plant before discharge into the common sewage stream. While many large companies are already participating in EPA programs, this Action Plan would focus on those that are not, including small companies. Industrial, academic, and health organizations hold permits for discharge into coastal and estuarine waters. Pretreatment can be required under current regulations.

ACTIONS/ACTIVITIES

1. NH DES will review existing small dischargers' permits for substances and amounts, both permitted and actual discharges. These permits allow direct discharge to surface waters. Investigate the use of computer software to make this process more efficient.
2. NH DES will review the municipal pre-treatment program, evaluate opportunities for new pollution prevention, and strengthen the program as appropriate. Pre-treatment permits refer to industrial wastes that are discharged to a wastewater treatment plant.
3. Identify substances and/or processes which can be modified to reduce toxic waste. This study could be done by a contractor, or by a consultant in cooperation with NH DES and EPA.
4. Using the information gained from the study, NH DES would re-evaluate permitted discharges, considering the potential for reduction, public and estuary health, and social and economic benefits of the industry.
5. NH DES would set up a time-table for reduction and/or fees for public facility treatment and/or remediation for those dischargers under new permit criteria. NH DES would develop positive incentives for businesses and industries to implement pollution prevention strategies.

RESPONSIBLE PARTIES

NH DES will be the lead implementer for this action.

IMPLEMENTATION LOCATION

To be implemented first in Zone A, and then extended to Zone B.

COSTS

NH DES investigations in Steps 1, 2, 4, 5	$50,000
Potential funding sources: permit fees, NHEP, NHCP	
Outside consultants/study in Step 3	$50,000
Potential funding sources: NHEP, CICEET or NH DES (fees)	
Total	**$100,000**

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other appropriate federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES or NH OSP could also support this action. Funding from permit fees and traditional academic avenues should be considered.

REGULATORY NEEDS

Revision of permit criteria and implementation.

EXPECTED BENEFITS

Reduced toxic waste accumulation, particularly in filter-feeding shellfish and in sediments.

MONITORING AND ENFORCEMENT

Not applicable, except through revised NPDES permits.

TIMETABLE

Initiate by 2007. This Priority action will be implemented as funds and resources become available.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION WQ-12A

Acknowledge and support the oil spill prevention and response activities of the Piscataqua River Cooperative.

PRIORITY

+

OIL SPILLS

BACKGROUND

Many oil spills of a wide range of volumes have occurred in coastal New Hampshire waters. From 1975-79, there were 103 reported spills in public waters. While most of those incidents were of small volumes, the nine spills of greater than 500 gallons accounted for 95% of total oil spilled. The most recent large spill was the July 1, 1996 spill of approximately 1,000 gallons of #6 fuel oil from the vessel Provence into the Piscataqua River. Investigators are still studying the impacts of this spill. Several preventable oil spills have occurred because of vessels that leaked due to poor condition or maintenance, dock line failure, or pump connection failure.

The Piscataqua River Cooperative was initially formed in 1967 as the Portsmouth Harbor Oil Spill Committee and incorporated in 1971. It was renamed and restructured in the early 1990s as a 501c(4) "Social Benefit" spill cooperative under United States IRS code, and as a 301A Cooperative under NH law, to more clearly identify its function and the region. As a 301A cooperative, the Co-op could retain nonprofit status and sign mutual aid agreements. A mutual aid agreement was signed with the US Navy/Portsmouth Naval Shipyard, the first non-governmental mutual aid agreement signed by the US Navy. The Shipyard added large and small equipment; trained personnel; response experience; shipyard background; and a strong desire to protect the port to the Cooperative's mid-sized equipment, trained personnel, experience with high currents/large vessel operations, and drive to protect the port. If the Piscataqua River Cooperative is ever dissolved for any reason, all of its assets go to the State of New Hampshire for response use in the port and related areas.

The Piscataqua River Cooperative's mission is to:

- Prevent, respond to, and minimize impacts from oil and hazardous substances in the marine environment.
- Coordinate responses from start to the point of transfer of command to the responsible party. If asked, the Cooperative stays to assist in the response as long as deemed necessary.

Piscataqua River Cooperative member companies include Irving Oil Terminals, Inc., Public Service Company of NH, and Sprague Energy Corporation, with Portsmouth Naval Shipyard as Mutual Aid Partner.

ACTIONS/ACTIVITIES

1. The NHEP staff will develop a relationship to the Cooperative, and communicate on a quarterly basis.
2. The New Hampshire Estuaries Project should assist and publicize the activities of the Piscataqua River Cooperative as needed and as appropriate.

RESPONSIBLE PARTIES

NHEP, Piscataqua River Cooperative.

IMPLEMENTATION LOCATION

Zone A

COSTS AND FUNDING

No additional costs anticipated.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Continued prevention of and preparedness for oil spills.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

This Priority action will be initiated in 2001.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION WQ-12B

Enhance oil spill clean up efforts through pre-deployment infrastructure and development of high-speed current barriers.

PRIORITY ++

OIL SPILLS

BACKGROUND

Standard oil booms will fail if its perpendicular component is facing current of over 0.6-1.0 knots. Piscataqua River currents are 2-3 knots. Use of angled booms is the current strategy, but it requires long lengths, and large anchoring forces (1,000-10,000 lbs.). Preset moorings at critical spots would speed the deployment process.

New oil barriers are under development that can hold 2-3 times as much as a standard boom. This technology needs to be developed and implemented.

ACTIONS/ACTIVITIES

1. Place moorings at a few critical locations for attaching deflection booms. The Piscataqua River Cooperative, US Coast Guard, NH DES, and Port Authority would select locations in consultation with other users.
2. The groups listed above with assistance from NHEP will identify support for efforts at UNH to develop and field test fast-current oil barriers.

RESPONSIBLE PARTIES

CICEET

IMPLEMENTATION LOCATION

This Action Plan will be implemented sections of the Piscataqua River or other locations deemed appropriate for research of high speed current barriers.

COSTS

Moorings and placement in Step 1	$50,000
New technology (Fast Current Oil Barriers) in Step 2	$200,000

FUNDING

This action may be funded by CICEET or in part through US EPA NHEP implementation funds or through other appropriate federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES or NH OSP will also support this action. Funding or in kind contributions to the implementation of this Action Plan from the USCG, Merchant Marine Service and traditional academic avenues should be considered. Potential funding sources for moorings and placement include an oil import fee and the Cooperative.

REGULATORY NEEDS

Establishment of moorings and buoys.

EXPECTED BENEFITS

Faster and more reliable oil spill response.

MONITORING AND ENFORCEMENT

Enforcement: US Coast Guard, Port Authority, NH DES.

TIMETABLE

Initiate by 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

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PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION WQ-13

Provide septic system maintenance information directly to shoreline property owners, and to other citizens of the Great Bay and coastal watersheds to help improve water quality.

PRIORITY
+++ SEPTIC SYSTEMS

BACKGROUND

In the New Hampshire Seacoast region, 35% of tidal shorelands are already developed, and 28% of the remaining shoreline is potentially available for further development – not restricted by permanent conservation easements or natural resource constraints. The activities of shoreline property owners can significantly influence the water quality of the estuaries.

Many shoreline areas rely on private septic systems for sewage and wastewater disposal. Because of their proximity to the estuary, proper septic system maintenance is a valuable message. The shoreline property owner database allows the NHEP to contact shoreline property owners directly and relate important information regarding the care and maintenance of their septic systems.

Many homeowners mistakenly think that once a septic system is installed it will work forever without maintenance. If a system is not taken care of, it will become clogged and overflow on the ground or cause wastewater to back up into the house. Preventing system failure is cheaper and easier than repair. A neglected system will likely fail, leaving a homeowner with unsanitary backups, overflows, and expensive repairs. Overflows in the ground will ultimately reach and pollute water resources.

ACTIONS/ACTIVITIES

NHEP outreach or other coastal outreach personnel will increase public awareness of septic system maintenance in the following ways:

1. Examine existing educational materials on septic system maintenance and in-home best management practices.

   Develop written materials that describe the principles of septic system operation and maintenance, using information available through NH DES and others.

2. Distribute septic system maintenance information to shoreline property owners using private septic systems.

3. Mail these materials to residents of areas where septic systems are used.

4. Give written materials to real estate offices to present to new home owners.

5. Submit articles to newspapers and newsletters regarding septic systems and advertising informational sessions.

6. Distribute written materials to town clerks to make available to residents.

7. Include this information on the CICEET Great Bay Radio broadcasts.

RESPONSIBLE PARTIES

NHEP, or other coastal outreach personnel, will act as the lead implementer of this Action Plan with assistance from and coordination with real estate agents, communities, homeowners, NH DES, UNH Cooperative Extension, UNH Sea Grant, New Hampshire Coastal Program, Strafford Regional and Rockingham Planning Commissions, Rockingham and Strafford County Conservation Districts, and the Granite State Designers and Installers (Steps 1-7). The Great Bay Stewards will be contacted for topical materials and publications, and contact and technical information.

IMPLEMENTATION LOCATION

This Action Plan will be implemented in all 43 communities in New Hampshire's estuarine watershed.

COSTS

Staff (NHEP outreach)	$0
Develop/enhance existing septic system outreach material in Step 1	$2,000
Printing in Step 1	$5,000
Mailings in Steps 2, 3, 4, 6	$2,000
Informational sessions in Steps 5, 7	$2,000
Total	**$11,000**

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other appropriate federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. Staff costs can be borne in the NHEP outreach budget. State funds available through natural resource management agencies such as NH DES or NH OSP will also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

- Reduction of septic pollutants reaching estuarine and coastal waters
- Increased life of on-site waste disposal systems
- Greater awareness of water quality issues for shoreline property owners
- Improved septic system maintenance in critical shoreland areas

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

This Highest Priority action will be initiated by 2004.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION WQ-14

Encourage the use of innovative, alternative technologies for failing septic systems to help improve water quality.

PRIORITY ++

SEPTIC SYSTEMS

BACKGROUND

Conversion from seasonal to year-round use places stress on shorefront home septic systems. Failures occur if the load exceeds the capacity of the leach field or the pipes become clogged. Replacing a failed system is often hindered by lack of good soils or space on the existing lot. Adjacent land is often not available for use by the homeowner for replacing the septic system. New alternatives are needed for homeowners caught in the bind of upgrading the system without the appropriate environmental conditions to meet state regulations. This Action Plan is not intended to encourage or allow new development on marginal sites, but rather to repair or replace existing, failed septic systems. The NH Department of Environmental Services recently adopted new rules that allow alternative technologies for subsurface disposal systems, but further effort is needed to ensure their acceptance and implementation.

ACTIONS/ACTIVITIES

1. Review and evaluate the most promising types of innovative and alternative technologies best suited for New Hampshire conditions and locations. Select the most promising suite of technologies for use in the estuarine and coastal watersheds. This study should include discussions with the designers and installers currently working in the Seacoast, and involve NHEP, NHCP, NH DES, UNH/JEL, CICEET and Grantie State Designers and installers.
2. Pursue provisional approval from NH DES under new rules Env-Ws 1024, which requires additional research and monitoring of the new technologies and documenting their performance. This will be done by objective third parties, such as the University of New Hampshire or other consultant.
3. Seek general approval from NH DES for the use of provisionally approved technologies. This requires sufficient operating history to allow general use of the technology. A design-specific manual will be written for each technology to avoid any contradictions with other sections of NH DES rules.
4. NHEP and Granite State Designers and Installers conduct workshops for designers and installers on the approved technologies and encourage their use in the appropriate situations.
5. To the extent practicable, ensure that the new technologies are used only for failed septic systems of existing structures only.

RESPONSIBLE PARTIES

The NHEP is the lead implementer and will coordinate with NHCP, NH DES, UNH/JEL, CICEET and Granite State Designers and Installers (GSDI) help to direct the research (Steps 1-3). Monitoring and intensive research to be done by UNH or a consultant (Step 2). The NHEP and GSDI will conduct workshops (Steps 4-5).

IMPLEMENTATION LOCATION

All 43 towns in the coastal watershed.

COSTS

Research most promising technologies in Step 1	$5,000
Research and monitoring for provisional approval in Step 2	$40,000
Continued research for general approval in Step 3	$40,000
Outreach in Step 4	$5,000
Total	**$90,000**

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other appropriate federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES or NH OSP will also support this action.

REGULATORY NEEDS

Possible administrative rule changes.

EXPECTED BENEFITS

Improved water quality.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

Initiate by 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

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PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION WQ-15

PRIORITY

AIR QUALITY

Support efforts to reduce deposition of atmospheric pollutants through eliminating loopholes in current laws, encouraging the construction of more efficient power plants, and encouraging energy conservation.

BACKGROUND

Fossil fuel-fired power plants emit pollutants that have immediate and long-term health effects on watersheds and estuaries. Pollutants of particular concern in New Hampshire include sulphur dioxide (SO^2), which is an acidifier; nitrous oxide (NOx), which as nitrate is a plant nutrient; and various toxins including heavy metals such as mercury, lead, and chromium; and chemicals such as dioxins.

Different fossil fuels and combustion technologies produce varying amounts of pollutants. For example, a coal-burning power plant has the highest rates of generation (quantity per unit power generated) but contributes more sulfur and toxins than a fuel oil-burning plant. But fuel oil-burning plants are a significant source of mercury.

Plants' contributions of pollutants also depend on efficiency. Older plants, regardless of fuel type, run at about 30% efficiency, while modern plants run at approximately 55%. Even with significant improvements, aged power plants will not achieve these modern standards. Outdated plants remain in operation due to a loophole in the Clean Air Act Amendment of 1978, which exempted old plants from the clean air standards for new plants, making it economical to keep them in use.

The goal for the following supportive actions is to ensure that all operating local conventional plants should attain Best Available Control Technology (BACT) standards. The state will implement a phased-in uniform emissions standard, effectively eliminating Clean Air Act loopholes for older plants in-state. The state will encourage the replacement of older plants with newer gas-fired plants. Waste-to-energy plant regulations will be revised with strict limits on mercury and other toxic emissions.

For out-of-state plants, efforts should focus on educating Congress about the negative effects of pollution transport and suggesting ways to reduce it. Progressive reduction of the overall allocation of pollution credits would create an economic incentive for cleaner plants.

ACTIONS/ACTIVITIES

The NHEP Management Committee should endorse the following actions:

1. Revise state standards to produce uniform standards which eliminate Clean Air Act loopholes and bring the local plants into BACT compliance. Discuss new waste-to-energy plant guidelines.
2. Implement tax credits or other rewards for exceeding BACT standards to encourage new plants to be cleaner than EPA guidelines.
3. If possible, hasten the construction of newer, cleaner, gas-fired power plants. Discuss further reduction of NOX.

4 With the State Energy Office, increase participation in and funding for conservation programs. Options include the federal Million Solar Roofs program; electric conservation technologies including alternative lighting and power generation; programs to disseminate information on conservation technologies; and a program to investigate and promote promising, viable technologies reaching commercialization (e.g., house sized fuel-cells, which should be available within two years).

RESPONSIBLE PARTIES

The NHEP will serve as the implementer of this action in cooperation with the NH Energy Office (Steps 1-4).

IMPLEMENTATION LOCATION

Not applicable

COSTS AND FUNDING

No additional costs (to be done by existing staff).

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Building support for reducing air pollution, and building a bridge to others interested in the environmental impacts of airborne pollutants.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

Initiate by 2007. This Priority action will be implemented as funds and resources become available.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION WQ-16

Find funding sources for key water quality strategies.

PRIORITY
+++

WATER QUALITY FUNDING

BACKGROUND

Finding and securing funding for environmental projects is not always easy. Fortunately, obtaining support is easiest for projects that result in real improvements, and the high-priority of coastal zones for many agencies results in allocation of significant financial resources for coastal areas. Each NHEP partner is aware of potential funding sources for New Hampshire coastal projects. Centralizing and sharing this information would help implement all of the key strategies in this Plan.

This action would help obtain funding to implement the Water Quality strategies. The resulting searchable database will be available to all NHEP partners, and could be stored on a partner's website server for on-line searching. Links to existing directory pages can avoid duplication of services.

ACTIONS/ACTIVITIES

1. Each partner participating in the NH Estuaries Project should submit a list of known funding sources, including program name, owner or organization which passes through funds, award range, funding cycle and deadline dates, and contact information including internet address and e-mail.

   The list should note categories for project funding such as monitoring, construction, geographic restrictions, etc. Most grant sources will have multiple categories.

2. NHEP will create a database in a common software program. Agency, nonprofit, or academic partners can contribute expertise or provide volunteers to build the database structure. One partner should agree to store the database during development.

3. Additional library and Internet research could locate additional funding sources not identified by the partners.

4. Partner staff or volunteers will enter data and eliminate duplications.

5. The database will be uploaded and stored on one partner's website and made available for searches. Hyperlinks to funding sources and other contacts may be added to the on-line version. The partners may decide whether to restrict access to the site or make it available to the public.

6. NHEP will promote use of the database.

RESPONSIBLE PARTIES

The NHEP will be the lead implementer of this Action Plan (Steps 1-6).

IMPLEMENTATION LOCATION

Not applicable

COSTS

Purchase of software if necessary	$500
Staff time to create database and enter data in Steps 1-4 (can be supplemented by volunteers)	$7,000
Maintenance of database such as updates and annual updates in Step 5	$2,500
Promotion of database in Step 6	$5,000
Total	**$15,000**

FUNDING

This action may be funded in part through US EPA NHEP implementation funds. State funds available through natural resource management agencies such as NH DES or NH OSP will also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

A funding resource database that is easy to use and update.

MONITORING AND ENFORCEMENT

Not applicable.

TIMETABLE

This Highest Priority action will be completed by 2004.

+++

PRIORITY

Highest Priority. Implementation of this action will greatly enhance implementation of many other Action Plans.

ACTION WQ-17

Coordinate public tours of wastewater treatment facilities

PRIORITY

+

WATER QUALITY OUTREACH

BACKGROUND

All estuarine watershed residents need to understand basic fundamentals of the water cycle, watersheds, how water flows to and from buildings, and what happens to the water once it disappears down a drain. Such understanding will encourage residents to help conserve and protect water resources.

The tax-paying public, advocacy groups, shoreline property owners, construction industry associations and commercial/industrial groups, and children were identified by various NHEP focus groups and committees as key audiences to learn about wastewater treatment facilities, their operation, overloading, and combined sewer overflows. Each audience needs specific information to help them protect water resources. This information includes the basic fundamentals of the water cycle, watersheds, how water flows to and from buildings, and what happens to water once it leaves people's surroundings. Each audience should have a message directed to their needs, in a friendly medium, from a credible person or organization.

The general public should understand how water flows to and from their home, the effects of bacteria and toxic chemicals on water quality, and how residents and homeowners can protect water quality, including the need for community support for funding of construction, repair, and maintenance of WWTF infrastructure.

Children should understand how water flows to and from their home, the water cycle, and watersheds. Basic understanding of water is important for future understanding and decision-making, and children will also educate their parents.

Advocacy groups and shoreline-property owners are important as opinion-leaders and influencers of officials, media, and the public. Educated advocacy groups will help educate the press, and also influence policy development and natural resource management.

Educational collaboration with construction industry associations and business groups will help the business community understand how their activities affect a town's wastewater treatment capacity; how they can be pro-active (e.g., educating new homeowners on water conservation), and how funding for wastewater treatment facility upgrades is important for economic growth and development.

ACTIONS/ACTIVITIES

1. The NHEP, or other outreach organization, will promote and coordinate tours of area municipal wastewater treatment plants.
2. Tours will be conducted by plant managers or other plant employees.
3. Identify existing information materials on these three topics or develop new pamphlets to provide to tour participants:
   - the basic natural water cycle;
   - the water cycle of a home (water entering/leaving the home); and
   - how homeowners can conserve water.
4. To invite the public to these tours, the NHEP and participating towns will put notices in water bills, tax bills, or other notices that homeowners might receive. Advocacy and business and industry groups could publicize the field trips in their newsletter calendars of events. Tours could also be publicized in newspapers or community calendar postings.

RESPONSIBLE PARTY

The New Hampshire Estuaries Project or other outreach organization would be responsible for identifying communities willing to open their facilities for tours, coordinating the tours with town officials and facilities managers, and assisting in tour promotion within the participating communities (Step 1-4). The plant managers would be responsible for the actual tours (Step 2). Watershed advocacy groups may assist in the promotion and implementation of the tour events (Step 4).

IMPLEMENTATION LOCATION

This Action Plan will be implemented in communities with wastewater treatment facilities throughout the 43 communities in New Hampshire's coastal watershed.

COST

Tour costs would be absorbed by the towns in Step 2	
Photocopying of existing pamphlets (per tour) in Step 3	approx. $100.00
Publicity costs in Step 4	approx. $100.00
Total	**approx. $200.00**

FUNDING

This action may be funded in part through US EPA NHEP implementation funds. State funds available through natural resource management agencies such as NH DES or NH OSP could also support this action. Towns might get grants from WWTF associations or water associations. Copying of the pamphlets could be done by the state or the NHEP.

EXPECTED BENEFITS

An educated voting public more willing to fund wastewater treatment plants and elimination of combined sewer overflows. The tours will raise awareness of watershed and water-cycle issues, water quality problems and solutions, and help residents understand the connection between their use of water and the costs and processes of treating wastewater.

MONITORING AND ENFORCEMENT

Ways of monitoring success of these tours might be a long term (10-20 yrs) look at voter support for and opposition to funding WWTFs and combined sewer overflow elimination in the Great Bay and coastal watersheds.

TIMETABLE

Initiate by 2007. This Priority action will be implemented as funds and resources become available.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

WATER QUALITY OUTREACH

PRIORITY

+

ACTION WQ-18

Support and coordinate stormwater technical workshops.

BACKGROUND

Non-point source pollution – particularly contaminated stormwater – is a high priority for the New Hampshire Estuary Project. Beginning in March 2003, Phase II of EPA's stormwater management NPDES permit program will extend regulations to discharges from construction sites disturbing between one and five acres, and discharges from small municipal separate stormwater systems in urbanized areas. Post-construction stormwater management in new development and redevelopment situations is also important to protecting water quality. Phase II requirements also include pollution prevention through good housekeeping practices for municipal operations.

Stormwater-related outreach Action Plans aim to increase public understanding of the direct links between people, stormwater, and other sewage issues, and of the importance of regional water quality to the unique character of the New Hampshire Seacoast. Educating the tax-paying public and municipal officials responsible for stormwater management about the profound impacts of contaminated stormwater on water quality and environmental character requires making the connections clear between everyday activities and the pollution that results.

Existing training courses include NH Department of Transportation Construction School and UNH Technology Transfer Program. The New Hampshire Stormwater Tradeshow showcases tools for controlling and treating stormwater runoff. The 1998 event was attended by 200 engineers, planners, regulators and public works employees.

New rules for NPDES stormwater discharge permits published in December 1999 require a permit and monitoring for new construction sites and impervious surfaces that disturb from one to five acres. Permits will be required starting March 2003, and must include development and implementation of a stormwater pollution prevention plan with best management practices to control runoff. Workshops will be needed to explain the new rules to town boards and DPW personnel. NH DES will be responsible for writing the rules, and EPA will assist with implementation.

The NHEP Outreach and Education Project Team identified five primary audiences for stormwater outreach activities: WWTF managers, public works departments, engineers, planning boards, and conservation commissions.

ACTIONS/ACTIVITIES

Conduct training for public works employees, road agents, NH Department of Transportation personnel, and others on reducing, treating, and improving the quality of stormwater. Use materials such as the New Hampshire Office of State Planning sedimentation and erosion control video, and the catalogue of available non-point source resources.

SUMMARY MATRIX OF STRATEGIES FOR STORMWATER OUTREACH

	Facility Managers	Public Works Departments	Engineers	Planning Boards, Conservation Commissions, and Wetlands Bureaus
Messages	How to manage, new technology, non-point source	Construction of, how to manage, new technology	New technology	How to manage, new technology, non-point source
Methods	Workshops	Demonstration projects	Workshops	Meetings, Pamphlets, Workshops (?)
Delivery	Towns, state, organizations	Towns	Towns, state, organizations	State, organizations, facilities managers, public works departments
Funding	Towns, states	Towns	State, organizations	State, organizations

RESPONSIBLE PARTY

The NH Estuaries Project will be the lead implementer of this Action Plan with assistance from NH DES and NHCP to develop relationships with training providers, help promote workshops, and possibly provide financial assistance.

IMPLEMENTATION LOCATION

This Action Plan will be implemented at various locations throughout the 43 communities in New Hampshire's estuarine watershed.

COSTS

$1,000 to $5,000 per year depending on NHEP workplans and funding levels. Money for stormwater management workshops and education may be available through future NHEP Technical Assistance Grants Programs.

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other appropriate federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES or NH OSP could also support this action.

EXPECTED BENEFITS

Stormwater information reaches beyond engineers to those implementing projects. The amount of stormwater runoff is kept to a minimum, and runoff is properly treated. Stormwater treatment systems are monitored and maintained.

TIMETABLE

This Priority action will be initiated in 2000 with a workshop for NPDES Phase II communities. Further activities will be initated as funds and resources are available.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

WATER QUALITY OUTREACH

PRIORITY

+++

ACTION WQ-19

Stormwater Awareness: Support and expand storm-drain stenciling programs.

BACKGROUND

Many citizens in communities with storm-drain systems are unaware that these systems can be conduits for pollution. Storm-drain stenciling is a community-based activity that as part of an educational effort heightens participants' and residents' awareness of how land-based pollution sources can contaminate water. This Action aims for at least 100 people each year to participate in storm-drain stenciling activities in Great Bay watershed communities.

Experience shows that storm-drain stenciling programs enhance the knowledge of both children and adults about the consequences of stormwater runoff in their community. Adults often comment with some amazement that they "just didn't know that drain led to the river." Stenciling storm-drains paints environmental awareness on the face of a neighborhood, making a lasting connection and creating pride in environmental stewardship in even the most urban settings.

Storm-drain stenciling is a natural news-photo opportunity that fits well with environmental celebrations or events such as Coastweeks and the Coastal Cleanup. Organized region-wide environmental events can attract media and public interest that can significantly benefit all associated organizations, natural resource concerns, and provide a lot of fun for participants. This Action will also help communities comply with EPA's Phase II NPDES stormwater management program.

ACTION/ACTIVITIES

Outreach and education staff from UNH Sea Grant Extension will:

1. Recruit community groups (schools, 4-H groups, scout troops, civic organizations, and others) to participate in storm- drain stenciling activities in their communities.
2. Conduct a non-point source pollution workshop with each stenciling group prior to activity.
3. Work with local Department of Public Works to determine appropriate locations and help secure safety cones and paints for stenciling.
4. Inform media contacts looking for local stories about the planned activity.
5. Prepare handouts to distribute in stenciled neighborhoods about the purpose of the activity, and alternatives to dumping hazardous materials down storm-drains.

RESPONSIBLE PARTY

Outreach and education staff from UNH Sea Grant Extension will take the lead on this activity (Step 1-5). Americorps and other groups may also be trained to conduct the activity

IMPLEMENTATION LOCATION

This Action Plan will be implemented in interested communities with municipal sewage and stormwater infrastructure in Zone A of New Hampshire's estuarine watershed.

COST

	Per Year	Over 5 years
35 stencils per year in Steps 1-5	$140	$700
paint brushes in Steps 1-5	$10	$50
printing handouts in Step 5	$100	$500
staff time and misc. in Steps 1-5	$1,000	$5,000
Total	**$1,250**	**$6,250**

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other appropriate federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES or NH OSP could also support this action. UNH, Sea Grant Extension, and interested communities may also be sources of cash or in-kind contributions to the implementation of this Action Plan.

EXPECTED BENEFITS

Anecdotal evidence indicates many adults in communities with storm drains do not realize that they drain directly into local water bodies. Benefits include:

- Increased awareness of the connection between land use and water pollution.
- Greater use of municipal hazardous waste collection and less use of storm drains for such waste.
- Increased awareness and implementation of household Best Management Practices to reduce non- point source pollution.

TIMETABLE

This Highest Priority action was implemented in 1998, 1999, and 2000 with CICEET funds.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

WATER QUALITY OUTREACH

PRIORITY

+

ACTION WQ-20

Conduct an Estuarine Field Day for municipal officials.

BACKGROUND

Much research is devoted to investigating more effective methods of stormwater management. However, municipal officials charged with stormwater oversight may find it difficult to keep up with the most recent advances in technology. This action calls for UNH and NOAA's Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) to conduct a Great Bay Field Day for municipal officials to visit local demonstration and field research sites to learn about the latest management techniques.

The goal is for at least 60 local decision-makers to attend a half-day program designed to introduce them to technology and methods being developed to address estuarine contamination, including contamination entering the system through stormwater systems.

Future field days can be expanded to include local business people, regional planning commissions, watershed and advocacy groups, and other natural resource professionals, and to cover other topics such as wastewater treatment, septic systems, and more. Coastal watershed locations such as Little Harbor, Hampton-Seabrook Harbor, or inland sites higher up the watersheds may be considered for future field days.

ACTION/ACTIVITIES

1. UNH Sea Grant Extension will invite municipal decision-makers from public works departments, planning boards, conservation commissions, etc. within the Great Bay watershed towns to participate in this educational event.
2. The event will introduce the use of innovative technology and techniques to help prevent and reduce contamination in the Great Bay Estuary. Great Bay Field Day will take participants to the field sites of different research projects. Participants will interact with the scientists, learn about the projects, and express their own perspectives on managing estuarine contaminants of municipal origin.

RESPONSIBLE PARTY

Outreach and education staff from UNH Sea Grant Extension (Steps 1 and 2) will coordinate the field day, which will involve university faculty, staff, and students, and highlight the research of the Cooperative Institute for Coastal and Estuarine Environmental Technology. The NHEP can assist in the coordination of future field days.

IMPLEMENTATION LOCATION

This Action Plan will be implemented as workshops with field components that may take participants to pertinent sites throughout the 43 communities in New Hampshire the estuarine watershed.

COST

A grant from CICEET covered costs for the 1999 and 2000 field days. Proposed costs (not including indirect charges) are $6,800 per field day. These costs cover staff time, local travel, promotional materials and supplies, printing of publications, research vessel rental, and room rental.

FUNDING

A grant from CICEET covered costs for the 1999 and 2000 field days. This action may be funded in part through US EPA NHEP implementation funds, or through other appropriate federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES or NH OSP could also support this action. UNH, Sea Grant Extension, and interested communities may also be sources of cash or in-kind contributions to the implementation of this Action Plan.

EXPECTED BENEFITS

- Municipal decision-makers will help move innovative techniques and technologies from development to application.
- Scientists will learn first-hand about municipal leaders' concerns and problems regarding municipal sources of estuarine pollution.
- Municipal leaders and scientists will have an opportunity for open dialogue addressing environmental problems.

TIMETABLE

This Priority action was initiated in 1999 and 2000 with CICEET funding. It will be continued as funds are available.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

LAND USE, DEVELOPMENT, AND HABITAT PROTECTION

5

NHCP

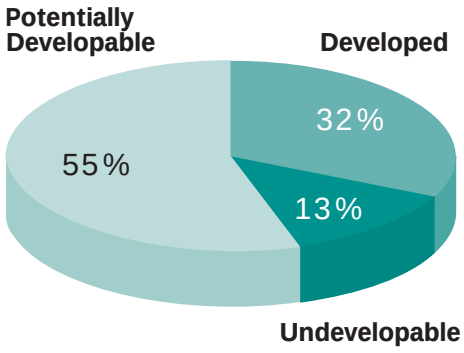
Atlantic coast: Hampton and Seabrook

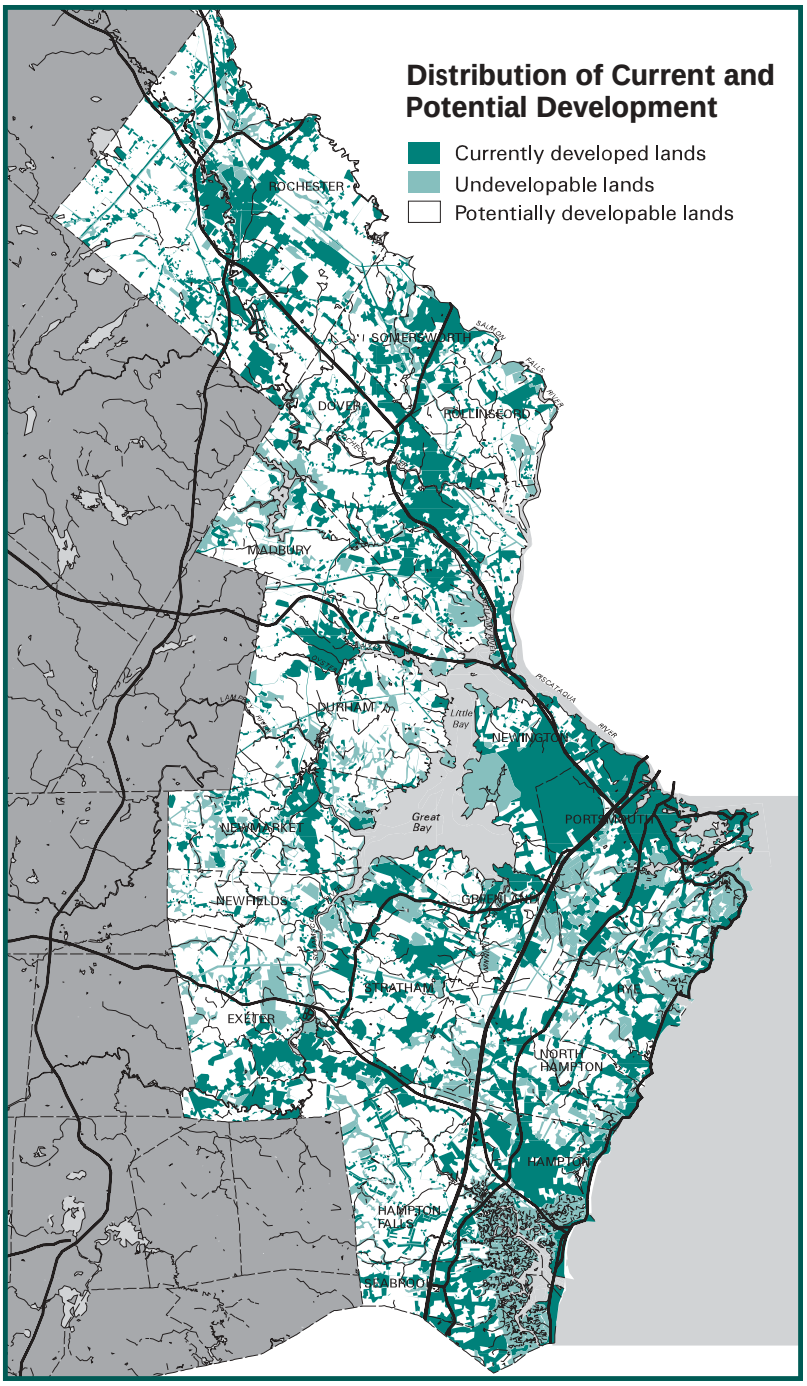
Population growth and development are the greatest challenges to New Hampshire's estuarine ecosystems. The NHEP's goals for land use, development, and habitat protection in the coastal watersheds of New Hampshire focus on human activities and use of land and other natural resources. NHEP's land-use goals aim to protect estuarine water quality, habitat, and aesthetic and other quality-of-life values as the region's population continues to grow. Human needs dependent on local natural resources include current and future water supplies, aesthetic and recreational values, safe harvesting and consumption of shellfish, health and sustainability of fisheries, and more.

The NHEP land use and habitat protection Action Plans relate directly to the priorities and problems addressed in Chapter 4: Water Quality. For example, stormwater runoff and wastewater treatment facility overflows are major contributors of pollutants to estuarine waters. Sound planning and provision of adequate sewage treatment for a growing population are critical. Future patterns of development and infrastructure will greatly affect estuarine water quality and habitats.

Impervious surfaces created in the built environment (buildings and roofs, paved surfaces, etc.) add to the volume and velocity of storm-water, sending more pollutants and sediments through drains and tributaries or directly into the estuaries. **Shoreland development** can destroy the natural buffering of vegetation against soil erosion and runoff. It also destroys wildlife habitat and travel corridors, and alters scenic vistas from both shore and water. Land-consuming and

Current and Potential Land Development in the 19 Coastal New Hampshire Municipalities





Developed, undeveloped, and potentially developable lands in coastal New Hampshire

scattered **sprawl development** patterns fragment wildlife habitat and corridors.

The problems and impacts caused by development and human interaction with the estuarine ecosystems are complex, diffuse, and pervasive. Humans are part of the complex and dynamic interactions between land and fresh and saltwaters, cultural and economic activities, and natural processes.

Land-use decisions made in the 43 coastal watershed communities will shape the future landscape and waterscape of the region, and will greatly influence both the estuarine environment and quality of life for residents and visitors. The Land Use and Habitat Protection Action Plans detail ways to achieve the goals of protecting water quality, habitat, and other important natural resource values. These Action Plans are interrelated with those for Water Quality, Shellfish Resources, Habitat Restoration, and Public Outreach and Education. All of these together comprise the comprehensive *Plan*.

WHY IT MATTERS

Many of the detrimental impacts on water quality and living resources are linked to human activities within the watersheds of the estuaries. Development of land for residential, commercial, industrial, and other uses can greatly increase stormwater runoff and other sources of estuarine water pollution. Human population growth and conversion of open land for development causes loss and fragmentation of habitat, stresses wildlife, and diminishes remaining habitat. Development patterns are consuming land at a faster rate than indicated by growth in population. Shoreland development and sprawl development in the watershed detract from the aesthetic values and rural character which attract people to the region, diminishing quality of life and recreational opportunities.

We have focused our land use planning and regulatory efforts on the impacts of development which directly affect water quality and aquatic habitats. We must now begin to evaluate the impacts of changing land use on terrestrial habitats, which also in turn alters water quality. By using available

land-use planning tools we can help protect the rich biodiversity of the coastal region.

The New Hampshire Ecological Reserves Project has recognized this area of the state–which comprises the New Hampshire portion of the Southern New England Coastal Lowland Eco-Region–as needing extensive conservation work to protect the region's unique biodiversity.

Two particularly important types of estuarine habitat are salt marshes and eelgrass beds. Both play economically and ecologically important roles in two critical estuary functions: **nursery to fish and shellfish resources**, and **filtering and purifying water**. Salt marshes also have a role in preventing coastal flooding. Salt marshes within the estuary support about 70 species of flowering plants, including about 20 that are unique to salt marsh habitats.

New Hampshire's estuarine waters support 95 species of phytoplankton, 169 species of seaweeds, and numerous beds of eelgrass, a submerged marine flowering plant. Eelgrass is particularly important as a filter for suspended sediments and dissolved nutrients, and for its roles in the life cycles of scallops, crabs, finfish, and waterfowl. Two-thirds of New Hampshire's commercially harvested fish rely on the estuaries at some point in their life cycles.

Many residents and visitors enjoy the abundant wildlife supported by the estuaries. The Great Bay Estuary is a major feeding and resting area for migratory birds, and hosts nesting ospreys and overwintering bald eagles. New Hampshire's estuaries have played a supporting role in the dramatic comeback of the striped bass.

LIFE IN AND AROUND THE ESTUARIES

Estuaries serve as nurseries, habitat, feeding, and resting areas for a diverse array of life – from the tiniest phytoplankton and zooplankton to tall trees, seals, and bald eagles. The health of the larger, more visible life forms depends on the health and availability of the whole system.

S. MIRICK

Snowy egret

Plant life in the estuarine watersheds ranges from tiny phytoplankton suspended in estuarine waters to the large trees of upland forests. Botanists have identified 67 rare plant species within the watershed, about a dozen associated with estuarine environments.

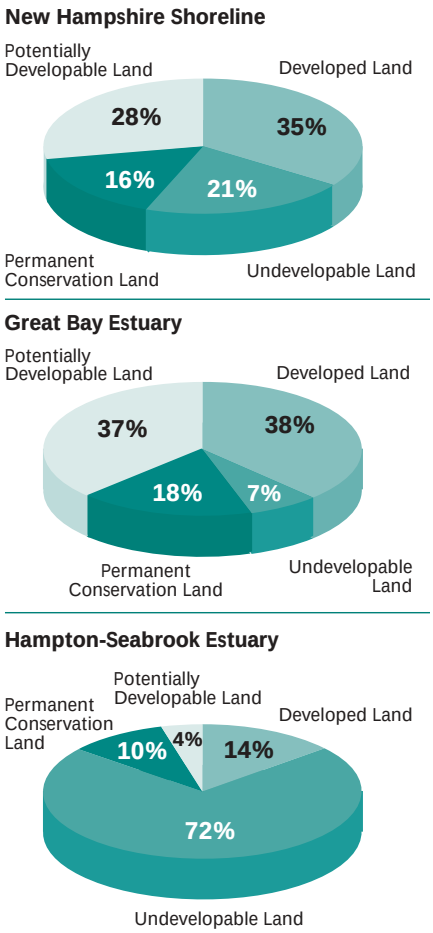
Animal life in the watersheds embraces a multitude of aquatic and terrestrial animals – from 32 kinds of microscopic invertebrates called zooplankton, to shellfish to large birds and mammals. Two species of freshwater and terrestrial invertebrates found in the watershed are considered globally rare: the banded bog skimmer dragonfly and a freshwater mussel called the brook floater. Vertebrate animals inhabiting the coastal watersheds include 248 native species: 46 mammals, 142 birds, 14 amphibians, 16 reptiles, and 63 fish. Non-native fish, bird, and mammal species also occur in the watershed.

The coastal watersheds are the only place in New Hampshire to find the harbor seal; eight bird species – mute swan, piping plover, willet, common tern, golden-winged warbler, sharp-tailed sparrow, and seaside sparrow; and the American brook lamprey, a fresh-water fish species. Another five bird species – double-crested cormorant, snowy egret, little blue heron, black-crowned night-heron, glossy ibis – nest on offshore islands and forage extensively in the mainland estuaries. Thirteen state-listed threatened or endangered birds and one federally-listed endangered fish occur in the watersheds.

The uplands of New Hampshire's coastal region provide important stopover habitat for migratory birds and bats using the Atlantic flyway, as well as important breeding habitat. The Great Bay and Hampton-Seabrook estuaries provide important migration and wintering habitat for 20 species of waterfowl, 27 species of shorebirds, and 13 species of wading birds. The Seacoast is New Hampshire's primary waterfowl wintering area, with Great Bay supporting about 75% of the state's wintering population

Shorelands are land within 300 feet of the water's edge.

Potential Development of Tidal Shorelands



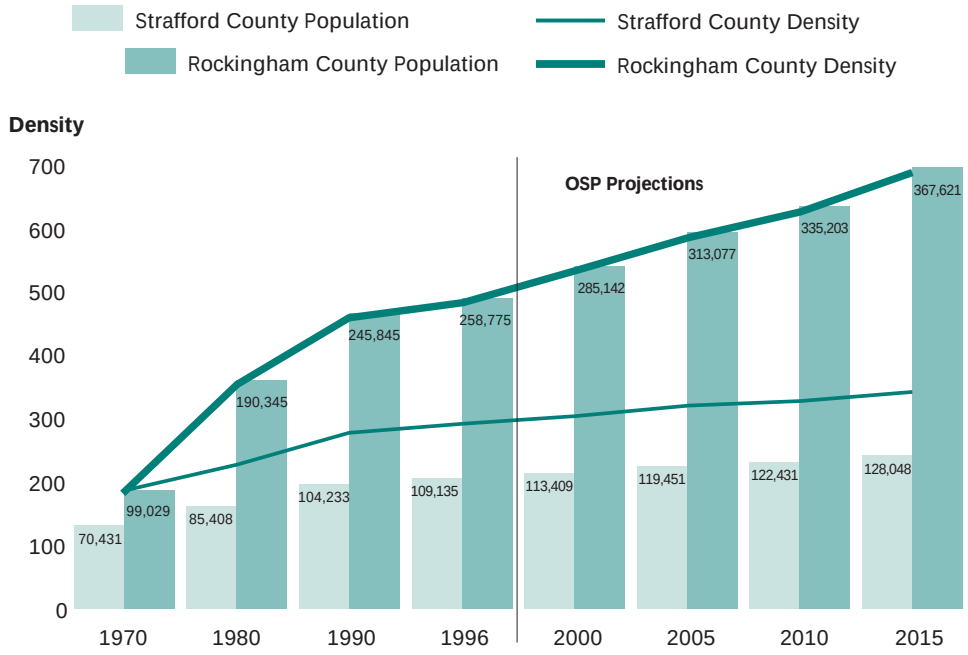
THE CHALLENGE

The human population in Rockingham and Strafford Counties is projected to grow 17% from 1998 to 2005. Pressure to develop land for residential, commercial, industrial, and other uses will intensify with population growth. In the NHEP Zone A consisting of 19 coastal area towns (see map on inside front cover), approximately 30% of the land area is currently developed. NHEP studies show an additional 55% of the total land area has development potential. Future development could make current problems worse, and would most likely create new problems. However, many of these detrimental effects on the estuarine environment can be managed or reduced through careful planning of development, and by protecting shorelands, wetlands, and other critical habitats for rare, endangered, and other important species.

Knowledge and awareness of the productive and ecological value of

Office of State Planning projections for Rockingham and Strafford Counties, New Hampshire: 1970-2015

Population Growth and Human Density



estuaries has grown rapidly in recent decades. During these same decades population growth and development in New Hampshire's Seacoast region have accelerated.

NHCP

Salt marsh restoration at Awcomin Marsh

The challenge for New Hampshire's estuaries is to balance human uses and population growth with maintaining the ecological integrity of these systems, so fundamental to the region's appeal for residents, tourists, and businesses. These aesthetic, recreational, and economic values are reflected in the high property values of waterfront real estate. Proximity to water makes property more desirable for development – and more vulnerable to environmental impacts from development. New Hampshire needs to take care that its estuaries are not 'loved to death.'

Research, monitoring, and stewardship efforts have also expanded through the 1990s. We have learned a great deal about the natural resources of New Hampshire's estuaries, how human activities affect water quality and aquatic life, and how people benefit from these resources. Monitoring programs, non-point source pollution assessments, and natural resource evaluations have built upon the body of information gathered over the years. The NH Coastal Program and UNH Complex Systems Research Center are using Global Information Systems information to measure and map all the various estuarine habitat types. This growing body of knowledge is helping to identify the problems in the estuaries, the causes, and ways to minimize problems.

Development is the leading cause of habitat loss and alteration within the coastal watershed, leading to significant net decrease in habitats capable of supporting wildlife and natural communities. The marked pressure from development on the coastal watershed has had detrimental impacts on the region's wildlife and natural communities. The New Hampshire Comparative Risk Project found that the most pronounced overall habitat loss in New Hampshire has occurred within the southeastern part of the state.

Different species have differing abilities to tolerate and adapt to habitat changes. Most native species, however, are unable to survive and reproduce in heavily developed areas. Habitat loss and alteration lead to changes in species composition within the watershed. Habitat specialists – such as wood thrush and fisher – disappear from urbanized areas, while habitat generalists (including some non-native species) such as house sparrows, pigeons, starlings, rats, and raccoons, increase. Remaining natural habitats are influenced and modified by adjacent land uses. Suburban habitats are prone to water and soil contamination, reduced air quality, and spread of invasive species.

Since development is the leading cause of habitat loss and alteration within the coastal watershed, protecting habitat is directly tied to land-use decisions,

and to planning and tax policy. Conversion of open land to development causes considerable net loss of habitats capable of supporting wildlife and natural communities, and causes further impacts to remaining adjacent or nearby natural habitats.

- Annual losses of forest land to development over the last 30 years have been estimated at about 1000 and 3000 acres (.2-.5%) in Strafford and Rockingham counties respectively, totalling approximately 15%.
- Agricultural land in Strafford and Rockingham counties combined has declined from 472,000 acres in 1850 to 42,000 acres in 1996.
- Human-caused tidal restrictions have altered more than 1,300 acres of salt marsh, 20% of the total remaining salt marsh area.
- Of all New Hampshire freshwater wetlands permits issued in 1995, 50% of the affected acres were located in Strafford and Rockingham Counties.
- In addition to preventing the travel of anadromous fish to historical spawning grounds, dams along New Hampshire's tidal rivers have nearly eliminated freshwater tidal marshes from the state.
- Coastal development now blocks the remaining dune systems from the natural wind-dynamics essential to maintain them.

NHCP

Development along tidal wetlands

Habitat fragmentation occurs when large, contiguous tracts of habitat are broken into smaller, more isolated patches. Residential and commercial development and construction of roads and utility corridors fragment habitats. Impacts of fragmentation on natural communities vary with the size and isolation of the habitat patch, the type of adjacent land use, road and waterway traffic volume, and the level of human activity. As the human population in the coastal watershed grows, the need for new housing, schools, and roads will result in more fragmented habitats. Road densities and forest-patch sizes are useful indicators of habitat fragmentation. In 1996 road density in the coastal watershed was the second highest in the state, at 4.94 miles of road per 1000 acres. The coastal watershed's average forest-patch size of 55.6 acres was second lowest in the state.

Water quality and quantity are essential to the ecological integrity and function of New Hampshire's estuaries. Estuarine habitats' quality and function depend on the quality of fresh and tidal waters flowing into them. Human activities throughout the watershed have degraded water quality in numerous ways – oil spills, dams, treated and untreated sewage, and runoff from impervious surfaces such as roofs and pavement. The major water quality problems in the Great Bay Estuary and coastal waters are discussed in Chapter 4.

Water quantity is also an important factor in habitat quality and function. Water quantity issues in the Seacoast region are increasing as the demands for municipal water supplies grow. Water withdrawals from rivers, lakes, and ponds may ultimately affect plants, animals, and natural communities that require particular water levels to meet their biological needs. Restrictions to tidal flows and quantities can seriously degrade or alter salt marsh habitats. Increased impervious surfaces and stormwater from developed areas can increase the volume of freshwater delivered to estuarine waters, altering salinity and other water quality factors that affect the living resources of the estuaries. Increased impervious surfaces, and loss of vegetation-covered land, can reduce groundwater recharge capacity.

Invasive species are another threat to the diverse array of native plant and animal species and communities that inhabit New Hampshire's estuaries and coastal watershed. The competition that results from historical and continuing introductions of non-native plants and animals from around the world can lead to reduced growth and survival for native species. Especially competitive and prolific introduced species are called invasive because they can reduce the overall biodiversity of an ecosystem, and may even cause complete displacement of native species. Although most invasive species have not significantly altered natural communities within the watershed, a few species are having considerable impact on the estuaries, for example green crabs, common reed or *Phragmites australis*, and purple loosestrife. Invasive species are often opportunistic, gaining advantage where other habitat threats occur, such as water quality and quantity impacts, soil disturbance, habitat fragmentation, and development.

NHCP

Phragmites in the Awcomin Marsh

- Introduced in the early 1900s, green crabs have been identified as a major predator of juvenile shellfish in the Great Bay Estuary. Green crabs also threaten efforts to restore eelgrass beds, because their foraging and burrowing activities kill and dislodge planted shoots.
- Encroachment of invasive plant species is an indicator of salt marsh degradation. *Phragmites australis* (common reed) invades salt marshes that have been degraded by human encroachment. Undersized culverts, tide gates, dredging and filling activities, and stormwater runoff interfere with the natural hydrology of the marsh, making affected areas susceptible to invasion by non-native plants.

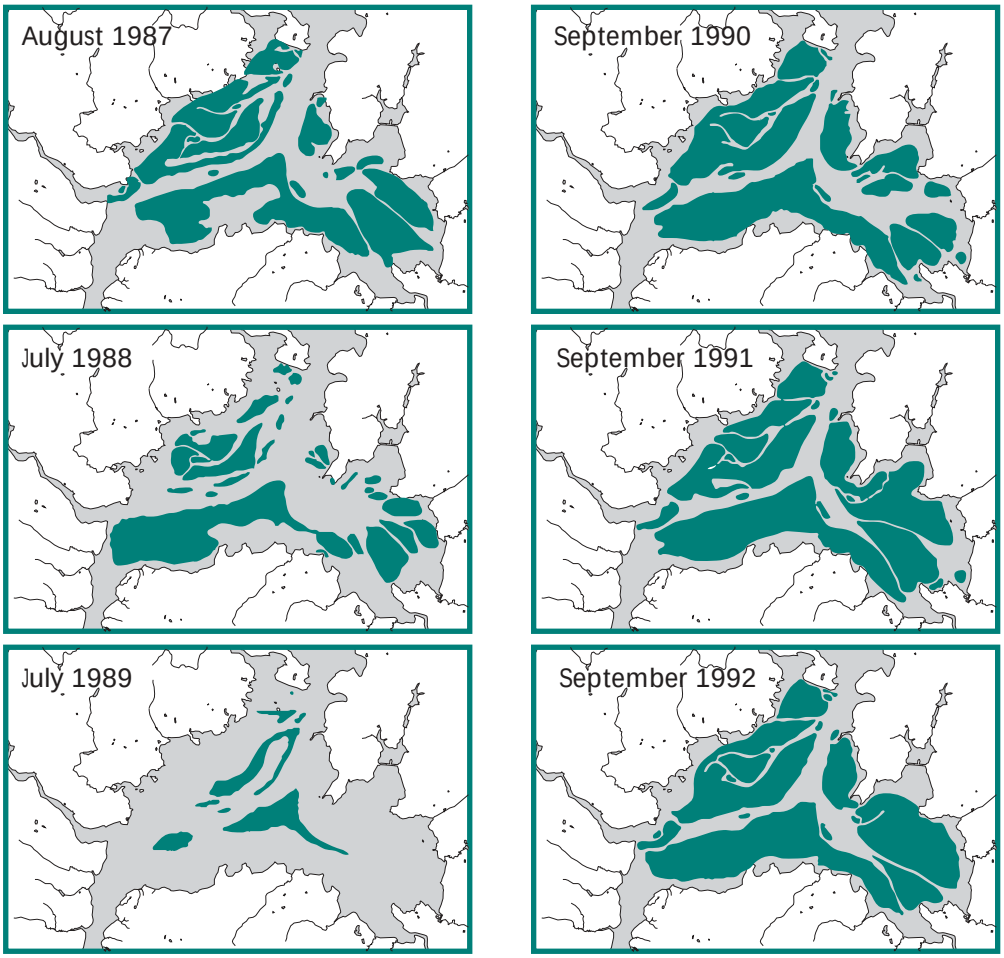
Phragmites becomes a problem after it colonizes disturbed soils surrounding or within marshes. These invasive marsh plants can replace desirable wildlife food plants, restrict bird and fish access to the marsh, and drastically reduce plant diversity. This species is visibly altering salt marshes within the estuaries.

Diseases are normal components of ecosystems, occurring through interactions of a pathogen, its host, and their environment. Altered or degraded environmental conditions can increase the occurrence and/or severity of the disease. Changes in water temperature, the presence of toxic contaminants, and overcrowding due to loss of habitat are all examples of environmental changes that can add stress, and reduce resistance to disease.

One example is the recent epidemic of the eelgrass wasting disease that caused dramatic losses of underwater estuarine eelgrass habitat in Great Bay and the Piscataqua River. Mortality as high as 80% of the eelgrass population in the Great Bay Estuary occurred each year in the 1980s. Since then, eelgrass has exhibited considerable re-growth in many of its former beds with the exception of a few areas in Little Bay. Eel grass wasting disease was first recognized in Great Bay in the 1940s. From the well known Great Bay report written by C.F. Jackson in 1944, it appears the initial onslaught of the myxomycete *laburinthula sp.* in Great Bay was in the 1930s.

Sarcomatous neoplasia is a lethal form of leukemia in clams, with the potential to cause extensive mortalities in softshell clams. To date the Hampton-Seabrook Estuary is the only known site of *neoplasia*- infected clams in New Hampshire. In 1987 some Hampton-Seabrook Estuary clamflats exhibited up to 50% mortality attributed to *neoplasia*. Between 1990 and 1995 adult clam densities quadrupled on the Middle Ground, remained stable on the Common Island flats, and decreased by 50% in the Hampton River. *Neoplasia* may have contributed to the decline in the Hampton River over this period.

Time series of eelgrass distribution in Great Bay.



The oyster diseases MSX and Dermo, caused by the protozoan parasites *Haplosporidium nelsoni* and *Perkinsus marinus* respectively, have recently been detected in oysters from the Great Bay Estuary. Although the parasite was first detected in the Piscataqua River in 1983, mortalities from MSX were first observed in 1995. Oysters in the Salmon Falls and upper Piscataqua rivers were most affected, with mortalities of up to 83% in some beds. Varying degrees of Dermo infection have been found in oysters from the Great Bay Estuary, but to date no oyster mortalities have been attributed to Dermo.

NHCP

Summer crowds at Wallis Sands State Beach, Rye

Human disturbance can directly affect wildlife species by altering wildlife behavior. Many of these changes are of short duration, although long-term behavioral changes, such as abandonment of preferred foraging areas and changes in food sources, do occur. Human activity can also alter habitat and damage or destroy plants. Development or recreational activities can alter characteristics of soil, vegetation, or aquatic systems. Such alterations may affect an animal's food supply, shelter, or living space. Impacts on food and living space may influence behavior, survival, reproduction, and/or distribution.

- Recreational activity on beaches is a major factor in the decline of the endangered piping plover. Human activity has disrupted nest sites, caused nest abandonment, and affected breeding success.
- Although oyster and some types of clam harvesting may improve shellfish productivity, standard recreational clam digging practices can reduce juvenile clam density by 50% through physical damage and exposure to predators.
- Recreational boating is a popular and fast-growing activity in the Great Bay Estuary. Many marinas are located in sheltered inlets, where anchors and propellers are likely to impact eelgrass and salt marsh habitats. Frequent motorboat activity can disturb nesting and foraging areas of aquatic species, and even prevent wildlife access to those areas depending on the level of activity.

REGULATORY AND MANAGEMENT PROGRAMS

While problems such as contaminants in estuarine water and declining shellfish populations persist, recent success stories show that management can make a dramatic difference even in a relatively short time. Examples include significant water quality improvements due to upgraded wastewater treatment, and the rebound of the striped bass thanks to Maryland's efforts in Chesapeake Bay, and the availability of summer feeding areas such as Great Bay and Hampton-Seabrook Harbor.

The *Ecological Reserve System Project* brought together more than 30 agencies and organizations involved in natural resource management and conservation to identify opportunities to conserve biodiversity in New Hampshire. The final report contains an analysis of the status of biodiversity in the state, and recommendations to maintain or enhance the current situation.

The New Hampshire Fish and Game Department (NH F&G) is responsible for management of all wildlife and fish in the **state**. They share responsibility for migratory birds, interjurisdictional fish, and threatened and endangered species with the U.S. Fish and Wildlife Service (USFWS). Different species receive varying levels of management attention, according to status as game or non-game, endangered, threatened, or "of special concern." NH F&G also owns and manages many of the sites providing access to tidal and non-tidal waters in the watershed.

The New Hampshire Natural Heritage Inventory (NHNHI) within the NH Department of Resources and Economic Development (NH DRED) tracks known locations of rare plants and animals, and works to define the types and distributions of natural communities in the state.

The New Hampshire Coastal Program within the New Hampshire Office of State Planning (NH OSP) provides technical assistance and natural resource information to local communities, assures consistency between existing laws and state and federal activities within the coastal zone, and administers an annual grants program for municipalities and non-governmental organizations working in the coastal zone.

The **federal** Endangered Species Act of 1973 and the New Hampshire Endangered Species Conservation Act of 1979 protect wildlife species most in danger of disappearing from the state and/or region. Five federally-listed species and 20 state-listed species occur in the coastal region. Some species, such as the piping plover and osprey, breed within the region and are closely monitored and managed. Other species, such as the peregrine falcon and northern harrier, are present only during migration. Protection for plant species listed under the federal Endangered Species Act of 1973 is similar to that for listed wildlife.

New Hampshire currently lacks comprehensive protection for state-listed threatened, endangered, or rare plant species. However, applicants for state wetlands permits must identify known locations of rare plants in their project area, and work to eliminate or minimize impacts on this resource. The Native Plant Protection Act of 1987 provides some protection for listed species on state and federal lands, through the jurisdiction of the New Hampshire Natural Heritage Inventory.

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Great Bay mudflats at low tide.

New Hampshire has recently focused considerable attention on coordinated non-point source (NPS) pollution control and prevention efforts, involving all **state** agencies with NPS-related responsibilities. The Office of State Planning, Regional Planning Commissions, and Conservation Districts all provide planning assistance to municipalities to prevent runoff problems that can result from development. The Coastal Non-point Pollution Control Program is coordinating with the state's Clean Water Act NPS program to assess existing regulatory frameworks and needs on a watershed basis. Studies of the coastal watersheds have begun.

Local governments in New Hampshire have authority to establish zoning ordinances and development regulations that give them the potential to exert substantial control over non-point source pollution. Zoning, subdivision regulations, and site-plan review procedures may include requirements for stormwater and erosion control; regulation of septic design, siting, and installation; and may address prohibited uses, open space requirements, and more. Zoning overlays can further protect shoreline habitats, wetlands, and other important natural resources from development. Municipalities and community groups can also acquire open space land, or protect it with easements, to preserve buffers for estuary or other water resources or to protect habitat.

Significant variations exist in regulation of development among municipalities. This variation reflects the diversity of communities in the region, even among those sharing common boundaries or watersheds, and New Hampshire's tradition of local control. For example, seven of the 19 coastal communities have Shoreland Protection Districts considered complete by state standards, while eight others have partial shoreland protection provisions. In certain cases

GBNERR

these inconsistencies can have impacts on the estuaries, which has lead the NHEP Land Use Team to suggest some coordinated and cooperative efforts among towns and cities in the estuarine watershed.

New Hampshire **state** laws and programs which help protect land and habitat include the Current-Use Taxation Program, Comprehensive Shoreland Protection Act, Rivers Management and Protection Act, Wetlands Law, Site Specific Program, NH Endangered Species Act, and NH Native Plant Protection Act. The recently enacted Land and Community Heritage Investment Program holds promise of new land protection opportunities for New Hampshire communities.

Federal laws related to these issues include the Clean Water Act, Coastal Zone Management Act, Wild and Scenic Rivers Act, National Flood Insurance Program, National Environmental Protection Act, Fish and Wildlife Coordination Act, Marine Mammal Protection Act, Magnuson Fisheries Conservation and Management Act, and Endangered Species Act.

EPA published new regulations on December 8, 1999 for Phase II of the NPDES permit stormwater management program. Compliance with these Phase II rules will be required by March 2003. Under Phase II rules, NPDES permit coverage will be required for small municipal separate storm sewer systems in urbanized areas – including Dover, Durham, Madbury, New Castle, Newington, Portsmouth, Rochester, Rollinsford, Rye, and Somersworth. Phase II NPDES stormwater rules will also apply to discharges from construction sites disturbing between one and five acres.

A working group led by the NH Office of State Planning has begun preparing for the technical assistance communities will need as they begin to address the requirements of the Phase II NPDES program. Working group members include some of the communities that will be affected by Phase II, NH OSP/ Coastal Program, NH DES, and NH DOT.

Clean Water Act Section 303(d) and its implementing regulations require states to list water body segments as impaired – defined as out of compliance with a water quality goal or designated use such as swimming or fishing, even after targeted pollution control practices have been implemented to address the problem. The Clean Water Act requires that this impaired waters list include a prioritized ranking of segments most in need of Total Maximum Daily Load (TMDL) analysis. The TMDL defines the maximum amount of a specific pollutant that can be discharged into a body of water without violating water quality goals for that water. NPDES permits and state wastewater discharge licenses are written to be consistent with the TMDL waste load allocations for the receiving water body. TMDLs are being developed and implemented for the Rochester segment of the Cocheco River for dissolved oxygen, and for the Salmon Falls River downstream of Somersworth for dissolved oxygen and phosphorous.

GOALS FOR LAND USE, DEVELOPMENT, AND HABITAT PROTECTION

The Action Plans for land use have been designed to protect estuarine water quality and habitat areas. They are drafted around the themes of future development, wetland protection, shoreland protection, land conservation, and outreach education. See *Appendix 3* sections on Land Use and on Habitat Protection and Restoration for complete lists of goals and objectives.

- Protect water quality in the estuaries and the rural quality of the watershed by encouraging development patterns in the coastal New Hampshire watersheds that limit impervious surfaces, buffer shorelands, and prevent sprawl.
- Protect and enhance the area and environmental quality of tidal wetlands or salt marshes, essential to the functioning and health of estuarine and marine ecosystems.
- Use buffers or setbacks along tidal and freshwater shorelands to protect estuarine water quality and other estuarine values such as habitat and scenic views.
- Protect estuarine water quality by ensuring that groundwater impacts are minimized.
- Allow no net loss of freshwater wetland functions in the New Hampshire coastal watershed.
- Maintain habitats of sufficient size and quality to support populations of naturally occurring plants, animals, and communities.
- Communities, government agencies, organizations, and individuals actively participate in achieving the goals for land use and habitat protection for New Hampshire's estuaries.

LAND USE AND HABITAT PROTECTION
ACTION PLANS

Future Development

LND-1	Prepare a report of current and future levels of imperviousness for the subwatersheds of the NH coastal watershed.	5-19
LND-2	Implement steps to limit impervious cover and protect streams at the municipal level.	5-21
LND-3	Conduct research in coastal NH watersheds to examine the relationship between percent impervious cover and environmental degradation.	5-23
LND-4	Prevent the introduction of untreated stormwater to wetlands by supporting the development of NH Minimum Impact Development Guidelines.	5-26
LND-5	Support the Natural Resource Outreach Coalition (NROC), a municipal decision-maker land-use planning outreach method modeled after the successful University of Connecticut Cooperative Extension “Non-point Education for Municipal Officials” (NEMO) program.	5-28

Sprawl

LND-6	Minimize urban sprawl in coastal watersheds.	5-31
LND-6A	Develop a regional pilot partnership to create a smart growth vision among Towns and Regional Planning Commissions in a single estuarine watershed.	5-34
LND-6B	Conduct a comprehensive review of the 43 towns within the estuaries and coastal watershed area to determine land-use polices that affect sprawl.	5-36
LND-6C	Develop and maintain a comprehensive database or library of new smart growth funding programs.	5-38
LND-6D	Develop a science-based handbook and video on the nature, causes, and remedies of sprawl for audiences in the coastal New Hampshire watershed area.	5-40
LND-6E	Actively participate and contribute to the development of new smart growth planning tools with particular emphasis on provisions that protect estuarine water quality.	5-42
LND-6F	Aggressively assist communities that embrace a strong smart growth philosophy to conduct comprehensive reviews, identify sources of funding, provide public education, and implement new land-use tools.	5-44

Tidal Wetlands

LND-7	Complete rulemaking and begin implementation of the Recommended New Hampshire Wetland Mitigation Policy for NH DES, prepared by the Audubon Society of NH and the Steering Committee on Wetlands Mitigation.	5-46
LND-8A	Strengthen enforcement and effectiveness of the state tidal buffer zone (TBZ) through outreach to local officials and tidal shoreland property-owners.	5-48
LND-8B	Amend state tidal buffer zone (TBZ) regulations to include regulation of deck construction.	5-50
LND-9A	Reduce the quantity, improve the quality, and regulate the timing of stormwater flow into tidal wetlands through policy changes at the NH DES Wetlands Bureau.	5-52
LND-9B	Reduce the quantity, improve the quality, and regulate the timing of stormwater flow into tidal wetlands through changes to the NH DES Site Specific Program.	5-54
LND-10	Using the Coastal Method and other techniques, identify and restore additional restorable tidal wetlands.	5-56
LND-11	Create a list of potential wetland restoration projects that could be used for wetland mitigation projects, and distribute the list to state agencies and Seacoast municipalities.	5-56
LND-12	Pursue restoration funding from the NH DOT, USDA/NRCS, US F&WS and other sources.	5-56

Shorelands

LND-13	Provide a framework specific and appropriate to the New Hampshire Seacoast for defining and delineating urban and non-urban shoreland areas.	5-57
LND-14	Develop and implement an outreach program to encourage and assist communities in developing and adopting land use regulations to protect undisturbed shoreland buffers.	5-59
LND-15	Support land conservation efforts in shoreland areas.	5-62
LND-16	Improve enforcement of the state Comprehensive Shoreland Protection Act and other applicable shoreland protection policies through outreach efforts to local officials and shoreland property-owners.	5-64
LND-17	Provide incentives for the relocation of grandfathered shoreland uses.	5-66

Groundwater

LND-18 Locate and quantify quantity and quality of groundwater inflow to the estuaries. 5-68

LND-19 Locate, reduce or eliminate, and also prevent groundwater contaminants. 5-70

Freshwater Wetlands

LND-20 Develop and implement a Wetlands Buffer Outreach Program for planning boards. 5-72

LND-21 Prevent the introduction of untreated stormwater to freshwater wetlands by enacting legislation giving NH DES authority to regulate stormwater discharge to wetlands. 5-74

LND-22 Prevent the introduction of untreated stormwater to wetlands by strengthening municipal site plan review regulations. 5-75

LND-23 Prevent the introduction of untreated stormwater to wetlands through an increased understanding of stormwater impacts on wetland ecology. 5-77

LND-24 Work with NH DES to encourage adoption of a state wetlands mitigation policy. 5-79

LND-25 Encourage municipal designation of Prime Wetlands and 100-foot buffers (or equivalent protection). 5-80

LND-25A Create a traveling Prime Wetlands display. 5-81

LND-25B Provide training and project assistance for towns interested in utilizing the Method for the Comparative Evaluation of Non-tidal Wetlands in New Hampshire. 5-82

LND-25C Work with local planning boards and conservation commissions on regulatory approaches to wetlands conservation. 5-83

LND-25D Create and/or enhance local land conservation programs with emphasis on high value wetlands and buffers. 5-85

Habitat Protection

LND-26 Support implementation of state and federal land protection programs (e.g., Conservation and Reinvestment Act, Land and Community Heritage, Teaming With Wildlife, Land and Water Conservation Fund, Coastal Initiative Program, Farmland Preservation Program). 5-86

LND-27 Support the efforts of the Great Bay Resource Protection Partnership. 5-88

LND-28 Encourage towns to dedicate current-use change tax penalties to conservation commissions for the purpose of natural resource acquisition, easements, restoration, and conservation land management. 5-90

LND-29	Provide technical assistance in land protection and management to regional land trusts and municipal conservation commissions.	5-92
LND-30	Develop and encourage use of biomonitoring standards to evaluate water quality.	5-94
LND-31	Use results of biomonitoring and water quality monitoring to prioritize watershed areas for protection and remediation.	5-96
LND-32	Encourage municipalities to incorporate wildlife habitat protection NTO local master plans by promoting NH Fish and Game's Identifying and Protecting Significant Wildlife Habitat: A Guide for Towns and other activities.	5-98
LND-33	Develop a model local planning approach to encourage the identification and maintenance of contiguous habitat blocks.	5-100
LND-34	Encourage appropriate buffers around important wildlife areas and rare or exemplary natural communities.	5-102
LND-35	Maintain current-use program.	5-104
LND-36	Encourage conservation easements.	5-106

PRIORITY

+++ **Highest**

++ **High**

+ **Priority**

ACTION LND-1

Prepare a report of current and future levels of imperviousness for the subwatersheds of the NH coastal watershed.

PRIORITY
+++ FUTURE DEVELOPMENT

BACKGROUND

Research from several areas in the country indicates that the overall health and ecological integrity of streams can generally be assessed by the degree of watershed imperviousness (roadways, parking lots, rooftops, etc.). A series of studies reviewed by the Center for Watershed Protection in Maryland indicates that generally watersheds with less than 10% impervious cover are protected from adverse water quality and biological impacts, while those above 10% tend to show higher degrees of impairment and degradation with increasing percent impervious cover. Although many NH Seacoast towns include limits to impervious cover in some zoning districts, these are not applied with the goal of limiting impervious cover in ecologically important watersheds within the town.

Managing impervious surface area to protect water quality is a complex issue. Uniform low-density zoning may succeed at limiting impervious surfaces, but may also encourage sprawl development. Managing overall impervious surface coverage may require dense development in some areas (e.g. around town centers), with protected lands and low-density development in other areas to yield an acceptable net impervious surface area.

ACTIONS/ACTIVITIES

Prepare and distribute a report of current and future imperviousness for subwatersheds of the NH coastal watershed. The Lamprey River watershed is proposed as the target watershed for the initial report, because it appears to have varying levels of imperviousness and because it straddles the regions of both Strafford and Rockingham Planning Commissions. The report will include:

1. Define and map second order subwatersheds (CSRC).
2. Estimate current amount and percent impervious surface by subwatershed (CSRC).
3. Project build-out amount and percent impervious surface by subwatershed, based on current zoning (OSP/NHCP and Regional Planning Commissions).
4. The completed report would be distributed to all municipal land-use boards and conservation commissions in the target watershed. Other Seacoast land-use boards and interested parties (e.g., developers, environmental groups) would be informed of the findings of the report, and of the possible next steps their communities can take (including those in this chapter), through direct mailing. Coastal outreach organizations, including the NHEP, would be responsible for widely distributing the report's findings through the media and other means.

RESPONSIBLE PARTIES

The two regional planning commissions and/or OSP/NHCP would be primarily responsible for preparing the report (Step 3 and 4). The UNH Complex Systems Research Center will conduct the GIS work (Steps 1 and 2).

IMPLEMENTATION LOCATION

This action will likely be implemented in the Lamprey River watershed with specific subwatersheds being determined by the responsible parties. Project methodology may be transferred to other subwatershed locations in the Great Bay and coastal watersheds.

COSTS

Research and report preparation in Steps 1-3	$35,000
Communications, outreach, and report distribution in Step 4	$5,000
Total cost	**$40,000**

FUNDING

Sub-watersheds were delineated for the Lamprey River watershed in 1999 with US EPA-NHEP implementation funds. A needs assessment to define methods for estimating impervious surface is funded by NHCP in 2001 (Step 2). Additional steps may be funded with NOAA Coastal Services Center funds, USGS Assistance to State Water Resources Research Institutes, or through other Federal programs identified in Tables 10.1 to 10.6 of this document.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

This report will generally raise awareness of the issues with impervious cover, and lay the groundwork for future work in planning for, and controlling, the inevitable increases in impervious cover that will occur with future growth. Water quality, habitat, and scenic values in the estuarine region will benefit from more effective planning for impervious cover from new development.

MONITORING AND ENFORCEMENT

No monitoring or enforcement is required.

TIMETABLE

Steps 1 and 2 were initiated in 2000. The remaining steps will be initiated by 2004.

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PRIORITY

Highest Priority. Other land-use Action Plans would be enhanced by completion of this report (e.g., LND-2, LND-17, et al).

ACTION LND-2

Implement steps to limit impervious cover and protect streams at the municipal level.

PRIORITY
+++ FUTURE DEVELOPMENT

BACKGROUND

Research from several areas in the country indicates that the overall health and ecological integrity of streams can generally be assessed by the degree of watershed imperviousness (roadways, parking lots, rooftops, etc.). A series of studies reviewed by the Center for Watershed Protection in Maryland indicates that generally watersheds with less than 10% impervious cover are protected from adverse water quality and biological impacts, while those above 10% tend to show higher degrees of impairment and degradation with increasing percent impervious cover. In a document entitled Site Planning for Urban Stream Protection, the Center for Watershed Protection outlines seven steps that land-use authorities can take to enhance protection of critical waterways and ecosystems.

ACTIONS/ACTIVITIES

Ideally, following completion of the report developed in Action Plan LND-1, one pilot project will be implemented in a target watershed (e.g., Lamprey River). The Regional Planning Commissions and/or UNH Cooperative Extension will select one community to pilot the seven-step stream protection strategy detailed in Site Planning for Urban Stream Protection. These seven steps are:

1. Watershed-based zoning based on projected level of impervious cover for watersheds or subwatersheds.
2. Protection of sensitive areas such as streams, wetlands, floodplains, shorelands, and critical habitat from development
3. Establish a stream buffer network.
4. Modify subdivision code to reduce creation of impervious cover, by utilizing narrower streets, green parking lots, subdivisions with smaller lots and more open space, etc.
5. Limit the disturbance and erosion of soils during construction, including use of non-structural controls (sequencing, footprinting, etc.).
6. Treat the quantity and quality of stormwater runoff by installing and maintaining stormwater BMPs.
7. Maintain stream protection infrastructure through BMP maintenance, enforcement, public outreach/pollution prevention, and stream monitoring.

Before implementing the seven steps, outreach efforts on the benefits of the above steps will be made to municipal officials, developers, and other interested parties. If the pilot community projects are successful, these programs

will be repeated for other towns in the coastal watersheds. This ongoing program will assist each community in improving municipal codes and practices with respect to impervious surfaces and stormwater runoff controls, and provide professional staff assistance to each community for following up on the training/education program.

RESPONSIBLE PARTIES

Lead parties will be the Strafford Regional Planning Commission and Rockingham Planning Commission, with assistance from UNH/Cooperative Extension (Steps 1-7).

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds.

COSTS

Estimated cost per community:	
Code work in Step 4	$15,000
Communications in Steps 1-7	$5,000
Training for the Conservation Commission in 7-Step methodology (Steps 1-7)	$2,500
Total	**$22,500**

FUNDING

This project will be funded with federal US EPA-NHEP implementation funds in 2001.

REGULATORY NEEDS

Implementation of all seven steps will likely require substantial revisions to local land-use regulations.

EXPECTED BENEFITS

Improved protection of natural resources and environmental quality.

MONITORING AND ENFORCEMENT

Implementation of the seven steps will require at least as much enforcement of local regulations as currently exists, if not more.

TIMETABLE

This pilot project will be completed by 2002.

+++

PRIORITY

Highest Priority. Implementation of this action will be strengthened by the completion of Action LND-1, and could be improved by the completion of Action LND-3 of the *NHEP Management Plan*. Action LND-17 could be implemented in conjunction with LND-2, et al.

ACTION LND-3

Conduct research in coastal NH watersheds to examine the relationship between percent impervious cover and environmental degradation.

PRIORITY

++

FUTURE DEVELOPMENT

BACKGROUND

Research from several areas in the country indicates that the overall health and ecological integrity of streams can generally be assessed by the degree of watershed imperviousness (roadways, parking lots, rooftops, etc.). A series of studies reviewed by the Center for Watershed Protection in Maryland indicates that generally watersheds with less than 10% impervious cover are protected from adverse water quality and biological impacts, while those above 10% tend to show higher degrees of impairment and degradation with increasing percent impervious cover. These studies have largely been conducted in the mid-Atlantic states, an area of differing climate and generally higher levels of development. The purpose of this project is to examine the validity of these relationships for the climate and land-use patterns of the northeastern U.S., particularly coastal New Hampshire.

PROJECT OBJECTIVES AND METHODS

The purpose of this research project is to:

1. Define the functional relationship between watershed imperviousness and stream ecological integrity; and
2. Utilize the relationship to assess the ecological integrity of subwatersheds in the coastal basin.

The project will utilize UNH Complex Systems-generated impervious cover data to determine the percent imperviousness of subwatersheds in the coastal basin. A subset of 20-30 subwatersheds in the coastal watershed with varying increments of imperviousness will be selected for comparative sampling to assess stream ecological integrity. The sampling protocol will produce consistent data on hydrologic, morphologic, water quality, habitat and biodiversity variables within each subwatershed, thus generating quantitative expressions of stream ecological integrity. The sampling data will be statistically and graphically analyzed to determine the presence of relationships between imperviousness and stream quality.

ACTIONS/ACTIVITIES

1. Delineate and categorize subwatersheds: The UNH Complex Systems Research Center (CSRC) will accomplish this task according to the standard data development procedures of GRANIT, the NH State Geographic Information [GIS] System.

2a. Select 20-30 subwatersheds for field sampling: Up to five second order reference streams will be selected, based on their lack of urban development, lack of confounding non-point and point sources of pollution, natural channels, good habitat structure, and impervious cover of less than

5%. Other subwatersheds of varying levels of imperviousness will be selected to obtain the widest possible range of percent-imperviousness. To the maximum extent practicable, all subwatersheds will have drainage areas from 100 to 500 acres, a known level of imperviousness, age, and presence or absence of Best Management Practices, and will be free of confounding sources (active construction, mining, agriculture, or point sources).

2b Sample subwatersheds: For each subwatershed, three random, non-overlapping, 100-foot reaches of stream will be selected for summer and winter sampling of selected variables in each of five key variables groups:

- Hydrologic variables: summer dry weather flow, wetted perimeter, cross-sectional area of stream, peak annual storm flow (if gauged).
- Channel morphology variables: channel alteration, height, angle and extent of bank erosion, substrate embeddedness, sediment deposition, substrate quality.
- Water quality variables: summer water temperature, conductance, dissolved oxygen.
- Habitat variables: pool-riffle ratio, pool frequency, depth and substrate, instream cover, riffle substrate quality, riparian vegetative cover, riffle embeddedness.
- Ecological variables: macroinvertebrate diversity

3 Data analysis: Graphical and statistical procedures will be used to quantify the relationship between watershed imperviousness and stream quality

4 Information Dissemination: Create graphs of each stream quality variable compared to stream imperviousness, a coastal watershed map depicting subwatersheds by imperviousness percentage, 43 town-based maps depicting subwatersheds by imperviousness percentage, and digital versions of all graphical products.

RESPONSIBLE PARTIES

The lead implementer will be NH DES (Steps 2a, 2b, 3, 4), with assistance from NHCP and UNH Cooperative Extension (Steps 2b, 3, 4), and UNH Complex Systems Research Center (Step 1).

IMPLEMENTATION LOCATION

This action will be implemented in field locations in the Great Bay watershed.

FUNDING

NHCP funded a mini version of three sub-watersheds in 2000. This project would likely be funded through a variety of sources, rather than by a single organization. Sources could include the US EPA NHEP implementation funds, the NH Coastal Program, UNH/CICEET, the NH Department of Environmental Services Biomonitoring Program, and UNH Cooperative Extension. Other federal funding programs identified in tables 10.1 to 10.6 of this document may be available for support of this project.

COSTS

Estimated two-year project. Expanded water quality sampling for toxins, turbidity, and other parameters would be desirable, but are not included here.

Staff NH DES Project Manager (half time) in Steps 1-4	$60,000
UNH/CSRC GIS services in Step 1	$24,000
UNH Coop. Extension services in Steps 2b-4	$20,000
Interns/volunteer training in Steps 2b	$10,000
Equipment (Computer, field equipment) in Steps 2b	$10,000
Supplies (Copying, etc.) in Step 2b	$ 5,000
Lab/Field Costs (Hydrolab) in Step 2b	$ 7,000
D.O./conductivity field meter in Step 2b	$ 2,000
39 staff gauges in Step 2b	$ 1,800
Flow meter in Step 2b	$ 1,000
39 temp. Meter/logger (HOBO) in Step 2b	$ 4,200
Macroinvert. Sampling Supplies in Step 2b	$ 5,500
Macroinvert. Analysis (contracted) in Step 2b	$22,500
Field log books, film, etc. in Step 2b	$ 300
Total	**$173,300**

REGULATORY NEEDS

NH Fish and Game Department may require a scientific permit for some invertebrate sampling.

EXPECTED BENEFITS

- Greater understanding of the effects of impervious cover on stream health.
- Information which could be used to assess the ecological integrity of other coastal NH watersheds.
- New Hampshire-specific scientific information on which to base recommendations for limits of impervious cover.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

A three-watershed version of this project was completed in 2001 by NHCP. An expanded study will be initiated by 2004. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

++

PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*, although its completion will improve the effectiveness of other actions such as Action LND-2. The results of Action LND-1 would provide some of the information needed to select subwatersheds for the studies outlined in this Action Plan.

FUTURE DEVELOPMENT

PRIORITY

+

ACTION LND-4

Prevent the introduction of untreated stormwater to wetlands by supporting the development of NH Minimum Impact Development Guidelines.

BACKGROUND

The NH Comparative Risk Project completed a report in 1998 that ranked environmental threats in the state of New Hampshire. A number of the threats identified were related to development. In response to these findings, the NH Comparative Risk Project is coordinating an effort to develop voluntary guidelines and practices intended for use by towns, developers, and others. The practices will be designed to minimize air, land, and water pollution; habitat loss and fragmentation; and energy use resulting from future development.

ACTIONS/ACTIVITIES

1 Through the efforts of technical working groups facilitated by the NH Comparative Risk Project, prepare report of written practices and indicators of minimum-impact development for residential, commercial/industrial, and institutional development addressing.

- Building siting, design, construction, operation, and maintenance.
- Site development of impervious surface, vegetation, public and private spaces, etc.
- Infrastructure support of roads, utilities, communications, safety, etc.
- Integration with the neighborhood.
- Regional setting that maintains diversity of development density.

2 Once the report is complete, work with communities and developers to encourage adoption of these practices.

RESPONSIBLE PARTIES

NH Comparative Risk Project as lead organization (Steps 1-2), with participation from developers, lenders, insurance agencies, planners, scientists, local and state government, environmental conservation organizations, utilities, citizens, and others.

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

Total cost of $250,000, almost half of which is already secured through federal grants.

FUNDING

This action may be funded in small part through US EPA NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds or in-kind contributions may be available through natural resource management agencies such as NH DES and NH OSP.

REGULATORY NEEDS

None identified, as the practices are intended to be voluntary. However, some towns may choose to incorporate the recommended practices into local land-use regulations.

EXPECTED BENEFITS

Reduced air, land, and water pollution; habitat loss and fragmentation; and energy use resulting from future development.

MONITORING AND ENFORCEMENT

No requirements identified.

TIMETABLE

This Priority action was initiated in 2000 and will be completed by 2002. Outreach and implementation of practices will be ongoing.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

FUTURE DEVELOPMENT

PRIORITY
+++

ACTION LND-5

Support the Natural Resource Outreach Coalition (NROC) municipal decision-maker land-use planning outreach method modeled after the University of Connecticut cooperative extension's non-point education for municipal officials (NEMO) program.

BACKGROUND

The Great Bay National Estuarine Research Reserve, NHEP Land Use Project Team, and the Natural Resources Outreach Coalition have been re-evaluating the way natural resource-based planning information is provided to Seacoast region land-use decision-makers. A study commissioned by the Research Reserve investigated the planning information needs of area land-use decision-makers through a survey and a number of follow-up interviews. The study drew several conclusions:

1. The boards' regulatory and administrative responsibilities consume most of their meeting time, leaving little time for long-term planning.
2. Most volunteer committee members do not have the time or resources to attend traditional workshops, or read volumes of technical support materials. The study suggests the best way to reach this audience is with direct presentations scheduled in advance into their regular meeting schedule.
3. If natural resource-based planning language is not already incorporated into the town master plan and by-laws, it is difficult to require specific natural resource considerations in new site plan determinations.
4. Internet access to information is increasing among board and committee members, often through home computers. Many local officials have become aware of the power of Geographic Information Systems, but most do not have a complete understanding of the technology and its power as an analytical tool in land-use planning applications.

With these findings in mind, the Natural Resources Outreach Coalition convened a meeting of Seacoast land-use planning and outreach organizations to discuss how they could better address the needs of local decision-makers and municipal land-use planners. The group developed an extensive list of natural resource topics central to land-use planning efforts. The group also agreed on the need for a creative educational and technical support outreach vehicle to incorporate natural resource-based planning into local decision-making to protect natural resources.

The group developed a pilot program that would employ a team of land-use, natural resource and outreach professionals to work with one or two communities. Work would focus on issues and concerns specific to the particular town, using the expertise of the program team to establish a foundation for integrating natural resource-based thinking into the planning process. The Connecticut NEMO model and its focus on impervious surfaces, water quality, and land use, was discussed at this meeting. The group concluded that

although NEMO was a valuable educational model, the outreach effort for the New Hampshire Seacoast should explore other unifying themes as well as impervious surfaces.

ACTIONS/ACTIVITIES

1. Develop a multi-organization, coordinated effort using new educational tools based on the NEMO model to deliver land-use planning information to communities. This program will present land-use planning information in a simpler, more understandable manner using language and topics familiar to most municipal officials. The ultimate goal of this educational program is for natural resource issues to be included as a fundamental consideration in local planning and land-use decisions (complete, piloted in 1999-2000).
2. Identify an appropriate lead coordinating organization or agency with extensive community education and planning expertise. Establish a sustainable structure for the core group of land-use planners, educators, and municipal officials involved in piloting the program. The pilot has been developed, marketed and implemented using NH OSP and NH DES/Regional Planning Commission funding and NROC professional staff time.
3. Provide programs to communities.

RESPONSIBLE PARTIES

Currently coordinated by the New Hampshire Coastal Program (Step 1), the NROC includes the NH Estuaries Project, NH DES, UNH Cooperative Extension, Strafford Regional Planning Commission, Rockingham Planning Commission, and Great Bay National Estuarine Research Reserve. The Conservation Law Foundation, the Audubon Society of New Hampshire, Strafford County Conservation District, USDA Natural Resources Conservation Service, EPA, and UNH Complex Systems Research Center also endorse NROC. The working partners will deliver the educational materials and coordinate the follow-up technical support (Steps 2-3).

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

Program development and current implementation are supported through existing staff resources and some funding from NH Coastal Program and NH DES (Steps 1, 3). One full-time staff person housed within one of the partner agencies can coordinate this program. Implementation will require resources from multiple partners. If the program is extended beyond the Seacoast region, staff and administrative costs will rise proportionately. Annual estimate for one full-time equivalent is $50,000 (Step 2). Additional costs for follow-up assistance are yet to be determined. Ongoing programming requires supporting costs estimated at $30,000/year (Step 3).

FUNDING

The NHEP has allocated $30,000 of its current implementation funds for this project in 2000, 2001, and 2002. Additional funds may be available through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. Additional support also comes from in-kind services from Natural Resources Outreach Coalition partners.

EXPECTED BENEFITS

- Natural resource issues will become a fundamental consideration in local land-use planning and decision-making.
- NHEP land-use Actions will be supported by this educational effort.
- Preserve the unique character of coastal New Hampshire.

TIMETABLE

This Highest Priority action was initiated in 1999 and will be ongoing.

+++

PRIORITY

Highest Priority: Implementation of this action is fundamental to achieving the Land Use and Habitat Preservation goals chapter of the *NHEP Management Plan*. Many of the concepts, messages and outreach activities proposed in Chapter 5: Land-Use, Development and Habitat Protection will be incorporated as key elements of the new educational programs.

ACTION LND-6

Minimize urban sprawl in coastal watersheds.

PRIORITY
+++ SPRAWL

BACKGROUND

A New Hampshire legislative study on land use management and farmland preservation published in October 1998 defines sprawl as "the haphazard and unplanned development of and use of land, be it physically, visually, or audibly, in such a manner that is contrary to the traditional and historic New Hampshire landscape." The study further defines sprawl as "the inflation, over time, in the amount of land area consumed per unit of human activity, and the degree of dispersal between such land areas." Many of the results of this haphazard and accelerated consumption of land represent a potential threat to water quality in adjacent estuarine areas. The results of haphazard and accelerated consumption of land include:

- loss and fragmentation of agricultural, forest, wildlife habitat, and wild lands
- increased air and water pollution, as well as risk of flooding
- aesthetic degradation of the landscape
- abandonment of commercial activities in cities and towns
- development of strip malls and shopping centers that congest the roads and eliminate open spaces
- proliferation of signs along highways
- increased levels of noise
- grid-type housing developments
- loss of vibrant villages and city centers, traditional character, and sense of community

Recent federal, regional, and state initiatives are responses to problems caused by sprawl. At the federal level, the Clinton-Gore livability agenda promotes cooperative action among federal agencies to provide communities with new tools and resources to preserve green spaces, ease traffic congestion and pursue 'smart growth' strategies. US EPA, US DOT, US HUD, US General Services Administration, US Department of Interior, US Department of Health and Human Services, Department of Defense (through the Army Corp of Engineers), US Department of Justice, US Postal Service, US Department of Energy, and the US Department of agriculture, have joined forces to promote regional New England 'smart growth' initiatives to cooperatively seek solutions to the environmental, social, and economic problems posed by sprawl. In New Hampshire the governor signed an executive order instructing key agencies to determine ways in which rules, regulations, granting programs, and

actions could be improved to reduce the consequences of sprawl. These state agencies include the Office of State Planning, Department of Environmental Services, and Department of Transportation.together these federal, regional and state initiatives on sprawl sponsor a set of actions including:

- studies to determine the local impacts of sprawl
- reviews of existing programs, rules, regulations, funding, etc., that contribute to sprawl
- education to raise public awareness and inform local decision-makers regarding sprawl
- expanded funding for land protection, conservation, and preservation
- greater use of technology to study sprawl (e.g., GIS)
- new land-use tools for municipalities to control sprawl
- new partnerships: inter-municipality, inter-regional, or inter-agency collaborations to address sprawl-related issues

ACTIONS/ACTIVITIES

The following set of six recommended action plans (LND6a to LND6f) for the New Hampshire estuaries and coastal watershed area are designed to complement these federal, regional, and state initiatives. This approach aims to build on existing actions that have already been developed and identified for potential funding.

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds. Different communities in the great bay and coastal watersheds will require different levels and types of information and assistance.

COSTS

Estimated total cost for implementation of Actions 6a-6f over 5 years: $498,000

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
LND-6A	26,000					$26,000
LND-6B	30,000					$30,000
LND-6C	12,000	6,000	6,000	6,000	6,000	$36,000
LND-6D		28,000				$28,000
LND-6E	30,000	12,000	12,000	12,000	12,000	$78,000
LND-6F	60,000	60,000	60,000	60,000	60,000	$300,000
TOTAL	**$158,000**	**$106,000**	**$78,000**	**$78,000**	**$78,000**	**$498,000**

FUNDING

These projects would likely be funded through a variety of sources, rather than by a single organization. Sources could include the US EPA NHEP implementation funds, the NH Coastal Program, UNH/CICEET, the NH Department of Environmental Services Biomonitoring Program, and UNH Cooperative Extension. Other federal funding opportunities, including NOAA, USGS, and US EPA programs, identified in tables 10.1 to 10.6 of this document may be available for support of this project.

REGULATORY NEEDS

Information generated in Action LND-6B and implementation of some anti-sprawl tools developed in Action LND-6E and pursued through Action LND-6F could lead to regulatory changes at the local level.

EXPECTED BENEFITS

Less urban sprawl, better protection of natural resources, and preservation of more of the region's traditional and rural character.

MONITORING AND ENFORCEMENT

Enforcement of revised land use regulations will be at the local level.

TIMETABLE

See the detail of specific Action Plans 6A through 6F.

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PRIORITY

Highest Priority. Results will be most effective if all actions (LND-6A to 6F) are implemented, although some could be implemented even if others are not.

SPRAWL

PRIORITY

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ACTION LND-6A

Develop a regional pilot partnership to create a smart growth vision among Towns and Regional Planning Commissions in a single estuarine watershed.

ACTIONS/ACTIVITIES

This Action would use a community visioning exercise for consensus on goals for growth, community and regional character, natural resources preservation, and overall quality of life. Based on the outcome of this exercise, a watershed master plan that articulates the values and goals expressed by the community would be developed. The Oyster River and Lamprey River watersheds are recommended for this project due to existing local interest, presence of many important natural resources, diversity of current land use patterns, and history of cooperation among Lamprey River communities in river protection under the NH Rivers Management Protection Program and the federal Wild and Scenic Rivers designation program. The long-term intent of this activity is to develop similar partnerships in other coastal watersheds.

RESPONSIBLE PARTIES

Strafford Regional Planning Commission will act as lead agency with participation of Rockingham Planning Commission.

IMPLEMENTATION LOCATION

The initial focus of this Action Plan will be the Oyster River watershed communities. However, it may be implemented in any or all of the sub-watersheds in the NH coastal watershed.

COSTS

0.1 full-time equivalent at Strafford Regional Planning	$6,000
Community visioning consultant	$20,000
Total	**$26,000**

FUNDING

US EPA NHEP implementation funds will be used to implement this action in 2000-2001.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Coordinated development plans and enhanced protection preserving community character and resources.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

This Highest Priority action will be completed by 2002.

+++

PRIORITY

Highest Priority. This Action Plan will be implemented by SRPC in the Oyster River watershed starting in Fall 2000. Implementation of this action is considered important to achieving the overall intent of Action LND-6.

SPRAWL

PRIORITY

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ACTION LND-6B

Conduct a comprehensive review of the 43 towns within the estuaries and coastal watershed area to determine land-use polices that affect sprawl.

ACTIONS/ACTIVITIES

1. Comprehensively review the land-use polices of the 43 municipalities within the estuaries and coastal watershed area to identify those policies that affect sprawl. The NHEP Base Programs Analysis documented environmental regulations in the 19 coastal municipalities, and will be useful in this review.
2. Use the review results to develop guidelines to help communities bring land-use policies in line with state, regional, and federal anti-sprawl initiatives.
3. The overall goal of these guidelines will be to maintain the unique character of each community, to protect natural resources, to maintain a high quality of life, and to ensure future prosperity and economic potential. Policies that affect estuarine water quality will be emphasized.

RESPONSIBLE PARTIES

Strafford Regional Planning Commission as lead agency with participation of Rockingham Planning Commission (Steps 1-3).

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds.

COSTS

Estimated cost is $30,000 for 0.5 full-time equivalent at Strafford and/or Rockingham Planning Commission (Steps 1-3).

FUNDING

This project is funded with an EPA Sustainable Development Challenge Grant. Additional work may be funded with federal US EPA-NHEP implementation funds, NOAA Coastal Services Center funds, USGS Assistance to State Water Resources Research Institutes, or through other federal programs identified in tables 10.1 to 10.6 of this document.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Will enable communities to target their anti-sprawl efforts more effectively on those activities, regulations, etc., which are contributing to sprawl.

MONITORING AND ENFORCEMENT

No requirements identified.

TIMETABLE

The Regional Planning Commission Project funded by EPA will be completed by 2001. Additional activities (as needed) to complete this action will be initiated by 2005.

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PRIORITY

High Priority. Implementation of this action is considered important to achieving the overall intent of Action LND-6.

SPRAWL

PRIORITY

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ACTION LND-6C

Develop and maintain a comprehensive database or library of new smart growth funding programs.

ACTIONS/ACTIVITIES

1. Regional Planning Commissions develop and maintain a comprehensive, up-to-date database or library of new anti-sprawl funding programs that builds on existing lists of funding programs, in both digital and hard-copy formats. Federal, regional, and state agencies will be restructuring existing funding programs to encourage land-use development that avoids sprawl. These same agencies, in concert with private organizations, will be developing new sources of open space and natural resource preservation funding to further assist in achieving this goal.
2. Assist coastal watershed municipalities that (1) have a major impact on estuarine water quality and (2) have developed strong anti-sprawl land-use policies, to acquire funding from these sources.

RESPONSIBLE PARTIES

Either Strafford Regional Planning Commission or Rockingham Planning Commission will manage funding for the library for the coastal watershed area (Step 1). Regional planning commissions will assist member communities in securing funds (Step 2).

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds.

COSTS

0.2 full-time equivalent in year 1 and 0.1 full-time equivalent in years 2-5 (Steps 1-2):

Year 1	Year 2	Year 3	Year 4	Year 5	Total
12,000	6,000	6,000	6,000	6,000	**$36,000**

FUNDING

This action may be funded through US EPA NHEP implementation funds or through other federal programs identified in tables 10.1 to 10.5 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP could also support this action. Local funds from regional planning commission dues or in-kind contributions toward the project may also be appropriate.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Achieving higher levels of funding for community anti-sprawl programs will greatly enhance the likelihood of completing such initiatives.

MONITORING AND ENFORCEMENT

No requirements identified.

TIMETABLE

Initiate by 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

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PRIORITY

High Priority. Implementation of this action is considered to be moderately important to achieving the overall intent of Action LND-6.

SPRAWL

PRIORITY

+

ACTION LND-6D

Develop a science-based handbook and video on the nature, causes, and remedies of sprawl for audiences in the coastal New Hampshire watershed area.

ACTIONS/ACTIVITIES

This educational initiative would create a science-based handbook and video for audiences in the coastal New Hampshire watershed area on the nature, causes, and remedies of sprawl. It would explain the direct connection between sprawl growth and estuarine water quality. The audience for the handbook will be the general public, including schools, youth and community organizations, and adult education programs.

RESPONSIBLE PARTIES

The NH Estuaries Project and the NH Office of State Planning can oversee document and video production.

IMPLEMENTATION LOCATION

The educational product called for in this action can be distributed to the 43 towns in the Great Bay and coastal watersheds, via the NHEP, NH Office of State Planning, UNH Cooperative Extension, the Strafford and Rockingham Regional Planning Commissions, or other groups participating in regional planning outreach activities.

COSTS

0.3 full-time equivalent	$18,000
Materials for handbook and video	$10,000
Total	**$28,000**

FUNDING

Can be funded through US EPA NHEP implementation funds or through state anti-sprawl and “smart-growth” initiatives.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

This educational effort will help explain the reasons for and benefits of anti-sprawl efforts. Many anti- sprawl actions will involve changes to local land-use regulations and zoning, which require approval by residents.

MONITORING AND ENFORCEMENT

No requirements identified.

TIMETABLE

Initiate by 2007. This Priority action will be implemented as funds and resources become available.

PRIORITY

Priority. This work should be coordinated with the development guidelines in Action LND-21 and other related work. Implementation of this action is considered to be of minor importance to achieving the overall intent of Action LND-6.

SPRAWL

PRIORITY

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ACTION LND-6E

Contribute to the development of new smart growth planning tools, with particular emphasis on provisions that protect estuarine water quality.

ACTIONS/ACTIVITIES

1. The NH Office of State Planning will be the lead agency in developing new model ordinances, regulations, codes, best management practices, and planning concepts that avoid sprawl.
2. Promote these new tools to assist local communities (planning boards, zoning boards, conservation commissions, codes officers, and other town officials).

RESPONSIBLE PARTIES

NH Office of State Planning and Strafford and Rockingham Regional Planning Commissions will be responsible for developing new tools (Step 1). Strafford and Rockingham Regional Planning Commissions will be responsible for the transfer of information and the delivery of assistance to member communities (Step 2). The Conservation Law Foundation and the Minimum Impact Development Project may also assist in the action since both organizations are developing smart growth tools (Steps 1-2).

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds.

COSTS

0.5 full-time equivalent in Year 1 in Step 1	$30,000
0.2 full-time equivalent in Years 2-5 ($12,000/year) in Step 2	$48,000
Total	**$78,000**

FUNDING

Increased budgets for RPCs have been included in the FY01 state budget. This funding will increase RPC capacity to implement Step 2. Funding for LND-4 to support Minimum Impact Development will also support this action. Additional funds may come through US EPA NHEP implementation funds, EPA Sustainable Development Challenge Grants, or through other federal programs identified in tables 10.1 to 10.5 in the *NHEP Management Plan*.

REGULATORY NEEDS

Some new instruments might involve changes to state statutes relative to zoning and land-use regulation.

EXPECTED BENEFITS

Strengthened capability of municipalities to develop a planning framework that avoids sprawl.

MONITORING AND ENFORCEMENT

None required to develop tools.

TIMETABLE

Initiate by 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

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PRIORITY

High Priority. Implementation of this action is considered to be moderately important to achieving the overall intent of Action LND-6.

SPRAWL

PRIORITY

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ACTION LND-6F

Assist communities that embrace a strong smart growth philosophy to conduct comprehensive reviews of existing regulations, identify sources of funding, provide public education, and implement new land-use tools.

ACTIONS/ACTIVITIES

1. Regional Planning Commissions (RPCs) will assist communities that embrace a strong anti-sprawl philosophy to conduct comprehensive reviews of local and state land use policies and regulations;
2. Identify funding sources (RPCs);
3. Provide public education (RPCs and NROC);
4. Implement new land-use tools (RPCs).

RESPONSIBLE PARTIES

The Rockingham and Strafford Regional Planning Commissions will act as lead agencies with assistance from state agencies (e.g., Office of State Planning, Department of Environmental Services, etc.) and federal agencies (US Environmental Protection Agency, et al.) (Steps 1-4). Natural Resource Outreach Coalition will assist with public education (Step 3).

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds.

COSTS

$30,000 for 0.5 full-time equivalent per year, for each Regional Planning Commission (Steps 1-4).

FUNDING

This action may be funded through US EPA NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. Funding for LND-5 to support NROC will also support this action. State funds available through natural resource management agencies such as NH DES and NH OSP could also support this action. Local funds from regional planning commission dues or in-kind contributions toward the project will also be available.

REGULATORY NEEDS

Implementing some new land-use tools may require new or amended regulations.

EXPECTED BENEFITS

More effective prevention of sprawl.

MONITORING AND ENFORCEMENT

Some land-use tools may require an enforcement component.

TIMETABLE

This Highest Priority action will be initiated by2004.

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PRIORITY

Highest Priority. Implementation of this action is considered to be important to achieving the overall intent of Action LND-6.

TIDAL WETLANDS

PRIORITY

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ACTION LND-7

Complete rulemaking and begin implementation of the Recommended New Hampshire Wetland Mitigation Policy for NH DES, prepared by the Audubon Society of NH and the Steering Committee on Wetlands Mitigation.

BACKGROUND

Wetlands mitigation has long been required as a condition of obtaining a state wetlands permit for projects that have significant adverse impact on wetlands, even after efforts to avoid and minimize impacts. Specific mitigation requirements have always been decided on a case-by-case basis, without the guidance of a policy outlined in state wetlands regulations. A state Steering Committee working with the Audubon Society of New Hampshire recently developed a written mitigation guidelines policy. The purpose of this Action is to encourage adoption of the policy into state wetlands regulation. Action LND-24 extends this mitigation policy to coastal area freshwater wetlands.

ACTIONS/ACTIVITIES

1 DES will complete state rulemaking and

2 Begin implementation of the wetlands mitigation policy entitled *A Recommended New Hampshire Wetland Mitigation Policy for NH DES,* developed by the Audubon Society of New Hampshire and the Steering Committee on Wetlands Mitigation. Some of the basic tenets these rules should address are:

- Any negative impact to tidal (as well as freshwater) wetlands function should be mitigated.
- Wetland enhancement and restoration are preferable to wetland creation.
- Acquisition of buffers as mitigation should be considered.
- Cumulative and secondary impacts should be considered in determining the need for mitigation.
- Required mitigation projects should be monitored for completion.

The draft rules will be reviewed by coastal wetland experts, NRCS, the NHEP, NHCP, and contractors prior to adoption into state wetlands regulations.

Fact sheets have already been written to assist permitees with mitigation, and the NHEP should help distribute the fact sheets to communities and contractors, and assist with training workshops.

RESPONSIBLE PARTIES

NH DES Wetlands Bureau will be the lead agency for this action (Steps 1-2), with outreach assistance from the NHCP, NHEP, Audubon and others (Step 2).

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds.

COSTS

No new costs are anticipated.

FUNDING

NH DES time for this action could come from current mitigation staff (currently 3/5 full-time equivalent and rulemaking staff. Existing NHCP and NHEP staff would provide outreach.

REGULATORY NEEDS

Significant changes to NH DES Administrative Rules for wetlands.

EXPECTED BENEFITS

A more uniform and consistent process for requiring mitigation on state-permitted projects.

MONITORING AND ENFORCEMENT

Existing NH DES Wetlands Bureau staff would enforce the new policy.

TIMETABLE

This High Priority action was initiated in 2001 and will be completed by 2002.

++

PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*. Action-LND 24 extends this action to freshwater wetlands.

TIDAL WETLANDS

PRIORITY

+

ACTION LND-8A

Strengthen enforcement and effectiveness of the state tidal buffer zone (TBZ) through outreach to local officials and tidal shoreland property-owners.

BACKGROUND

One of the problems with the state Tidal Buffer Zone law is that few people are familiar with it. Planning boards, code enforcement officers, and conservation commissions need information on the law's requirements. Construction-related activities such as excavation, filling, and new building construction within 100 feet of the "highest observable tide line" (defined as the landward extent of tidal flow, excluding storm events) may be subject to the TBZ regulations. Because so much of the coast is developed, many projects in the TBZ are not noticed by regulators. Effective enforcement of the TBZ law requires vigilance of local conservation commissions and code enforcement officers.

ACTIONS/ACTIVITIES

1. Strengthen the enforcement of the state tidal buffer zone (TBZ) by educating planning boards, code enforcement officers, conservation commissions, and landowners in towns with tidal shoreline about the types locations (within 100 feet of the highest observable tide line) of activities that are subject to the TBZ regulations. Offer workshops or direct presentations and/or training for local officials (NH DES with assistance from other "responsible parties").
2. NH DES staff could also inspect activities in the TBZ via field surveys and/or aerial photographs.

RESPONSIBLE PARTIES

NH DES would be the lead agency for this activity (Steps 1-2), with assistance from NHEP, NHCP, regional planning commissions, and local conservation commissions (Step 1).

IMPLEMENTATION LOCATION

This action may be implemented in all 17 NH coastal communities with tidal frontage.

COSTS

Additional NH DES wetlands staff person at approximately $40,000 (Steps 1-2). Outreach involvement of NHEP and NHCP would be accomplished with existing staff at no additional cost (Step 1).

FUNDING

State funds could be pursued for an additional staff person. Federal programs identified in Tables 10.1 through 10.6 may be sources of funds for specific projects once staff requirements are met.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Improved enforcement of Tidal Buffer Zone regulations to protect salt marshes and other tidal areas.

MONITORING AND ENFORCEMENT

TBZ regulations to be enforced by NH DES staff

TIMETABLE

Initiate by 2007. This Priority action will be pursued as funds and resources become available.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

TIDAL WETLANDS

PRIORITY

+

ACTION LND-8B

Amend state tidal buffer zone (TBZ) regulations to include regulation of deck construction.

BACKGROUND

Under the state Tidal Buffer Zone law, construction-related activities such as excavation, filling, and new building construction within 100 feet of the "highest observable tide line" (defined as the landward extent of tidal flow, excluding storm events) may be subject to TBZ regulations. However, some types of activities in the TBZ are not regulated. Exceptions include landscaping, deck construction, and others. In some situations activities such as deck construction can adversely affect sensitive areas such as salt marshes. A change in NH DES administrative rules for the TBZ would increase the law's effectiveness.

ACTIONS/ACTIVITIES

Pursue and implement changes to NH DES Wetlands Administrative Rules to require a permit for deck construction in the TBZ. The intent of this action is not to prohibit deck construction in the TBZ, but to ensure that salt marshes and other sensitive areas are not adversely affected by such construction. Other changes to simplify and strengthen the TBZ regulations may be desirable, but may require additional statutory authority and additional field staff for NH DES.

RESPONSIBLE PARTIES

NH DES would be the lead agency for this activity.

IMPLEMENTATION LOCATION

This action will be implemented in all 17 NH coastal communities with tidal frontage.

COSTS

Rule changes, to be pursued by existing wetlands staff, would require no additional expense. Implementation of the changes would be greatly enhanced with the additional wetlands staff person at NH DES noted in Action LND-6A.

FUNDING

See Action LND-8A

REGULATORY NEEDS

Changes to NH DES Wetlands Administrative Rules

EXPECTED BENEFITS

Improved protection of salt marshes and other tidal areas.

MONITORING AND ENFORCEMENT

TBZ regulations to be enforced by NH DES staff

TIMETABLE

Initiate be 2007. This Priority action will be pursued as funds and resources become available.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*, but would be enhanced by implementation of LND-6A.

TIDAL WETLANDS

PRIORITY

+++

ACTION LND-9A

Reduce the quantity, improve the quality, and regulate the timing of stormwater flow into tidal wetlands through policy changes at the NH DES Wetlands Bureau.

BACKGROUND

Current state wetlands regulations can allow the use of salt marshes as receiving waters for stormwater runoff. The resulting influx of freshwater and/or pollutants can degrade salt marsh functions.

ACTIONS/ACTIVITIES

1. NHCP, with assistance from NH DES, will reduce the quantity, improve the quality, and regulate the timing of stormwater flow from new development into tidal wetlands by changing NH DES policies.

   NH DES policies – and regulations if necessary – should limit the use of salt marshes as receiving waters for stormwater runoff.

2. The guiding concept for the policies and regulation should be that post-development runoff rates and impacts shall not exceed pre-development rates and impacts.

3. NH DES should also implement other policies currently under consideration, such as NHCP's request that wetland permits include conditions requiring the applicant to fix any damage to the salt marsh caused by the stormwater inflow.

4. Regional Planning Commissions will support regulations at the local level could also be encouraged.

RESPONSIBLE PARTIES

State policy change to be accomplished by NHCP staff, with assistance from NH DES (Steps 1-3). Regional planning commissions, with assistance from NHCP, NHEP, and NH DES will encourage local regulatory changes (Step 4).

IMPLEMENTATION LOCATION

This action may be implemented in all 17 NH coastal communities with tidal frontage.

COSTS

No costs for policy changes, as work is to be done by existing staff.

FUNDING

Implementation and monitoring will add to NH DES workload and may require additional funds.

REGULATORY NEEDS

Changes to wetlands administrative rules may be required.

EXPECTED BENEFITS

Reduced damage and degradation of salt marshes.

MONITORING AND ENFORCEMENT

NH DES Wetlands Bureau.

TIMETABLE

This Highest Priority action will be initiated in 2001.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

TIDAL WETLANDS

PRIORITY

+++

ACTION LND-9B

Reduce the quantity, improve the quality, and regulate the timing of stormwater flow into tidal wetlands through changes to the NH DES Site Specific Program.

BACKGROUND

Current Site Specific Program regulations enable the state to require temporary and permanent erosion and stormwater control measures on development sites with land disturbance greater than 100,000 square feet (50,000 square feet in areas subject to the state Comprehensive Shoreland Protection Act). However, developers build some large development projects in a sequential lot-by-lot fashion so impacts are apportioned to individual lots, which can reduce the area disturbed at any one time to below the regulatory threshold. But once completed, the large development can have substantial stormwater impacts on adjacent areas.

ACTIONS/ACTIVITIES

This action calls for a change in the implementation of the Site Specific Program to ensure regulation of all sites with land disturbance greater than 100,000 square feet (50,000 square feet in areas subject to the state Comprehensive Shoreland Protection Act), even when projects employ impact/disturbance partitioning. The goal of this Action is to ensure the Site Specific regulations (stormwater and erosion controls on large developments) are applied as intended.

RESPONSIBLE PARTIES

NH DES would be the lead agency for this action.

IMPLEMENTATION LOCATION

This action may be implemented in all 17 NH coastal communities with tidal frontage.

COSTS

No additional costs, work would be done by existing staff.

REGULATORY NEEDS

Changes to Site Specific administrative rules may be required.

EXPECTED BENEFITS

Improved control of stormwater impacts from large developments.

MONITORING AND ENFORCEMENT

To be accomplished by NH DES Site Specific Program staff.

TIMETABLE

This Highest Priority action is expected to be initiated be 2004.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

TIDAL WETLANDS

PRIORITY

++

ACTION LND-10

Using the Coastal Method and other techniques, identify and restore additional restorable tidal wetlands.

Tidal wetlands are often degraded as a result of land-use decisions such as siting development projects adjacent to tidal wetlands, or constructing roadways that limit tidal flow to and from wetlands. In Chapter 7: Habitat Restoration, Action RST-2 proposes a restoration strategy to address the legacy of land-use decisions that have destroyed or degraded tidal wetlands.

TIDAL WETLANDS

PRIORITY

++

ACTION LND-11

Create a list of potential wetland restoration projects that could be used for wetland mitigation projects, and distribute the list to state agencies and Seacoast municipalities.

Developers whose projects will cause some degree of wetland modification can be required to mitigate the alteration of wetlands by restoring other wetland areas. But local land-use decision-makers may not be aware of wetland restoration opportunities available for mitigation projects. A strategy to facilitate wetland mitigation is proposed in Chapter 7: Habitat Restoration, Action RST-5.

TIDAL WETLANDS

PRIORITY

+++

ACTION LND-12

Pursue restoration funding from the NH DOT, USDA/NRCS, US F&WS, and other sources.

Wetland restoration strategies are expensive. A strategy to secure funding for wetland restoration projects in coastal New Hampshire is proposed in Chapter 7: Habitat Restoration, Action RST-6.

ACTION LND-13

Provide a framework specific and appropriate to the New Hampshire Seacoast for defining and delineating urban and non-urban shoreland areas.

PRIORITY

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SHORELANDS

BACKGROUND

Many of the shoreland protection actions recommended in the *NHEP Management Plan* distinguish urban from non-urban areas – loosely defined as areas which are highly developed versus those that remain relatively undeveloped. But a clear, understandable, consistent, and practical method to determine and apply this distinction is needed.

ACTIONS/ACTIVITIES

Develop a standardized definition of urban and non-urban shoreland areas in the NHEP study area that municipalities can use to delineate these areas. This action might best be accomplished through a working group or project team that includes some local land-use officials, Strafford and Rockingham Planning Commissions, UNH Complex Systems Research Center, NH Office of State Planning, and NH Department of Environmental Services. Existing definitions should be sought and considered first, but new standards may need to be tailored to the conditions and needs of NH Seacoast communities. The resulting definition will be used in outreach efforts outlined in other Action Plans.

RESPONSIBLE PARTIES

The Strafford Regional and Rockingham Planning Commissions with assistance from UNH Complex Systems, NH OSP, and NH DES.

IMPLEMENTATION LOCATION

All of the 43 towns in the Great Bay and coastal watersheds would benefit from the delineation and definitions developed in this action.

COSTS

Estimated cost $5,000.

FUNDING

This action may be funded through US EPA NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP could also support this action. Local funds from regional planning commission dues or in-kind contributions toward the project may also be appropriate.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Will allow and support implementation of LND-14.

MONITORING AND ENFORCEMENT

None required.

TIMETABLE

Initiate by 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

++

PRIORITY

High Priority. Implementation of this action is necessary to fully implement Action LND-14.

ACTION LND-14

PRIORITY +++ SHORELANDS

Develop and implement an outreach program to encourage and assist communities in developing and adopting land-use regulations to protect undisturbed shoreland buffers.

ACTIONS/ACTIVITIES

Using the standardized definition for urban and non-urban areas from Action LND-13, increase the use of vegetated buffers of the following widths (with no new impervious surfaces and no cutting of vegetation) around surface waters:

- Non-urban freshwater shorelands: 100 feet or the width of the 100-year floodplain, whichever is more restrictive. Wider buffers should be encouraged for protection of wildlife habitat.
- Urban freshwater shorelands: Sufficient width to ensure no negative water quality impacts. Engineered solutions that produce equivalent water-quality protection are acceptable.
- Non-urban tidal shorelands: 300 feet from high tide as defined by state law or the 100-year floodplain, whichever is more restrictive. (Alternative approaches which produce similar results are acceptable.)
- Urban tidal shorelands: 100 feet from high tide as defined by state law, or an engineered solution that produces equivalent results.

These buffers are intended to supplement, not supersede, the Comprehensive Shoreland Protection Act (CSPA). Where the CSPA requires a 150-foot buffer in which some vegetation cutting can occur, the buffers proposed by this plan prohibit all cutting of vegetation and new impervious surfaces. NH OSP is working on a model ordinance for wetlands and surface waters that will include buffers and provide for requirements that vary depending on the degree of development. The specific buffer requirements in that ordinance may differ from the NHEP recommendations above, but the model ordinance will serve as a starting point and may be a useful substitute.

This Action should involve several steps:

1. Outreach professionals develop a clear rationale for protecting shoreland areas as a means of protecting water quality, habitat, and aesthetic qualities of the estuaries.
2. Develop tools such as model ordinances and land-use regulations, case studies, and illustrations of the benefits of natural buffers over engineered solutions. Pay special attention to simplifying and improving enforcement (outreach professionals).
3. Develop an outreach strategy to distribute these tools and materials and assist local governments in implementing the regulations (the outreach program outlined in Action Plan LND-5 may serve as a useful model) (outreach professionals).

4 Provide a review of regulations and land-use controls (RPCs)

5 Pilot-test the outreach strategy in a selected watershed (Outreach and RPCs)

6 Develop and implement training on the shoreland buffer ordinances for code-enforcement officials (Outreach and RPCs)

7 Create tax-incentive models to encourage buffer protection (OSP)

8 Find ways to identify and eliminate incentives to develop shoreland (OSP)

9 Begin with a pilot project in a single sub-watershed and/or town, and continue as appropriate (Outreach and RPCs)

RESPONSIBLE PARTIES

UNH Cooperative Extension and/or Regional Planning Commissions (RPCs) would be the lead implementers for outreach and training (Steps 1-6); RPCs for code work (Step 9); NH OSP for model ordinances and other tools (Steps 7-8). NROC will incorporate information into its outreach programs.

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds, particularly in communities with less developed shoreline areas.

COSTS

Code work and outreach (per community) in Steps 1-5	$20,000
Training sessions in Step 6	$5,000
Total	**$25,000**

Cost efficiencies would be gained if done in conjunction with sprawl and impervious surfaces Actions.

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP could also support this action. Local funds from regional planning commission dues or in-kind contributions toward the project may also be appropriate.

REGULATORY NEEDS

Could require changes to local land-use regulations.

EXPECTED BENEFITS

Improved protection of shorelands protects water quality, habitat, and aesthetic quality of the area.

MONITORING AND ENFORCEMENT

Evaluate the number of training sessions held, and the number of communities that incorporate buffers into their land-use regulations.

TIMETABLE

This Highest Priority action will be initiated in 2001.

+++

PRIORITY

Highest Priority. Initial phase of work on rationale and tools is not dependent on implementation of other actions listed in the *NHEP Management Plan*, but completion of Action LND-11 is important to the full implementation of this action.

SHORELANDS

PRIORITY
+++

ACTION LND-15

Support land conservation efforts in shoreland areas.

BACKGROUND

Freshwater and tidal shoreland areas are ecologically important for a number of reasons, including maintenance of water quality and habitat for a variety of wildlife. Many shorelands are also desirable places for development, which threatens the ecological integrity of waterbodies and habitat.

ACTIONS/ACTIVITIES

This action consists of several steps, some of which have already been done:

1. Identify and prioritize appropriate shoreland areas for protection.
2. Promote priorities with traditional land conservation groups.
3. Promote protection by communities by fee simple acquisition and/or easements.
4. Focus NHEP resources on protecting key areas by funding property appraisal and survey costs.

Several recent projects, most notably the Great Bay Resource Protection Partnership and the NHEP Critical Lands Analysis mapping effort, have focused on identifying important coastal watershed lands suitable for protection. These projects provide the information needed to identify and prioritize shoreland areas for protection. The NHEP will encourage conservation groups to include the results of these projects (particularly the NHEP Critical Lands Analysis) in their acquisition priorities.

The NHEP and/or Natural Resources Outreach Coalition will encourage protection of these areas by municipalities in the coastal watershed. The NHEP and/or Natural Resources Outreach Coalition will inform these communities about priority shoreland areas and the value of protecting them. Groups like the NH Wildlife Federation provide presentations on the value of open space and could be included in a larger outreach effort. Where appropriate, the NHEP should focus its funding resources on protection of key areas. This might involve using specific funds for purchases or easements, or for identifying funding sources for communities and/or conservation groups to use to protect specific areas.

This is largely an outreach effort using existing materials. It may also involve some research of funding options by either staff or a contractor.

RESPONSIBLE PARTIES

Land conservation organizations will take lead for promotion of NHEP land conservation goals. Great Bay Resource Protection Partnership (GBRPP), Land and Community Heritage Commission, Natural Resources Outreach Coalition, Strafford and Rockingham County Conservation Districts, Land Conservation Investment Program (LCIP), Land and Water Conservation Fund (LWCF) are responsible for land acquisition or easements.

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

Cost estimate for outreach efforts in Step 1-3	$15,000
Property survey and appraisal costs in Step 4 (varies with size of property)	$5,000 to $25,000
Acquisition of land and easements:	$millions

FUNDING

Outreach/education and survey and appraisal costs may be funded through US EPA NHEP implementation monies. Federal funds for land or easement acquisition may be available through NOAA and the Great Bay National Estuarine Research Reserve and various USFWS programs that target land acquisition for coastal habitat protection, and the USDA/NRCS Farmland Protection Program. State and local funds will play an important role in providing non-federal match, or the background research and legal work required for land or easement acquisition.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Increased acreage of protected shoreland would secure long-term protection of water quality, habitat, and aesthetic and other values.

MONITORING AND ENFORCEMENT

Evaluation by acreage of target areas protected.

TIMETABLE

This Highest Priority action will be initiated in 2001. It will also be emphasized through LND-27 which will be implemented in 2001-2002.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHORELANDS

PRIORITY
+++

ACTION LND-16

Improve enforcement of the state Comprehensive Shoreland Protection Act and other applicable shoreland protection policies through outreach efforts to local officials and shoreland property owners.

BACKGROUND

The effectiveness of the state Comprehensive Shoreland Protection Act (CSPA) is limited primarily by lack of thorough and consistent enforcement.

ACTIONS/ACTIVITIES

Develop an outreach program for code enforcement officers and building inspectors on the importance of the CSPA and other shoreland protection policies. NH DES will shift some of their education efforts toward these local officials, bringing outreach programs directly to the communities instead of through regional or statewide workshops. NH DES will include training in shoreland protection requirements and state resources available to assist in enforcement. Efforts might include support for increased outreach by NH DES to shoreland property-owners, both to improve compliance and to spur the awareness of abutters. The state should consider a toll-free phone number for the public to report violations.

This project should be conducted throughout the coastal watershed, starting with the 17 towns with tidal shoreline. The state Shoreland Protection Program's outreach and enforcement staff should coordinate with coastal outreach efforts, including the Natural Resources Outreach Coalition and the NH Coastal Program.

RESPONSIBLE PARTIES

NH DES Shoreland Protection Program would be the lead implementer of this action with assistance from the Natural Resources Outreach Coalition.

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds wherever the CSPA applies, starting with the 17 towns with tidal shoreline.

COSTS

Workshops for towns	$0
Outreach material and regional workshop	$5000
Total	**$5000**

FUNDING

US EPA NHEP implementation funds will be used in 2001-2002 with in-kind staff support from NH DES Shoreland Protection Program.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Improved enforcement of the state CSPA would protect water quality, habitat, and aesthetic values.

MONITORING AND ENFORCEMENT

Evaluate by the number of training sessions held.

TIMETABLE

This Highest Priority action will be implemented in 2001-2002.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHORELANDS

PRIORITY

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ACTION LND-17

Provide incentives for the relocation of grandfathered shoreland uses.

BACKGROUND

A considerable amount of shoreland development was in existence before enactment of the state Comprehensive Shoreland Protection Act (CSPA), and was exempted from the statute's requirements. Yet these sites often contribute significantly to water quality and habitat degradation. Targeting incentives to relocate these grandfathered uses could substantially improve the estuaries and other waterbodies to which the CSPA applies.

ACTIONS/ACTIVITIES

1 Study options for incentives to remove grandfathered uses that adversely affect waters subject to the CSPA (e.g., tax or regulatory relief, financial incentives, etc.).

2 Use the information gained to develop an implementation strategy. Where local government is involved, this Action could be coordinated with other planning outreach efforts in the *NHEP Management Plan*. This effort should focus on shoreland areas in the Great Bay and coastal watershed.

Step 1 involves researching and compiling incentive options. Step 2 involves working with individual municipalities to identify sites and develop a strategy for contacting the owners. This might best be done in conjunction with the sub-watershed pilot approach of the sprawl and impervious surfaces efforts of Action LND-1, et al. The municipalities would follow through, with assistance from NHEP or the Regional Planning Commissions.

RESPONSIBLE PARTIES

The NHEP will convene possible implementers such as the Strafford Regional and Rockingham Planning Commissions as well as NH OSP to discuss the work plan level detail associated with this action prior to its implementation.

IMPLEMENTATION LOCATION

This action may be implemented at grandfathered shoreland sites throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

Research in Step 1	$5000
Implementation in Step 2	$5000
Total	**$10,000**

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP will also support this action. Local funds from regional planning commission dues or in-kind contributions toward the project may also be appropriate.

REGULATORY NEEDS

None identified

EXPECTED BENEFITS

Improved condition, water quality, and habitat functioning of important shoreland areas.

MONITORING AND ENFORCEMENT

Evaluate on the number of grandfathered uses relocated.

TIMETABLE

Initiate by 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

++

PRIORITY

High Priority. While implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*, it could be implemented in conjunction with Actions LND-1, LND-2, et al.

GROUND-WATER

PRIORITY

+++

ACTION LND-18

Locate and quantify quantity and quality of groundwater inflow to the estuaries.

BACKGROUND

The quality of surface waters flowing into the state's estuaries receives considerable attention, but little is known about the impact of groundwater quality on the estuaries. Such knowledge could contribute to better management of the state's estuarine resources.

ACTIONS/ACTIVITIES

UNH/NOAA Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) is funding a three-year study of "Inflow and Loadings from Groundwater to the Great Bay Estuary." Study objectives are to:

- Quantify the characteristics of groundwater flows to Great Bay;
- Assess groundwater chemical loads to Great Bay;
- Integrate the information gathered with the groundwater data requirements of the ongoing Estuarine Contaminant Status and Forecasting System (ECOSTAFS) project, and propose a model that best represents the groundwater processes and will work with ECOSTAFS; and
- Assess the impact of water resource use and land uses on groundwater freshwater discharges to the estuary. This project focuses on the Great Bay area, however the methodology could likely be extended to other coastal NH areas.

The project uses analysis of water samples, remote sensing based on public domain and classified intelligence imagery, thermal infrared imaging, potentiometric measurement of groundwater flow in existing and newly drilled wells (located using military grade Global Positioning Systems), isotopic age-dating of water samples, and synthesis of a conceptual model to describe the link between groundwater flow and surface waters.

This project should be duplicated in Hampton-Seabrook Harbor.

RESPONSIBLE PARTIES

The NHEP will convene possible implementers such as UNH Civil Engineering Department, US Geological Survey, NH DES, Great Bay National Estuarine Research Reserve, UNH Jackson Estuarine Laboratory, and UNH/CICEET to discuss the work plan level detail associated with this action prior to its implementation.

COSTS

CICEET has already funded the Great Bay Study at $299,876.
Estimated $20,000 cost for extension to the Hampton-Seabrook Estuary, to be funded by NHEP.

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP could also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Greater understanding of the effect of groundwater quality and quantity on the state's estuarine systems.

MONITORING AND ENFORCEMENT

No requirements identified.

TIMETABLE

This Highest Priority action will be initiated by 2004.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

GROUND-WATER

PRIORITY

+++

ACTION LND-19

Locate, reduce, or eliminate – and also prevent – groundwater contaminants.

ACTIONS/ACTIVITIES

This action could be approached in two different ways.

1a One option is to wait for completion of Action LND-18 to identify potentially sensitive areas with respect to land use and preferential pathways for contaminants. Contaminant elimination work would then be focused on those sensitive areas.

1b The second option is to begin with a review and summary of existing information. The NH DES Waste Management Division and Source Water Protection Program could provide site assessments for contaminated sites, and lists of potential sources of contaminants within 4,000 feet of wellheads. NH DES's proposed Public Water Supply Land Conservation Program could help identify Source Water Protection Areas in the coastal watershed.

Preventing contamination should also be emphasized, especially in particularly sensitive areas (e.g., aquifers), as well as locating and eliminating sources of groundwater contamination. Prevention strategies could include stricter land-use controls, and land conservation measures.

2 Knowledge gained from these studies will be communicated to the public with outreach programs on groundwater issues. Outreach programs would include education to ensure compliance with groundwater protection BMPs. This may require adoption of a groundwater protection ordinance and/or changes in zoning regulations by municipalities.

RESPONSIBLE PARTIES

The NHEP will convene possible implementers, such as NH DES, coastal watershed municipalities, NHEP outreach, and Natural Resources Outreach Coalition, to discuss the work plan level detail for this action prior to implementation.

COSTS

Three months' time for a summer intern (Step 1a or 1b)	$4,000
0.1 full-time equivalent for education and compliance work at NH DES (Step 2)	$5,000
Total	**$9000**

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP could also support this action.

REGULATORY NEEDS

Prevention work may require some changes to local land-use regulations.

EXPECTED BENEFITS

Improved protection and quality of groundwater.

MONITORING AND ENFORCEMENT

Expected to be a joint state and local effort.

TIMETABLE

Initiate by 2004.

PRIORITY

+++ Highest Priority. Implementation of this Action is not dependent on implementation of other actions listed in the *Management Plan*, although information gained from Action LND-18 would be useful in targeting pollution elimination efforts to the most sensitive areas.

FRESHWATER WETLANDS

PRIORITY

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ACTION LND-20

Develop and implement a wetlands buffer outreach program for Planning Boards.

BACKGROUND

Buffers around wetlands give a greater level of protection to wetland value and function. Several state agencies and conservation organizations recently completed Buffers for Wetlands and Surface Waters: A Guidebook for N.H. Municipalities, to provide scientific justification and techniques for protecting and enhancing wetland buffers.

ACTIONS/ACTIVITIES

1. Update and focus existing buffer programs for use in the coastal area.
2. Distribute the buffer guide for municipalities.
3. Create a series of zoning regulation models for use by all towns in the coastal watershed.

RESPONSIBLE PARTIES

NHEP Outreach, UNH Cooperative Extension, NH OSP, USDA/NRCS, and Audubon Society of New Hampshire (Steps 1-2); Strafford and Rockingham Regional Planning Commissions (Step 3).

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

$12,000 for Steps 1-3.

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP could also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Enhanced protection of buffers around wetlands, resulting in greater protection of wetland function, water quality, and habitat.

MONITORING AND ENFORCEMENT

No requirements identified.

TIMETABLE

Initiate by 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

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PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

FRESHWATER WETLANDS

PRIORITY

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ACTION LND-21

Prevent the introduction of untreated stormwater to freshwater wetlands by enacting legislation giving NH DES authority to regulate stormwater discharge to wetlands.

BACKGROUND

The NH DES currently has authority to regulate dredge and fill in wetlands for the purpose of protecting the values and functions that wetlands provide. However, the introduction of stormwater to wetlands is not regulated. Large volumes of stormwater and the contaminants it typically carries can degrade the wetland functions that state law is intended to protect.

ACTIONS/ACTIVITIES

Pursue legislation to give NH DES statewide authority to prevent wetlands degradation from introduction of stormwater. Regulation of meltwater from snow piles and dumps should also be considered in developing this legislation.

RESPONSIBLE PARTIES

NH DES can be the lead implementer of this action.

IMPLEMENTATION LOCATION

This action will be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

None anticipated - to be accomplished by existing NH DES staff.

REGULATORY NEEDS

Change in statute and/or administrative rules.

EXPECTED BENEFITS

Enhanced protection of wetland function.

MONITORING AND ENFORCEMENT

To be accomplished with existing NH DES staff.

TIMETABLE

Initiate be 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

++

PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION LND-22

Prevent the introduction of untreated stormwater to wetlands by strengthening municipal site plan review regulations.

PRIORITY

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FRESHWATER WETLANDS

BACKGROUND

Local officials play a key role in land-use decisions. Some development projects can degrade wetlands through introduction of untreated stormwater. Such degradation can be avoided by requiring stormwater management provisions in local land-use regulations.

ACTIONS/ACTIVITIES

1. Develop site plan review regulations for coastal watershed municipalities to protect wetlands from stormwater degradation.
2. Conduct outreach to municipal boards
3. Implement new regulations locally

RESPONSIBLE PARTIES

Regional Planning Commissions will lead development of model regulations (Steps 1-3); Natural Resources Outreach Coalition will assume the lead for outreach (Step 2); municipal planning boards will implement site plan review regulations (Step 3).

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds..

COSTS

$5,000 to draft new site plan review regulations. No additional costs for outreach and assistance to communities, as this can be worked into existing educational efforts.

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other federal programs identified in Tables 10.1-10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP could also support this action.

REGULATORY NEEDS

Changes to local land use regulations.

EXPECTED BENEFITS

Enhanced protection of wetland function.

MONITORING AND ENFORCEMENT

To be accomplished through local land-use regulation.

TIMETABLE

Initiate by 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

++

PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION LND-23

Prevent the introduction of untreated stormwater to wetlands through an increased understanding of stormwater impacts on wetland ecology.

PRIORITY

+

FRESHWATER WETLANDS

BACKGROUND

Much research has been conducted on the value and function of wetlands. However, better understanding of the impacts of human activities on wetlands – such as how the quantity and quality of stormwater introduced to wetlands affect the wetlands and the wildlife that use them – would contribute to developing more effective stormwater management regulations.

ACTIONS/ACTIVITIES

Develop a research project to increase our understanding of wetlands and the impacts associated with the introduction of stormwater, focusing on the towns closest to tidal waters.

RESPONSIBLE PARTIES

The NHEP will convene possible implementers such as UNH, NH Association of Wetland Scientists, and the Audubon Society of New Hampshire to discuss the work plan level detail associated with this action prior to its implementation.

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

Research project	$200,000

FUNDING

This action may be funded in small part through US EPA NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Greater understanding of wetlands and the effects of stormwater introduced to wetlands, leading to more effective management of stormwater impacts on wetlands.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

Initiate by 2007. This Priority action will be pursued as funds and resources become available.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION LND-24

Work with NH DES to encourage adoption of a state wetlands mitigation policy.

PRIORITY

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FRESHWATER WETLANDS

Action LND-7 presents a complete development of this action in the context of tidal wetlands. Provisions for freshwater wetlands are also presented in the "Recommended New Hampshire Wetland Mitigation Policy" cited in Action LND-7. This action, LND-24, seeks to include coastal area freshwater wetlands in state rulemaking and wetlands mitigation policy implementation.

FRESHWATER WETLANDS

PRIORITY

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ACTION LND-25

Encourage municipal designation of Prime Wetlands and 100-foot buffers or equivalent protection.

BACKGROUND

Designation of non-tidal Prime Wetlands (or equivalent protection) provides additional protection to wetlands of exceptional value through the state wetlands permitting process.

ACTIONS/ACTIVITIES

Assist communities through a series of steps (LND-25A - 25D) in designating Prime Wetlands, or in developing other means of giving enhanced protection to exemplary wetlands.

RESPONSIBLE PARTIES

The NHEP will convene possible implementers such as NH OSP, NH DES, the Strafford Regional and Rockingham Planning Commissions, and the Audubon Society of New Hampshire to discuss the work plan level detail associated with this action prior to its implementation.

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

Total cost for full implementation of Actions 25A-25D in one town is estimated at $35,000, but will vary on a town by town basis depending on the amount of existing information, availability of volunteers, etc.

TIMETABLE

Initiate by 2005 (LND-25B will be initiated by 2004).

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PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION LND-25A

Create a traveling Prime Wetlands display.

PRIORITY

FRESHWATER WETLANDS

BACKGROUND

Few coastal watershed communities have elected to pursue Prime Wetlands designation. This Action Plan is designed to educate local officials and the public about the purpose and benefits of Prime Wetland designation.

ACTIONS/ACTIVITIES

Develop a traveling display and public presentation for coastal watershed communities to increase public understanding and appreciation of Prime Wetlands.

RESPONSIBLE PARTIES

Audubon Society of New Hampshire will be the lead implementer with assistance from NHEP and NH DES Wetlands Bureau.

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

Static display $750; public presentation per town approximately $200/town.

FUNDING

US EPA NHEP implementation funds or NH Coastal Program grants program funds could be used to implement this Action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Improved understanding of the Prime Wetlands designation process.

MONITORING AND ENFORCEMENT

No requirements identified.

TIMETABLE

Initiate be 2007.

PRIORITY

Priority. Implementation of this action is not considered to be important to achieving the overall intent of Action LND-25.

FRESHWATER WETLANDS

PRIORITY +++

ACTION LND-25B

Provide training and project assistance for towns interested in utilizing the Method for the Comparative Evaluation of Non-tidal Wetlands in New Hampshire.

BACKGROUND

The first step in designating non-tidal Prime Wetlands is evaluating the value and function of some or all wetlands in a town, in order to identify exemplary wetlands. The NH Method is a comparative wetland evaluation method designed for this task.

ACTIONS/ACTIVITIES

Provide technical assistance to all coastal watershed towns in conducting wetland evaluations to identify exemplary wetlands.

RESPONSIBLE PARTIES

Audubon Society of New Hampshire as lead, with assistance from Regional Planning Commissions, USDA Natural Resources Conservation Service, Strafford and Rockingham County Conservation Districts, and the UNH Complex Systems Research Center and students.

IMPLEMENTATION LOCATION

This action may be implemented wherever non-tidal wetlands occur throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

$5,000 to $12,000/town depending on volunteer and/or student involvement.

FUNDING

This project may be funded with federal US EPA-NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.6 of this document.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Better understanding of the value and function of particular wetlands, and increased likelihood of some of them receiving greater protection.

MONITORING AND ENFORCEMENT

No requirements identified.

TIMETABLE

This Highest Priority action will be initiated be 2004.

+++

PRIORITY

Highest Priority. Implementation of this action is considered to be important to achieving the overall intent of Action LND-25.

ACTION LND-25C

Work with local planning boards and conservation commissions on regulatory approaches to wetlands conservation.

PRIORITY

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FRESHWATER WETLANDS

BACKGROUND

Local land-use officials play an important role in protecting wetlands in many ways, including incorporating wetland protection into local ordinances, and commenting on wetland projects being considered for state permits. Certain local wetland protection measures are often more strict than state protection (e.g., local requirements for buffers around freshwater wetlands).

ACTIONS/ACTIVITIES

1. Provide local planning boards with community land-use regulation options for protecting wetland values (RPCs and NROC)
2. Audubon Society of NH will provide training to conservation commissions on how to work with state wetland permit applicants prior to formal application, to minimize wetland impacts of proposed projects on wetlands.

RESPONSIBLE PARTIES

Regional Planning Commissions and the Natural Resources Outreach Coalition (Step 1). Audubon Society of New Hampshire and NH DES Wetlands Bureau may provide conservation commission training (Step 2).

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

$8,000 - $10,000 for Steps 1 and 2.

FUNDING

This action may be funded through US EPA NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. The NH Coastal Program and NH DES may be sources of additional funding.

REGULATORY NEEDS

None identified, but implementation of the action could lead to changes in local land-use regulations.

EXPECTED BENEFITS

Greater protection of wetland value and function.

MONITORING AND ENFORCEMENT

No requirements identified.

TIMETABLE

Initiate in 2005.

++

PRIORITY

High Priority. Implementation of this action is considered to be moderately important to achieving the overall intent of Action LND-25.

ACTION LND-25D

Create and/or enhance local land conservation programs with emphasis on high-value wetlands and buffers.

PRIORITY ++

FRESHWATER WETLANDS

ACTIONS/ACTIVITIES

After undertaking a wetlands evaluation project as outlined in Action LND-25B, train coastal watershed conservation commissions and local land trusts in land conservation techniques. Involve regional and/or statewide land conservation experts in the effort.

RESPONSIBLE PARTIES

The NHEP will convene possible implementers such as Conservation Commissions, Local Land Trusts, Great Bay Resource Protection Partnership, Strafford and Rockingham County Conservation Districts, and Society for Protection of New Hampshire Forests, to discuss the work plan level detail associated with this Action prior to its implementation.

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

$12,000.

FUNDING

This action may be funded through US EPA NHEP implementation funds, or through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Enhanced capacity for land conservation.

MONITORING AND ENFORCEMENT

No requirements identified.

TIMETABLE

Initiate by 2005.

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PRIORITY

High Priority. Implementation of this action is considered to be moderately important to achieving the overall intent of Action LND-25.

HABITAT PROTECTION

PRIORITY +++

ACTION LND-26

Support implementation of state and federal land protection programs (e.g., Conservation and Reinvestment Act, Land and Community Heritage, Teaming With Wildlife, Land and Water Conservation Fund, Coastal Initiative Program, Farmland Protection Program).

BACKGROUND

Loss and alteration of wildlife habitats is recognized as one of the greatest threats to New Hampshire's environment. Habitat loss and alteration is especially problematic in New Hampshire's Seacoast region. Annual loss of forest land to development over the last 30 years is estimated at 1,000 and 3,000 acres (.2 and .5%) in Strafford and Rockingham counties respectively, totaling approximately 15%.

One way to protect habitat is to increase the amount of permanently protected conservation lands in the region. This requires a stable funding source that will allow governments and environmental organizations to purchase ecologically important lands, or conservation easements on such lands, from willing sellers. The New Hampshire Land and Community Heritage Program is considering options to create a permanent source of state funding to leverage federal and private funds for protection of both natural and cultural resources important from a state, regional, or community perspective.

The U.S. Congress is considering programs to fund land protection and other environmental projects. If adopted, the Conservation and Reinvestment Act of 1999 could provide significant financial resources to natural resource research and protection in the coming years through three programs:

- Teaming With Wildlife would help fund projects to increase our understanding of nongame wildlife and to assist in the purchase of important habitat areas;
- The Land and Water Conservation Program would also help the state and municipalities purchase lands for recreation and natural resource preservation;
- The Coastal Initiative Program could provide funds to use for natural resource protection in the coastal zone.

ACTIONS/ACTIVITIES

1. Develop a slide show and displays to inform New Hampshire citizens about the opportunities the proposed programs would offer, and to encourage support and involvement.
2. Display the developed materials at appropriate locations (e.g., libraries, town halls, Sandy Point Center, Seacoast Science Center, etc.) throughout the New Hampshire Seacoast.
3. Educate citizens interested in habitat protection and land conservation.

RESPONSIBLE PARTIES

The New Hampshire Citizens for Land and Community Heritage would act as lead implementer with assistance from environmental, cultural and historical non-profit organizations (Steps 1-6); Strafford and Rockingham County Conservation Districts; the New Hampshire Coastal Program; New Hampshire Fish and Game Department; New Hampshire Department of Resources and Economic Development; and New Hampshire Department of Environmental Services, UNH Cooperative Extension (Steps 5-6).

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

Program development in Step 1	$5,000
Program scheduling and presentation in Step 1 and 2	$5,000
Total	**$10,000**

FUNDING

Funding to support the NH Citizens for Land and Community Heritage was secured from various sources during 1990-2000. Additional monies may be available through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. Other possible funding sources would include private foundations.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

- Permanent protection of important historical, cultural and natural sites.
- Involvement of local communities in protecting resources.

MONITORING AND ENFORCEMENT

None required.

TIMETABLE

NHEP will monitor ongoing activities of LCHIP and initiate additional activities as necessary by 2004.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

HABITAT PROTECTION

PRIORITY

+++

ACTION LND-27

Support the efforts of the Great Bay Resource Protection Partnership.

BACKGROUND

The Great Bay Partnership was formed in 1994 by federal and state agencies and the four largest statewide environmental organizations with a goal of protecting important wildlife habits in the Great Bay and coastal areas of New Hampshire. The Partnership has completed a detailed regional habitat analysis and developed a list of priority areas for protection. Land protection work has begun in towns around the Great Bay with funds from the North American Wetland Conservation Fund and the National Oceanic and Atmospheric Administration (through the Great Bay National Estuarine Research Reserve).

The Partnership's efforts are coordinated by a part-time staff person working in the Seacoast. This person facilitates communication between partners and with local land trusts and municipal governments, as well as managing special projects that improve land protection and management activities in the region.

The Partnership plans to continue to support biodiversity by seeking funds from a variety of sources, and working on protecting and managing lands in priority areas.

ACTIONS/ACTIVITIES

1. State agencies, UNH Cooperative Extension and Audubon Society of New Hampshire provide assistance to municipalities in completing three community-based habitat assessments per year to provide the Partnership with increased habitat value information.
2. State agencies assist Partnership in securing funding to maintain a coastal staff coordinator.
3. Local land trusts and conservation commissions work in their respective focus areas in cooperation with the Partnership to increase their success rate.

RESPONSIBLE PARTIES

The New Hampshire Fish and Game Department, with the Great Bay National Estuarine Research Reserve that hosts the Great Bay Partnership, is the agency administrator (Step 2). Other groups supporting the Great Bay Resource Protection Partnership are: Regional Land Trusts, local Conservation Commissions, UNH Cooperative Extension (Step 1), Audubon Society of New Hampshire (Step 1), New Hampshire Estuaries Project, and New Hampshire Coastal Program (Steps 1, 3).

IMPLEMENTATION LOCATION

This action may be implemented throughout the Great Bay watershed.

COSTS

Community Habitat Assessment in Step 1	
$8,000/town for 3 towns per year	$24,000
Partnership Coordinator Position per year	$25,000
Total	**49,000**

FUNDING

This action will be funded with US EPA-NHEP implementation funds in 2001-2002. Funding sources for protection of conservation lands include current member organizations of the Great Bay Resource Protection Partnership.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

- Increased acreage of permanently protected conservation lands.
- Increased understanding of habitat values in NHEP focus area.
- Greater cooperation among land protection agencies and organizations.
- Greater protection of New Hampshire's biodiversity and important habitats

MONITORING AND ENFORCEMENT

None required.

TIMETABLE

This Highest Priority action will be implemented in 2001-2002.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*, though it is related to Actions LND-13 and LND-36.

HABITAT PROTECTION

PRIORITY +++

ACTION LND-28

Encourage towns to dedicate current-use change tax penalties to conservation commissions for the purpose of natural resource acquisition, easements, restoration, and conservation land management.

BACKGROUND

The current use program was created by state law (RSA 79-C) to encourage the preservation of open space by providing tax incentives to landowners. If a landowner removes his or her property from the current-use program the owner must pay a penalty tax to the local tax collector based on the time the property has been in the program. The statute allows the municipality to use all or a portion of these funds for land conservation. Town meeting or city council must approve this provision of the statute for it to take effect in a municipality.

Conservation commissions can use these current-use change tax penalties to help establish a fund for local land conservation that is directly related to the land development pressures in their community. As more properties are removed from the current-use tax program and converted to other uses, the money available for conservation will increase as the need to protect open space becomes more critical.

Most government land protection funding programs require a local match. Having these funds available for land conservation gives municipalities leverage to seek those governmental funds.

ACTIONS/ACTIVITIES

1. Develop materials and inform municipal officials about the use of the current-use change penalty for land conservation. Include the reasons to dedicate current-use change penalty funds for conservation, such as the positive impacts of open space on municipal budgets. Materials should be designed to encourage all towns to set up a current-use change penalty fund in their budgets dedicated to conservation-related activities.
2. Develop and implement an outreach strategy to reach all Seacoast region communities with information on this provision for Current-Use change tax funds.
3. Create a model warrant article for town meeting approval.

RESPONSIBLE PARTIES

The New Hampshire Association of Conservation Commissions could act as the lead implementer (Steps 1-3), with assistance from the NH Wildlife Federation, New Hampshire Estuaries Program, UNH Cooperative Extension, Strafford and Rockingham County Conservation Districts, Great Bay Resource Protection Partnership, and the New Hampshire Coastal Program (Steps 1-3).

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

Development of outreach materials in Step 1	$4,500
Community outreach in Step 2	$20,000
Model warrant article in Step 3	no cost
Total	**$24,500**

FUNDING

The NHEP has allocated $24,500 of its current implementation funds for this project. Additional money may be available through other federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*.

REGULATORY NEEDS

None required.

EXPECTED BENEFITS

- Additional funding for local land protection efforts.
- Protection of additional land to support New Hampshire's biodiversity.
- Recreation opportunities and open space for community enjoyment.

MONITORING AND ENFORCEMENT

None required.

TIMETABLE

This Highest Priority action will be initiated by 2004.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

HABITAT PROTECTION

PRIORITY

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ACTION LND-29

Provide technical assistance in land protection and management to regional land trusts and municipal conservation commissions.

BACKGROUND

Conservation lands should be managed to maximize their capacity to support natural biodiversity in the coastal region, whether owned and managed by federal to town governments or other agencies or organizations.

A number of federal, state, and private groups with land protection expertise could assist others involved in land protection. A new land management system must be developed to help implement the goals of the New Hampshire Ecological Reserve System (ERS) Project, a public-private program to enhance ecological conservation in the state. This will help manage lands for support of the great diversity of plants and animals in this area of expanding human population and development.

ACTIONS/ACTIVITIES

1. Develop management guidelines and incentives for land trusts to engage in supporting the goals of the New Hampshire Ecological Reserve System Project.
2. Develop program to assure local land trusts and conservation commissions have access to land protection, management, and monitoring expertise, to help them protect and manage lands for biodiversity.
3. Use the Ecological Reserve System selection and design criteria to evaluate conservation and non-conservation lands for biodiversity features in collaboration with interested landowners.
4. Work with academic institutions to evaluate the impacts of land-use changes on environmental quality and the capacity to conserve the region's biodiversity.

RESPONSIBLE PARTIES

The New Hampshire Ecological Reserves Project will act as the lead implementer of this action (Steps 1-4), with assistance from New Hampshire Fish and Game Department, New Hampshire Chapter of The Nature Conservancy, Audubon Society of New Hampshire, Strafford and Rockingham County Conservation Districts, NH Department of Resources and Economic Development Division of Forest and Lands, Great Bay Resource Protection Partnership, Society for the Protection of New Hampshire Forests, UNH Cooperative Extension, University of New Hampshire, US Environmental Protection Agency, US Fish and Wildlife Service, and USDA Natural Resources Conservation Service.

IMPLEMENTATION LOCATION

This action may be implemented throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

Guidelines and incentives for land trusts in Step 1	$10,000
Technical assistance to land trusts in Step 2	$15,000
Screen lands using Ecological Reserve System criteria (5 lands/yr) in Step 3	$10,000
Management and development of public use guidelines in Step 3	$15,000
Land use impact research in Step 4	$25,000
Total	**$75,000**

FUNDING

Possible funding sources include: EPA sustainability grant, private foundations, US Fish and Wildlife's Teaming With Wildlife, New Hampshire Coastal Program grant program, New Hampshire Estuaries Project, and New Hampshire Fish and Game Department

REGULATORY NEEDS

None required.

EXPECTED BENEFITS

- More effective local and regional land protection and management projects.
- Management of lands to support biodiversity.

MONITORING AND ENFORCEMENT

None required.

TIMETABLE

Step 1 initiated in 2001 by ERS. Steps 2-3 initiated by 2005.

++

PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

HABITAT PROTECTION

PRIORITY

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ACTION LND-30

Develop and encourage use of biomonitoring standards to evaluate water quality.

BACKGROUND

The quality of the surface waters in the coastal region directly affects the ability of those waters to support the full array of wetland, aquatic, and estuarine species that rely on them. Much work has been done over the last 30 years to improve the quality of these waters. Much monitoring done to assess and track water quality trends looks at physical and chemical properties of water, including measuring the presence of nutrients, chemicals, and suspended particles in the water.

To gain a better perspective on the habitat values of surface waters, we need to look at the biological component in our waters as well as the physical and chemical. Biological monitoring is currently used in many places including some in New Hampshire. Gaining knowledge of the invertebrates and vertebrates present in water will help us learn more about the impact of chemical and physical changes on living things. It will provide an additional way to measure the impact of water quality on habitat, and a basis for recommending changes to improve the habitat value of these waters.

ACTIONS/ACTIVITIES

1. Investigate active biomonitoring programs in the Northeast.
2. Develop biomonitoring standards for the New Hampshire coastal region. Develop standards for use in the freshwater environments of coastal New Hampshire watersheds, which involves three general tasks:
   - Collect data across the state to develop biomonitoring standards (this activity is currently being done by NH DES).
   - Develop a stream classification system largely based on stream morphological characteristics.
   - Develop biomonitoring standards based on the adopted stream classification system.
3. Incorporate standards into existing water-quality monitoring programs.

RESPONSIBLE PARTIES

The NH Department of Environmental Services will be lead implementer of this action (Steps 1-3)

IMPLEMENTATION LOCATION

The information and standards developed in this action could be applied to surface waters throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

Existing NH DES staff and resources can accomplish most of these tasks (Steps 1-3), although the development of criteria would be substantially boosted through the collection of data as outlined in Action LND-3.

REGULATORY NEEDS

Possible changes to NH DES statutes and/or administrative rules relative to stream classification standards.

EXPECTED BENEFITS

New and more accurate methods to assess stream condition.

MONITORING AND ENFORCEMENT

To be accomplished by NH DES.

TIMETABLE

Initiate be 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

++

PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*, but would be substantially enhanced through the completion of Action LND-3.

HABITAT PROTECTION

PRIORITY

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ACTION LND-31

Use results of biomonitoring and water quality monitoring to prioritize watershed areas for protection and remediation.

BACKGROUND

Developed and adopted biomonitoring criteria (see Action LND-30) are useful for a wide range of purposes including evaluating overall health of a particular watershed, identifying specific stream reaches in need of strengthened enforcement of environmental laws, and identifying specific areas needing restoration.

ACTIONS/ACTIVITIES

1. As Action LND-30 nears completion, NH DES develops a plan for evaluating coastal NH watersheds, which is expected to take one to two years to complete.
2. Use the biomonitoring standards developed in Action LND-30 to evaluate the overall health and ecological integrity of coastal NH watersheds and streams.
3. Use the information gained to help identify and prioritize watershed areas for protection and remediation efforts.

RESPONSIBLE PARTIES

The NH Department of Environmental Services would be lead implementer of this action (Steps 1-3).

IMPLEMENTATION LOCATION

Biomonitoring standards could be applied throughout the 43 towns in the Great Bay and coastal watersheds.

COSTS

Two full-time staff (salary, benefits, supplies, etc.) at NH DES in Steps 1-3	$120,000
Two summer interns in Step 2	$6,000
Total	**$126,000**

FUNDING

Some or all of these costs could be absorbed by the current NH DES Biomonitoring Program. Additional monies might be secured through US EPA NHEP implementation funds or through other federal programs identified in tables 10.1 to 10.5 in the *NHEP Management Plan*. State funds available through other natural resource management agencies such as NH OSP will also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Greater understanding of the environmental quality of coastal NH watersheds.

MONITORING AND ENFORCEMENT

To be accomplished by NH DES.

TIMETABLE

Initiation to follow LND-30.

++

PRIORITY

High Priority. Implementation of this action is dependent on the completion of Action LND-30 of the *NHEP Management Plan*.

HABITAT PROTECTION

PRIORITY
+++

ACTION LND-32

Encourage municipalities to incorporate wildlife habitat protection into local master plans by promoting NH Fish and Game's *Identifying and Protecting Significant Wildlife Habitat: A Guide for Towns,* and other activities.

BACKGROUND

Local land-use officials are in a position to guide future development and protect wildlife habitat in their towns. A regional habitat evaluation has been completed by the Great Bay Resource Protection Partnership, but more information specific to each town or city would be useful in developing or revising local master plans. The first step is community-based habitat evaluations to identify and prioritize significant habitats that should be recognized in master plans. The new publication Identifying and Protecting Significant Wildlife Habitat: A Guide for Towns (a.k.a., Community Habitat Manual), from the New Hampshire Fish and Game Department's Nongame and Endangered Species Program, will provide guidance to local conservation commissions and planning boards in identifying and prioritizing habitat. Community-specific wildlife information will strengthen a town's ability to address habitat protection and balance this need with growth.

ACTIONS/ACTIVITIES

1. Prioritize municipalities for application of the Community Habitat Manual based on community interest.
2. Provide technical assistance to coastal watershed communities in evaluating and prioritizing wildlife habitats.
3. Develop model wildlife habitat format for local master plans.
4. Develop and implement training programs for planning boards, conservation commissions and regional planners in using the Community Habitat Manual.

RESPONSIBLE PARTIES

The New Hampshire Fish and Game Department (Steps 1-2) and Strafford Regional and Rockingham Planning Commissions (Steps 3-4) would be lead implementers of this action, with assistance from UNH Cooperative Extension, New Hampshire Coastal Program, Audubon Society of New Hampshire, and Natural Resources Outreach Coalition.

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds.

COSTS

Municipal Prioritization in Step 1	No cost
Master Plan Habitat Model in Step 2	$2,500
Training Program in Step 4	$8,000
Total	**$10,500**
Technical Assistance in Step 2	$4,000/municipality

FUNDING

Possible funding sources include: New Hampshire Estuaries Project, New Hampshire Coastal Program Grant Program, US Fish and Wildlife's Teaming With Wildlife, and private foundations.

REGULATORY NEEDS

None required.

EXPECTED BENEFITS

- Identification of significant local wildlife habitats.
- Increased awareness and understanding of wildlife habitat identification and value by local and regional officials and citizens.
- Recognition of wildlife habitat as an important feature to be integrated into local planning decisions

MONITORING AND ENFORCEMENT

None required.

TIMETABLE

This Highest Priority action will be initiated by 2004.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

HABITAT PROTECTION

PRIORITY +++

ACTION LND-33

Develop a model local planning approach to encourage the identification and maintenance of contiguous habitat blocks.

BACKGROUND

Human use and development of land breaks the contiguous expanses of habitat in which most of our native plants and animals evolved into smaller patches isolated by roads, development, utility corridors and intensive agriculture. This development and fragmentation also directly decreases overall habitat area. Wildlife are affected through direct mortality from roadkill, increased predation, and decreased productivity due to disturbance and nest predation. Loss of species particularly sensitive to these problems can change the structure and function of the ecosystem.

The Seacoast region has the second highest road density (measured as road miles per 1,000 acres) in the state. The coastal watershed's average forest-patch size of 55.6 acres is second smallest in New Hampshire. Only 14 forest patches larger than 500 acres survived in Rockingham County in 1996. The Seacoast region also has the highest percentage of land cover defined as urban (18.7%) and the highest population density (0.72 people/acre) in New Hampshire. Whether and how Seacoast towns focus growth to protect remaining large contiguous habitat blocks will determine the future for many sensitive species in the region.

ACTIONS/ACTIVITIES

1. Review available region-wide information to identify existing habitat blocks over 500 acres (including the NHEP Critical Lands Analysis maps).
2. Research how maintenance of the contiguous habitat blocks has been approached in other areas of the country or world.
3. Develop a model approach to habitat protection.
4. Educate town officials about the importance of large, contiguous habitat blocks.
5. Ensure coordination of planning model for contiguous blocks of habitat with the regional anti- sprawl growth plan (see LND-6A).
6. Review state actions that influence sprawl for compliance with the state sprawl initiative (see LND-6).

RESPONSIBLE PARTIES

The NHEP will convene possible implementers such as New Hampshire Fish and Game Department, NH DRED/New Hampshire Natural Heritage Inventory, UNH Cooperative Extension, The Nature Conservancy, Audubon Society of New Hampshire, UNH Cooperative Extension, Strafford and Rockingham County Conservation Districts, municipal conservation

commissions, and planning boards to discuss the work plan level detail associated with this action prior to its implementation (Steps 1, 3).

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds.

COSTS

Review of fragmentation status in Step 1	$2,000
Research new approaches in Step 2	$6,000
Municipal outreach in Step 4	(covered by LND-5)
Model approach in Step 3	No cost
State action review in Step 6	No cost
Integration with anti-sprawl growth plan in Step 5	$8,000
Total	**$16,000**

FUNDING

Possible funding sources include EPA Sustainable Development Challenge Grant, New Hampshire Estuaries Project, New Hampshire Coastal Program Grant Program, US Fish and Wildlife's Teaming With Wildlife, Private Foundations.

REGULATORY NEEDS

Pass legislation that allows towns to include biodiversity protection in their land-use regulations.

EXPECTED BENEFITS

- Preservation of habitat areas for sensitive species.
- Increased awareness of the problems resulting from fragmentation of habitat.
- Creation of a model for focusing discussion of growth and biological diversity in the coastal region.
- Creation of a model for towns and cities interested in considering wildlife habitat in land-use decisions.

MONITORING AND ENFORCEMENT

None required

TIMETABLE

This Highest Priority action will be initiated by 2004.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*, but would be enhanced by implementation of LND-6A.

HABITAT PROTECTION

PRIORITY

++

ACTION LND-34

Encourage appropriate buffers around important wildlife areas and rare or exemplary natural communities.

BACKGROUND

The value of buffers for protecting water quality is well understood, and reflected in a number of town and state regulations. Less understood is the importance of buffers to protect sensitive wildlife habitats and natural communities. Increasing distance from human disturbance increases the value of habitat, and limits both the direct and secondary impacts of human presence – light and chemical pollution, and increased predation by species associated with human development (e.g., dogs, cats, raccoons, skunks).

Buffer requirements for individual species are well known, but it is impossible to specify a single buffer width that will prove adequate for all species. Many species - such as moose, bear, wood turtles, and wild turkeys - range over large areas and use a variety of habitat types. One approach is to identify important habitat areas including, but not limited to wetlands, travel corridors, riparian areas, and vernal pools. Guidelines specific to species and natural-communities will be provided to local communities for these sensitive areas found in southeastern New Hampshire.

ACTIONS/ACTIVITIES

1. Once important wildlife habitat areas have been identified (see LND-32), map these locations of rare and exemplary natural communities and determine appropriate buffers.

2. Work with conservation commissions to adopt appropriate buffers into local zoning ordinances

3. Work with private landowners to create adequate buffers to protect priority areas.

RESPONSIBLE PARTIES

The NHEP will convene possible implementers such as New Hampshire Fish and Game Department, NH DRED/New Hampshire Natural Heritage Inventory, UNH Cooperative Extension, The Nature Conservancy, Audubon Society of New Hampshire, UNH Cooperative Extension, Strafford and Rockingham County Conservation Districts, municipal conservation commissions, and planning boards to discuss the work plan level detail associated with this action prior to its implementation (Step 1, 3).

Strafford Regional and Rockingham Planning Commissions will be responsible for editing and redrafting zoning regulations ordinances that establish buffers around exemplary natural communities (Step 2).

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds.

COSTS

Priority area identification	See Action LND-32
Adoption of zoning ordinances in Step 2	No cost
Private landowner agreements in Step 3	No cost
Redrafting zoning regulations in Step 2	$5,000
Total	**$5,000**

FUNDING

Possible funding sources include New Hampshire Estuaries Project, New Hampshire Coastal Program grant program, US Fish and Wildlife's Teaming With Wildlife, and private foundations.

REGULATORY NEEDS

Adoption of local zoning ordinances.

EXPECTED BENEFITS

- Increased awareness of the need for protection of wildlife habitat and natural communities.
- Enhanced protection of significant areas through buffering.

MONITORING AND ENFORCEMENT

None required.

TIMETABLE

Target initiation by 2005, but coordinate with completion of LND-25 and LND-32.

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PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*, but is related to numerous other actions including LND-25A- D, LND-32 and other actions related to habitat goals, fresh and tidal wetlands, and more.

HABITAT PROTECTION

PRIORITY +++

ACTION LND-35

Maintain the current-use tax program.

BACKGROUND

The current-use taxation program was created by state law (RSA 79-C) to encourage preservation of open space by providing tax incentives to landowners who keep their lands under the current open-space land use. This program has been widely accepted and used by landowners all around the state. Despite many attempts in recent years to change or eliminate this program, it enjoys tremendous support from state agencies, local conservation commissions, environmental organizations, the timber industry, and private landowners. Statewide Program of Action to Conserve our Environment (S.P.A.C.E.) is a watchdog and lobbying organization working to ensure the current-use program is maintained. The changing state tax structure may necessitate a review of the law to ensure it continues to serve its intended purpose of protecting open space.

ACTIONS/ACTIVITIES

1. Keep state legislators aware of the importance of the current-use program to protecting open space in New Hampshire.
2. Track proposed changes to the current-use program.
3. Assess the role of the program in the state's changing tax structure.

RESPONSIBLE PARTIES

The NHEP will convene possible implementers such the Audubon Society of New Hampshire, the Society for the Protection of NH Forests, S.P.A.C.E., and The Nature Conservancy to discuss the work plan level detail associated with this action prior to its implementation.

COSTS

State legislator contact, tracking legislative changes to current use in Step 1	No cost
Assessing role of program in Step 3	$3,000
Total	**$3,000**

FUNDING

This action may be funded through US EPA NHEP Implementation funds. State funds available through natural resource management agencies could also support this.

REGULATORY NEEDS

Currently none but will require further study.

EXPECTED BENEFITS

Protection of habitat, water quality, and other community and regional values by maintaining privately owned open space.

MONITORING AND ENFORCEMENT

None required

TIMETABLE

This Highest Priority action will be initiated be 2004.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

HABITAT PROTECTION

PRIORITY +++

ACTION LND-36

Encourage conservation easements.

BACKGROUND

Open space for habitat can be protected through two different approaches. One is through state and local regulatory controls, the other is a non-regulatory, voluntary approach using land acquisition and conservation easements. A conservation easement is an agreement between a private landowner and a government, natural resource agency, or organization in which the owner (grantor) transfers certain rights to his or her property (e.g., right to sub-divide or develop the land and the right to mine sand, gravel or other minerals) by deed to the agency or organization (grantee). The owner (grantor) retains all other ownership rights to the land. This sale or gift of development rights ensures that property will remain as open space in perpetuity.

Conservation easements offer advantages for both the community and the landowner. Land protected through a conservation easement remains in private ownership and on municipal tax rolls. The landowner continues to own, maintain, and use the land consistent with terms of the easement, including for timber or agricultural management. Easements provide wildlife habitat and water quality protection, aesthetic values, and possibly recreational opportunities to the community and the environment in perpetuity.

ACTIONS/ACTIVITIES

1. Collect and distribute existing fact sheets on conservation easements, and where to obtain technical assistance, to municipal officials and owners of priority wildlife habitat properties, identified through Actions LND-32 and LND-33.
2. Make land conservation expertise (such as members of Great Bay Resource Protection Partnership) available to municipal conservation commissions at no cost.
3. Present an estate-planning workshop annually in the Seacoast region for owners of identified priority lands.

RESPONSIBLE PARTIES

The Great Bay Resource Protection Partnership will act as lead implementer (Steps 1-3), with assistance from the Society for the Protection of New Hampshire Forests, UNH Cooperative Extension, local land trusts, Strafford and Rockingham County Conservation Districts, Audubon Society of New Hampshire, Natural Resources Outreach Council, and municipal conservation commissions.

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds.

COSTS

Collection and distribution of information in Step 1	$2,000
Free land conservation technical assistance in Step 2	$3,000 - 6,000
Estate-planning workshop (annually) in Step 3	$2,500
Total	**$7,500-10,500**

FUNDING

Possible funding sources include New Hampshire Estuaries Program, New Hampshire Coastal Program, private foundations, and other federal funding sources identified in Tables 10.1 through 10.6 in the *NHEP Management Plan*.

REGULATORY NEEDS

None required.

EXPECTED BENEFITS

- Increased acreage permanently protected as open space.
- Increased awareness of land conservation options among municipal officials and landowners.

MONITORING AND ENFORCEMENT

None required.

TIMETABLE

This Highest Priority action will be initiated by 2004. Some steps may be coordinated with implementation of LND-27 in 2001-2002.

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PRIORITY

Highest Priority. Implementation of this action is enhanced by implementation of Actions LND-32 and LND-33.

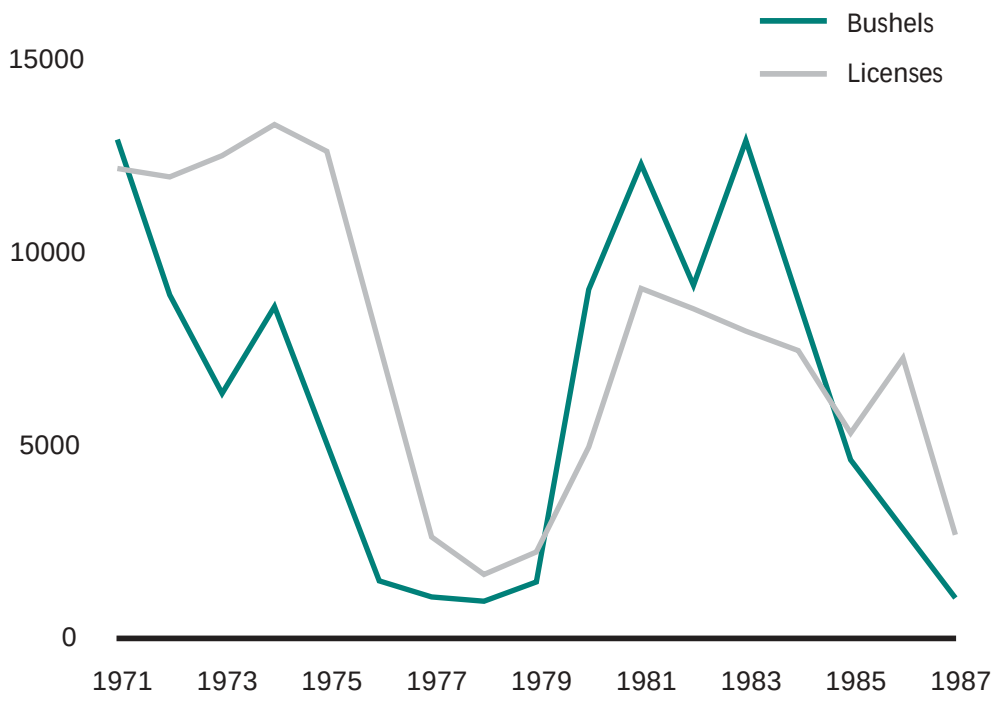
SHELLFISH RESOURCES

6

Declining shellfish populations and associated habitats are among the most significant living resource problems in coastal New Hampshire. According to the New Hampshire Estuaries Project's review of status and trends within the estuaries, oyster habitat and populations in the Great Bay Estuary are in decline and may be at historic lows. Clam densities overall have improved somewhat in the last seven to ten years, but population fluctuations related to harvest pressure in the Hampton-Seabrook Estuary are well documented. Overall, shellfish and other living resources were much more abundant a century ago. Predators, harvesting effects, disease, and changing management scenarios have all contributed to shellfish declines.

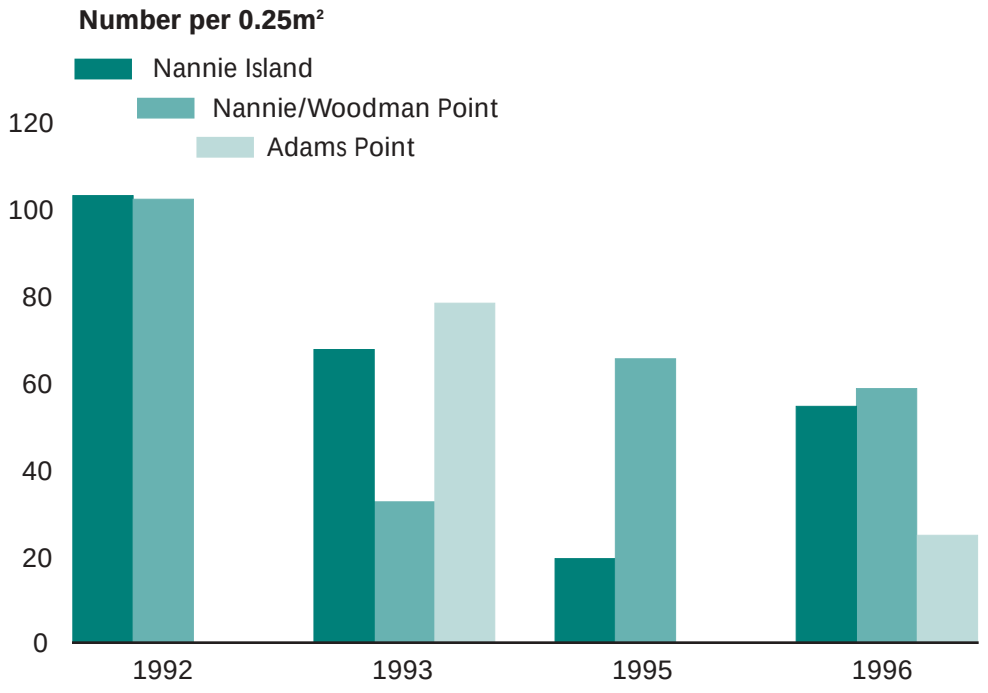
Closure of shellfish beds due to bacterial contamination is another major problem affecting shellfish and human use of shellfish resources. Shellfishing is a popular recreational activity in the state, part of the Seacoast's economic and cultural heritage. Residents from throughout the state obtain licenses and participate in recreational shellfishing. Yet over 50% of New Hampshire's

Clam Harvests in Hampton-Seabrook Harbor



Number of clam licenses and the adult clam standing crop (bushels) in Hampton-Seabrook Harbor: 1971-1987. Data from NAI (1995)

Oyster Bed Density in Great Bay: 1991-1996



estuarine waters are closed to shellfishing. These closures not only restrict popular recreational activities, but also sound an early warning of potential environmental problems.

Healthy, sustainable shellfish populations both indicate and contribute to a healthy estuarine ecosystem. Abundant shellfish communities are natural water-purifiers, enhancing water quality in the estuaries. Efforts to open shellfish beds by improving water quality will also benefit other living resources and the overall function of the estuarine ecosystem.. Water quality improvements are inextricably linked to the health and management of shellfish resources.

Steps to improve the environmental condition of New Hampshire's estuaries identified in the Water Quality, Land Use, Habitat Restoration, and Public Outreach sections of the *Plan* will contribute to improvements in shellfish resources for both human utilization and the ecological well being of the shellfish themselves. Expanding sustainable harvest of all shellfish species will bring economic and recreational benefits to the region. Expanding sustainable commercial harvest opportunities for ocean species such as the surf clam and ocean quahog, as well as expanding shellfish and finfish aquaculture opportunities, is increasingly critical as the state's fishing industry copes with reduced stocks and severe regulatory restrictions.

Harvest from some New Hampshire shellfish areas has been limited by lack of adequate monitoring to classify areas as open to harvesting. Lack of U.S. Food & Drug Administration certification is a continuing barrier to potential commercial harvest of native ocean quahogs and surf clams and to shellfish aquaculture in New Hampshire estuarine and ocean waters. Implementation of a new state shellfish program to obtain certification and coordinate planning and management activities to address these issues has already begun.

WHY IT MATTERS

Shellfish are part of the human food chain, a vital and symbolic link between people and the estuaries. Shellfish health and their wholesomeness for human consumption requires clean water. The decline in overall acreage and density of shellfish beds raises both economic and ecological concerns. Healthy shellfish populations and habitats are a high priority for NHEP, in part as a unifying outreach focus to advance the cause of clean water. Shellfish play a key role in our understanding of the interrelated web of life of the estuaries. Shellfish are a valuable resource for improving environmental quality for three reasons:

1. Shellfish are important indicators of water quality and overall health of the coastal and estuarine environments, the 'canary in the coal mine' of the estuaries. Declining shellfish populations and habitat may signal other problems in the estuarine ecosystems. Healthy populations of shellfish are also part of nature's purification system, helping to filter and clean estuarine waters. Ensuring water quality and habitat that can support healthy populations of shellfish species will also help the shellfish communities to filter and purify the water of the estuaries more effectively.
2. Shellfish are an economic, recreational, cultural, and natural resource for the Seacoast region. Recreational shellfishing in Hampton-Seabrook Harbor is estimated to contribute more than $3 million a year to the local and state economy. While no sale of shellfish is allowed, the value of oysters in major beds in the Great Bay Estuary was estimated at $3 million in 1994. A 1991 study estimated that 1,000 license-holders harvested 5,000 bushels worth $300,000 annually. However, a 1997 study estimated 661 licensed harvesters took only 2,700 bushels of oysters in 1996, reflecting the declining resource.
3. Shellfish offer an easily understood public education and awareness vehicle. Because shellfish management relies on monitoring fecal bacteria, shellfish and shellfish harvesting provide an effective illustration of the connections between sources of fecal bacteria (e.g. wastewater treatment facilities, septic systems, stormwater runoff), impaired water quality, and the availability of uncontaminated shellfish that are safe for human consumption. Observing shellfish in tide pools and along the shore, as well as harvesting and eating local shellfish, are popular and traditional parts of life on the Seacoast. Many people identify with the estuaries and coastal waters of New Hampshire and recognize shellfish, particularly softshell clams, oysters, and blue mussels, as characteristic features of the coastal environment.

Shellfish and finfish aquaculture is an issue that may hold promise for New Hampshire's economic future, particularly in view of the severe problems facing the fishing industry. Attaining FDA certification for New Hampshire's shellfish sanitation program will allow the potential development of shellfish aquaculture and commercial harvest of surf clams. Efforts are needed to effectively regulate all aspects of aquaculture in a way that simultaneously allows progress and protects the environment. However, native softshell clams and oysters will likely continue to be limited to recreational harvest. Effluent from aquaculture facilities and introduction of invasive species through shellfish or finfish aquaculture must be closely monitored to avoid adverse impacts to Great Bay and Hampton Harbor.

THE CHALLENGE

Increasing the acreage of classified and open softshell clam and oyster beds, and expanding shellfish and finfish aquaculture opportunities, are vital to the NHEP vision for New Hampshire's estuaries. Introducing commercial harvest of ocean quahogs and surf clams, both found off the open coast, is a related goal. Recreational clam licenses peaked at nearly 14,000 in 1975, but had fallen to less than 300 by the early 1990s with the closure of beds and tight harvesting restrictions due to water quality issues.

Public interest in clamming was clearly demonstrated with the rebound in licenses that accompanied the 1994 reopening of Hampton-Seabrook Harbor to harvesting. Clam license sales rose from 250 in 1993 to over 2,900 in 1994. Interest has remained high: N.H. Fish & Game estimates that 2,880 recreational harvesters took 900 bushels of clams from the Hampton-Seabrook Harbor clamflats in just 19 days open for harvesting in the 1996-97 season. The re-opening of 1,622 acres of shellfish waters in coastal New Hampshire is one of the early successes of the NHEP and its shellfish team of government agencies, scientists, and citizens.

Shellfish harvest in New Hampshire is a popular recreational pursuit. However, oyster resources in the Great Bay Estuary have declined in recent years. From 1991 to 1996 oyster density in three beds of recreational importance decreased by amounts ranging from 42% to 69%. Other oyster beds have lost significant bed acreage, especially in the Oyster and Bellamy rivers. Oyster harvests reflect these declines: a 1991 study estimated a total harvest of 5,000 bushels of oysters by 1,000 license holders, but by 1997 the estimated harvest had declined to 2,700 bushels by 661 harvesters. Predation, limited availability of suitable larvae attachment substrate, disease, harvest pressure, and a variety of management issues are likely factors in these declines.

B. PENHALE

Soft-shell clamming

New Hampshire must accomplish two major regulatory and management tasks to advance the NHEP goals for shellfish. The state needs a legitimate shellfish program with adequate state funding and staffing to meet National Shellfish Sanitation Program requirements. The state must also work in concert with Seacoast communities and individual property-owners, to resolve the water pollution sources that contribute to the high fecal coliform counts in many areas of the estuaries.

The shellfish beds are closed when treatment plants fail, pump stations overflow, and Combined Sewer Overflows discharge. *Chapter 4: Water Quality* addresses water quality improvement needs and plans for the estuaries in detail. Non-point sources of pollutants also increase with added development.

GBNERR

Chapter 5: Land Use, Development, and Habitat Protection addresses non-point source pollution through actions to limit impervious cover and sprawl, protect tidal and freshwater wetlands, groundwater, and shorelands.

The NHEP and its shellfish team determined that a new, coordinated state shellfish program was needed to more effectively increase the availability and stewardship of the state's shellfish resources. All state agencies involved in various aspects of shellfish and water quality monitoring and management were represented on the shellfish team, along with researchers from the University of New Hampshire's Jackson Estuarine Laboratory and interested citizens. From these discussions, the NH Department of Environmental Services spearheaded a collaborative, inter-agency effort to develop and obtain resources for a restructured shellfish sanitation program, which is outlined in Action SHL-1. Implementation of the seven-year plan began in 1999 when the Legislature reassigned authority for shellfish sanitation to NH DES. However, NH DES has secured resources for this program only for the short term. Long term, stable funding remains an issue.

The New Hampshire Estuaries Project has identified information gaps related to shellfish and the stresses they are under in New Hampshire's estuaries. More research and monitoring is needed to ensure the shellfish resources of coastal New Hampshire are managed sustainably. The public, particularly shellfish harvesters, can help protect and enhance shellfish populations and vitality – or harm these valuable resources. Education and outreach efforts are planned to inform members of the public how they can have a positive impact on shellfish resources as active shellfishers, shoreline property owners, or as residents of the Great Bay and coastal watersheds.

REGULATORY AND MANAGEMENT PROGRAMS

Regulation and management of shellfish resources involves two distinct aspects:

1. Sanitation monitoring and regulation to ensure human health and safety;
2. Resource management to assure sustainable harvest of healthy shellfish.

The U.S. Food and Drug Administration (FDA) oversees the National Shellfish Sanitation Program (NSSP), a program to regulate the commercial shellfish industry. The NH Department of Health & Human Services (NH DHHS) has handled sanitary management at the state level, but in 1999 the state Legislature enacted legislation to reorganize the state's shellfish sanitation efforts, with the NH Department of Environmental Services (NH DES) taking the lead. (See Action SHL-1 in the Shellfish Action Plans for details of the new state shellfish sanitation program.) The National Marine Fisheries Service manages oceanic shellfish resources under the Magnuson Fisheries Conservation and Management Act, but resource management of estuarine shellfish fisheries is primarily under state control through the NH Fish & Game Department (NH F&G).

Unlike some states, local governments in New Hampshire have no regulatory authority over shellfish harvesting or licensing. Municipalities do play an important role in controlling water pollution sources that impact shellfish health and safety through land use and stormwater management and wastewater treatment systems. NH DES has also had an indirect role in shellfish management through its role in protecting water quality.

EPA published new regulations on December 8, 1999 for Phase II of the NPDES permit stormwater management program. Compliance with these Phase II rules will be required by March 2003. Under Phase II rules, NPDES permit coverage will be required for small municipal separate storm sewer system discharges in urbanized areas--including Dover, Durham, Madbury, New Castle, Newington, Portsmouth, Rochester, Rollinsford, Rye, and Somersworth. Phase II NPDES stormwater rules will also apply to discharges from construction sites disturbing between one and five acres.

Clean Water Act Section 303(d) and its implementing regulations require states to list water body segments as impaired if they fail to comply with a water quality goal or use (such as fishing or swimming) even after targeted pollution control practices have been put into place. The Clean Water Act requires that this impaired waters list include a prioritized ranking of segments most in need of Total Maximum Daily Load (TMDL) analysis. The TMDL defines the maximum amount of a specific pollutant that can be discharged into a body of water without violating water quality goals for that water. NPDES permits and state wastewater discharge licenses are written to be consistent with the TMDL waste load allocations for the receiving water body. TMDLs are being developed and implemented for the Rochester segment of the Cocheco River for dissolved oxygen, the Salmon Falls River downstream of Somersworth for dissolved oxygen and phosphorous, and the Lamprey River in Epping for dissolved oxygen and phosphorous.

Although FDA has no authority over recreational harvesting, New Hampshire state law (RSA 485-A8, v) mandates following NSSP guidelines in the management of tidal waters used for growing or taking of shellfish. FDA has not found the state to be in full compliance with all NSSP requirements. This has limited or prohibited commercial shellfish harvesting and shellfish aquaculture in the state.

Coastal New Hampshire has benefitted from the application of the federal standards. Following NSSP guidelines for water quality monitoring and sanitary survey protocols, state agencies partnering with the NHEP recently re-opened productive shellfish areas for recreational harvesting while adequately addressing public health concerns.

New Hampshire must accomplish two major regulatory and management tasks to advance the NHEP goals for shellfish:

1. The state needs a legitimate shellfish sanitation program with adequate state funding and staffing to meet NSSP requirements.
2. The state and municipalities must continue to identify and eliminate pollution sources, particularly sources of fecal coliform bacteria that are degrading the water quality of the estuaries and limiting the potential for recreational and commercial harvest and commercial cultivation of shellfish.

SHELLFISH RESOURCES: GOALS FOR ECOLOGICAL AND RESOURCE HEALTH

The Action Plans for shellfish resources address sanitary, ecological, and resource management of shellfish; aquaculture and commercial harvest of shellfish; and public outreach and education efforts. See *Appendix 3* for a complete list of goals and objectives for shellfish resources.

- Achieve sustainable shellfish resources by tripling the area of shellfish beds that are classified open for harvesting to 75% of all beds, and tripling the quantity of harvestable clams and oysters in New Hampshire's estuaries.
- Assure that shellfish are fit for human consumption, and support a healthy marine ecosystem.
- Provide opportunities and strategies for restoration of shellfish communities and habitat.
- Support coordination to achieve environmentally sound shellfish aquaculture activities.
- Ensure that communities, government agencies, organizations, and individuals actively participate in achieving the shellfish-related goals for New Hampshire's estuaries.

SHELLFISH RESOURCES
ACTION PLANS

Shellfish Sanitation Management

SHL-1	Implement National Shellfish Sanitation Program guidance to develop an FDA- certified shellfish program.	6-11
SHL-2	Identify sources of and reduce or eliminate contaminants in the New Hampshire estuaries watersheds.	6-15
SHL-3	Institute land-use practices in estuarine watersheds that improve water quality and shellfish habitat.	6-16
SHL-4	Enhance funding to maintain a comprehensive shellfish program.	6-17
SHL-5	Regularly collect and monitor water quality to identify sources and reduce or eliminate contaminants.	6-19
SHL-6	Periodically collect and monitor shellfish tissue samples as appropriate for toxins and biotoxins.	6-20

Shellfish Resource Management

SHL-7	Maintain an ongoing shellfish resource assessment program.	6-22
SHL-8	Develop and implement a plan for shellfish resource enhancement and habitat restoration.	6-25
SHL-9A	Decrease shellfish resource depletion and increase productivity with stricter state penalties for illegal harvesting.	6-28
SHL-9B	Increase outreach and education about methods to control shellfish predators.	6-30
SHL-9C	Explore alternative recreational shellfish harvest methods.	6-32
SHL-9D	Increase productivity by discouraging the harvest of immature shellfish.	6-34

Shellfish Outreach

SHL-10	Provide information regarding public access to shellfish beds through distribution of maps/booklets.	6-36
SHL-11	Establish *Bounty of the Bay* shellfishing field education program.	6-38
SHL-12	Develop and maintain a shellfisher license information database for use in outreach activities.	6-41
SHL-13	Update materials and improve distribution of shellfish-related information.	6-43
SHL-14	Provide for direct citizen involvement in NH shellfish management decisions.	6-45

Shellfish Aquaculture

SHL-15	Evaluate and address barriers to aquaculture and promote environmentally sound aquaculture practices.	6-48

ACTION SHL-1

Implement procedures in the National Shellfish Sanitation Program guidance to gain certification by the FDA for a recreational and commercial shellfish program.

PRIORITY
+++ SHELLFISH SANITATION MANAGEMENT

BACKGROUND

Although the New Hampshire shellfish sanitation program adheres to the federal guidelines, the program has never been legally certified by the FDA. This lack of certification has stymied the efforts of commercial ventures (limited wild-stock harvest of selected species such as surf clams or quahogs, and commercial aquaculture of species such as oysters and mussels).

The purpose of this Action Plan is to continue implementing the steps needed to create an FDA-certified shellfish program. FDA certification would give the state the option of approving commercial shellfish operations in selected coastal waters. Steps taken to date to gain FDA certification include establishing an NHEP-coordinated shellfish/living resources working group, the hiring of a full-time shellfish sanitation program staff person, and 1999 legislation changing state agency regulatory authorities for the shellfish program from NH DHHS to NH DES. Using the strong agency partnerships and the involvement of the working group, this Action Plan calls for completing the required steps to apply for FDA certification.

ACTIONS/ACTIVITIES

1. The state agencies will work together to address comments raised previously by the FDA concerning deficiencies in New Hampshire's shellfish program. Much of this action has been accomplished during the 1999-2000 transition period when certain authorities and responsibilities are transferred from the NH Department of Health and Human Services (NH DHHS) to the NH Department of Environmental Services (NH DES). Staff funding sources will be investigated and pursued.
2. All pertinent rules and regulations will be reviewed for consistency with federal requirements, and new rules and regulations will be drafted as necessary.
3. The partnering agencies will draft and agree upon the necessary memoranda of agreement required by the FDA and state law.
4. NH DES and NH DHHS has submitted an application to the FDA after review and approval by the NH Fish and Game Department and the NHEP Shellfish/Living Resources working group.
5. NH DES will be responsible for implementing the Schedule of Growing Area Work 1999- 2005 (see schedule below), including any modifications agreed upon during the transition period.

RESPONSIBLE PARTIES

NH Department of Environmental Services is the lead agency responsible for implementing and coordinating this Action Plan (Steps 1-5), with assistance from NH Department of Health and Human Services, NH Fish and Game Department, and NH Estuaries Project.

IMPLEMENTATION LOCATION

See "Schedule of Shellfish Growing Area Work: 1999-2005" in Timetable section below for specific locations.

COSTS

Base NH DES shellfish program costs are estimated at approximately $150,000 per year (Step 5). Sanitary survey costs for specific areas can range from $30,000 to $100,000 depending on location (Step 5).

FUNDING

Funding for two NH DES staff assigned to the NH DES Shellfish Sanitation Program is secure for 2000-2001. NHEP and DES are pursuing state funding for the staff positions (see SHL-4). Assistance from existing staff in other state agencies will also support this action. NHEP implementation funds will be applied to program functions in 2001-2002, and potentially through completion of sanitary survey schedule outline on pages 6-14.

REGULATORY NEEDS

FDA compliance may require some administrative rules and legislative changes.

EXPECTED BENEFITS

The state will have a long-term, effective shellfish program supported by cooperating state agencies to safeguard public health for the consumption of shellfish. This will enable commercial harvesting of soft-shell clams, oysters, and other shellfish. Intensive sanitary surveys of growing areas will result in identification of pollution sources and elimination of water quality problems.

MONITORING AND ENFORCEMENT

The monitoring of shellfish waters and pollution sources is a large but achievable task. NH DES and NHEP have proposed an aggressive monitoring schedule to achieve maximum acreage of open shellfish waters. NH F&G is a proven effective enforcement agency, but details for patrolling shellfish growing areas by NH F&G need to be worked out.

TIMETABLE

Steps 1-4 were initiated and NH DES submitted an application to FDA (Step 4) in December 2000.

Schedule of Shellfish Growing Area Work: 1999-2005 (Step 5)

The following schedule for the shellfish growing area work was developed by the New Hampshire Estuaries Project, based on previous work by the UNH Jackson Estuarine Laboratory. It was modified by the NH Department of Environmental Services to reflect the pollution source elimination work.

The criteria used to set this schedule are listed below in order of priority.

- Scheduling sanitary survey updates to meet the three year schedule required by the National Shellfish Sanitation Program.
- Meeting commitments tied to the use of the funding announced in July 1998 by Vice President Al Gore, for Little Harbor/Back Channel, Hampton-Seabrook Harbor, and Bellamy River.
- Geographically synchronizing shoreline surveys.
- Accommodating the expressed priorities of the NHEP Shellfish/Living Resources Team.

DEFINITIONS OF PROJECT TYPE

Full sanitary survey means the completion of a shoreline survey; evaluation of any meteorological effects, hydrographic influences, and geographic characteristics that may affect the distribution of pollutants over the growing area; and analysis of the results of routine bacteriological water sampling.

Sanitary survey update means a reevaluation, every third year, of all pollution sources identified in the sanitary survey and documentation of newly identified sources with effect on the growing area evaluated. Also included is an analysis of the results of routine bacteriological water sampling.

Pollution source elimination means comprehensive investigations of the identified pollution sources and actions taken to eliminate the source or control the impact to the growing areas.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*, although completion of this action will enhance implementation of Action SHL-1

SHELLFISH PROGRAM SCHEDULE

Area	1999	2000	2001	2002	2003	2004	2005
HAMPTON/SEABROOK (H/S)							
H/S Harbor	PSE	SSU	PSE		SSU	PSE	
H/S Tributaries	PSE	SS	PSE		SSU	PSE	
COASTAL							
Atlantic Coastline	SS	PSE		SSU	PSE		SSU
Rye Harbor	SS	PSE		SSU	PSE		SSU
PORTSMOUTH AREA							
Little Harbor/Back Channel	SS	PSE		SSU	PSE		SSU
Lower Portsmouth Harbor						SS	PSE
Upper Portsmouth Harbor						SS	PSE
Lower Piscataqua River						SS	PSE
GREAT BAY ESTUARY							
Great Bay SSU	SSU			SSU	PSE		SSU
Upper Little Bay	SSU			SSU	PSE		SSU
Lower Little Bay			SSU	PSE			
Upper Piscataqua River			SS	PSE		SSU	PSE
GREAT BAY TRIBUTARIES							
Salmon Falls River			SS	PSE		SSU	PSE
Cocheco River			SS	PSE		SSU	PSE
Bellamy River	PSE	PSE	SS	PSE		SSU	PSE
Oyster River			SS	PSE		SSU	PSE
Lamprey River					SS	PSE	
Squamscott River					SS	PSE	
Winnicut River				SS	PSE		SSU

SS: Sanitary Survey
SSU: Sanitary Survey Update
PSE: Pollution Source Elimination

ACTION SHL-2

Identify sources, and reduce or eliminate contaminants in the New Hampshire estuarine watersheds.

PRIORITY

+

SHELLFISH SANITATION MANAGEMENT

See Chapter 4:
Water Quality Goals for New Hampshire's Estuaries

To ensure New Hampshire's shellfish resources are healthy, and that shellfish habitat water quality is sufficient for sustainable harvest without undo risk to public health, pollution sources throughout the estuarine watersheds must be identified, reduced, or eliminated. Strategies to identify, reduce, and eliminate pollution sources in coastal New Hampshire are developed in detail throughout Chapter 4: Water Quality. Nearly all water quality improvements achieved through the actions in Chapter 4 will benefit New Hampshire's shellfish resources.

SHELLFISH SANITATION MANAGEMENT

PRIORITY

+

ACTION SHL-3

Institute land-use practices in the New Hampshire Estuaries Watersheds that improve water quality and shellfish habitat.

See Chapter 5: Land Use Goals for New Hampshire Estuaries.

To ensure new hampshire shellfish resources are healthy, and that shellfish habitat water quality is sufficient for sustainable harvest without undo risk to public health, land-use practices must not degrade water quality and estuarine habitats. Chapter 5: land use, development, and habitat protection develops detailed strategies to restrict or eliminate land-use practices that adversely affect estuarine habitats.

ACTION SHL-4

Enhance the amount and reliability of funding for strategies and actions to maintain a comprehensive shellfish program.

PRIORITY
+++ SHELLFISH SANITATION MANAGEMENT

BACKGROUND

Funding for a NH shellfish program to classify and monitor shellfish-growing areas has been neither stable nor adequate over the years, resulting in the closure of many areas to harvesting. The lack of a stable program has also precluded development of commercial shellfish aquaculture operations – which could generate some funding to support the evaluation of recreational harvest areas.

Shellfish program funding and staff have been patched together from state and federal sources since the early 1990s. While this approach resulted in reopening some shellfish beds, it does not provide long-term stability for the program. Without such stability, periodic monitoring and assessment of shellfish waters will be inadequate. The result will be:

- Closure of shellfish areas that are currently open for harvesting
- Continued closure of shellfish areas that are currently closed for harvesting
- Fewer pollution sources identified and eliminated through shellfish sanitary surveys
- Continued difficulty in establishing shellfish aquaculture operations

ACTIONS/ACTIVITIES

Funding for a fully staffed shellfish sanitation program has been secured for the first two years of implementation of the *NHEP Management Plan*. The New Hampshire General Court (Legislature) will be approached to secure state funding for the program beyond the first two years.

RESPONSIBLE PARTIES

NH DES is responsible for securing the necessary funding with assistance from the NH Estuaries Project.

IMPLEMENTATION LOCATION

Not applicable

COSTS

Base funding for a shellfish sanitation program is estimated at $150,000 per year. Additional costs to conduct sanitary surveys in specific shellfish growing areas vary with location (costs typically range from $30,000 to $100,000). Cost estimates for specific growing areas are currently being developed.

FUNDING

Funding will be sought for state funds (e.g., the state general fund). Other potential sources could include proceeds from an increase in shellfish license fees, aquaculture license fees, etc.

REGULATORY NEEDS

A state appropriation and possible changes to laws on state license fees may be required.

EXPECTED BENEFITS

A stable shellfish program will enable the state to fully comply with National Shellfish Sanitation Program guidelines, allowing the state to reopen some beds currently closed, keep currently open beds in their open status, and permit commercial shellfish aquaculture.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

This Highest Priority action will be initiated in 2000-2001.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION SHL-5

Regularly collect and monitor water quality samples to identify sources and reduce or eliminate contaminants.

PRIORITY
+++

SHELLFISH SANITATION MANAGEMENT

Implemented by Shellfish Action SHL-1

The National Shellfish Sanitation Program guidance requires a comprehensive water quality monitoring program, as proposed in Action SHL-1 (see the work plan for 1999-2005 in SHL-1). This monitoring program will provide the basis for making shellfish harvesting and management decisions in the interests of both public health and environmental quality of the shellfish resource. A comprehensive water quality monitoring program will also provide a valuable gauge of overall water quality in the estuaries.

SHELLFISH SANITATION MANAGEMENT

PRIORITY +++

ACTION SHL-6

Periodically collect and monitor shellfish tissue samples as appropriate for toxins and biotoxins.

BACKGROUND

Monitoring for toxins and biotoxins in shellfish waters is required by the National Shellfish Sanitation Program guidelines. The state's current monitoring program for Paralytic Shellfish Poison (PSP), commonly referred to as "red tide," involves collecting mussels on a weekly basis from April to October at one Hampton-Seabrook Estuary site. New Hampshire and neighboring states share data readily to track the occurrence and movement of red tide blooms in the Gulf of Maine. The state shellfish control authority did not historically assess other toxic substances (e.g., heavy metals) in shellfish waters in a comprehensive manner. However, numerous coastal NH studies and monitoring programs, including NH Department of Environmental Services, currently generate information on toxins in sediment, fish tissue, shellfish tissue, and other media (the GulfWatch program's monitoring of mussel tissue for toxic substances is one example). Furthermore, sites that have the potential for releasing toxic substances to the environment are evaluated during sanitary surveys of specific shellfish growing areas.

ACTIONS/ACTIVITIES

Develop a more comprehensive monitoring program for toxic assessment of shellfish tissue and biotoxin monitoring. This program should build on existing PSP and toxin monitoring programs. The National Shellfish Sanitation Program requires assessment of the presence of toxic substances in shellfish meats, but management of this assessment on the state level needs additional development. The new program should:

1. Consider an additional PSP collection site, possibly on the Atlantic Coast, to augment the current Hampton-Seabrook Estuary site.
2. Support the development of a volunteer biotoxin-monitoring program. Both shoreline and boat stations should be considered.
3. Work with the GulfWatch Program to establish and share permanent monitoring sites in suspect areas for toxic substances, including heavy metals (mercury and lead are primary contaminants of importance) and chlorinated hydrocarbons. In addition, NH DES should develop and adopt protocols for determining the presence and extent of toxic contamination around marinas.
4. Consider using surf clams in addition to mussels in the evaluation of PSP and/or toxic substances.
5. Monitor soft-shell clams and oysters for toxic contamination.

RESPONSIBLE PARTIES

NH Department of Environmental Services is primarily responsible (Steps 1-5), with additional involvement by the UNH Jackson Estuarine Laboratory (possibly through doctoral programs) (Steps 1, 2, 4) and local volunteer monitoring groups (Step 2).

IMPLEMENTATION LOCATION

The new PSP monitoring location is at the Isle of Shoals (Step 1). Clam and oyster beds will be monitored on a rotational basis in Great Bay, Hampton Harbor, and the tidal tributaries (Step 5).

COSTS

New PSP monitoring site in Step 1	
Analytical Costs per year	$6,200
Sampling and transportation costs per year	$2,300
Setting up a volunteer PSP monitoring program in Step 2	
Cost for a program with four monitoring sites	$18,000
Working with GulfWatch to collect and analyze mussel tissue for toxic substances in Step 3	
Costs per site for analysis per year	$2,240
Monitor clams and oysters annually in Step 5	$5,000

FUNDING

Steps 1 and 3 will be funded with NHEP implementation funds in 2000-2002. Step 5 will be funded with NHEP implementation funds as a component of the NHEP monitoring program on an ongoing basis. Additional money may be available through other appropriate federal programs identified in tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH Fish and Game, NH DES and NH OSP could also support this action.

REGULATORY NEEDS

Possible adoption of administrative rules for sampling and analytical protocols.

EXPECTED BENEFITS

Protection of human health for those that consume shellfish.

MONITORING AND ENFORCEMENT

No enforcement required.

TIMETABLE

This Highest Priority was initiated in 2000 and will be ongoing.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH RESOURCE MANAGEMENT

PRIORITY +++

ACTION SHL-7

Maintain an ongoing shellfish resource assessment program focusing on softshell clam and European and American oysters, but also considering blue mussels, sea scallops, surf clams, ocean quahogs, and razor clams.

BACKGROUND

The New Hampshire coast and estuaries support populations of molluscan shellfish, including European and American oysters, blue mussels, sea scallops, softshell clams, surf clams, ocean quahog, and razor clams. These species are ecologically important, and are all harvested recreationally, and in some cases commercially (currently commercial use is limited to a small harvest for scallops, and harvest of other species for bait).

Molluscan shellfish are subject to many natural and anthropogenic influences that affect their abundance and population structure. Recruitment of young of the year shellfish depends on adult spawning success, larval survival, and post-metamorphosis survival. The success of these stages depends on temperature, salinity, food quantity and quality, availability of preferred substrates, sedimentation, predator density, and inadvertent harvest-related mortality. Juvenile and adult populations are affected by natural pressures such as predation, disease, prolonged temperature and salinity extremes, and harmful algal blooms, in addition to human influences such as harvest pressure and pollutants.

Effective resource management requires an understanding of the spatial distribution, abundance, and age structure of shellfish species, and how these change over time. Regulatory actions can minimize or prevent harvest at times and in locations where stocks are depressed, and education efforts can encourage harvest at times and locations where harvestable size shellfish are abundant. Assessment programs to identify the locations of shellfish resources and track their status and trends over time should be maintained for species for which there is historical data, and initiated for others.

ACTIONS/ACTIVITIES

1 NH Fish and Game, in consultation with local fishermen, the UNH Jackson Estuarine Laboratory (JEL), and other constituents, should develop a five-year strategic plan and assessment schedule, including the species to be assessed, locations, and assessment interval (e.g. annual, bi-annual, etc.), and time of year. This plan should include a schedule of what, where, and how an area is to be surveyed, what additional areas should be added, and identify the amount and potential sources of funding needed for each year's activity.

Routine sampling is being conducted in the Great Bay Estuary by the NH Fish and Game Department, and in Hampton-Seabrook Harbor by Normandeau Associates Inc. (NAI) under a requirement of the Seabrook Station NPDES permit. UNH and other scientific contractors would conduct studies in Little and Rye Harbors, near-shore coastal areas, and Back Channel on a two-year cycle or longer, depending on availability of funds.

2 Establish standardized sampling protocols to make valid year-to-year comparisons. For species under ongoing assessment, all parties should agree to use existing procedures (e.g., NHF&G standard population sampling protocol) when appropriate. Sampling methodology should be developed for species that have not been subject to assessment. This could be accomplished in a meeting of the three groups (NHF&G, JEL, and NAI).

3 Establish a data management and reporting protocol and ensure data distribution. This could also be accomplished with a meeting of the three groups (NHF&G, JEL, and NAI).

4 Evaluate natural (e.g., disease) and human (e.g., harvest pressure) influences on population changes. This should be done cooperatively with NHF&G and the scientific community.

5 Ensure that results are reported to other agencies, especially to those agencies charged with scheduling and conducting surveys to determine if specific shellfish areas can be opened for harvest.

RESPONSIBLE PARTIES

New Hampshire Fish and Game will be the lead agency responsible for the implementation and coordination of this action (Steps 1-5) with assistance from NAI, JEL, and other contractors that have been granted scientific permits by NH Fish and Game.

IMPLEMENTATION LOCATION

The resource plan will address shellfish resource issues throughout New Hampshire estuaries and the near-shore environment based on existing or potential habitat for molluscan shellfish, including European and American oysters, blue mussels, sea scallops, softshell clams, surf clams, ocean quahog, and razor clams.

COSTS

New costs (i.e. those beyond the existing assessment programs) will range from a minimum of $3,000 up to $30,000 annually, depending on the workplan (Steps 1-5).

FUNDING

NHEP implementation funds will be applied to Steps 1-3 in 2001-2002. NHEP monitoring staff will assist with Steps 3-5 in 2001-2003. New funding sources, if needed, should augment that currently provided by NHF&G, Seabrook Station, and NHEP. Additional sources could include state and federal agencies such as UNH Sea Grant, NH Coastal Program, National Marine Fisheries Service, and the Great Bay National Estuarine Research Reserve.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

An adequate shellfish resource assessment program will help the state to manage shellfish more effectively to ensure a healthy, sustainable resource.

MONITORING AND ENFORCEMENT

NH Fish and Game and the scientific community should be responsible for monitoring and reporting on progress. Reports should go to Fish and Game, which would then discuss any recommendations with the Advisory Committee for Shore Fisheries, and to the state shellfish sanitation agency (NH DES) and its advisory committee.

TIMETABLE

This Highest Priority action will be initiated in 2001 and will be a component of the NHEP monitoring program.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION SHL-8

Develop and implement a plan for shellfish resource enhancement and habitat restoration activities to achieve a sustainable resource contributing to a healthy environment.

PRIORITY
+++ SHELLFISH RESOURCE MANAGEMENT

BACKGROUND

A number of factors can contribute to declines in shellfish populations including siltation, disease, predators, invasive species, lack of suitable substrate, and over-harvesting. Shellfish beds may recover on their own over time, but some may never recover, resulting in loss of habitat value, ecosystem function, and recreational opportunities. Many of Great Bay's oyster beds (Adams Point, the Bellamy, Salmon Falls, Oyster, and Piscataqua Rivers, and southwest Great Bay) have experienced dramatic declines in size of area, abundance, and recruitment of oysters in recent years, and clam beds that were once productive have very low numbers of clams.

Many technologies and methods practiced in commercial shellfish culture can be applied to public resources to benefit recreational harvesting and habitat structure and function. Enhancement of public shellfish resources would benefit the recreational shellfishing community. Shellfish restoration would also provide important habitat for invertebrates and fish, and improve water quality by enhancing filtration capacity. Areas where resource enhancement and habitat restoration are needed should be identified, and a plan to implement specific activities developed.

ACTIONS/ACTIVITIES

1 NH F&G or contractor will develop a strategy to use aquaculture technologies for shellfish resource enhancement and habitat restoration. Resource enhancement could involve the following steps:

- Identify areas where enhancement is needed The UNH Jackson Estuarine Laboratory is completing this study with NHEP funding.
- Remove silt from oyster beds during spawning closure periods
- Remove mussels from clamflats
- Support demonstration projects for preparing substrate for clam settlement
- Produce educational material on returning oyster shell to the beds and distribute with licenses
- Create shell deposit areas and redistribute accumulated oyster shells in July
- Consider a rule change to allow on-site shucking of oysters (intended to encourage the return of shell to the beds to increase larval settling sites)
- Consider hatchery seed for clams and disease-resistant seed for oysters
- Educate the public on the benefits of healthy shellfish beds

2 Restoration could involve the following step:

- Identify areas where restoration is needed, and prioritize with input from the public and other interested entities.

3 NH F&G or contractor will determine and implement appropriate technology (similar to activities described above, but may also include new or other methods and technology)

Consider methods such as opening and closing beds based on the amount of resource available, and managing habitat on an ongoing basis (pursuing this option will require enforcement and education efforts). Resource enhancement or restoration could be conducted by NH F&G, or a NH F&G-permitted entity, in Great Bay, Hampton-Seabrook Harbor, and Little Harbor.

RESPONSIBLE PARTIES

New Hampshire Fish and Game, JEL, and other entities granted permits by NH F&G (Steps 1-3).

IMPLEMENTATION LOCATION

Resource enhancement or restoration could be conducted in Great Bay, Little Bay, Hampton- Seabrook Estuary, Little Harbor, and in selected locations in estuarine tributary rivers.

COSTS

The NHEP funded a report in 1999 which identifies locations for enhancement and restoration activities. Resource enhancement costs can range from $3,000 to $50,000 per site. Restoration Costs in the Great Bay tidal rivers can range from $10,000 to $50,000 per site.

FUNDING

NHEP will apply $40,000 in 2001-2002 to shellfish restoration activities. Projects could be funded by NH F&G, grants from NH Coastal Program, NH Estuaries Project, UNH Sea Grant, CICEET and other appropriate federal programs as identified in tables 10.1 through 10.6 of this document.

REGULATORY NEEDS

A rule change would be needed to allow on-site shucking.

EXPECTED BENEFITS

Habitat restoration and enhancement will provide greater opportunities for shellfish harvest, provide water quality benefits from shellfish filter-feeding, and increase habitat productivity in the ecosystem.

MONITORING AND ENFORCEMENT

NH Fish and Game, the scientific community, and constituents could be responsible for monitoring efforts. Management through opening and closing of beds would require enforcement and education activities. All progress reports, concerns, and recommendations on resource enhancement and restoration by the scientific community and interested groups and individuals would be reported to NH Fish and Game, who will communicate on these issues with the Advisory Committee for Shore Fisheries.

TIMETABLE

This Highest Priority action will be initiated in 2001-2002.

PRIORITY

+++ Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH RESOURCE MANAGEMENT

PRIORITY

+

ACTION SHL-9A

Decrease shellfish resource depletion and increase productivity with stricter state penalties for illegal harvesting.

BACKGROUND

Illegal harvesting is a problem for resource managers of New Hampshire's shellfish. The most prominent examples of this are probably the out-of-season, over-limit, and non-approved area taking of clams at the Hampton-Seabrook Estuary. Deterrence of illegal shellfish taking is being addressed by law enforcement vigilance. Apprehending shellfish poachers and the issuance of citations for rule violations is just one facet of the total effective control against this type of illegal activity. Equally important is the penalty imposed by the judicial system for poaching violations.

The NH Fish and Game Department considers the current penalty of $58.50 per quart of clams taken in excess of the 10-quart limit, with a misdemeanor charge if the infraction is more than a bushel or if clams are taken between sunset and sunrise, to be adequate. However, some people think that current court-imposed penalties prescribed by law are too low.

ACTIONS/ACTIVITIES

1. Monitor the effectiveness of the penalties for shellfish harvesting violations (NH F&G).
2. Formulate recommendations for increased penalties if deemed necessary. The executive director of NHF&G may recommend an increase in penalties up to a maximum of $100 per quart, if warranted.

RESPONSIBLE PARTIES

The NH Fish and Game Department is the law enforcement agency for shellfish harvesting (Step 1). NH Fish and Game will also monitor and assess the effectiveness of the current system of penalties for shellfish harvesting violations, making recommendation for changes as warranted (Step 2).

IMPLEMENTATION LOCATION

The Hampton-Seabrook Estuary is considered the site of most illegal shellfish harvesting activities.

COSTS

Costs are estimated to be minimal, since these activities are part of NH Fish and Game Department standard enforcement procedures.

FUNDING

Funding for these activities is already in place at NH Fish and Game.

REGULATORY NEEDS

Possible change in the law to increase the poaching penalty.

EXPECTED BENEFITS

Actions are expected to decrease the illegal taking of shellfish and increase the number of harvestable clams and oysters in New Hampshire.

MONITORING AND ENFORCEMENT

The New Hampshire Fish and Game Department will implement and monitor the results, and report on progress. All enforcement activities to be conducted by NH Fish and Game.

TIMETABLE

Initiate by 2007.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH RESOURCE MANAGEMENT

PRIORITY

+

ACTION SHL-9B

Decrease shellfish mortality and increase productivity through outreach and education about methods to control shellfish predators.

BACKGROUND

Both of New Hampshire's principal recreational shellfish species – American oyster *(Crassostrea virginica)* and softshell clam *(Mya arenaria)* – are subject to predation by a wide variety of marine invertebrates. Much of this natural predation occurs on very small size classes which do not yet have heavy protective shells.

Classic examples of these predators are the oyster drill *(Urosalpinx cinerea)*, which is a boring snail, and the green crab *(Carcinus maenas)*, an introduced species that consumes small clams. Green crab assessment is ongoing by NH F&G. Oyster drill abundance is calculated annually with oyster resource surveys. Other predators may also affect populations, depending on the location of oysters and clams. Identifying all possible predators for these two recreationally valuable shellfish may be useful, but is probably less important than focusing on well-known primary predators.

Strategies to reduce known predators such as the oyster drill and green crab may help reduce mortality of young clams and oysters. These strategies can be extended to other predators as they are recognized.

ACTIONS/ACTIVITIES

1. Prepare and disseminate a press release to educate the public about the predators of harvestable shellfish.
2. Develop a brochure for shellfishing license-holders on identifying predators and their egg cases, and how to remove them.
3. Encourage the harvest of predators such as green crabs for bait.
4. Assess the need for a program to track the relative abundance of selected shellfish predators.

RESPONSIBLE PARTIES

NH Fish and Game Department will be the lead agency in this educational effort (Steps 1-4).

IMPLEMENTATION LOCATION

43 coastal communities.

COSTS

Producing the brochure and press release would cost $5,000. Some savings could be realized by including this information in the informational materials distributed by NH Fish and Game with the purchase of a NH Shellfish license.

FUNDING

This action may be funded through US EPA NHEP implementation funds or through other federal programs identified in tables 10.1 to 10.5 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH Fish and Game and NH OSP could also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

These activities are expected to affect the shellfish beds of the Great Bay Estuary and the Hampton-Seabrook Estuary. They may increase the number of harvestable clams and oysters in New Hampshire by educating licenseholders about shellfish predators and encouraging them to remove these predators.

MONITORING AND ENFORCEMENT

No monitoring or enforcement is needed.

TIMETABLE

Step 1 was initiated in 2000 by including information on predators in the Recreational Saltwater Fishing Guide produced by NH F&G. Step 4 is an ongoing activity at NH F&G to assist green crabs.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH RESOURCE MANAGEMENT

PRIORITY

+

ACTION SHL-9C

Decrease shellfish mortality and increase productivity through the investigation of alternative recreational harvest methods.

BACKGROUND

Clams and oysters are harvested recreationally in New Hampshire only by certain prescribed methods. Clams may be dug by hand or with a hand-held tool with a handle not exceeding 18 inches. Oysters may be taken only by hand or by hand tongs. In actual practice oyster harvesters wade in shallows and hand-pick or use a slightly modified rake. In deeper water harvesters take oysters by diving or use of oyster tongs.

Resource managers are concerned about collateral damage to non-target shellfish – typically breakage of undersize oysters or clams during legal taking. While the currently allowed harvest methods are reasonably protective of the resource, some non-target sizes may be inadvertently damaged. Investigation of less damaging methods may reduce losses of under-sized clams and oysters.

ACTIONS/ACTIVITIES

1. Upon request, the NH Fish and Game Department will provide information on obtaining a scientific permit for controlled experiments designed to evaluate alternate harvest methods.
2. These alternate methods will be evaluated by NH F&G and the Advisory Committee on Shore Fisheries.

RESPONSIBLE PARTIES

NH F&G (Steps 1-2) would be responsible for issuing permits and reviewing research findings. Entities granted scientific permits by NH F&G to research this issue are responsible for creating an experimental design that addresses the resource concerns posed in this Action Plan.

COSTS

The cost for issuing permits and evaluating experimental results would be absorbed by the existing NH F&G budget. Costs for the actual experiments cannot be estimated until specific proposals are developed by interested entities.

FUNDING

Funding for the permitting and review portion of this action is already provided by NH F&G.

REGULATORY NEEDS

None anticipated, unless alternative methods are identified that require regulatory changes specified by law.

EXPECTED BENEFITS

An increase in the number of harvestable clams and oysters in New Hampshire through the implementation of less damaging harvesting methods for shellfish.

MONITORING AND ENFORCEMENT

The NH Fish and Game Department will implement and monitor the results, and report on progress.

TIMETABLE

Initiate by 2007 or as research proposals are made.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH RESOURCE MANAGEMENT

PRIORITY

+

ACTION SHL-9D

Increase productivity by discouraging the harvest of immature shellfish.

BACKGROUND

Size limits are a very common method of managing many fishery resources. Conventional wisdom holds that allowing year classes of young to survive to reproductive maturity and activity will increase chances for a sustainable and even burgeoning stock. The concept of spawning stock biomass has long been a general index of stock health.

A heavily exploited resource will show a nearly continuous decline in average size of catch as time passes. Left unchecked, catches could tend to include more individuals not yet sexually mature, depriving the stock of future recruits into the spawning stock biomass, and diminishing overall stock reproductive potential. For these reasons individual size limits usually reflect some knowledge of the species reproductive biology and the size at which sexual maturity is attained.

Shellfish species of interest to New Hampshire coastal recreational harvesters are the American oyster *(Crassostrea virginica)* and the softshell clam *(Mya arenaria)*. State regulations for harvest of these two species do not include size limits.

Size limits for oysters have not been imposed because the natural settlement and cementing of oyster spat on existing live oyster shell creates an unenforceable condition. It would be nearly impossible to expect the harvester to closely inspect and remove small spat or even yearling oysters from those taken. Complicating this still further is the likelihood that attempting to remove small oysters would result in their destruction. Clams are perhaps a more likely candidate because they exist in solitary burrows in the substrate. It is conceivable that a digger would be able to take only those of a certain size and larger.

Previous public hearings on this subject have shown the public views the ability to take smaller clams as an important option. However, it may be appropriate to try an educational program to persuade diggers over a period of time to voluntarily take mature specimens and leave the immature ones.

ACTIONS/ACTIVITIES

A brochure could be developed, or information included in a comprehensive brochure given to license-holders, encouraging resource enhancement by returning oysters with small spat or yearling oysters, and not harvesting clams smaller than two inches in length. A comprehensive brochure could incorporate information already distributed in the form of a flier on the proper digging of clams.

RESPONSIBLE PARTIES

The New Hampshire Fish and Game Department.

COSTS

The educational brochure could be funded by state or federal funding, estimated cost $5,000.

FUNDING

This Action Plan may be funded through US EPA NHEP implementation funds or through other appropriate federal programs identified in Tables 10.1 to 10.5 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH F&G, NH DES, and NH OSP could also support this action

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

More knowledgeable recreational harvesters will help maintain a healthy, sustainable resource, contributing to a healthy environment.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

Initiate by 2007.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH OUTREACH

PRIORITY
+++

ACTION SHL-10

Provide information regarding public access to shellfish beds through distribution of maps/booklets.

BACKGROUND

The state of New Hampshire is currently in the process of classifying and opening additional shellfish beds for recreational harvesting of clams and oysters. A map showing the locations of these resources and how to access these locations would be helpful for both resource managers and the general public.

New Hampshire Fish and Game's current efforts in outreach publications pertaining to recreational shellfish beds include a map, *New Hampshire Boating and Fishing Public Access Map;* two brochures, *New Hampshire Recreational Saltwater Fishing Guide* and the 1999 *New Hampshire Saltwater Fishing Digest;* and a flier on the proper digging of softshell clams. To supplement these informational publications, NH Fish and Game, with assistance from the UNH Jackson Estuarine Laboratory and the Office of State Planning, will record new locations of recreationally harvestable shellfish resources. Information included in the current publications would be combined with the proposed map to support conservation and a sustainable resource.

ACTIONS/ACTIVITIES

1. Collate information from existing maps to produce one map showing harvestable shellfish resource locations and public access points.
2. Produce map of current harvestable locations. Office of State Planning GIS personnel will put the information on the base map. The information will become part of the statewide GIS (GRANIT) system.
3. An additional component of this project will be updating the existing shellfish location database with the acreage of the resource, an estimate of the density, and date of the most recent inventory. The database will be kept by NH OSP and updated as more beds are identified and existing beds are re-inventoried (as personnel and funds are available).
4. Distribute the completed map to resource managers, and to the public with the purchase of a shellfish license.
5. Post this information on pertinent websites, including NH Fish and Game, NHCP, NHEP, and UNH/CICEET and update when necessary.

RESPONSIBLE PARTIES

NH Fish and Game is responsible for the implementation of this action (Steps 1-5) with assistance from the UNH Jackson Estuarine Laboratory (Steps 1, 3), NH Office of State Planning (Step 2), and NHEP (Steps 3-5).

IMPLEMENTATION LOCATION

Not applicable

COSTS

The cost of producing 5,000 maps (24" x 17" folded brochure, 2-sided, 4-color) for distribution to the public will be approximately $5,000.

FUNDING

This action may be funded through US EPA NHEP implementation funds or through other appropriate federal programs identified in tables 10.1 to 10.5 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH Fish and Game, NH DES, and NH OSP could also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

NH F&G will be able to more easily respond to public inquires for information. Shellfish harvesters will know how to find and access productive beds.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

This Highest Priority action will be initiated by 2004.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

SHELLFISH OUTREACH

PRIORITY

+

ACTION SHL-11

Establish Bounty of the Bay shellfishing field education program.

BACKGROUND

Current shellfisher licensing information reveals an aging constituency. Like many outdoor recreational pursuits, participation and continuing commitment usually results from an early introduction by a family member or other mentor. Increased shellfish license sales and the opening of more shellfish beds to harvest shows growing interest in shellfishing in New Hampshire in recent years, but outreach programs to families and young people would encourage more children and families to discover this traditional Seacoast activity. A *Bounty of the Bay* shellfishing course will provide opportunities for a new generation of shellfishers to enjoy the activity and learn the most current information on proper harvesting techniques, public health and water quality issues, and natural history. A more informed constituency should lead to more support for the resource and for management programs.

ACTIONS/ACTIVITIES

1. Offer the Bounty of the Bay: Shellfishing from the Flats to the Table Field Education course. This course is initially intended to promote clamming in Great Bay using the Sandy Point Discovery Center as a base of operations and source of staff and expertise. This program can be extended to oystering in Great Bay and/or clamming in Hampton-Seabrook Harbor at additional expense.
2. Coordinate with recreational users and professionals from related agencies to assist with the course.
3. Use appropriate media to advertise and register participants.
4. Establish course curriculum:
   - Who and what are involved in New Hampshire shellfish management (e.g. openings and closures, sanitary surveys, and resource assessments).
   - Welcome to Shellfishing in New Hampshire slideshow.
   - Natural history information on the ecological value of shellfish to a fully functioning estuarine system.
   - Water quality issues relating to shellfish.
   - Public health and shellfishing.
   - Equipment: To make or to buy?
   - Hands-on component: include proper harvesting techniques with an emphasis on “taking only what you need”
   - Proper care of harvest and hands-on preparation: “101 ways to cook a clam”

5 Consider charging a nominal fee for the workshop and arranging to apply workshop fee toward the purchase of a shellfish license, or obtaining money to purchase shellfish license for participants, as an incentive to participate.

RESPONSIBLE PARTIES

Great Bay National Estuarine Research Reserve will take the lead in developing this program with assistance from New Hampshire Fish and Game Department (Steps 1-5), the New Hampshire Shellfish Sanitation Program (New Hampshire Department of Environmental Services), and New Hampshire Department of Health and Human Services will be consulted.

IMPLEMENTATION LOCATION

The pilot field day will be offered at the Great Bay National Estuarine Research Reserve Sandy Point Discovery Center. Other sites may be developed where appropriate shellfish resources and land-based facilities are available.

COST

Participation by the public will require the purchase of a New Hampshire shellfish license ($21.00). Cost for the program will be borne by the New Hampshire Fish and Game Department and Great Bay National Estuarine Research Reserve (Steps 1-5). A limited amount of equipment is currently available, but availability of clam forks, etc., would enhance the program. Estimate for supplies: $250-300 (Step 1).

Costs for programs conducted at locations other than Sandy Point are estimated at $1,000 per offering including staff time, materials, and promotions (Step 1).

FUNDING

This action will be funded by the Great Bay Research Reserve. Supplies may be funded by charging a fee for the workshop or through State funds available through natural resource management agencies such as NH DES, NH F&G and NH OSP could also support this action.

EXPECTED BENEFITS

A new constituency of shellfishers will:

- Bring needed support to new shellfish management programs and efforts.
- Continue a rich New Hampshire tradition.
- Help to improve shellfish resources and water quality by building the support of a more informed public.
- The classes will provide a fun, newsworthy media event creating a spotlight on shellfish, water quality, and the host of current management activities.

MONITORING AND ENFORCEMENT

Program attendance is the best direct measure of field class success. No enforcement actions are anticipated.

TIMETABLE

This Priority action will be initiated in 2001.

PRIORITY

Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION SHL-12

Develop and maintain a shellfisher license information database that includes mailing and demographic information.

PRIORITY

+

SHELLFISH OUTREACH

BACKGROUND

A Memorandum of Agreement (MOA) will be drafted in 2000, establishing the new, restructured state shellfish sanitation program as detailed in Action SHL-1. This MOA between the New Hampshire Fish and Game Department, New Hampshire Department of Environmental Services, and the New Hampshire Department of Health and Human Services will outline the responsibilities of the various state agencies charged with managing shellfish growing waters classification in accordance with the National Shellfish Sanitation Program. This agreement should ensure that mailing and demographic information compiled by New Hampshire Fish and Game from shellfish license applications is available to the agencies responsible for shellfish growing waters classification and shellfish resource management for the purpose of distributing educational information to license holders. The database is currently kept at New Hampshire Fish and Game Department offices in Concord.

ACTIONS/ACTIVITIES

1. Ensure a shellfisher database will be maintained, and made available to all New Hampshire agencies involved in shellfish management.
2. Limit the use of the database to the distribution of educational information, e.g., water quality and public health information, shellfish resource management, regulatory information, meeting notices, harvesting tips, maps, and other material specifically related to the New Hampshire shellfishery.

RESPONSIBLE PARTIES

New Hampshire Fish and Game is the lead on this action. NH F&G currently maintains a database of information gleaned from license applications (Step 1); New Hampshire Shellfish Sanitation program, represented by New Hampshire Department of Environmental Services, the New Hampshire Office of State Planning, NHEP, and New Hampshire Department of Health and Human Services, are potential recipients and users of the database information (Step 2).

IMPLEMENTATION LOCATION

Not applicable

COST

No additional costs anticipated

FUNDING

Costs for building and maintaining the database will be borne by NHF&G, as they already maintain the information in a database format.

EXPECTED BENEFITS

- More effectively distribute current information on shellfish resource management, water quality, and shellfish, and their roles in estuarine ecology to those stakeholders who are most affected.
- Establish direct communication with the shellfishing public to build the credibility of shellfish resource management and shellfish sanitation practices in New Hampshire.
- Enhance stewardship of shellfish resources by a more informed shellfishing public.
- The database may help in identifying key members of the shellfishing community who may be enlisted as "shellfish stewards."
- Agencies charged with all aspects of shellfish management in New Hampshire will have direct mail access to shellfishers.
- Agencies charged with all aspects of shellfish management in New Hampshire will have access to demographic and harvest pressure information from shellfishers.

REGULATORY NEEDS

Memorandum of Agreement.

TIMETABLE

This shellfisher database (Step 1) currently exists and is maintained by NH F&G. Use of the database for mailings by DES and DHHS (Step 2) will occur on a regular basis.

PRIORITY

Priority. Implementation of this action will help in the implementation of other Action Plans listed in the *NHEP Management Plan*, particularly Action EDU-5.

ACTION SHL-13

Update materials issued with shellfish licenses, improve distribution of pertinent information, and better utilize the New Hampshire Fish and Game Department's "Clam Hotline."

PRIORITY

+

SHELLFISH OUTREACH

BACKGROUND

Active New Hampshire shellfishers are directly affected by many aspects of estuarine management. As a group the shellfishers may have a profound positive influence on New Hampshire's estuarine resources.

New Hampshire Fish and Game provides vendors of shellfish licenses with harvesting and regulatory information to distribute with the purchase of a New Hampshire shellfishing license, but these materials may not always be given to the shellfishers. A more reliable means of distribution needs to be devised to ensure this information is received by the shellfishing public.

New Hampshire shellfishers have come to rely on NH F&G's "Clam Hotline" for the most current information on the status of the shellfish beds. The hotline can deliver brief messages directly to the shellfishing public, such as location of bed openings and closings.

ACTION/ACTIVITIES

Seasonal mailings can be used to reach active New Hampshire shellfishers directly with information on:

- proper harvesting techniques;
- the resource management program;
- updates on water quality improvements that support shellfishing;
- maps and shellfish-specific tide information;
- invitations to shellfish-related meetings, workshops, and activities.

RESPONSIBLE PARTIES

New Hampshire Fish and Game Department and New Hampshire Department of Environmental Services will take the lead in updating existing materials and identifying needs for new materials. The New Hampshire Department of Health and Human Services, the New Hampshire Coastal Program, and the New Hampshire Estuaries Project may assist where appropriate.

IMPLEMENTATION LOCATION

Not applicable.

COSTS

Postage (per year)	$2,000
Administration/publication/printing costs	$4,000
Map reproduction by NHCP - 5000 copies	$0 (in SHL-10)
Reproduction of existing materials (no color)	$500
Total	**$6,500**

FUNDING

New funding for this program should augment that currently provided by New Hampshire Fish and Game Department. The restructured New Hampshire shellfish sanitation program under New Hampshire Department of Environmental Services will contribute assistance to the efforts. Additional sources could include New Hampshire Coastal Program grants, New Hampshire Department of Environmental Services non-point source program education funds, and the New Hampshire Estuaries Project.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

- Provide current shellfish resource management, water quality, and public health information to those stakeholders who are most directly affected.
- Help the New Hampshire shellfish sanitation program improve its credibility with the shellfishing public.
- Increase shellfishers' sense of participation in the management of the resource.
- The shellfish resource will benefit from better-informed harvesters.
- More shellfishers may become active supporters of estuarine water quality improvements.

TIMETABLE

Initiate by 2007.

PRIORITY

Priority. Implementation of this action will be significantly enhanced by implementation of Action SHL-11.

ACTION SHL-14

Provide for direct citizen involvement in the New Hampshire shellfish management decision- making process.

PRIORITY
+++ SHELLFISH OUTREACH

BACKGROUND

Throughout the *NHEP Management Plan* development process, both the Shellfish and Public Outreach and Education project teams have discussed the benefits of citizen participation in shellfish resource management and shellfish sanitation programs. The project teams recognized that citizen participation may increase shellfisher confidence in the state's public health, shellfish sanitation, and shellfish resource management strategies. Citizens who choose to become involved in the shellfish management decision-making process may become a core of advocates or "shellfish stewards." Active harvesters with a role in managing the resource may be effective "on-the-flats" educators, assisting the state agencies charged with administering the New Hampshire shellfish management programs.

Some avenues for citizen participation in shellfish management already exist in New Hampshire. The Advisory Committee on Shore Fisheries is a legislatively appointed committee of citizens and agency representatives charged with overseeing and developing policy for many of New Hampshire's marine and estuarine resources. New Hampshire Fish and Game Department solicits input from this committee on policy and management decisions related to many marine topics including the shellfisheries. The Advisory Committee on Shore Fisheries is an appropriate venue for citizens to voice concerns regarding shellfish management and shellfishery policies. However, public knowledge of the committee and its public participation process appears limited.

Since 1997 the New Hampshire Estuaries Project has provided for public input into the New Hampshire Department of Health and Human Services shellfish sanitation program through the NHEP Shellfish Project Team. Shellfishers participating in this working group helped shape and prioritize the sanitation and water quality monitoring program that resulted in the opening of 1,622 acres of shellfish-growing waters, including the Seabrook Middle Ground and Lower Little Bay.

The New Hampshire Department of Environmental Services has found input from this group so valuable that NH DES intends to continue to use the NHEP Shellfish Team as a public advisory committee as it takes the lead in the restructured shellfish sanitation program. If NHEP were to disband the Shellfish Team, NH DES would create a similar public advisory committee. However, shellfisher knowledge of the NHEP Shellfish Team and its opportunities for public participation also appears limited.

Concerned citizens may also participate more or less directly in New Hampshire shellfish management through citizen's groups like Great Bay Coast Watch. The water-quality monitoring and pollution-source identification work of Great Bay Coast Watch volunteers has been instrumental to the progress made in the shellfish sanitation and pollution source identification efforts of NH DHHS, NHEP, and NH DES.

ACTION/ACTIVITY

1 NH F&G will inform the shellfishing public about the Advisory Committee on Shore Fisheries, including:

- who serves on the committee and how members are appointed;
- the Committee's responsibilities, jurisdiction, and limitations;
- how public input is submitted to the committee, and how committee findings are reported to the public;
- committee meeting dates, times, and locations, available from New Hampshire Fish and Game Department at (603) 868-1095.

2 NH DES will inform the shellfishing public about the Shellfish Sanitation Advisory Committee/NHEP Shellfish Project Team, to include:

- encouragement of open public participation in committee meetings;
- definition of the Committee's responsibilities, jurisdiction, and limitations.

3 Continue support for volunteer monitoring activities that support shellfish resource management and shellfish sanitation programs (see Action EDU-5).

RESPONSIBLE PARTIES

- Activities related to the Advisory Committee on Shore Fisheries (Step 1): New Hampshire Fish and Game Department.
- Activities related to the Shellfish Sanitation Advisory Committee (Step 2): New Hampshire Department of Environmental Services should take the lead with possible assistance from NHEP and New Hampshire Department of Health and Human Services.
- Volunteer monitoring: see Action EDU-5.

COST

Advisory Committee on Shore Fisheries in Step 1	
Mailing and public notification	$2,000
Workshops and meetings	$2,000
NH DES Shellfish Sanitation Advisory Committee in Step 2	
Mailing and public notification	$2,000
Workshops and meetings	$2,000
Total	**$8,000**

FUNDING

This action, except for costs for workshops and meetings, may be funded in part through US EPA NHEP implementation funds or through other federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP will also support this action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

- Provide current shellfish resource management, water quality, and public health information to those stakeholders most directly affected.
- Help build the credibility of the New Hampshire shellfish sanitation program with the shellfishing public.
- The shellfish resource will benefit from a more informed shellfishing public.
- Increase shellfishers' sense of participation in the management of the resource.
- More shellfishers may become active supporters of estuarine water quality improvements.

TIMETABLE

Step 1 currently initiated by NH F&G public comment procedures. Step 2 will be initiated in 2001. Step 3 is supported by funding for WQ-5, volunteer support for shoreline surveys, in 2000-2002.

+++

PRIORITY

Highest Priority. Implementation of this Action is in part related to implementation of Action EDU-5.

SHELLFISH AQUACULTURE

PRIORITY +++

ACTION SHL-15

Evaluate and address perceived and real institutional barriers to aquaculture and promote environmentally sound aquaculture practices.

BACKGROUND

Commercial shellfish aquaculture can provide a variety of benefits to the Seacoast region but must be carefully examined to ensure it does not negatively affect the environment. The unintended introduction of exotic species and effluent from aquaculture areas can have negative impacts on environmental quality. Aquaculture can co-exist with recreational shellfishing and be consistent with environmental stewardship. The application of aquaculture technologies to public resource management can also benefit both recreational harvesting and resource restoration for habitat and ecological health.

A commercial shellfish aquaculture industry in New Hampshire would be small compared to neighboring states due to geographic limitations, but excellent opportunity exists to develop a viable industry. For example, if 50 acres of the tidal waters in the Great Bay Estuary were effectively cultivating oysters and disease problems could be overcome, farmers could potentially produce 25,000 bushels of oysters and gross revenues of $1.5 million annually.

Considering the current crisis and uncertain future of the capture fisheries, the commercial fishing community and the Seacoast economy could benefit from identifying and realizing aquaculture opportunities. Recent scientific evidence of water quality and ecosystem benefits from increased filtration by bivalves indicates that expanding shellfish culture could also improve water quality. Environmentally sound aquaculture practices that do not impact existing benthic (bottom-dwelling) or pelagic (open ocean) resources can increase filtration capacity by adding large numbers of bivalves to the system.

Obstacles to development of the industry include negative attitudes toward aquaculture held by some recreational harvesters and riparian landowners; philosophical disagreements over granting exclusive rights to a cultivated resource in public waters; concerns about the lack of federal shellfish sanitation certification (NSSP) in New Hampshire; leasing and permitting processes and costs; and product security issues. Education, planning and technology transfer activities are needed to stimulate industry development.

ACTIONS/ACTIVITIES

1 UNH Sea Grant has funded an ongoing effort to evaluate perceptions and attitudes toward aquaculture including commercial fishermen, tourists, policy makers, and coastal communities.

In addition, plan and hold a series of informational and discussion sessions on aquaculture. Identify and invite stakeholders including all those mentioned above, plus recreational fishermen and riparian landowners. Areas of disagreement or conflict should be identified and resolutions sought. Desired outcomes include a public better educated about aquaculture of shellfish, finfish, seaweed, etc.; identification of methods and

locations where conflict is minimal; and an estimate of the capacity for industry development. Hold meetings in Durham, Portsmouth, Stratham, Rye, and Seabrook.

2 **Permitting**. Streamline the permitting process so applicants will know how to submit one permit that is reviewed by all appropriate agencies in a timely manner. Review licensing and other fees for aquacultural operations and revise as necessary. All regulatory agencies requiring or involved in permit applications should meet and develop a plan to adequately address coordination, communication, and other issues. Specific changes need discussion, such as developing administrative rules requiring a written application to the state agency which certifies sanitation for aquaculture ventures in a shellfish-growing area.

3 **State compliance with NSSP**. Agencies need to identify and correct deficiencies in the program, as authorized by state law (RSA 143) and outlined in Action SHL-1.

4 **Technology transfer.** Offer training programs for prospective aquaculturists including methods to reduce environmental impacts. Successful examples are Harbor Branch in Florida and Pemaquid Oyster in Maine. UNH laboratories are ideal locations for training sessions.

5 **Ongoing review of scientific knowledge.** Regularly review and disseminate current knowledge of aquaculture-related issues – environmental impact reduction and control, disease control, improvements in aquaculture methods, etc. – to assist the aquaculture industry, regulatory community, and other interested parties.

RESPONSIBLE PARTIES

Evaluation of perceptions and attitudes toward aquaculture (Step 1)

UNH Sea Grant has funded a series of surveys on this topic with cooperation from NH Fish and Game, the scientific community, aquaculture professionals, the commercial fishermen's association, non-governmental environmental groups, and outreach and education professionals from organizations such as UNH Sea Grant, NHEP, NH Coastal Program, and the Seacoast Science Center.

Permitting (Step 2)

NH Fish and Game, Army Corps, NH DES, National Marine Fisheries Service, US Fish and Wildlife Service, NH Coastal Program

State Compliance with NSSP (Step 3)

NH DES (lead agency), with assistance from NH DHHS, NH Coastal Program, and NH Fish and Game

Technology Transfer (Step 4)

Scientific community, aquaculture and fishing industry, UNH Sea Grant, NHEP, NH Coastal Program, NH Fish and Game

Ongoing Review of Scientific Knowledge (Step 5)

Scientific community, aquaculture and fishing industry, UNH Sea Grant,

NHEP, NH Coastal Program, NH Fish and Game

IMPLEMENTATION LOCATION

Opportunities for marine aquaculture development in New Hampshire are very site specific, and will be considered or addressed in detail in the public perceptions, state permitting and NNSP compliance activities of this Action Plan.

COSTS

Evaluation of aquaculture perceptions and attitudes (Step1)

Grant to cover cost of workshops/meetings
from UNH Sea Grant: $3,000-$5,000

Permitting (Step 2)

NH Fish and Game, Army Corps, NH DES Wetlands Bureau,
NH Coastal Program (staff time only). No cost beyond staff time.

State compliance with NSSP (Step 3)

Accomplished by, and costs accounted for, Action SHL-1

Technology transfer (Step 4)

UNH Sea Grant, NHEP,
NH Coastal Program, NH F&G: $10,000-$20,000/year

Ongoing review of scientific knowledge (Step 5)

UNH Sea Grant, NHEP, NHCP, NHF&G: $5,000-$10,000/year

FUNDING

This action may be funded in part through US EPA NHEP implementation funds, or through other appropriate federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES, NH F&G and NH OSP could also support this action. Scientific research may be funded through other academic research awards.

REGULATORY NEEDS

Changing permitting procedures and gaining FDA certification of the state shellfish program may require some changes to state laws and/or administrative rules.

EXPECTED BENEFITS

A viable aquaculture industry can provide:

- economic benefits to commercial fishermen and the Seacoast region;
- environmental benefits through increased water filtration capacity of the estuarine ecosystem;
- the development of technologies that can be used to enhance or restore shellfish resources for recreational harvest.

MONITORING AND ENFORCEMENT

Evaluation of aquaculture perception/attitudes

NH F&G, NH Coastal Program, NHEP

Permitting

NH F&G, Army Corps of Engineers, NH DES, NH Coastal Program.

State compliance with NSSP

NH DES (lead agency), with assistance from NH DHHS,
NH Coastal Program, NH Estuaries Project, and NH Fish and Game.

Technology transfer

No requirements identified.

Ongoing review of scientific state of knowledge

No requirements identified

TIMETABLE

Step 1 has been studied through a series of surveys between 1997-2000.
+++ Steps 2-5 will be initiated by 2004.

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions in the *NHEP Management Plan*, although Action SHL-15 is related to Action SHL-1.

HABITAT RESTORATION

7

Habitat is the setting in which particular plants or animals live, feed, find shelter, and reproduce. Plants and animals need specific types and quality of habitat to meet their particular needs. Plants need moisture, light, nutrient, temperature, and soil conditions specific to particular species. Animal habitats must provide necessary food, shelter, breeding sites, and travel corridors. Many animal species require specific plant species in their habitat. New Hampshire's estuaries provide a wealth of unique and productive habitats that support a diverse array of plant and animal populations, including threatened and endangered species. The key to protecting animal and plant species is protecting and restoring the appropriate habitats.

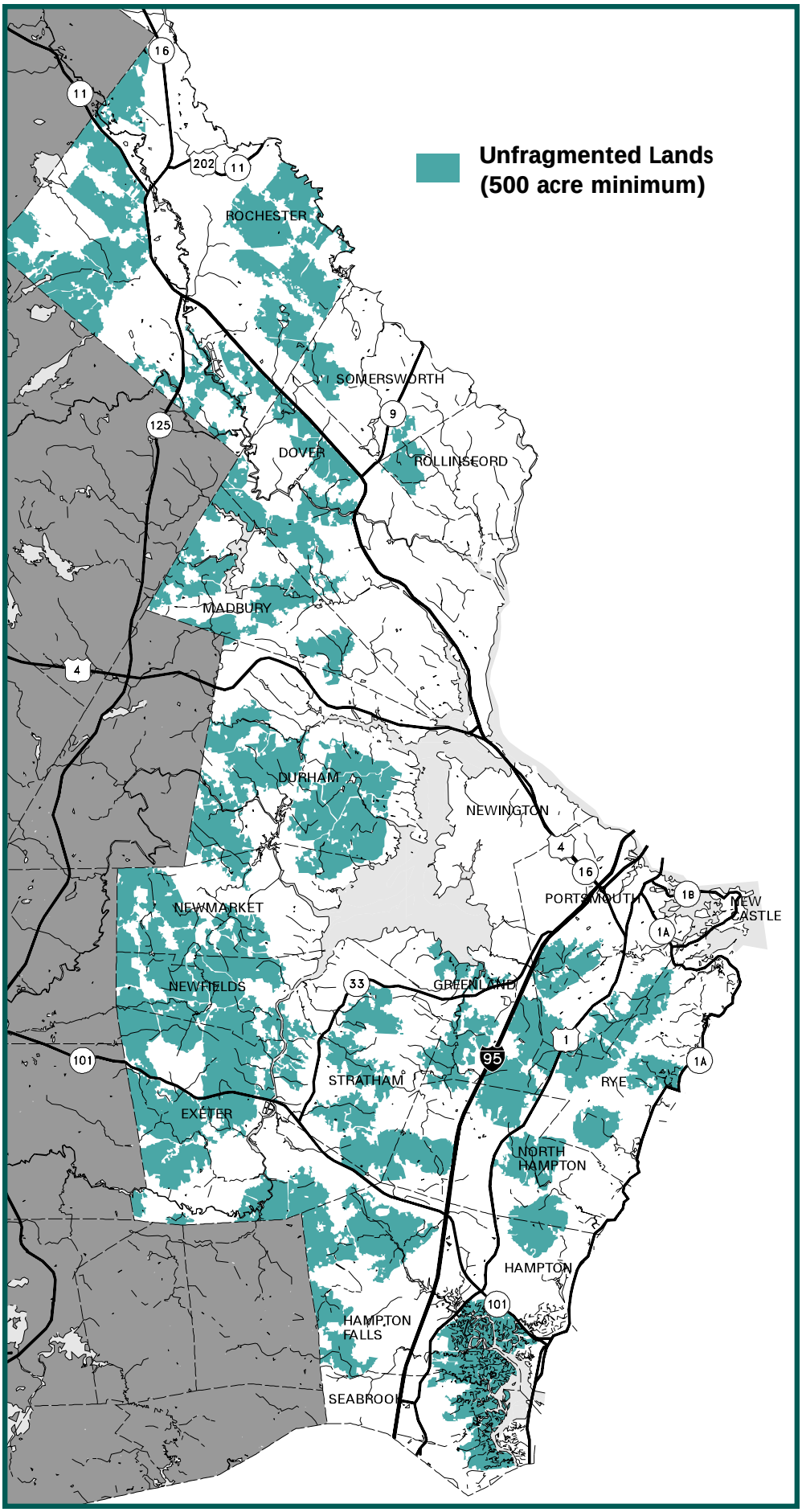
GBNERR

Great blue heron

More opportunistic species, such as raccoons, can live in a wide range of habitats – suburban and urban developments, agricultural areas, and forests. Other species, like the salt marsh-dwelling seaside sparrow, live only in one or two very specific kinds of habitat. Still other species need several very different kinds of habitats to survive. An example is the great blue heron, which nests in colonies in trees and feeds in wetlands. Extent of habitat area is also important. A meadow vole or marsh wren can survive in a very small area, but white-tailed deer or pileated woodpeckers require many contiguous acres of suitable habitat to survive and reproduce.

Natural communities are assemblages of plants and animals that occur together on the landscape in response to specific habitat conditions. Some natural communities are widespread, while others are relatively rare. The health of these mutually dependent or beneficial natural communities reflects habitat quality. Fifteen types of natural communities identified by ecologists are found in New Hampshire only in the coastal watershed.

The NHEP has identified several types of habitat that serve important ecological functions and are at greatest risk in the estuarine region. Protection of these habitats is addressed in *Chapter 5: Land Use, Development, and Habitat*


Unfragmented Lands
(500 acre minimum)
ROCHESTER
SOMERSWORTH
DOVER
ROLLINSFORD
MADBURY
DURHAM
NEWINGTON
PORTSMOUTH
NEW CASTLE
NEWMARKET
NEWFIELDS
GREENLAND
STRATHAM
RYE
EXETER
NORTH HAMPTON
HAMPTON
HAMPTON FALLS
SEABROOK
16
11
202
11
125
9
4
4
16
1B
1A
33
1
95
1A
101
101

Protection. Preventing loss or degradation of habitats is the best course, but in some situations important impaired or lost habitat can be repaired or restored. *Chapter 7: Habitat Restoration* of the *Plan* addresses remedial opportunities to enhance and/or restore critical habitats as part of NHEP efforts to protect and improve water quality, fish and shellfish resources, the rich diversity of species in the estuaries, and the quality of life enjoyed by people in the New Hampshire Seacoast. The NH Coastal Program and UNH Complex Systems Research Center are using Global Information Systems information to measure and map all the various estuarine habitat types, which will help resource managers measure change in habitat over time.

Some degraded habitats in the region can be restored to increase functional values and/or available habitat area. Potential habitat restoration projects include a whole range of activities, including recreating specific habitat that has been lost; and enhancing existing habitats that have been degraded or diminished by human activity. Habitat restoration may be part of a regulatory mitigation effort designed to compensate for habitat loss due to development or other human intervention. Mitigation can also include creating habitat–such as wetlands--that did not previously exist in a specific location. Techniques for restoring habitats have been developed, studied, and refined over the last two to three decades, making restoration, and in some cases creation, of habitat a viable option in certain situations.

The NHEP has identified the greatest needs for habitat restoration and enhancement:

- shellfish habitat
- wetlands (tidal and freshwater)
- significant upland habitats

The Audubon Society of New Hampshire, Great Bay Resource Protection Partnership, the Lamprey River Advisory Committee, and other watershed and conservation groups are identifying critical habitats in the NHEP study area. This information will lead to identification of the most practical and critical opportunities for habitat restoration and enhancement efforts. Restoration of tidal marshes is the best known type of habitat restoration in the Seacoast region. The NHEP and New Hampshire Coastal Program (NHCP) have already supported several salt marsh restoration projects in the estuaries.

The USDA Natural Resources Conservation Service (NRCS), with assistance from several other organizations and agencies, published a guide to identifying salt marshes degraded primarily by the restriction of tidal waters entitled *Evaluation of Restorable Salt Marshes in New Hampshire*. NRCS is developing a second guide to assist conservation commissions and other municipal officials in identifying restoration opportunities for a number of other habitat types. The NHEP is working with the Audubon Society of New Hampshire, the NRCS, and the Town of Rye to field test this manual. This project will refine and simplify the process for communities and agencies.

Salt marsh restoration volunteers at Sandy Point

NHCP

WHY IT MATTERS

New Hampshire's estuaries and their watersheds support great diversity of plant and animal species. These healthy living resources in turn contribute to the overall health of the ecosystem. For example, shellfish help filter and purify estuarine waters. Estuarine habitats play critical roles as nursery, feeding, and resting areas for countless aquatic and terrestrial species. Two-thirds of New Hampshire's commercially harvested fish rely on the estuaries at some point in their lives.

These special estuarine habitats are crucial to the future survival and success of these species. As development and human uses of the watershed increase, protecting habitat area and quality is not enough. Restoring degraded habitat areas is a viable and important strategy to improve the health and integrity of the estuarine environment, and to protect and support the living resources of the estuaries.

Habitat restoration and enhancement is not just good for plants and animals. Restoring habitat is also good for people – for quality of life, recreation, economic opportunities, and more. Many residents and visitors to the New Hampshire Seacoast enjoy the excellent wildlife and bird watching, shellfishing, fishing, and hunting supported by the estuarine and upland habitats of the watershed.

The estuaries are nursery areas for commercially important fish and shellfish including lobsters, winter flounder, cod, pollack, eels, and hake. The estuaries also sustain runs of shad, alewives, and lampreys, which travel from the ocean through the estuaries to reproduce in the freshwater tributaries. The estuaries host runs of smelt to their spawning grounds at the heads-of-tide. The remarkable recovery of the striped bass is supported by summer feeding areas such as the Great Bay and Hampton-Seabrook estuaries.

New Hampshire's estuaries and associated uplands also provide significant breeding, feeding, and overwintering habitat for many species of birds, from bald eagles to marsh wrens. Thirteen state-listed threatened or endangered birds occur in the watershed. New Hampshire's coastal watershed provides important stopover habitat for migratory birds and bats using the Atlantic flyway. The Great Bay and Hampton-Seabrook estuaries provide important migration and wintering habitat for 20 species of waterfowl, 27 species of shorebirds, and 13 species of wading birds. The Seacoast is New Hampshire's primary waterfowl wintering area, with Great Bay supporting about 75% of the wintering population.

Restoration and enhancement of lost, degraded, or diminished estuarine habitats can also help accomplish or work in concert with other key goals of the NHEP – such as increasing healthy and sustainable shellfish populations, improving estuarine water quality, and protecting habitat areas through sound land- use planning.

D. DELUCA

Above: Tern restoration project on Seavey Island

A. SMITH

Left: Mussel seeding at the North Mill Pond, Portsmouth

THE CHALLENGE

Development is the leading cause of habitat degradation within the coastal watersheds. Development can cause considerable direct loss of habitat for wildlife and natural communities, plus degradation of adjacent or nearby areas. Water quality is essential to habitat value and function, and pollutants from new development can contaminate water and degrade habitat far beyond the development site. Examples of habitats affected by development include:

Shorelands and Streambanks

Shoreland development often involves clearing of vegetation, which removes the shoreland's natural ability to filter pollutants, shade the water, prevent soil and bank erosion, and provide habitat and travel corridors for a wide range of species. Increased impervious surfaces can lead to dramatic increases in volume and velocity of runoff to surface waters. Such increases often lead to severe streambank erosion, which in turn causes the same types of negative impacts as elimination of shoreline vegetation. Examples of shoreland restoration projects in coastal New Hampshire include bank revegetation in North Mill Pond in Portsmouth, and erosion control and bank stabilization along the Piscataqua River in Dover.

Salt Marshes

Development adjacent to salt marshes often results in reduced salinity of water and soil, either through increased freshwater runoff from impervious surfaces, or through restricted tidal flow from undersized culverts and/or filling. Reduced soil salinity encourages the growth of invasive species such as *Phragmites*. In 1994 approximately 20% of New Hampshire's remaining salt marshes were affected by tidal restrictions. Many of these tidal-restrictions have been or are being addressed through culvert replacements and other marsh restoration techniques in Rye, Hampton, Seabrook, Stratham, and other locations. Opportunities to restore salt marshes affected by freshwater runoff or negative impacts other than tidal restrictions may remain to be identified.

Salt marsh restoration: culvert replacement in Stratham

NHCP

Eelgrass Beds

Eelgrass beds or meadows form subtidal and intertidal seagrass habitats which cover the greatest area of all habitat types in the Great Bay Estuary. Eelgrass habitats are important as breeding and nursery grounds for finfish, shellfish, and other invertebrates, and as feeding grounds for many fish, invertebrates, and birds. Eelgrass stabilizes bottom sediments, and may also filter nutrients, suspended sediments, and contaminants from estuarine waters.

Eelgrass wasting disease (caused by the myxomycete *laburinthula sp.)* was first recognized in Great Bay in the 1940s. In the late 1980s wasting disease caused dramatic eelgrass declines in the Great Bay Estuary, arousing great concern into the early 1990s. However, historical eelgrass beds have made an impressive recovery of acreage and densities, and new beds have been observed in areas previously devoid of eelgrass. While overall the resource is improving, recovery of lost eelgrass areas has been significantly slower in Little Bay.

Development and recreation threaten eelgrass beds, too. Boat propellers and mooring chains cause physical disruption, docks shade the sunlight, and degraded water quality damages eelgrass beds. In certain cases restoration is required as compensatory mitigation for wetland impacts, such as the expansion of the Port of New Hampshire facility in Portsmouth Harbor. Eelgrass restoration efforts have been conducted at several sites in the Great Bay Estuary, including Little Bay where beds killed by the wasting disease have not recovered in over 10 years, and the Bellamy River. Rye Harbor is another recent eelgrass bed restoration site.

Shellfish Beds

The oyster resources of the Great Bay Estuary have declined in recent years. Oysters in the Salmon Falls and Piscataqua rivers were severely affected by the MSX disease, suffering mortalities of 25%-83% in 1995. This disease outbreak likely affected oyster populations throughout the Great Bay Estuary, but test information indicates other areas of the estuary were not affected as severely as the Salmon Falls and Piscataqua rivers. Oysters in the Great Bay Estuary (Adams Point and Nannie Island) showed signs of infection, but no mortalities were found. However, these beds and others have declined in density and acreage. The cause is not clear, but siltation, predators, or other factors may have played a role. UNH CICEET is planning an oyster bed restoration project in the Salmon Falls River, one of the areas most severely affected by the MSX disease.

Anadromous Fish

A dam marks the head of the tide in nearly every tributary of the Great Bay Estuary. Prior to the installation of fish ladders, populations of several species of fish suffered from the dams blocking access to their breeding grounds. Some breeding grounds were degraded by shoreline erosion, sedimentation, and poor water quality. Fish ladders and stocking programs, in concert with water quality improvement programs, are now commonly used to rebuild some of these populations, although it is thought that commercial ocean fishing may be limiting the success of some restoration efforts.

NHCP

Sandy Point Salt Marsh: pre-restoration

REGULATORY AND MANAGEMENT PROGRAMS

Mitigation is a process required in federal environmental regulations for major public and private development projects that have impact on legally protected environments, most commonly wetlands. Mitigation involves avoiding, minimizing, and then compensating for impacts. When estuarine or coastal habitats are affected by such development, habitat restoration is preferred over habitat creation as a mechanism of compensatory mitigation.

Federal wetland policy stems from Section 404 of the Clean Water Act which requires permits for dredging and filling activities in wetlands. Permit applications are coordinated and issued by the US Army Corps of Engineers (ACOE), with review by several federal agencies including EPA, US Fish & Wildlife Service, and the National Marine Fisheries Service. A 1990 Memorandum of Agreement (MOA) between EPA and ACOE established a national goal of "no net loss"of wetlands. A prioritized, three-step policy was established to achieve the "no net loss" goal. Permit applicants must:

- Avoid impacts or investigate alternative sites;
- Reduce and minimize impacts; and finally
- Replace the functions and values of the habitats affected by the development through compensatory mitigation.

Federal wetland regulatory programs are coordinated with state wetland programs, led by the NH DES Wetlands Bureau. All projects in salt marshes are considered major and must go through the federal permit process regardless of size. Mitigation includes creation, restoration, enhancement, and preservation, and projects may combine these options. On-site mitigation is preferred to off-site wherever possible.

Mitigation is not required for "minimum impact" or "minor" projects, and is only sometimes required for major projects. A 1997 study of New Hampshire wetland permits and mitigation projects found only 20% of major project permits required mitigation, and the success rate of wetland mitigation projects was not high.

Still, mitigation requirements for development and public works projects such as road construction that affect wetlands offer opportunities to restore or enhance lost or degraded tidal and freshwater wetland habitats in the coastal region.

Because roads and bridges cause many of the restrictions to tidal flow in salt marshes (and other wetland degradation), routine road repair and maintenance work at both local and state levels can provide opportunities to restore and enhance wetland habitats. Plans for repair, replacement, and new construction should be monitored to limit further impact on tidal and freshwater wetlands.

Wetland restoration projects, especially in tidal waters, must also go through the rigorous wetland review and permitting process, and require cooperation among all participating agencies and landowners.

EPA published new regulations on December 8, 1999 for Phase II of the NPDES permit stormwater management program. Compliance with these Phase II rules will be required by March 2003. Under Phase II rules, NPDES permit coverage will be required for small municipal separate storm sewer systems in urbanized areas--including Dover, Durham, Madbury, New Castle, Newington, Portsmouth, Rochester, Rollinsford, Rye, and Somersworth. Phase II NPDES stormwater rules will also apply to discharges from construction sites disturbing between one and five acres.

Clean Water Act Section 303(d) and its implementing regulations require states to list water body segments as impaired if they fail to comply with a water quality goal or use (such as fishing or swimming) even after targeted pollution control practices have been put into place. The Clean Water Act requires that this impaired waters list include a prioritized ranking of segments most in need of Total Maximum Daily Load (TMDL) analysis. The TMDL defines the maximum amount of a specific pollutant that can be discharged into a body of water without violating water quality goals for that water. NPDES permits and state wastewater discharge licenses are written to be consistent with the TMDL waste load allocations for the receiving water body. TMDLs are being developed and implemented for the Rochester segment of the Cocheco River for dissolved oxygen, and for the Salmon Falls River downstream of Somersworth for dissolved oxygen and phosphorous.

Sandy Point Salt Marsh: post-restoration at high tide

NHCP

GOAL FOR RESTORING HABITATS

The NHEP has one chief goal for restoration of valuable habitats in the estuaries and the estuarine watersheds. See *Appendix 3* Habitat Protection and Restoration Goals, Objectives, and Strategies for a complete list of goals and objectives. The Action Plans for habitat restoration offer several ways for agencies, communities, and landowners to work together to:

- Maintain habitats of sufficient size and quality to support populations of naturally occurring plants, animals, and communities.

HABITAT RESTORATION
ACTION PLANS

Shellfish Restoration

RST-1 Develop and implement a plan for shellfish resource enhancement and habitat restoration activities to achieve a sustainable resource contributing to a healthy environment. 7-13

Wetland Restoration (tidal)

RST-2 Using the Coastal Method and other techniques, identify and restore additional restorable tidal wetlands. 7-14

RST-3 Continue to restore the restorable tidal wetlands listed in the Natural Resources Conservation Service report, *Evaluation of Restorable Tidal Marshes in New Hampshire*. 7-17

Habitat Restoration

RST- 4 Identify and implement habitat restoration projects in other important non-tidal habitat areas, such as uplands and freshwater wetlands. 7-19

Wetland Restoration

RST-5 Create a list of potential wetland restoration projects that could be used for wetland mitigation projects, and distribute the list to state agencies, US Fish & Wildlife Service, and Seacoast municipalities. 7-21

RST-6 Pursue restoration funding from the NH Department of Transportation, US Department of Agriculture/National Resources Conservation Service, US Fish and Wildlife Service, and other sources. 7-23

ACTION RST-1

Develop and implement a plan for shellfish resource enhancement and habitat restoration activities to achieve a sustainable resource contributing to a healthy environment.

+++ SHELLFISH RESTORATION

See Action SHL-8.

WETLAND RESTORATION (TIDAL)

PRIORITY

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ACTION RST-2

Using the Coastal Method and other techniques, identify and restore additional restorable tidal wetlands.

BACKGROUND

Restoring tidal wetlands is consistent with the objectives of numerous state, regional, and international initiatives addressing significant habitat types. Salt marshes are important beyond their borders because they serve as nursery grounds for fish and as a source of primary productivity for near-shore areas. Both the NH Coastal Program (NHCP) and the Gulf of Maine Council on the Marine Environment list salt marsh restoration among their objectives. The Global Programme of Action Coalition (GPAC) recently endorsed salt marsh restoration as one of its major interests.

In its 1994 report entitled *Evaluation of Restorable Salt Marshes in New Hampshire,* the USDA Natural Resources Conservation Service identified all the tidal restrictions which may be causing salt marsh degradation. The report documented a list of tidal restrictions, typically undersized culverts, that were adversely affecting the state's salt marshes. Since the report was published, more than half of the restrictions have been removed, helping to restore marsh function and health. These restorations are continuing at a rapid pace and most of the practical restoration sites list in the report will be completed within the next few years.

The next challenge is to continue the momentum of restoration activities and restore marshes degraded by factors other than tidal restrictions. Especially desirable are projects that take an integrated approach to look at tidal restrictions, stormwater inflow, invasive species, waterfowl habitat, mosquito control, and historical resources.

The NRCS publication is the main reason NH has been able to leverage millions of dollars to eliminate tidal restrictions. That document allows anyone to see which projects are available. The document helped US Fish & Wildlife Service (USFWS)obtain and apply funds from the Natural Resource Damage Assessment Program, which is dedicated to purchasing and protecting habitat near Superfund sites, along the Little River in Hampton. The NHCP used it to direct competitive grant funds, and NRCS used it to access the Wetland Reserve Program.

A similar document is now needed for other types of restoration. An educational campaign is needed to get more people thinking about restoration opportunities, both proactively and as mitigation. Funds are needed to support restorations and the long-term monitoring required to evaluate the success of projects.

ACTIONS/ACTIVITIES

1. Identify additional restorable tidal wetlands, focusing on those affected by factors other than tidal restrictions – such as fresh-water runoff, invasive species, filling, excavation, and disposal of dredged material. Methods to accomplish this task include using the Coastal Method in all communities, aerial photograph evaluation, and field examination. Shoreline surveys can be used to look for stormwater inflow and invasive species. Talking with local historians and long-time residents can help identify where salt marshes occurred in the past. Prepare a report that identifies and explains degraded salt marsh locations.

2. Local, state, and federal agencies and organizations will work to restore sites determined to be good candidates for tidal wetland restoration. Communities and other implementers should pursue several options to restore the identified sites. In addition to seeking traditional funding sources (NHCP, EPA, USFWS, NRCS, etc.), the identified potential restoration sites can be proposed as candidates to satisfy mitigation requirements, or be completed as public works projects occur in the area.

RESPONSIBLE PARTIES

NRCS as the lead to develop the report (Step 1), with development and report promotion assistance from EPA, US Army Corps of Engineers, NHCP, US Fish & Wildlife Service, UNH/Jackson Estuarine Laboratory, regional planning commissions, Conservation Districts, Conservation Commissions, volunteer groups, UNH Sea Grant, Project SERVE, and landowners (Step 2).

IMPLEMENTATION LOCATION

Tidal wetland locations throughout the 17 New Hampshire tidewater communities should be assessed during implementation of this action.

COSTS

Project Identification in Step 1	$50,000-100,000
Report production in Step 1	$10,000
Restoration activities in Step 2	millions
Coastal restoration specialist to coordinate projects and pursue funding in Step 2 (per year)	$50,000

FUNDING

Step 1 of this project will be funded in part by NHCP in the 2001 field season. This project may also be funded in small part with federal USEPA-NHEP implementation funds, USFWS Partners for Fish and Wildlife and Natural Resource Damage Assessment programs, NOAA Coastal Services Center funds, USGS Assistance to State Water Resources Research Institutes, or through other federal programs identified in Tables 10.1 to 10.6 of this document.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Restored and enhanced salt marsh habitat and function.

MONITORING AND ENFORCEMENT

Monitoring restoration success should be part of each restoration project, following guidelines currently being developed by the NH Coastal Program and other coastal NH organizations.

TIMETABLE

INitiate in 2001

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PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION RST-3

Continue to restore the restorable tidal wetlands listed in the Natural Resources Conservation Service report, Evaluation of Restorable Tidal Marshes in New Hampshire.

PRIORITY
+++ WETLAND RESTORATION (TIDAL)

BACKGROUND

In 1994 the USDA Natural Resources Conservation Service published a report, *Evaluation of Restorable Tidal Marshes in New Hampshire*. The report documented a list of 31 tidal restrictions, typically undersized culverts, that were adversely affecting the state's salt marshes. Coastal municipalities, state agencies, NRCS, U.S. Fish & Wildlife Service, and others have aggressively pursued funding to restore salt marsh sites listed in the report. The NH Coastal Program reports that of the 31 sites in 2000:

15 tidal restrictions have been eliminated

4 projects are in the planning or restoration process

6 restoration projects are possible but difficult

6 restrictions are probably permanent

Projects thought to be difficult, or sites where degradation of a wetland habitat is considered permanent, may be due to proximity of houses and flooding potential, current recreational use of the former salt marsh site, high cost, etc.

ACTIONS/ACTIVITIES

Pursue planning and restoration funds for the remaining restorable tidal wetland (including freshwater tidal wetlands) sites, approximately 300 acres, listed in the NRCS report that are deemed practical and have not yet been restored. In most cases this involves:

1. Investigate and/or monitor the site to determine the post-restoration potential for flooding of nearby properties, collect data where needed to design a restoration methodology that involves more than just removing a tidal restriction, etc.
2. Restore the site as needed by removing some or all tidal restrictions, removing any fill, ditching, creating open water areas, transplanting salt marsh vegetation, etc.
3. Post-restoration monitoring is critical to determine the success of the effort, and to collect information that can help refine restoration techniques for future projects. Data collected typically include pore-water salinity and pH; mapping of vegetation; surveys of birds, fish, and other animals using the area, etc.

RESPONSIBLE PARTIES

NRCS and the NH Coastal Program (Steps 1-3), in partnership with several coastal municipalities, have taken the lead in encouraging restoration of these sites, providing technical assistance to design site restoration plans, and providing funding to conduct the work. These agencies should continue in these roles. Agencies such as the US Fish and Wildlife Service, US EPA, US Army Corps of Engineers, NH Estuaries Project, and others should also continue to assist municipalities and landowners in restoring these habitats.

IMPLEMENTATION LOCATION

Tidal wetland locations identified in the 1994 NRCS document, *Evaluation of Restorable Tidal Marshes in New Hampshir*e.

COSTS

Costs vary greatly from site to site, ranging from a few thousand dollars to hundreds of thousands of dollars. Planning, restoration, and some monitoring is often accomplished within the range of $40,000-80,000 per project.

FUNDING

NHEP will apply $50,000 of implementation funds to Steps 1-3 in 2001-2002. Other funding sources include USFWS Partnership for Fish and Wildlife and Natural Resource Damage Assessment programs, or other federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds available through natural resource management agencies such as NH DES and NH OSP will also support this action. Local funds or in kind contributions toward the project may also be appropriate, especially for post-restoration monitoring (Step 3).

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Restored salt marsh acreage and enhanced wetland and habitat value and function.

MONITORING AND ENFORCEMENT

No enforcement required, though both pre- and post-restoration monitoring of the site should be pursued.

TIMETABLE

Three salt marsh restoration projects were conducted during the NHEP Planning phase. Additional projects will be initiated in 2001-2002.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION RST-4

Identify and implement habitat restoration projects in other important non-tidal habitat areas, such as uplands and freshwater wetlands.

PRIORITY

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HABITAT RESTORATION

BACKGROUND

Many previous efforts to identify habitat restoration projects have focused on tidal habitats, particularly salt marshes. Considerable opportunities for restorations of other habitat types include freshwater wetlands, rivers, streams, lakes, riparian, and terrestrial habitats. A joint effort combining the knowledge of the local conservation commission and other interested citizens with the habitat restoration expertise from agencies and organizations can best identify a list of sites that would benefit from some form of restoration. The USDA/Natural Resource Conservation Service is developing a method to assist communities interested in exploring restoration opportunities, and field-testing it in the town of Rye with help from the New Hampshire Estuaries Project and Audubon Society of New Hampshire.

ACTIONS/ACTIVITIES

1. Review the NRCS document for publication and to expand understanding and interest in using the method. Solicit input from town of Rye on the effectiveness of this approach.
2. Assist two communities each year in analyzing restoration opportunities.
3. Create a habitat restoration project funding database.
4. Complete at least one restoration project per year.

RESPONSIBLE PARTIES

The USDA Natural Resource Conservation Service will lead implementation (Steps 1-4) assisted by New Hampshire Estuaries Project, New Hampshire Coastal Program, US Fish & Wildlife Service, UNH Cooperative Extension, and the Audubon Society of New Hampshire.

COSTS

Review and publication in Step 1	$20,000
Community assistance in Step 2	$8,000/ town
Database in Step 4	no cost
Restoration projects in Step 4	unknown at this time

FUNDING

This action (Steps 2-4) may be funded through US EPA NHEP implementation funds; Step 1 cannot be funded with this money. Other possible funding sources include the New Hampshire Coastal Program grant program, USDA Wildlife Habitat Incentive Program, and the USFWS Partners for Fish and Wildlife Program and Natural Resource Damage Assessment Program.

REGULATORY NEEDS

None required.

EXPECTED BENEFITS

- Publication of a peer-reviewed document for municipalities to use to identify habitat restoration opportunities will have benefits beyond the coastal zone and beyond state boundaries.
- A list of restoration opportunities in the estuarine watersheds for use by federal, state, and local officials.
- Information to assist local communities in obtaining funding to undertake restoration projects.
- Restoring habitats of many types (rivers, lakes, terrestrial, etc.) will benefit a wide range of fish and other wildlife, and improve the ecological function and value of wetlands, etc.

MONITORING AND ENFORCEMENT

Monitoring restoration success should be a part of each project, following guidelines currently being developed by coastal New Hampshire organizations.

TIMETABLE

Initiate by 2005.

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PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*, although it will help in the implementation of Action LND-11.

ACTION RST-5

Create a list of potential wetland restoration projects that could be used for wetland mitigation projects and distribute the list to state agencies, US Fish & Wildlife Service, and Seacoast municipalities.

PRIORITY

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WETLAND RESTORATION

BACKGROUND

Although conservation commissions can request mitigation on any wetlands project, this rarely happens because NH DES does not usually suggest mitigation except for large projects, and it is only expressly required on projects in particularly valuable wetlands (e.g., those designated as Prime Wetlands through the local/state designation process outlined in state statute). Identifying and promoting mitigation opportunities might result in more wetlands being protected.

The NH Department of Transportation (NH DOT) is aware of mitigation and is somewhat used to providing for mitigation. The U.S. Fish & Wildlife Service's Natural Resource Damage Assessment (NRDA) Program uses Superfund settlement money to purchase, protect, and restore habitat near Superfund sites. NRDA funds have been used along the Little River in Hampton and are a possible funding source for additional restoration work in the estuarine and coastal watersheds. Mitigation may involve freshwater wetlands, salt marsh, and eel grass beds.

ACTIONS/ACTIVITIES

1. Increase the amount of wetland restoration performed as mitigation in the coastal area by providing information to and developing long-term agreements between NH DOT and other state agencies.
2. NH DES would work primarily with NH DOT to develop a list of potential wetland mitigation sites (freshwater wetland, salt marsh, eelgrass) for distribution and outreach to agencies, conservation commissions, and wetland permit applicants.
3. Use GIS (geographic information systems) technology to identify and illustrate potential sites in the seacoast.
4. Monitoring of restoration work will be conducted to ensure long-term success.

RESPONSIBLE PARTIES

NH DES would be the lead agency (Steps 1-4), assisted by NHCP, NH DOT, Rockingham and Strafford Conservation Districts, and local conservation commissions. NH DES Wetlands Bureau GIS staff could coordinate the GIS work. With a better database system, the present Wetlands Bureau staff could also track the mitigation projects (Step 3).

IMPLEMENTATION LOCATION

This action may be implemented in any or all of the 43 towns in the Great Bay and coastal watersheds.

COSTS

GIS services to digitize all sites in Step 3	$20,000
Distribute this information to the agencies and towns in Steps 1-2	$10,000
Total	**$30,000**

FUNDING

Projects may be funded through US EPA NHEP implementation funds, USFWS Partners for Fish and Wildlife and Natural Resources Damage Assessment programs, or through other federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds will be available through natural resource management agencies such as NH DES and NH OSP. Local funds or in kind contributions from participating communities may also be applied to project costs.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Increased restoration of wetlands through the regulatory wetland mitigation process.

MONITORING AND ENFORCEMENT

NH DES Wetlands Bureau and/or individual permit applicants would be responsible for monitoring mitigation success.

TIMETABLE

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Initiate be 2005. Opportunities to implement this High Priority action will be pursued in the next four years as funds and resources become available.

PRIORITY

High Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION RST-6

Pursue restoration funding from the NH Department of Transportation, US Department of Agriculture/National Resources Conservation Service, US Fish and Wildlife Service, and other sources.

PRIORITY
+++ WETLAND RESTORATION

BACKGROUND

Recent interest in wetland restoration has led to identification of many potential projects, and will likely lead to identification of still more projects. Funding is needed to take advantage of these restoration opportunities. NH DOT is especially relevant due to wetland mitigation requirements for road and bridge construction.

ACTIONS/ACTIVITIES

1. Pursue restoration funding from the EPA, NH DOT, USDA/NRCS, US F&WS, NOAA, et al. Seek traditional and non-traditional sources of funding for projects identified in RST-5. The new TEA-21 program through the U.S. Department of Transportation is a potential source of funds.
2. Keep funding sources informed of potential restoration opportunities, and make sure project proponents are aware of and understand the various funding sources.

RESPONSIBLE PARTIES

NH DES will pursue funding with assistance from NHEP (Step 1). Proponents and practitioners of salt marsh and other wetland restorations will pursue sources of funding (Step 2).

COSTS

DES or NHEP staff time to approach funding agencies and write grants. This could be part of the coordinator position identified in Action RST-2.

FUNDING

Projects may be funded through US EPA NHEP implementation funds, USFWS Partners for Fish and Wildlife and Natural Resources Damage Assessment programs, or other federal programs identified in Tables 10.1 to 10.6 in the *NHEP Management Plan*. State funds may be available through natural resource management agencies such as NH DES and NH OSP.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

Increased number and acreage of salt marshes restored, resulting in improved salt marsh and other wetland health, function, and habitat.

MONITORING AND ENFORCEMENT

None required.

TIMETABLE

This Highest Priority action will be initiated by 2004.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*, but would be pursued most effectively along with, or after completion of Action LND-10.

PUBLIC OUTREACH AND EDUCATION

8

Successful implementation of this *Management Plan* depends on the support of an informed, motivated public and the active involvement of the many stakeholders, interest groups, and regulatory authorities identified throughout this document. NHEP outreach activities aim to:

- Raise awareness of the ecological, recreational, historical, and economic value of New Hampshire's estuaries;
- Promote the natural resource improvements outlined in the *Management Plan;*
- Build a foundation of support for Management Plan implementation.

NHCP

Coastal Cleanup volunteers

Most of the Action Plans presented in the Water Quality; Land Use, Development and Habitat Protection; Shellfish Resources; and Habitat Restoration chapters of this document include educational or outreach activities to aid in the successful implementation of specific actions. Outreach Action Plans specifically related to the above chapter topics are found in those chapters. General outreach and education Action Plans are found in this chapter.

The NHEP emphasizes an issues-oriented approach to public education, connecting water quality and other natural resource issues with the daily activities of people who live, work, and recreate within New Hampshire's estuarine watershed. In this *Plan*, the NHEP presents realistic, positive solutions designed to address many of the natural resource, growth, and economic problems identified for the state's estuaries. The educational messages present both the constructive and destructive influences that people living, working, or recreating in the state's estuarine watershed can have on the region's coastal character, natural resource and economic values, and the environmental condition of the estuaries.

Shellfish harvesting, septic-system maintenance, waste water treatment system investments, development pressures, road and stormwater runoff, shoreline protection and access, boat and marina impacts, and commercial and recreational fishing are just some of the human activities and related issues that have major implications for the estuaries and their management. A wide variety of audiences are interested in these issues and activities.

NHCP

Summer crowds at Hampton Beach

WHY IT MATTERS

Every environmental problem threatening New Hampshire's estuaries is related at some level to human activity. Our desire to live, work, and play in unspoiled natural surroundings or near sensitive estuarine and coastal areas should motivate us to guard these precious resources. However, the popular demand for Seacoast locations and resources complicates important land use and resource management decisions. Seacoast communities struggle to balance property-owner rights and economic development with maintaining community character, water quality, and habitat and open space.

The cumulative impacts of numerous small land use decisions can incrementally erode the local landscape, degrade water quality and habitats, and undermine the long-term economic viability of a community for the sake of short-term goals. NHEP's public outreach and education efforts aim to raise awareness about this fragile balance between growth and progress, and community character and natural resources. The NHEP Outreach Project Team wants Seacoast area residents to recognize the wealth and benefits the estuaries bring to the region and state, and the importance of responsible use and stewardship of estuarine resources. The outreach and education Action Plans are designed to help New Hampshire Seacoast communities envision a healthy environmental future for their communities and the region, and take the steps needed to ensure that future.

Beachfront development

NHCP

THE CHALLENGE

NHCP

Portsmouth Harbor

The outreach and education actions of the NH Estuaries Project ask residents of the estuarine watershed to re-examine together their influences on the environmental condition of their communities and the estuaries. These activities are designed to connect natural resource conservation and management with the goals of preserving community character, ensuring sustainable economic vitality, and improving environmental conditions. Changing attitudes, and local priorities and planning procedures, is a gradual process that takes time. But time is short for the estuaries, due to the continuing pressures of growth and development in the New Hampshire Seacoast.

NHEP outreach activities aim to raise awareness of these pressures, and establish natural resource considerations as fundamental to decision-making at the individual, community, and regional levels. The New Hampshire Estuaries Project asks people and communities to consider their relationships to the natural beauty and resource wealth of the Seacoast region, and to commit to an ethic of stewardship.

Outreach Message: Shellfish Are Indicators of Water Quality

Recreational shellfishing is part of the history and tradition of coastal New Hampshire, and shellfish are an easily understood symbol of the area. Many people identify with the estuaries, beaches, and rocky shores of New Hampshire's coast, and recognize shellfish – particularly clams, oysters, and blue mussels – as characteristic features of the coastal environment. Thousands of people enjoy harvesting and eating soft-shell or steamer clams from the Hampton-Seabrook Estuary and oysters and clams from the Great Bay Estuary, but more than 50% of the state's shellfish waters are closed to harvesting.

Shellfish are a direct link between sources of fecal bacteria (e.g., wastewater treatment facilities, faulty septic systems, stormwater runoff), impaired water quality, and human health and well-being. Availability of shellfish that are safe for people to harvest and eat depends on clean water. Shellfish are also important indicators of water quality and overall health of the coastal and estuarine environments – the 'canary in the coal mine' of the estuaries. Declining shellfish populations and shellfish habitat may signal other problems in the estuarine ecosystems. Healthy, abundant populations of shellfish are also contributors to the ecological health of the estuaries by helping to filter and purify estuarine water.

For all these reasons, shellfish provide an easy-to-read yardstick for measuring the environmental quality of the state's estuaries. Safe human consumption of shellfish relies on a shellfish sanitation and management program that closely monitors shellfish-growing waters and shellfish themselves for fecal bacteria

GBNERR

Oyster harvesting

and other pollutants. As actions are implemented to protect and improve estuarine water quality through changes in land use or development practices, habitat protection and restoration activities, and sewage treatment upgrades, the status of the shellfisheries and shellfish resources will serve as a barometer of ecological health in the estuaries. Acreage of open shellfish beds, and health and numbers of shellfish populations, will provide a report card to the state on environmental progress in the estuaries.

Shellfish are a valuable economic, recreational, cultural, and natural resource for the Seacoast region. Several thousand New Hampshire residents enjoy harvesting shellfish. While shellfish in New Hampshire are limited to recreational harvest, with no sales permitted, the region's recreational shellfishery is worth millions of dollars annually to the local economy. Many long-time Seacoast residents who do not dig clams or tong oysters say they feel better about their communities knowing they could harvest nearby shellfish if they chose. Opening more areas to shellfishing would extend that peace of mind to still more people living near the estuaries.

Outreach Organizations Working Together With Seacoast Communities

The New Hampshire Seacoast has a number of public outreach and education organizations committed to advancing natural resource management and conservation, and improving water quality. Representatives from the New Hampshire Estuaries Project, New Hampshire Coastal Program, NH Fish and Game Department, NH Department of Environmental Services, Rockingham and Strafford Regional Planning Commissions, and UNH Sea

Grant/Cooperative Extension have begun working together to coordinate their Seacoast outreach activities. The cooperating agencies recognize that effective coordination of their efforts can help avoid duplication and overburdening audiences.

Nearly all of the outreach organizations put local decision-makers and municipal officials at the top of their audience list. However, busy local leaders can quickly be swamped with information and demands on their time. Working effectively with this influential audience requires coordination and better understanding of the information needs of local decision-makers.

The NH Fish and Game Department and Great Bay National Estuarine Research Reserve sponsored a study to gain new insights into the information needs of Seacoast region municipal officials. The study confirmed that planning boards, conservation commissions and planning staff are appropriate audiences for natural resource-based planning and conservation information. Survey results indicate specific education programs on estuary management and protection would be well received. But respondents also said that traditional workshops have limited appeal.

GBNERR

Hands-on salt marsh restoration

Local officials suggested information brought directly to their boards and commissions would be more likely to be considered and integrated into the planning process. Many officials preferred to receive written information, but written information must be presented in a more clear, focused, and organized manner. Municipal officials also encouraged outreach agencies to explore using electronic media to communicate information.

These comments and observations are reflected in the outreach and education actions geared to local officials and decision-makers presented in this *Plan* (see Action LND-5). Other issues addressed throughout the *NHEP Management Plan* require different strategies with different messages intended for other important audiences. Outreach components for the shellfish actions have targeted shellfishers and shoreline property-owners (see Actions SHL-10 through 14, and EDU-4). Water quality actions are supported by outreach efforts intended to deliver information on contaminated stormwater (Actions WQ-18 and 19), wastewater treatment facilities(WQ-17), and septic system (WQ-13) issues to shoreland property-owners and municipalities, as well as to broader audiences.

OUTREACH WORK HAS BEGUN

The NHEP has already begun building the foundations for working with important stakeholder groups within the estuarine watershed.

The Critical Lands Analysis was an early NHEP outreach project addressing land use. Experts in Geographic Information Systems (GIS), land and habitat conservation, and water resource management, plus planning board and conservation commission members and other municipal planners contributed to this project to create a series of maps identifying high-value natural resource areas that might be especially susceptible to development pressures.

UNH Cooperative Extension educators have used products of this project extensively in GIS workshops for local officials. Critical Lands Analysis presentations and map products are continually requested and adapted for other planning purposes, such as the NH Natural Resources Outreach Coalition's presentation "Dealing With Growth." The Coalition uses the Critical Lands Analysis to create a potential development picture for interested towns, and asks the communities to integrate natural resource-based planning into the community decision-making process.

The NHEP has begun working with shoreline property owners, and has encouraged their participation in developing this *Plan*, because this important constituent group can have a major influence on the environmental condition of estuarine waters and habitats. Shoreland property owners have been invited directly to all NHEP meetings, conferences, and workshops. The NHEP has provided shoreland property owners with information on sound shoreland development and maintenance practices, and with NH DES, has hosted shoreland workshops for several Seacoast communities.

ANMP

Results of the 1998 Advocates of the North Mill Pond CleanUp

During the first three years of the planning process the NHEP awarded more than $275,000 in technical assistance grants for 27 projects (see Appendix 5). These grants were awarded to communities, citizen groups, environmental organizations, university research, and state agencies, for water quality and habitat improvements, and for planning and outreach projects. This program has established the NHEP as a valuable partner and instrument of environmental progress in New Hampshire's Seacoast.

In July 1998, the NHEP hosted a tour of the Great Bay Estuary for local decision-makers, business people, and members of environmental organizations. The three-hour boat tour was hosted by Dr. Richard Langan, director of the UNH Jackson Estuarine Laboratory, co-director of the UNH/NOAA Cooperative Institute for Coastal and Estuarine Environmental Technology, and NHEP Management Committee Vice Chair. Response to the first tour

was so overwhelming that a second was scheduled and filled in short order. The tours were tremendous opportunities for the NHEP to showcase valuable estuarine resources and highlight NHEP projects for an audience of people who are responsible for many decisions affecting the estuary. Regional media coverage was extensive, and the NHEP demonstrated potential as a progressive force of positive environmental change in coastal New Hampshire.

The opening of the Seabrook Middle Ground clamflats in the Hampton-Seabrook Harbor in November 1998 was an early milestone of progress for NHEP outreach efforts, and drew the attention of a statewide audience. For the first time in 10 years the Middle Ground was reopened to recreational shellfishing, thanks to the work of NH Department of Health and Human Services, NH Department of Environmental Services, NH Fish and Game, the towns of Hampton and Seabrook, volunteers from the UNH Cooperative Extension/Sea Grant Great Bay Coast Watch program, and North Atlantic Energy Service Corporation (Seabrook Station). Television viewers statewide watched a live broadcast of the event which attracted an estimated 800 shellfishers plus numerous state officials on a cold November morning. Statewide print media documented the reopening with articles, photos, and editorials acknowledging the efforts of all involved.

J. CHASE

Clammers at the Middle Ground

Citizen Participation is Critical to the Estuaries and to the Plan

The NHEP relies on an involved public to ensure that the *Management Plan* and its implementation reflect their concerns. The public was invited to contribute their thoughts throughout the process of identifying priority issues and developing Action Plans. Participation in the Project Teams was open to anyone interested, and open invitations were extended at all meetings, and in all appropriate press releases and mailings. The shoreline database was used to extend personal invitations to participate in NHEP activities to that key group of estuarine stakeholders. Along with the NH Coastal Program, the NHEP hosted two NH Estuaries Environmental Network Conferences. The scientific and academic community, agency representatives, environmental organizations, and citizen groups were invited to present a “year in review” perspective of their projects and activities. The NHCP and NHEP hoped that useful interaction would occur between groups not normally in contact, but with similar missions and interests. The conferences proved quite successful with over 60 people attending each conference to hear as many as 28 presentations. The work of the New Hampshire Estuaries Project has just begun, and citizen and community support and participation are essential to meeting the ambitious goals of this *Plan*.

GOALS FOR PUBLIC OUTREACH AND EDUCATION

NHEP's goals for public education and outreach all aim to engage communities, government agencies, organizations, and individuals in active stewardship of estuarine resources, and participation in the *Management Plan*'s priorities and actions to protect and improve the environmental quality and character of the region.

The outreach and education goals and Action Plans reflect the Outreach Project Team's objectives. These include emphasizing a positive, issues- and solutions-based watershed approach; a focus on friendly approaches to specific groups and constituencies; and coordinated educational efforts to communicate the ecological, social, economic, historical, and cultural significance of
the estuaries. See *Appendix 3* for a complete list of goals and objectives.

- Communities, government agencies, organizations, and individuals are aware of the importance of, and participate actively in responsible use of New Hampshire's estuaries.
- Communities, government agencies, organizations, and individuals actively participate in achieving water quality-related goals for New Hampshire's estuaries.
- Communities, government agencies, organizations, and individuals actively participate in achieving land use and habitat protection goals for New Hampshire's estuaries.
- Communities, government agencies, organizations, and individuals actively participate in achieving shellfish-related goals for New Hampshire's estuaries.

PUBLIC OUTREACH AND EDUCATION
ACTION PLANS

General Outreach

EDU-1	Utilize the media to enhance educational efforts.	8-11
EDU-2	Work with the Seacoast Newspapers to establish a monthly newspaper column devoted to coastal natural resource issues.	8-13
EDU-2A	Develop an agreement with Strafford County UNH Cooperative Extension to enable the NHEP Outreach Project Team to contribute coastal natural resource information to the UNH Cooperative Extension column in *Foster's Daily Democrat*.	8-15
EDU-3	Establish and fund a Technical Assistance Grant Program to promote and fund projects that support the *NHEP Management Plan*.	8-17
EDU-4	Maintain and expand the New Hampshire Estuaries Project's Shoreline Property-Owner Database.	8-19

Volunteer Involvement

EDU-5	Support volunteer organizations active in water quality, habitat, or other estuarine watershed natural resource issues.	8-21

ACTION EDU-1

Utilize the media to enhance educational efforts.

PRIORITY

++

GENERAL OUTREACH

BACKGROUND

The Seacoast region's numerous natural resource outreach and education organizations and institutions have formed the Natural Resources Outreach Coalition.* The committee was established to avoid redundant outreach and education efforts, to bring combined resources to bear on key issues where appropriate, and to evaluate the effectiveness of natural resource outreach activities in the Great Bay and coastal areas.

Volunteer groups such as Great Bay Coast Watch, advocacy groups such as Advocates of North Mill Pond, and rivers and watershed groups also provide a great deal of local environmental education related to estuarine and watershed topics.

Focusing the resources of this network to make effective, coordinated, and unified presentations to regional media outlets can increase the newsworthiness and popular appeal of estuarine and natural resource topics and events.

ACTION/ACTIVITIES

Create a coordinated approach to better utilize existing media in the following ways:

- Utilize outdoor recreation media to increase awareness of water quality, wildlife, and other natural resource issues related to shellfish and anadromous fish.
- Utilize CICEET low power radio to promote the Management Plan Actions.
- Arrange to contribute to New Hampshire Public Radio conservation programming.
- Pursue television conservation and public affairs programming.
- Continue to provide articles and information for newsletters and local print media. Submit press releases (possibly in the form of a "Report Card") highlighting improvements in the environmental condition of the estuaries and the progress of the New Hampshire Estuaries Project.

*The New Hampshire Estuaries Project, New Hampshire Coastal Program, UNH Sea Grant Cooperative Extension, New Hampshire Fish and Game Department, Great Bay Estuarine Research Reserve, Sandy Point Discovery Center, Seacoast Science Center, the UNH/NOAA Cooperative Institute of Coastal and Estuarine Environmental Technologies (CICEET), and Rockingham and Strafford Regional Planning Commissions.

RESPONSIBLE PARTIES

The New Hampshire Coastal Program will take the lead in organizing coordinated use of the media. The NHEP can help with this effort. UNH/CICEET, Great Bay National Estuarine Research Reserve, UNH Cooperative Extension/Sea Grant, New Hampshire shellfish sanitation and resource management programs, and the regional planning commissions are expected to be partners in this effort.

IMPLEMENTATION LOCATION

This action will be implemented throughout the Great Bay and Coastal watersheds.

COSTS AND FUNDING

The NHCP and the New Hampshire Estuaries Project outreach program can support the cost of coordinating this Action.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

- Increased visibility for estuarine issues
- Public communication and education about numerous water quality and natural resource topics and Plan actions.

MONITORING AND ENFORCEMENT

None anticipated.

TIMETABLE

Initiate by 2005.

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PRIORITY

High Priority. Implementation of this action is related to, but not dependent on, implementation of Action EDU-2.

ACTION EDU-2

Work with the Seacoast Newspapers to establish a monthly newspaper column devoted to coastal natural resource issues.

PRIORITY

+

GENERAL OUTREACH

BACKGROUND

The Seacoast Newspapers have provided the NHEP considerable print media exposure over the three years of the NHEP planning process. These newspapers have expressed continued interest in coastal topics including the Coastal Clean-Up, New Hampshire shellfishing and shellfish management, and the Year of the Oceans. The New Hampshire Coastal Program has approached the Seacoast Newspapers about starting a monthly Coastal Issues column. While the editors were interested, concerns regarding submission details and long-term commitment placed the idea on the back burner.

ACTIONS/ACTIVITIES

1. Build a team of writers who will draft water quality and natural resource related articles for regular submission to regional print media outlets. The NHCP can coordinate the formation of the writer team with support and participation from the other members of the Natural Resources Outreach Coalition. UNH publicists, as well as watershed and non-profit groups, will be solicited to contribute to the submission schedule.
2. With the writers team in place, the NHEP is positioned to continue discussions about a monthly coastal resources column with Seacoast Newspapers. Enlisting the writers team will address many of the earlier concerns, and use the combined resources of the coastal outreach community.

RESPONSIBLE PARTIES

The NHCP will establish the writers team, develop a submission assignment list, and act as liaison with the newspaper editorial staff. The NHEP Outreach project team will take an active role in topic development and the research and writing of articles. UNH publicists, as well as watershed and non-profit groups, will be asked to contribute to the submission schedule (Step 1).

The New Hampshire Coastal Program and the NHEP can begin discussions with regional print media (Step 2).

IMPLEMENTATION LOCATION

This Action will be implemented throughout the Seacoast region communities served by the Seacoast Newspapers.

COSTS AND FUNDING

Costs will be borne within the administrative budgets of the existing Seacoast outreach organizations (Steps 1-2).

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

- Increased exposure for natural resource issues and the organizations that promote them.
- Strengthened relationships between Seacoast Newspapers and NHEP and natural resource outreach organizations.
- Natural resource issues will become a long-term media feature in the local press.
- Increased public awareness of a variety of issues related to environmental quality of life in New Hampshire's Seacoast.
- Readers receive contact information regarding particular issues.
- Readers learn about how their own actions impact the environment.
- Readers learn about natural history and opportunities to enjoy and experience the natural environment of the Seacoast.
- The *NHEP Management Plan* can be a significant source of materials for columns.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

Initiate by 2007.

PRIORITY

Priority. Implementation of this action is related to, but not dependent on, implementation of Action EDU-1.

ACTION EDU-2A

Develop an agreement with Strafford County UNH Cooperative Extension to enable the NHEP Outreach Project Team to contribute coastal natural resource information to the UNH Cooperative Extension column in Foster's Daily Democrat.

PRIORITY

GENERAL OUTREACH

BACKGROUND

Strafford County UNH Cooperative Extension contributes an educational column to *Foster's Daily Democrat* on natural resources conservation and stewardship. This long-established column rotates on a five-week cycle among different Cooperative Extension programs. *Foster's* does not offer space for additional natural resource educational articles on a regular basis. If an editorial arrangement does not work out with the Seacoast Newspapers, the NHEP Outreach Team may have the option of inclusion in the rotation of the Cooperative Extension column in *Foster's*.

ACTIONS/ACTIVITIES

1. If an editorial arrangement cannot be made with the Seacoast Newspapers, the NHEP Outreach Team will partner with the Great Bay Coast Watch to apply for an editorial slot in UNH Cooperative Extension's rotation.
2. The writing team (see Action EDU-2) and Great Bay Coast Watch will supply an article every five weeks.

RESPONSIBLE PARTIES

NHEP Outreach Project Team, Great Bay Coast Watch, and the writing team (see EDU-2) (Steps 1-2).

IMPLEMENTATION LOCATION

This Action would reach readers in the Seacoast region communities served by *Foster's Daily Democrat*.

COSTS AND FUNDING

Costs can be borne in the administrative budgets of the existing outreach organizations, as this strategy provides them with a new communication vehicle (Steps 1-2).

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

- Provide increased exposure for natural resource issues and the organizations that promote them.
- Natural resource issues will become a long-term media feature in the local press.

MONITORING AND ENFORCEMENT

None identified.

TIMETABLE

Initiate by 2007.

PRIORITY

Priority. Implementation of this action is related to, but not dependent on, implementation of Actions EDU-1 and EDU-2.

ACTION EDU-3

Establish and fund a Technical Assistance Grant Program to promote and fund projects that support the NHEP Management Plan.

PRIORITY
+++

GENERAL OUTREACH

BACKGROUND

The NHEP Technical Assistance Grant Program has been effective in improving water quality and promoting natural resource conservation and restoration, and as a valuable tool for educating the public and building local support. (See Appendix 5 for a list projects funded by these grants.)

ACTIONS/ACTIVITIES

1. Establish a continuing Technical Assistance Grants program, structured similarly to previous NHEP grant programs. Emphasize projects that transfer or apply knowledge or technology on a broader basis, and that are consistent with the *NHEP Management Plan*. Develop specific review criteria to be used for funding decisions.
2. Grants should be awarded through a competitive process overseen by the NHEP Management Committee. (See page 10-6, Action Plan Implementation, for NHEP process to manage conflict of interest.)

RESPONSIBLE PARTIES

NHEP Management Committee in coordination with New Hampshire Coastal Program, UNH Cooperative Institute for Coastal and Estuarine Environmental Technology, and NH DES will provide input (Steps 1-2).

IMPLEMENTATION LOCATION

This Action can be implemented throughout the 43 towns, or can be focused on NHEP Zone A.

COSTS

$50,000 to $100,000 per year, depending on NHEP funding levels.

FUNDING

This action will be be funded with US EPA NHEP implementation funds at $50,000/year in 2001 and 2002.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

- Projects funded through these grants result in water quality and natural resource improvements focused on the priorities and areas of particular concern outlined in the *NHEP Management Plan*
- Projects provide opportunities to communicate water quality and other natural resource messages.
- Project success stories help make environmental improvement and protection contagious.

MONITORING AND ENFORCEMENT

Funded projects should demonstrate ongoing function and water quality improvements. No enforcement is required.

TIMETABLE

This Highest Priority action will be implemented in 2001-2002.

PRIORITY

+++ Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

ACTION EDU-4

Maintain and expand the New Hampshire Estuaries Project's Shoreline Property-Owner Database.

PRIORITY

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GENERAL OUTREACH

BACKGROUND

The NHEP has developed a database of contact information for all owners of tidal shoreline property in New Hampshire. This tool allows the NHEP to communicate directly with shoreline property-owners. The database currently includes all property-owners with tidal frontage in New Hampshire, plus property-owners above the head of tide on the Squamscott/Exeter River, the Cocheco River and the Oyster River. The database should be expanded to include more owners of shoreline property further up the watershed, and property-owners with frontage on the Atlantic coastline between Rye and Seabrook.

ACTION/ACTIVITIES

1. The NHEP shoreline property-owner database will need continual updating and revision to remain effective. Annual corrections and additions will address real-estate transfers, tax map and data-entry errors, and new development.
2. Expand the database to include Atlantic coastline properties and properties with frontage on freshwater lakes, rivers, and streams within the Great Bay and coastal watersheds.

RESPONSIBLE PARTIES

The New Hampshire Estuaries Project will update and maintain the database (Steps 1-2).

IMPLEMENTATION LOCATION

This Action will expand the database somewhat beyond the Zone A tidal shorelines.

COST

Intern	$3000/yr
Travel	$1000/yr
Photocopying & supplies	$300/yr
Total	**4,300/yr**

FUNDING

This action will be funded with US EPA NHEP implementation funds.

REGULATORY NEEDS

None identified.

EXPECTED BENEFITS

- Continuing communication capability with shoreline property-owners on water quality issues.
- A powerful tool for maintaining contact with an important group of estuarine stakeholders.

TIMETABLE

Maintenance of the database (Step 1) is ongoing. Expanding the database (Step 2) will be initiated by 2005.

++

PRIORITY

High Priority. Implementation of this action is not dependent on other actions listed in the *NHEP Management Plan*.

ACTION EDU-5

Support volunteer organizations active in water quality, habitat, or other estuarine watershed natural resource issues.

PRIORITY
+++ VOLUNTEER INVOLVEMENT

BACKGROUND

Local residents can contribute to cleaner estuarine and coastal waters through involvement in volunteer conservation, monitoring, and educational programs. Cleaner waters are vital for opening more shellfish beds to recreational harvest.

ACTIONS/ACTIVITIES

Continue to support volunteer monitoring organizations such as Great Bay Coast Watch to help build an expanded water-quality database, and to locate 'hot spots' for further investigation by the appropriate regulatory agencies. Monitoring and conservation activities also educate and empower local citizens. Informed citizens are effective educators of local officials and others on a variety of water quality topics. Specific activities could include:

1. Financially assist volunteer monitoring organizations such as Great Bay Coast Watch in coastal and estuarine monitoring for water quality, harmful algal blooms, sources of pollution, and habitat description.
2. Train water-quality monitoring volunteers four to six times each year through workshops on specific water-quality topics and monitoring techniques. Provide for speakers and pertinent materials from other programs such as UNH/CICEET, NH DES Non-point Source Pollution Program, Great Bay Stewards, Great Bay Wildlife Refuge, etc.
3. Recognize and support non-profit groups, such as Advocates of North Mill Pond and the Cocheco River Watershed Coalition, as models for non-profit community participation. Provide information on successful community partnering, fundamental organizational techniques for community-based environmental monitoring, and actions that local people can take to preserve their environment.
4. Engage two to three school groups a year in monitoring, habitat restoration, storm-drain stenciling, coastal clean-ups, etc. These activities provide opportunities for hands-on learning about the need for clean coastal waters and habitats.
5. Assist volunteer organizations with their speaking commitments to conservation commissions and other town government bodies to explain monitoring and survey results. Train volunteers in public-speaking, interpretation of graphs, creation of maps, and current presentation technology.

RESPONSIBLE PARTIES

Great Bay Coast Watch, a Seacoast region-wide volunteer monitoring network, has already established itself as lead coordinator for citizens' water quality monitoring in the region (Steps 2, 4, and 5). Other volunteer groups

such as the Advocates of North Mill Pond and the Cocheco River Watershed Coalition draw upon the monitoring expertise and training of Great Bay Coast Watch. Other environmental organizations such as the Lamprey River Watershed Committee, the Lamprey River Advisory Board, the Strafford River Conservancy, the Exeter River Advisory Committee, and the Great Bay Stewards can be sources of significant volunteer energies and spin-off opportunities (Steps 3, 4, and 5)

IMPLEMENTATION LOCATION

This Action can be implemented throughout the Great Bay and coastal watersheds.

COSTS AND FUNDING

Volunteer monitoring program in Steps 1-2	$10,000-15,000/yr
Volunteer education (materials, speaker fees, travel) in Step 3	$300/yr
Volunteer presentations to local government in Step 5	$1,000/yr
Support for and development of public advocacy groups in Step 3	$1,500/yr
School-related environmental monitoring and natural resource projects in Step 4	$2,500/yr
Total	**$15,300-20,300/yr**

FUNDING

Funding support for voluntary monitoring programs (Steps 1-2) has been supplied by NHEP in support of WQ-5 from 1997-2000. Support for other local organizations will be available through EDU-5 (local grants) in 2001-2002. Step 3 will not be funded with US EPA NHEP implementation funds.

EXPECTED BENEFITS

Volunteer monitoring is one of the few direct means for the citizenry of New Hampshire to participate in estuarine and shellfish management. Active citizens and students engaged in water quality monitoring or local advocacy groups bring energy, credibility, and newsworthiness to environmental projects that can help influence opinions and attitudes in coastal communities.

Volunteers engaged in environmental conservation, monitoring, and educational work make substantial contributions to raising public awareness and protecting and improving environmental quality.

MONITORING AND ENFORCEMENT

Volunteer contributions to the coastal water-quality database can be documented. The number and activity of local advocacy groups can be tracked. No enforcement activities are required.

TIMETABLE

This Highest Priority action was initiated in 1997 and is ongoing.

+++

PRIORITY

Highest Priority. Implementation of this action is not dependent on implementation of other actions listed in the *NHEP Management Plan*.

REGULATION AND MANAGEMENT

9

A BASE PROGRAM ANALYSIS SUMMARY

Regulation and Management of New Hampshire's Estuaries: A Base Program Analysis reviews the management framework of New Hampshire's estuaries. The report was prepared by Carl Paulsen and submitted by NH Department of Fish and Game and the Great Bay National Estuarine Research Reserve to the NH Estuaries Project. This review and the Technical Characterization of Estuarine and Coastal New Hampshire (summarized in Chapter 2: State of the Estuaries) prepared by the UNH Jackson Estuarine Laboratory, provided a baseline for developing the New Hampshire Estuaries Project Comprehensive Conservation and Management Plan. The Base Program Analysis (BPA) identifies the institutional framework for managing the estuaries, assesses the effectiveness of that framework, and recommends changes to address weaknesses or limitations.

The NHEP project area covers the entire watershed for the estuaries. Towns as far west as Candia and as far north as Wakefield are within the drainage basin. Although approximately one third of the watershed lies in the state of Maine, the NHEP is focused on the New Hampshire portion. In recognition of the importance of proximity to the estuaries, the project was divided into two areas: Zone A and Zone B (see inside cover). Zone A municipalities are those towns that border on tidal waters, plus Rochester and Somersworth. Zone B municipalities are those in the drainage area but with no tidal shoreline. The BPA review of the local management framework focuses primarily on Zone A municipalities.

Inadequate funding and enforcement were general themes that arose out of the analysis across program areas. Staffing and funding levels vary across programs, but state and local budgets are generally limited, impeding the effectiveness of the programs. Some federal budgets (eg., point source permitting) are also limited. Limits are reflected in work loads, backlogged permits, availability of staff for assistance, and in some cases, lack of programs. Despite these limitations, state programs tend to be well coordinated. State agencies and their staff often have developed strong relationships among programs to share responsibilities and information. Coordination between state and federal programs is less effective, with several instances of problems identified during this project.

While funding is not a panacea for all weaknesses in environmental protection, budget improvements are clearly needed. Creative funding strategies can supplement state general funds. For example, stormwater utilities that

create a fee structure to fund stormwater management may be applicable, especially in NPDES Phase II communities.

Enforcement is another weak link in the regulatory framework of the estuaries. The sheer number of septic systems renders system maintenance and performance requirements unenforceable, and the state has not developed an alternative approach for ensuring proper maintenance and repair. Although the NH DES Site Specific Program has significantly improved its monitoring commitment since 1999, program staff limitations have inhibited monitoring of NH Department of Transportation projects for stormwater and erosion control. Local regulations are also only partially enforced. Enforcement officials are often not fully aware of permit requirements. In some cases, permit conditions are never monitored and there are no local programs to ensure long-term monitoring and maintenance of stormwater and erosion control measures.

The NHEP's focus on New Hampshire, while nearly one third of the drainage area lies in Maine, may be an important limitation. As a result of the single state focus, only a limited examination of policies in the state of Maine was included in the BPA report.

The Base Program Analysis made recommendations for each policy area highlighted below. The recommendations were developed into Action Plans. (The number of the Action Plan is shown in parentheses after each recommendation.) Where no Action Plan number is referenced, Action Plans are still under development.

Non-point Source Pollution

The most important non-point source problems in the estuaries of New Hampshire are stormwater runoff, septic system problems, and construction runoff and erosion. A wide variety of other non-point source contributors such as agriculture, boating, solid waste management, toxic/hazardous wastes, and underground storage tanks add to the cumulative effects of non-point source pollution. The coastal basin has the highest priority for dedication of resources within the state's new watershed approach to non-point source pollution.

- Improve regulatory approach and/or state funding of non-point source programs – Non-point source pollution is incremental, and difficult or impossible to identify. New Hampshire's pollution policy of 'anti-degradation' relies on being able to attribute the cause of pollution to a single responsible person or organization. While funding is not a panacea, the state appears to have provided little funding to address non-point source pollution. Recent increases in shoreline and sanitary surveys and related activities seem to reflect the recent influx of funds through the NHEP, rather than a sustained increase in state support. [Action WQ-16]
- Continue to evaluate and revise Best Management Practices – New Hampshire relies heavily on BMPs for control of non-point source pollution, yet many BMPs are out-dated or inadequate. The state is beginning to examine stormwater BMPs for appropriateness for

New Hampshire conditions and effectiveness in protecting water quality. Other BMPs also need review and revision. Most importantly, the state needs to shift focus from flood and volume control to overall water resource management. Since BMPs are the foundation of the state's non-point source management efforts, this research should receive substantial focus and resources. Results from this research should be incorporated into the Green Book and widely circulated, and the Green Book should be updated regularly. [Action WQ-10]

- Improve local regulation of stormwater and erosion control – Local governments should adopt standards for erosion control and long-term stormwater management. Current coverage among Zone A municipalities is limited, and requirements are highly variable. By adopting the standards of the Green Book by reference, as the state recommends, municipalities can avoid having to update their ordinances frequently. Pooper-scooper laws, hazardous waste collection programs, storm drain stenciling, and other programs foster improved runoff quality, but are rarely used. [Actions WQ-9, WQ-10, WQ-19]

- Explore ways to improve outreach efforts for local officials – Low participation by volunteer local officials in educational and training workshops has probably slowed progress in developing strong resource protection regulations. [Actions LND-5]

- Work to improve local regulation of development project impacts – Local regulation, monitoring and enforcement is needed to supplement the state program, while state support of the Site Specific Program needs to be improved. (Actions LND-2, LND-4, LND-6B, LND-6E, LND-7, LND-8A, LND-8B, LND-9A, LND-9B)

- Improve education of shoreland property owners – Given the potential for water quality and habitat impacts, activities within close proximity to surface waters should receive special attention. Education of shorefront property owners regarding laws and responsibilities (e.g., appropriate landscaping activities) is important. [Actions LND-14 LND-16, EDU-4, WQ-13]

- Increase land protection through acquisition or conservation easements – One of the most effective means for protecting water quality and important habitat is to limit development in proximity to sensitive resources. [Actions LND-26, LND-27, LND-28, LND-29, LND-35, LND-36]

- NHEP should work with the state to allow the use of Clean Water State Revolving Loan Fund (SRF) money for activities identified as priorities through the Management Plan – The state's restriction of Clean Water Act SRF money to landfill closure and wastewater treatment facility construction and upgrade limits the effectiveness and benefits of these funds in the Seacoast watersheds. [Action WQ-16]

Point Source Pollution

A relatively extensive and well coordinated set of state and federal regulations address point sources of pollution. The federal Clean Water Act and state Water Pollution and Waste Disposal Act require permits for point sources, and a reasonable amount of technical and financial assistance is available for construction, system upgrade, and operation and maintenance. Staffing limits may cause some delays and/or inadequacies in permitting and oversight.

- Develop a coordinated program and funds to identify and resolve illicit connections, infiltration and inflow, leaky collection systems, and similar problems – These activities are currently implemented haphazardly as funds are available. Since pathogens are one of the primary water quality concerns for the estuaries, greater commitment to resolving the known factors is needed. [Actions WQ-4A, WQ-4B, WQ-4C, WQ-7]
- Improve local regulations to prevent contamination of stormwater runoff – Regulations aimed at preventing non-point source pollution are key to eliminating urban stormwater runoff problems. [Actions WQ-8, WQ-9, WQ-10, LND-23, WQ-18, LND-5, LND-22]
- Continue investigations into stormwater management technology for improving runoff quality – Research should continue to focus on potential solutions for contamination from stormwater runoff systems. [Actions WQ-8, LND-1, LND-2, LND-3]
- Improve training of WWTF operators – Concerns about the adequacy of the state's existing training programs warrant evaluation and improvement of the programs. [Action WQ-3]

Habitat Alteration

Despite recent development, a significant portion of the estuarine watershed remains undeveloped, or lightly developed. Some estuary shoreland areas also remain relatively undeveloped. State regulations protect certain shoreland areas, and shoreland protection is well coordinated among state agencies. These regulations restrict land use in shoreland areas near large surface water bodies, but smaller water bodies are left unprotected. Limited state budgets effectively leave primary implementation and enforcement to municipalities. Local governments, however, are often reluctant to implement their own land use controls in shoreland areas, and may be even more reluctant to enforce them. Only seven of the 19 Zone A towns have adopted local shoreland protection districts.

Shoreland Development and Riparian Buffers

- Improve implementation and enforcement of Comprehensive Shoreland Protection Act (CSPA) – The NH DES Shoreland Protection Program, in cooperation with the NH Coastal Program and Regional Planning Commissions, should strengthen efforts to implement and enforce the CSPA through education and outreach to

Planning Boards and Code Enforcement Officers (CEOs). Budget increases or alternative funding sources are also needed. Municipalities should be encouraged to develop shoreland protection ordinances that apply to smaller streams.[Actions LND-14, LND-16, LND-17]

- Use real estate transfers for outreach about shoreland protection – Real estate transfer presents an opportunity to inform new landowners of their responsibilities as waterfront property owners. [Actions WQ-13, EDU-4]

Wetland Loss and Alteration

- Develop wetlands mitigation policy – NH DES should develop and adopt a formal wetland mitigation policy and increase the use of mitigation through the state permit process. [Actions LND-7, LND-24]
- Track impacts to wetlands from permitted and non-permitted activities – Cumulative impacts of permitted activities are not currently monitored but should be, and estimates of non-permitted (e.g. illegal) filling should be developed.
- Protect vernal pools – NH DES, in cooperation with local officials, Conservation Commissions, and Regional Planning Commissions, should develop a program for protecting vernal pools. [Actions LND-32, LND-26, LND-28, LND-33, LND-34, LND- 35, LND-36]

River and Estuary Protection

- Develop a more comprehensive approach to water habitat protection and improve coordination of surface water programs – The new approach should include addressing issues around consumption of ground and surface waters.
- Improve coordination of NH DOT projects with agencies that protect natural resources – Existing practices of meeting with state and federal agency officials to review projects should be expanded and formalized. NH DOT should be more environmentally accountable. [Actions RST-5, RST-6]

Open Space and Habitat Protection

- Revive Land Conservation and Investment Program (LCIP) – The state should revive the LCIP and seek new funding mechanisms to ensure priority conservation sites are protected. Federal agency and private sector programs could be used to leverage a highly effective land conservation program. [Action LND-26]
- Encourage local governments to earmark all of the Current Use change tax penalty for land protection efforts. [Actions LND-28, LND-35]

Living Resource Management

Most living resources in the NHEP study area are healthy. Some shellfish populations and several species of anadromous fish face problems. Management is primarily at the state level, spread among several agencies. The NH Fish and Game Department has lead responsibility for fish and wildlife, while the Natural Heritage Inventory Program of the NH Department of Resources and Economic Development (NH DRED) handles most aspects of plant protection. The NH Department of Health and Human Services plays a role in harvesting of species where public health is a concern. Municipalities have little authority to manage living resources, and the federal government generally has regulatory authority only in the cases of threatened or endangered species and wild species commerce.

Finfish Management

- Ensure NH Fish and Game budgets and staff remain sufficient to manage fisheries regardless of fishing effort – This includes maintaining an active role in federal and interjurisdictional fisheries management to ensure regulations support New Hampshire fisheries goals and improving fisheries resource inventories. Gaps exist in the stock assessments and species information on which adequate management depends.

Shellfish Management

- Develop a shellfish program that meets the requirements of the NSSP and provides for adequate management of shellfish resources – This includes taking the necessary steps to gain FDA approval of the state's shellfish program. Financing strategies should ensure the shellfish program is self-sustaining. [Actions SHL-1, SHL-4]
- Improve shellfish management coordination – State and federal shellfish sanitation programs need to improve communication and coordination. [Action SHL-1]
- Identify and mitigate pollution sources – Existing pollution sources are probably significant enough to prevent recreational harvesting or commercial aquaculture in some areas. Mitigation of these sources will have wide-spread benefits for the estuaries. Federal, state, and local governments should focus more resources on identifying and mitigating pollution sources. [Actions SHL-2, SHL-5; WQ-1, WQ-3, WQ-4C, WQ-5, WQ-6, WQ- 7, WQ-14]
- Educate audiences about illegal shellfish harvesting – Such efforts might involve state, local, and non-governmental partnerships. [Actions SHL-9B, SHL-10, SHL-13, SHL-14]
- Improve shellfish resource inventories – Gaps exist in the stock assessments and species information on which adequate management depends. [Action SHL-7]

Endangered Species

- Improve and sustain staffing and resources for protection of rare species – The staffing level at the Natural Heritage Inventory Program probably limits the effectiveness of the program. Several of the staff are provided by non-state organizations supported by non-state funds. The rare animal program is similarly hampered. Revenue from a conservation license plate might provide an appropriate budget source. [Actions LND-32, LND-33, LND-34]
- Improve rare species inventories – Conservation Commissions and UNH students have provided valuable assistance in assessing natural resources at the local level. [Actions LND-32, LND-33, LND-34]

Marine Aquaculture

- Determine state commitment to aquaculture development and develop formal state policy – Since regulations and programs affecting aquaculture involve several agencies, such a policy should be developed through a coordinated, multi-agency effort (including NHFG, NH DHHS, NH DAMF, NH DES, et al.). [Actions SHL-15, SHL-1]
- Provide funding and staff consistent with level of commitment to aquaculture development – Current staff and funding may be insufficient to handle expanded aquaculture. [Action SHL-4]

Local Management Framework

Municipalities in New Hampshire play a significant role in environmental management through local land-use controls. Limited state budgets elevate the importance of local regulations. A number of tools are available for local resource management, from standard zoning and land- use regulations to resource protection overlays, cluster development, and growth management ordinances. All municipalities in NHEP Zone A have developed Master Plans and have adopted zoning ordinances and land-use regulations. Specific provisions, such as stormwater management or shoreland protection, vary widely from town to town. The level of sophistication and resources with which individual towns manage development and enforce regulations also varies.

- Improve resource protection regulations – Regulations are quite variable across the estuarine region, leaving some major gaps. [Shoreland: Actions LND-14, LND-16; Wetlands: LND-8A, LND-20, LND-22, LND-25, 25C; Stormwater: LND-22, WQ-9, WQ-10]
- Increase outreach to local officials on importance of resource protection regulations – The NH Coastal Program in conjunction with the regional planning commissions should increase efforts to educate local officials on the importance of resource protection, and assist them in improving local land-use planning and controls. This outreach should be brought directly to town officials rather than provided through regional workshops. [Actions LND- 5, LND-25C, LND-20, LND-14, LND-8A, WQ-10]

- Improve development review and permit procedures – Strategies for improving permit review include increasing staff and budgets, increasing the levels of review, and increasing the use of Conservation Commissions for review. All towns should consider a technical review committee, where individuals with expertise help assess development proposals and permits. [Action LND-6F]

- Ensure adequate enforcement of land-use regulations in all towns – Enforcement of local land-use regulations appears to be limited by lack of coordination between planning boards and building inspectors. Building inspectors and code enforcement officers should be present during planning board meetings to ensure planning board recommendations and conditions are fully understood. Procedures should be implemented for recording and verifying field changes to development projects.

- Improve outreach for developers and landowners – All agencies involved in resource protection should work to educate landowners and the development community on regulations and requirements. [Actions LND-4, LND-8A, LND-16, EDU-4, WQ-13, WQ-18]

- Develop long term monitoring of permit conditions – All towns should develop programs for long-term inspection of erosion and stormwater control measures to ensure proper functioning. Seacoast towns currently have no mechanism for monitoring these structures, with property owners left to maintain them and decide whether or not they are functioning properly.

- All construction permits should receive more than one level of local review – Permits for single-family residential construction on pre-existing lots that do not receive planning board review should nonetheless at least receive one other review for consistency with resource setbacks and other requirements.

- Review variance practices – Towns should examine their zoning board of appeals practices to ensure the requirements of state law are being met.

- Reconsider reliance of NH DES Shoreland Protection Program and other state programs on local governments for enforcement of state regulations – Limited local budgets and staff mean that state programs like the shoreland protection program are often not well implemented or enforced at the local level. Local governments also may not have sufficient motivation to thoroughly enforce state regulations, since pollution and other resource impacts often cross boundaries. [Action LND-14, LND-16]

- Consider watershed-based planning agreements – Communities within individual watersheds should meet as a group to develop common goals and practices that will meet an agreed upon resource protection goal. Minimum resource protection standards developed in this way could help reduce impacts that cross boundaries. [Action LND-6A]

- Examine land-use regulations in the Zone B towns – Zone B towns tend to be smaller, have less staff and resources available, and may have substantial impacts of water quality in the estuary watersheds. The NHEP should work with NH OSP and the regional planning commissions to review land-use regulations in Zone B towns. [Action LND-6B]

- Increase the number of circuit-rider planners to improve assistance to towns without planning staff – Circuit-rider planners provided by the regional planning commissions play a crucial role in implementing local land-use planning and controls, particularly when small towns are confronted with large development projects.

IMPLEMENTATION AND FINANCING

10

Many groups, agencies, commissions, boards, and individuals are working to protect the environmental quality of New Hampshire's estuaries. No single entity has the authority or ability to manage all aspects of environmental protection in coastal New Hampshire, yet coordination is essential to effective and comprehensive management. Many of those currently working to protect the estuaries were involved in developing the *New Hampshire Estuaries Project Management Plan*. This chapter describes that involvement, as well as the participation of others in implementing the *Plan*.

RECOMMENDED MANAGEMENT STRUCTURE

The initial stage of the New Hampshire Estuaries Project (NHEP) was a three-year planning effort to develop a *Management Plan* for New Hampshire's estuaries. The next stage is to implement the *Plan* to improve environmental quality by protecting, restoring, and managing the state's estuarine systems.

During the planning phase, the NH Estuaries Project was guided by a 25 to 30-member Management Committee representing federal, state, and local government; academic and scientific communities; citizens and recreational resource users; non-governmental and educational organizations; and coastal businesses. The Management Committee was responsible for directing the NHEP, developing the *Management Plan*, developing annual work plans, overseeing budgets and schedules, and establishing and supporting committees, subcommittees, and four advisory Project Teams for the topics of water quality, land use and habitat protection, shellfish resources, and public outreach.

In the second and third years (1998-1999) of the project, the University of New Hampshire's Program on Consensus and Negotiation (UNH PCN) led the creation of the foundational components of the *Management Plan*. The UNH PCN contractor worked with the Management Committee and facilitated public meetings and project team work to 1) identify priority issues, 2) formulate action plans, and 3) develop an implementation strategy for the *Plan*. The following consensus on NHEP governance as it moves into implementation evolved through UNH PCN-facilitated deliberations with the NHEP Management Committee, the advisory Project Teams, and NHEP staff.

Governing Board

Project participants agreed the Management Committee provided a valuable forum for coordination and discussion of issues during NHEP's planning phase. The general consensus is for an oversight Board similar to the Management Committee to continue to direct and guide implementation of the NH Estuaries Project. The governing structure of the Board has already proven to promote significant interagency cooperation, and the Board will play a key role in assuring the success of the *Management Plan*. Members of the Board will actively serve as advocates for the NHEP within their organizations and with the public. They will assist in as many ways as possible to provide resources, enhance outreach efforts, directly implement Action Plans, etc.

Responsibilities

The Board will set policy and priorities, oversee the implementation and timing of the *Management Plan*, help secure funding and other resources, provide direction to the Director, and review and approve grants, contracts, and workplans. Final fiduciary responsibility will be held by the NH Office of State Planning as sponsoring state agency, and/or non-profit(s) authorized to receive funds for the NHEP. Board members will serve on subcommittees as needed for tasks or discussions requiring smaller groups, such as annual workplan development.

Representation

The Board will include representatives of federal, state, and local government agencies, non-governmental organizations, business and industry, research and education institutions, and the public. The Partnerships list at the end of this chapter provides a list of possible organizations for Board representation. The size of the board will remain the same as the current Management Committee, with membership to be as inclusive as possible. The Board should make special efforts to include local officials (especially elected officials) and industry representatives (especially from the fishing industry). At least one-fifth of Board members should be citizens not representing any agency or organization (e.g., a shellfisher, a volunteer water quality monitor, et al.) Less than half of the members should be from state agencies. Except for the preceding two restrictions, selection of Board members should remain flexible.

Selection

New board members will be jointly approved by the agency or organization involved and a majority of the NHEP Board. Members not representing agencies or organizations will be chosen by a majority of the NHEP Board from publicly solicited nominees. The Board will develop a detailed process for selecting new Board members as soon as possible.

Service

The term of service for a Board member will be three years. Board members may serve up to a maximum of three consecutive terms, unless a longer term of service is approved by two thirds of the Board. The Board may establish exceptions to this policy by creating permanent Board positions for representatives of agencies, communities, etc. The Board will elect a chair from among its members for a two-year term. The chair may only be re-elected twice, unless $^{2}/_{3}$ of the Board votes to re-elect a chair for additional terms.

Implementation/Planning Teams

The NHEP's four current Project Teams -- water quality and pollution identification, land use and resource regulation, shellfish and other living resources, and public outreach and education -- are open to any interested individuals. The Teams have worked on both planning and implementation, and have included state and federal agency staff, researchers, and individuals closely associated with the estuaries. Team chairs may also be Board members, but are not required to be. NHEP staff will participate in all teams to facilitate communication between teams and with the board. Team recommendations will be passed through the Director to the Board.

The current Project Team structure will remain in place and the current Team members will be asked to continue through December 31, 2000. At that time, Project Team structure and membership will be reviewed and revised as appropriate.

These Teams will help implement and monitor relevant sections of the *Management Plan*, and continue to review and revise the *Plan*. The size and membership of these Teams will be determined by the Board, which may choose to increase the number of Team members. The Board may also restructure the Teams as circumstances and needs change. The Board will review the Project Team structure and membership at the end of the first year of implementation, and make any appropriate changes.

The Teams will organize and conduct their work in a way that fosters maximum communication among the agencies, organizations, groups, and individuals represented. Joint meetings of the Teams are advisable. The Board will develop an annual meeting schedule for the Teams.

Staff

During implementation the NHEP will be staffed with a full-time Executive Director, a full-time Program Assistant, and a full-time Coastal Scientist.

The Executive Director will have administrative skills, sufficient knowledge of technical issues, and demonstrated ability to work with local communities. The Executive Director will report to the New Hampshire Office of State Planning Senior Planner and Coastal Zone Management Director, who reports to the Director of the New Hampshire Office of State Planning and receives directions from the Governing Board.

The Project Assistant will assist the Executive Director with all aspects of program implementation and will have primary responsibility for outreach activities. Other responsibilities will include developing and implementing outreach strategies to accomplish the goals and objectives of the program, assisting with contracting, grant management and grant writing, participating in annual program review procedures, facilitating project teams, and attending/organizing meetings, workshops, public hearings.

The Coastal Scientist position will be funded jointly with the NH Department of Environmental Services (75% NHEP, 25% NH DES). This staff will be responsible for implementation and evaluation of the NHEP monitoring plan. Responsibilities will include analyzing estuarine data, tracking NHEP

EXECUTIVE DIRECTOR JOB DESCRIPTION

Scope of Work

Directs, administers and coordinates the New Hampshire Estuaries Project (NHEP) as part of the National Estuary Program.

Responsibilities

- Administers the NHEP program supervises staff to accomplish program activities; takes direction from and provides support to the Estuaries Project's Management Committee and coordinates the work of the Project Teams/Committees.
- Directs, monitors, and evaluates implementation of the *NHEP Management Plan*.
- Administers grants and contracts which provide financial assistance to projects which implement the recommendations of the *Management Plan*.
- Prepares annual status reports describing activities undertaken to date and assessing their effectiveness in achieving the goals set forth in the *Management Plan*.
- Develops and manages a public outreach program to inform and involve local governments, public and private entities and the public at large regarding all aspects of the New Hampshire Estuaries Project.
- Proposes annual work plans for the New Hampshire Estuaries Project, in coordination with the Management Committee, and submits same to the Environmental Protection Agency.
- Coordinates NHEP activities with federal and state agencies, local governments, non- profit organizations, educational, and research institutions, and others.
- Writes new grant proposals to secure supplemental funding to support program activity and administers same.

monitoring plan, evaluating data needs, and creating reports on monitoring results. A Technical Advisory Committee will be created to advise the Coastal Scientist and to enable coordination of monitoring activities and data management.

The NHEP staff will:

1. Coordinate, track, and evaluate implementation of the *Management Plan*;
2. Develop and implement annual work plans and other regular submissions (e.g. Bienniel Review or Government Performance Results Act)
3. Seek and secure funding;
4. Provide funding to appropriate projects through grants and contracts;
5. Provide outreach and education about estuarine issues;
6. Provide technical assistance to local communities where appropriate;
7. Maintain liaison with the National Estuary Program;
8. Work closely with the regional and national offices of the Environmental Protection Agency; and
9. Work with Estuary Programs in other states.

The Executive Director's job description is shown at left; the job descriptions for other staff members will be developed in the future.

The staff will be based in the New Hampshire Seacoast area in the current program office at 152 Court Street in Portsmouth, New Hampshire.

IMPLEMENTING THE PLAN

The *NHEP Management Plan* will be the basis for all NHEP implementation activities, although flexibility will be exercised to take advantage of all opportunities for improving the estuaries. The overall success of the *Management Plan* will be measured against the goals listed in their entirety in *Appendix 3: Results of the NHEP Planning Process*. The goals specific to water quality; land use, development, and habitat protection; shellfish resources; habitat restoration; and outreach and education are also found in Chapters 4 through 8 of the *Plan (*see Table of Contents). The Action Plans ranked 'Highest Priority' were deemed most critical to achieving the *Plan*'s goals and objectives, and will be the main focus of the first four years of implementation.

The key to success of *NHEP Management Plan* implementation will be cooperation with as many agencies, organizations, and individuals as possible to advance common agendas. (For a list of active partners to date, see the Appendix 6 listing of the Management Conference participants.*) The implementation process must honor existing organizations, relationships, projects, and political realities, while working to reorder them where advisable. Efforts were made to involve as many eventual *Management Plan* implementers as possible in designing the implementation strategy so they will have confidence in the governance and will want to participate in implementing the *Plan*. The NHEP Project Teams, staff, and Management Committee discussed the options, and their comments were incorporated into the initial draft implementation strategy, which was widely distributed for comment.

Host Agency

The general consensus called for the NHEP to continue to be affiliated with the New Hampshire Office of State Planning (OSP). NH OSP will oversee and provide grant administration services, submit the annual grant application, provide administrative services, oversee resource and funding allocations based on the annual workplan, and provide general office support. NH OSP will have final authority for authorizing funding, and for entering into and enforcing memoranda of agreement and contracts with other participating organizations and agencies.

Annual Public Review

The Board, staff, implementation Teams, and members of the public will annually review the *Management Plan* goals, priorities, and implementation to be sure the *Plan* remains relevant to changing circumstances. A wholesale re-evaluation of the *Plan* will not occur until the completion of five years of implementation, roughly in 2005-2006. Public meetings will be held to review the *Management Plan* and/or discuss the State of the Estuaries. Public progress reports will be published annually. (Also see *Chapter 8: Public Outreach and Involvement*.) The timetable established for each Action Plan can be amended during this process.

* For a list of potential partners, see page 10-15.

Work Plan Development

The NHEP staff and implementation Teams will prepare annual work plans describing specific Action Plans to be funded by the NHEP in that particular year, based on the *Plan* and the annual review. Actions not being pursued by other agencies or funded by other sources will be emphasized, as well as projects to be undertaken by others that lead to the actions and outcomes included in the *Management Plan*. Workplans will focus on completion/initiation of highest priority actions first.

Quarterly Review

The Board must approve the annual work plans, and will review progress quarterly. A tracking system with specific progress benchmarks will be developed to aid in review. The New Hampshire Office of State Planning will ultimately be responsible for ensuring Action Plans are implemented.

Action Plan Implementation

The Board will use a Request for Proposals and competitive bidding process to select contractors or grantees to implement Action Plans and maintain monitoring data not carried out by the NHEP staff or other agencies or organizations through their own work plans and budgets. Board members and their affiliated organizations may submit proposals through the Request for Proposals process to implement Action Plans. However, when those seeking funding also participate on the proposal review committee, they may not contribute to discussion or vote on the proposal or its competitors.

FUNDING THE PLAN

Implementing the entire *NHEP Management Plan* will require substantial funding. Obtaining the necessary funding will be a challenge, given the current realities of public funding at the local, state, and federal levels, but the *Plan* was developed with this challenge in mind. Project participants recognized that much environmental protection, restoration, and outreach work is already occurring in and around the estuaries. Many Action Plans were designed to leverage and complement, rather than duplicate, these efforts.

Cost Estimates

Cost estimates are presented for each Action Plan in Chapters 4-8. Due to the difficulty of accurately predicting costs for many of the actions listed in the *Plan*, these are only estimates. For example, accurate estimates for remediating a stormwater outfall or restoring a salt marsh can only be generated from detailed examination of the site. Some Action Plans calling for activities in a number of communities will likely vary in cost from town to town, depending on the availability of existing information, in-kind services, and other factors. Cost estimates in the *Plan* are intended as a general guide of the funding required. Cost estimates will be refined each year as the NHEP Board selects Action Plans for implementation.

General Strategy

Federal funds and collaborative application of state agency budgets will finance the majority of NHEP implementation in the short term. NHEP staff will leverage local and private funding on an ongoing basis, and will seek outside grants whenever relevant and necessary for Action Plan implementation. Long-term goals for finance are a Line Item in the state budget and creating a 'Friends of the NHEP' 501(c)3 non-profit organization. NHEP staff will participate in an EPA Finance Workshop in Fall 2000 to learn more about additional funding mechanisms.

Budget Management

The NHEP staff will use competitive bidding to allocate funds for *Plan* actions not undertaken and funded by partner organizations. The Board and the Office of State Planning will review proposals. Since Board members may be associated with those seeking funds, the Board will develop a mechanism for assuring fairness in selecting grantees and contractors as soon as possible.

The Office of State Planning will have final authority for authorizing funding, and for entering into and enforcing memoranda of agreement and contracts with other implementing organizations and agencies.

Funding Strategy by Source

Federal Funding

1. The Environmental Protection Agency (EPA) is expected to provide at least $300,000 each year from 2000 through 2004. Approximately half of the EPA funds should be used for staff salaries and benefits, and half will be used for program implementation through the NHEP and outside grants and contracts. This may be supplemented by other direct federal appropriations as circumstance and conditions warrant.

2. The NHEP generated a list of federal grant programs that could potentially fund NHEP actions. These funding sources will be explored as annual work plans are developed and Action Plans are selected for implementation. The NHEP identified estimated costs and potential funding sources for each Action Item to help with this process. (See Table 10.1)

State Funding

State agencies, such as the Office of State Planning, Department of Environmental Services, Fish and Game Department, and Department of Health and Human Services, already provide substantial support for the types of actions outlined in the *Plan*. Many actions in the *Plan* were written to complement and enhance these efforts.

1. NHEP will encourage its partners to cross-reference the new NHEP Action Plans with existing agency work plans, and to prioritize activities with NHEP goals in mind. Some agencies operate grant programs which could provide support for the *Plan*.

    a. The State Revolving Loan Fund for water quality can be leveraged for wastewater treatment facilities and on-site (septic system) projects.

    b. NH DES 319 Local Initiatives Grants support watershed management, BMPs, watershed planning, outreach and education, monitoring and assessment, and organization building (40% match required).

    c. NH DES 319 Restoration Grants support restoration of impaired water quality (40% match required).

    d. NH DES Drinking Water Source Protection Grants support source delineation, assessment/planning, inventory supply, and implementation of protection programs (no match required).

    e. NH Coastal Program Community Grants support resource protection, planning restoration/construction, water quality monitoring, research, education and public access (50% match required).

2. NHEP will also encourage its partners to incorporate the Action Plans of the *Management Plan* in any new work plans.

3. The NHEP hopes to build support for a state budget Line Item appropriation to continue state support for *Management Plan* implementation after federal funding is exhausted.

Local Funding

Local funding will continue to aid in implementing the *Management Plan* over time. Many Action Plans call for activities at the local level. Local support for these Action Plans is anticipated to combine in-kind services and local cash match. For example, the City of Dover is matching $12,000 from NHEP with $106,000 of local money to implement Action WQ-7 in the first year of implementation. The NHEP will encourage and leverage local support whenever possible. Stormwater utilities as a local funding mechanism was introduced at the EPA Finance Workshop in September 2000. Some communities under NH DES Phase II requirements have shown interest in pursuing this funding mechanism further.

Private Funding

During the planning phase the NHEP received cash donations from Seacoast businesses such as North Atlantic Energy Service Corporation and Public Service of New Hampshire. Many other contractors donated in-kind services in the course of completing individual projects. Some private sector entities have indicated their intention to continue to contribute to implementation of the *NHEP Management Plan*, although funding levels cannot be estimated at this time because donation amounts are determined annually. The NHEP will consider the following mechanisms to facilitate receiving these funds during the first annual review.

1. A possible short-term mechanism for receiving external funds is to create partnerships with existing non-profit organizations to receive funds for *Management Plan* projects.

2. A more permanent mechanism for receiving external funding should be developed, such as a 'Friends of the New Hampshire Estuaries Project' 501-C(3) organization. (A subset of the NHEP governing Board could serve as the board of the non-profit.)

See Table 10.1.

Table 10.1 General Coastal Resources Related Funding Source Programs.

CFDA NO.	PROGRAM	AGENCY	OBJECTIVES	PROGRAM REQ'S	MATCH GRANT	AVG. EXAMPLES OF PROJECTS FUNDED	NHEP ACTION PLANS
11.417	Sea Grant Support	NOAA	Fund marine research and education programs at major university centers	0-33 %	No data	Fish habitat relationships; effect of pollutants on marine resources; seafood quality and safety; coastal erosion; marine fouling and corrosion	SHL 7, 4, 5
11.419	Coastal Zone Management Administration Awards	NOAA	To implement and enhance CZM Programs that have been approved under Section 306.	None	$1.3 mil	Funds are mostly used to support CZM programs including salaries, travel and other related costs. Ten to 20% of the funds can be used for specific Action Plans.	WQ 1, 2, 4b, 5-9, 12b, 14, 15, 18; EDU 1, 2; SHL 1-3, 15; LND 1, 3-5, 6C, 7, 8A, 8B, 9A, 9B, 10-17, 20-25 (a-d), 26-36
11.42	Coastal Zone Management Estuarine Research Reserves	NOAA	To assist in land acquisition, water quality monitoring, research and public education.	0-50%	$100,000	Projects include acquisition of land toFed limit ofbe included in reserve, management $5.0 mil. plan development; construction projects; operation of the reserve; WQ research and educational activities.	LND 5, 15, 26, 27, 28, 29, 32, 34-36 EDU 5, SHL 11
11.426	Ocean Resources Conservation and Assessment Program	NOAA	To evaluate and define management alternatives which minimize the adverse impacts of human use and activities.	None	$80,000	Analyses of marine contaminants, habitats and biodiversity. Developing data bases of physical and chemical characteristics including erosion rates, vulnerability indices and coastal hazards for GIS use or other predictive modeling.	Potential Monoring Activities
11.429	Marine Sanctuary Program	NOAA	To identify areas of special national significance and to assist in management research, monitoring and public awareness of these areas.	None	$50,000	Funds have been used for research and educational programs; solicitation of private donations for additional support; enforcement activities and other purposes consistent with the National Marine Sanctuaries Act.	N/A
11.46	Special Projects Announcements	NOAA	NOAA periodically releases special announcements to initiate or supplement specific studies.	None	No data	Previously funded project includes UNH' s Coastal Initiative in the Marine Sciences and Ocean Engineering.	TBD
11.473	Coastal Services Center	NOAA	To fund projects focused on science-based approaches to improve environmental quality and allow for economic growth.	none	NA	Grants have been used to conduct land cover and change analyses using GIS Systems, spatial database development, ecological and landscape characterization and restoration planning and other remote sensing activities.	LND 1, 3, 13; SHL 7, 8
11.478	Coastal Ocean Program	NOAA	To fund research related to coastal ecosystems, cumulative impacts and forecasting natural hazards.	None	$375,000	Not Applicable (New in FY1998)	N/A
66.456	National Estuary Program	USEPA	To develop a Comprehensive Management Plans and initiate monitoring of program activities.	25%	$100,000	Awards have been granted to conduct water quality baseline assessments, monitoring and field surveys, review historical data and develop public education and outreach programs.	EDU + WQ sections potential monitoring

Table 10.2 Wetland and Habitat Protection Assistance Programs.

CFDA NO.	PROGRAM	AGENCY	OBJECTIVES	PROGRAM REQ'S	MATCH GRANT	AVG. EXAMPLES OF PROJECTS FUNDED	NHEP ACTION PLANS
11.463	Habitat Conservation	NOAA	To protect and restore wetlands and other coastal habitat areas.	Varies: 0-25%	NA	Funds can be used for public policy, research, management, and public education activities	RST 1-6, LND 20-24, 25a-d, 26-36
66.461	Wetlands Protection Development Grants	USEPA	To assist States and local govt. in enhancing existing wetlands protect. and restoration programs.	25%	NA	Program focuses on Wetland/Watershed and River Corridor Protection Demonstration Projects and Wetland Restoration Projects.	LND 15-17, 23, 25, 25c, 25d; RST 2, 3, 5, 6
15.611	Wildlife Restoration	USFWS	To restore and manage wildlife populations and the provision of the public use of these resources	Varies: Formula	$2.75 mil	Funds are granted annually to states to fund statewide wildlife conservation and hunting safety programs; however, funds can be used to purchase quality wetland areas to benefit waterfowl	LND 27, 34
15.614	Coastal Wetlands Planning	USFWS	To promote coastal wetlands conservation projects	25-50 %	$500,000	Grants are principally awarded for the acquisition of land or protection interests and preserving or restoring coastal wetland areas on a competitive basis with all coastal States.	LND 27; RST 2, 3
15.615	Cooperative Endangered Species Conservation Fund	USFWS	To assist any State fish and wildlife agency in protecting habitat of endangered or threatened species	10 to 20%	$100,000	Funds can be used for studies and land acquisition to improve protection efforts for T & E species. In 1998, 200 applications. were received for habitat conservation and land acquisition projects.	LND 27
15.623	North American Wetlands Con-servation Fund	USFWS	To promote wetlands conservation projects	50%	$423,000	Projects may involve acquisition, restoration and enhancement of wetlands and wetland ecosystems for waterfowl or migratory birds or fish.	LND 27; RST 2, 3, 5, 6
15.617	Wildlife Conservation and Appreciation	USFWS	To carry out and promote wildlife conservation and appreciation projects.	60-67 %	$27,628	Eligible projects may include any actions designed to conserve fish and wildlife species and their habitats.	LND 27, 32
10.914	Wildlife Habitat Incentive Program	USDA; NRCS	To protect various types of wildlife habitat incl. coastal wetland & fish habitat	25%	$4,600	Technical assist. and cost-share payments provided to help implement the needed wildlife habitat practices. Minimum cost-share agreement period is 5 to 10 years.	LND 32, 33
10.072	Wetlands Reserve Program	USDA NRCS	To restore and protect previously farmed wetlands along riparian and coastal buffer areas.	Varies from 0 to 25 %	NA	Funds are granted to landowners for the purposes of retiring crop production in wetland areas and establishing permanent or 30-year protection easements or restoration agreements.	N/A
10.069	Conservation Reserve Program	USDA; FSA	To reduce soil erosion and sedimentation, improve water quality and wildlife habitat.	50%	$4,000	Rental agreements of 10 -15 years are established with landowners who have farmland in environmentally-sensitive areas.	N/A

Table 10.3 Water Quality, Waste Water, and Storm Water Assistance Programs.

CFDA NO.	PROGRAM	AGENCY	PROGRAM OBJECTIVES	MATCH REQ'S	AVG. GRANT	EXAMPLES OF PROJECTS FUNDED	NHEP ACTION PLANS
10.760	Water and Waste Disposal Systems for Rural Communities	USDA: RUS	Low interest loans to install, improve or expand waste water facilities in Rural Areas	None	$877,000	Funds can be used to construct or improve treatment facilities: booster pumps; collection pipes, etc.	WQ 3
10.906	Watershed Surveys and Planning	USDA; NRCS	Technical assistance to improve water quality related to agricultural sources and promote wetland preservation.	Varies	NA	NYC Water Supply Watershed Study to assess ag-related pollution on water quality. Focus is placed on specific problems such as erosion control, flood damage, water quality impacts and wetland losses and preservation.	WQ 7
11.300	Public Works and Economic Development Grants	Econ. Dev. Admin	To construct or improve\public infrastructure to promote commercial/industrial development in economically distressed regions	0 to 50%	$851,000	Grants can be used for infrastructure improvements I.e., water and sewer systems, access roads, industrial parks or tourism facilities. Indian tribes may be funded up to 100% of project costs.	WQ 3, 4B, 4C
11.473	Coastal Services Center	NOAA	To fund projects focused on science-based approaches to improve environmental quality and allow for economic growth.	none	NA	Grants have been used to conduct land cover and change analyses using GIS Systems, spatial database development, ecological and landscape characterization and restoration planning and other remote sensing activities.	LND 3
15.616	Clean Vessel Act Pumpout Grant Program	USFWS	To assist installation of pumpout/ dump stations and develop educational programs to prevent sanitary discharges from recreational boats.	25%	$171,000	Grants are awarded for boat surveys, planning, facility construction or renovations and education programs. In FY97, 1,100 pumpouts and 900 dump stations were constructed in 33 states. Educational programs were started in 22 States.	N/A
15.805	Assistance to State Water Resources Research Institutes	USGS	To support University WRRIs to study regional water problems and provide information transfer.	None: Each state is allocated a portion of funds based on formula	NA	Projects generally focus on non-point source issues and the effects of human activities on groundwater and surface waters. Given significance of NH Estuaries additional weight may be given to projects focusing on Great Bay and other coastal areas.	LND 18
66.458	Capitalization Grants for State Revolving Funds	USEPA	To create State Revolving Funds (SRFs) as a source of financing for treatment facilities and other WQ management activities	20%	$30 mil	Funds have been used for wastewater treatment facility construction and upgrades, non-point source projects, i.e., storm water and ag runoff controls, and estuary protection measures.	WQ 1, 3, 13, 14
66.46	Non-point Implementation Grants Section 319 funds	USEPA	Assist in carrying out non-point source pollution control BMPs and programs	40%	$2.0 mil	Funds are used to support local BMP implementation initiatives and demonstration projects that are selected on a statewide competitive basis	WQ 7, 10; LND 4
66.463	NPDES State Program Grants	USEPA	To develop and implement methods to control point source discharges (i.e., CSOs, storm water & waste water).	None	NA	Characterization of wet-weather discharges from tributaries; WWTFs; and CSTs; stormwater/CSO modeling; integrating watershed approach into NPDES Program. Primary focus on advancing the EPA's knowledge on wet-weather problems.	WQ 1, 3, 11
20.006	Oil Spill Liability Trust Fund	Coast Guard; DOT,	Funds are used for immediate spill cleanup and removal costs for actual or threatened discharges of oil into waters.	NA	NA	NA	AS NEEDED
11.459	Climate and Air Quality Research	NOAA	To support research geared toward improving the predictive capability of short and long-term climate and air quality fluctuations.	None	NA	Previous projects include numerical weather prediction using Global Weather Experiment Data and An Analysis of the Effects of Nitrate and Sulfate Deposition on Surface Waters.	WQ 15

Table 10.4 SHellfish Resources, Aquaculture, Fishery Management, and Habitat Assistance Programs.

CFDA NO.	PROGRAM	AGENCY	PROGRAM OBJECTIVES	MATCH REQ'S	AVG. GRANT	EXAMPLES OF PROJECTS FUNDED	NHEP ACTION PLANS
11.405	Anadromous Fish Conservation Act	USFWS	To support projects designed to restore, manage or enhance anadromous fish stocks.	10-50%	$40,000	Funds can be used for spawning area improvements, fish ways and ladders, hatcheries, population data collection. In 1999, 16 projects were funded with a similar amount expected for FY 00	RST 4
11.407	Inter-Jurisdictional Fisheries Act	NOAA	To support research, enforcement, and restoration of fishery resources	10-25%	$100,000	Previous projects include fisheries monitoring, data assessment, enforcement and aquaculture experiments.	SHL 15
11.427	Fisheries Development and Utilization Research	NOAA	To promote sustainable fisheries, seafood quality and recreational opportunities.	Varies: min 10%	$140,000	Previous projects focused on improving fishery management, sustainability, product quality and develop aquaculture systems.	SHL 15
11.433	Marine Fisheries Initiative	NOAA	To assist in research and development projects that will improve the use of and enhance fish stocks.	None	$64,000	Most of the projects have been in the South Atlantic and Gulf of Mexico region. Funding only recently opened to Northeast region since FY98.	N/A
11.452	Unallied Industry Projects	NOAA/NMFS	To support research, and innovative methods to ensure safety, quality and prosperity in fishery products.	None	$213,700	Funds have been used to restore bay scallops in Florida and shellfish stocks in Miss. And eradicate exotic plants from shorelines to reduce beach erosion.	SHL 8
11.454	Unallied Management Projects	NOAA/NMFS	To support research geared toward improving management and harvesting practices for fishery resources and protected species.	None	NA	Previous projects have primarily focused on researching appropriate harvesting levels and assessing populations of various species.	SHL 7
11.472	Unallied Science Program	NOAA/NMFS	To promote scientific research on fishery stocks and other protected resources of the marine and coastal environment.	None	NA	Grants used to support a wide variety of high-priority marine and estuarine research issues. In RI, a long-term, wq, meteorolog. and fishery monitoring program was developed for Narragansett Bay and other coastal waters. Aquaculture technology.	SHL 7-15 Monitoring program development
11.474	Atlantic Coastal Fisheries Cooperative Management Act	NOAA/NMFS	To support/enhance fishery research and planning; enforcement and habitat conservation.	None	NA	Previous projects have included a marine recreational fishery statistics survey, and a biomonitoring and assessment project for American Shad and River Herring.	LND 30, 31
15.605	Sport Fish Restoration Act	USFWS	To support projects designed to restore, manage or preserve sport fish populations and/or improve sport fishing.	25%	$4.8 mil	Activities can include land acquisition, development for boating access or habitat protection. Lake and stream rehabilitation and surveys of fish populations and habitat usage. Public education tasks are not eligible.	SHL 7

See also Wetland Habitat Program 15.615 and General Coastal Programs 11.417, 11.419 and 11.429.

Table 10.5 Land Use and Development Impact Assessment and Control Funding Assistance ProgramS.

CFDA NO.	PROGRAM	AGENCY	PROGRAM OBJECTIVES	MATCH REQ'S	AVG. GRANT	EXAMPLES OF PROJECTS FUNDED	NHEP ACTION PLANS
10.906	Watershed Surveys and Planning	USDA, NRCS	Technical assistance to improve water quality related to agricultural sources and promote wetland preservation.	Varies	NA	NYC Water Supply Watershed Study to assess ag-related pollution on water quality. Focus is placed on specific problems such as erosion control, flood damage, water quality impacts and wetland losses and preservation.	LND 6a, 25b-d, WQ 7
11.426	Ocean Resources Conservation and Assessment Program	NOAA	To evaluate and define management alternatives which minimize the adverse impacts of human use and activities.	None	$80,000	Analyses of marine contaminants, habitats and biodiversity. Developing data bases of physical and chemical characteristics including erosion rates, vulnerability indices and coastal hazards for GIS use or other predictive modeling.	LND 18
11.473	Coastal Services Center	NOAA	To fund projects focused on science-based approaches to improve environmental quality and allow for economic growth.	none	NA	Grants have been used to conduct land cover and change analyses using GIS systems, spatial database development, ecological and landscape characterization and restoration planning and other remote sensing activities.	LND 1-3
11.478	Coastal Ocean Program	NOAA	To fund research related to coastal ecosystems, cumulative impacts and forecasting natural hazards.	None	$375,000	Not Applicable (New in FY1998)	N/A
15.805	Assistance to State Water Resources Research Institutes	USGS	To support University WRRIs to study regional water problems and provide information transfer.	None:	NA	Projects generally focus on non-point Each state is source issues and the effects of human allocated a activities on groundwater and surface portion of waters. Given significance of NH funds based Estuaries additional weight may be on formula given to projects focusing on Great Bay and other coastal areas.	LND 3, 18 SHL 2
15.808	USGS Research and Data Acquisition	USGS	To support scientific research projects relevant to the USGS mission w/ respect to mapping, hydro data & description of resources.	Varies;	$50,000	Projects may involve cooperative up to 50% mapping efforts; WQ data collection for surface and groundwaters and other water resources cooperative efforts. Studies are generally coordinated through local USGS district.	SHL 1,2,5
66.651	Sustainable Development Challenge Grants	USEPA	To integrate environmental protection and economic prosperity and promote sustainable development.	min 20%	NA	The Society for Protection of NH Forests recently received a grant to promote sustainable forestry practices. Emphasis placed on using funds to leverage private and public investment to promote sustainable communities and possibly limit urban sprawl.	LND 5, 6(a-f)
66.454	Water Quality Management Planning	USEPA	To assist State and Regional Planning Commissions to carry out WQ management activities	None	$250,000	Grants to States for revising WQ standards; performing waste-load allocations/total maximum daily loads, point and non-point source planning activities. At least 40% of the allocation must be passed through to Regional Planning Commissions or Interstate Org	WQ 11: LND 2, 6e, 14, 31
66.456	National Estuary Program	USEPA	To develop Comprehensive Management Plans and initiate monitoring of program activities.	25%	$100,000	Awards have been granted to conduct water quality baseline assessments, monitoring and field surveys, review historical data and develop public education and outreach programs.	Monitoring program implementaion
66.46	Non-point Implementation Grant Section 319 funds	USEPA	Assist in carrying out non-point source pollution control BMPs and programs	40%	$2.0 mil	Funds are used to support local BMP implementation initiatives and demonstration projects that are selected on a statewide competitive basis	LND 4
66.606	Surveys, Studies, Investigations and Special Purpose Grants	USEPA	To support specific studies to evaluate and demonstrate alternative pollution control techniques.	Variable	NA	Examples of previous projects are highly variable ranging from a reporter's guide to climate change, to development of solid waste system, lead-based workshops and radon information for real estate companies.	WQ 2, 8

Table 10.6 Public Education and Outreach Funding Assistance Programs.

CFDA NO.	PROGRAM	AGENCY	PROGRAM OBJECTIVES	MATCH REQ'S	AVG. GRANT	EXAMPLES OF PROJECTS FUNDED	NHEP ACTION PLANS
11.419	Coastal Zone Management Administration Awards	NOAA	To implement and enhance CZM Programs that have been approved under Section 306.	None	$ 1.3 mil	Funds are mostly used to support CZM programs including salaries, travel and other related costs. Ten to 20 % of the funds can be used for specific Action Plans.	LND 5; EDU 1, 2, 5; WQ 17, 18
11.429	Marine Sanctuary Program	NOAA	To identify areas of special national significance and to assist in management research, monitoring and public awareness of these areas.	None	$50,000	Funds have been used for research and educational programs; solicitation of private donations for additional support; enforcement activities and other purposes consistent with the National Marine Sanctuaries Act.	N/A
11.463	Habitat Conservation	NOAA	To protect and restore wetlands and other coastal habitat areas.	Varies: 0-25%	NA	Funds can be used for public policy, research, management, and public education activities	SHL 8; RST 1-6; LND 7-17, 20-25d, 26-36
66.456	National Estuary Program	USEPA	To develop Comprehensive Management Plans and initiate monitoring of program activities.	25%	$100,000	Awards have been granted to conduct water quality baseline assessments, monitoring and field surveys, review historical data and develop public education and outreach programs.	Montitoring program development
66.951	Environmental Education Grants	USEPA	To support projects that design, demonstrate and disseminate practices or methods related to environmental education.	25%	$100,000	Funds can be used to establish an education and training program; hands-on projects to demonstrate environment problems; improving education techniques and curriculum.	LND 5
20.219	Recreational Trails Program	Federal Highway Admin.	To develop and maintain recreational trails and trail-related facilities for both nonmotorized and motorized uses.	20%	$965,686	funds may be used property acquisition and easements; construction of new trails; educational programs to promote safety and environmental protection.	LND 26, 27

PARTNERSHIPS

The key to successful implementation of the *NHEP Management Plan* will be working cooperatively with as many agencies, organizations, and individuals as possible to advance common agendas. Some of the important partners for the NHEP include:

Federal Agencies

U.S. Army Corps. of Engineers
U.S. Department of Agriculture (including Natural Resources Conservation Service)
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service (including Great Bay National Wildlife Refuge)
Food and Drug Administration
Housing and Urban Development
National Marine Fisheries
National Oceanic and Atmospheric Administration (including Great Bay National Estuarine Research Reserve)
National Park Service
U.S. Geological Survey

State Agencies

Air National Guard
Attorney General's Office
Department of Agriculture, Markets and Food
Department of Environmental Services (including Wetlands Board)
Department of Health and Human Services
Department of Resources and Economic Development (including Division of Parks & Recreation and Natural Heritage Inventory Program)
Department of Transportation
Governor's Office
Legislature
N.H. Fish and Game Department (including Great Bay National Estuarine Research Reserve and the Sandy Point Discovery Center)
N.H. State Port Authority
Office of State Planning (including N.H. Coastal Program)
State Geologist

Education/Research Organizations

Complex Systems Research Center
Regional Association for Research on the Gulf of Maine
UNH/NOAA Cooperative Institute for Coastal and Estuarine Environmental Technology
UNH Cooperative Extension/Sea Grant (including Great Bay Coast Watch)
UNH Jackson Estuarine Laboratory
UNH Department of Natural Resources

Non-governmental and Regional Organizations

Advocates for the North Mill Pond
American Planning Association
Association of Conservation Commissions
Audubon Society of New Hampshire
Chambers of Commerce
Clean Water Action
Coastal Conservation Association
Conservation Districts
Ducks Unlimited
Great Bay Resource Protection Partnership
Great Bay Stewards
Lamprey River Advisory Committee
Marine Trades Association
The Nature Conservancy
New England Association of Environmental Biologists
New Hampshire Coalition for Sustaining Agriculture
New Hampshire Commercial Fishermen's Association
New Hampshire Consulting Engineers
New Hampshire Municipal Association
New Hampshire Planners Association

New Hampshire Rivers Council
New Hampshire Society of Professional Engineers
Cocheco River Watershed Association
Lamprey River Watershed Association/ Lamprey River Advisory Committee
Exeter River Watershed Association
Oyster River Watershed Association
Pease Development Authority
Piscataqua River Coordinating Council
Rockingham Land Trust
Rockingham County Conservation District
Rockingham Planning Commission
Seacoast Anti-Pollution League
Seacoast Metropolitan Planning Organization (MPO)
Seacoast Science Center
Society for the Protection of New Hampshire Forests
Strafford County Conservation District
Strafford Regional Planning Commission
Strafford Rivers Conservancy
The Nature Conservancy
Trout Unlimited - Great Bay Chapter

Professions

Agriculture
Aquaculture
Architects
Boat Tour Companies
Developers
Engineers
Ferry Services
Foresters
Golf Clubs
Marinas
Well drillers
Septic designers
Septic haulers
Soil scientists
Wastewater treatment plant operators
Water companies
Wetlands scientists/specialists

Communities

Code-enforcement officers group
Conservation commissions
Elected officials
Health Officers
Highway/Public Works departments
Planning boards
Wastewater treatment plant operators

Foundations

New Hampshire Charitable Foundation
Piscataqua Foundation
Switzer

Businesses

Aquaculture Resources Development
Banks
Chambers of Commerce
Irving Oil
Fisher Scientific
Foss Manufacturing
General Electric
Great Bay Aquafarms
Green Pages
Hannaford Brothers
Liberty Mutual
MBNA
Other Pease International Tradeport businesses
Public Service of New Hampshire
Red Hook Brewery
Restaurants
Seabrook Station
Shaws
Sprague Energy
Timberland
Tyco
Walmart
Waste Management, Inc.
Wentworth-by-the-Sea
Xylan

Public

Recreational users of the estuaries
Shoreland property owners

MONITORING PLAN

11

The NHEP Management Plan presents a series of goals, objectives, and specific actions designed to improve, protect, and enhance the environmental quality of the state's estuaries, and outlines a process for implementing the Plan's most critical actions. Measuring the effectiveness of these actions in achieving NHEP goals is an essential part of implementation. Understanding the status and trends in environmental quality will help the NHEP evaluate the success of the Management Plan, and provide information that can be used to redirect or refocus implementation efforts as needed. The NHEP staff will continually track and evaluate information from NHEP programs. The NHEP Monitoring Program will generate information needed to answer the following questions.

- Are the goals and objectives of the Management Plan being met?
- Are the actions in the Management Plan having the desired effect?

Although many agencies and organizations monitor various aspects of New Hampshire's estuaries, there is not a coordinated, integrated, comprehensive monitoring plan in place. The purpose of the NHEP Monitoring Program is to provide scientifically credible information which increases understanding of New Hampshire's estuaries, its resources, and the effects of human activities over time. The monitoring program has been designed to ensure that high quality data are collected and analyzed and that results are made available to many audiences.

The overall goal of the NHEP Monitoring Program is to develop a better understanding of the status and trends of environmental quality in coastal New Hampshire. Therefore, the Monitoring Plan's central focus asks:

- Is the environmental condition of the estuaries and their resources improving over time?

SCOPE

The NHEP Monitoring Plan focuses on the New Hampshire Estuary Project study area, which includes the 43-municipality watershed that drains to the tidal rivers and Great Bay and Hampton Harbor estuaries. Although most of the actual data collection will occur in the tidal portions of the watershed, upper watershed influences will be considered. For example, the NH Department of Environmental Services will restructure aspects of its ambient sampling regime for freshwater tributaries to be consistent with the monitoring goals of the NHEP Monitoring Plan.

Although the Monitoring Plan is intended to be comprehensive and all inclusive, the resources needed to enact a comprehensive program cannot be met in the short term. The Monitoring Plan has identified gaps in data and information from all existing monitoring efforts, and selected additional monitoring activities to be initiated in 2001. As resources become available and our knowledge base increases, the scope and coverage of the NHEP monitoring program will likely expand or change. The NHEP intends to periodically update the Monitoring Plan to reflect new knowledge, changing priorities, and emerging issues.

RELATIONSHIP TO THE MANAGEMENT PLAN

The NHEP Management Plan sets management goals for a series of major environmental management issues: water quality, shellfish, land use and habitat protection, habitat restoration, and outreach and education. The goals of the Monitoring Plan are derived from the goals of the Management Plan. Table 1 shows the monitoring goals and the related management goals.

To develop a Monitoring Plan that is tied to the NHEP Management Plan, the objectives of the Monitoring Plan were derived from the objectives of the Management Plan. Management Plan objectives were converted into monitoring questions. For example, the Management Plan objective, “Achieve water quality in Great Bay and Hampton Harbor that meets shellfish harvest standards,” became the monitoring question, “Do NH tidal waters meet fecal coliform standards of the National Shellfish Sanitation Program for approved shellfish areas?” The complete list of monitoring questions, found on pages 11-46 to 11-48, defines the information that a comprehensive monitoring plan could gather.

The monitoring questions were prioritized by project participants based on the importance and relevance as indicators of environmental quality and change. The monitoring questions that were voted highest priority were developed into the objectives of the Monitoring Plan. The monitoring objectives, their related management objectives, and the relevant management Action Plans are included in Table 2.

Table 1: Program Goals

MONITORING GOALS	MANAGEMENT GOALS
Water Quality ■ Determine the status and trends of the sanitary quality (bacteria and other disease-causing organisms) of shellfish-growing and recreational waters. ■ Determine the status and trends of eutrophic conditions in New Hampshire's coastal and estuarine waters. ■ Determine the status and trends of toxic contaminants in water, sediment, and biota of coastal New Hampshire.	**Water Quality** ■ Ensure NH's estuarine waters will meet standards for pathogenic bacteria. ■ Ensure NH's estuarine waters will meet standards for organic and inorganic nutrients ■ Ensure NH's estuarine waters, sediments and biota meet standards for toxic contaminants.
Shellfish ■ Determine the status and trends of shellfish populations in New Hampshire's coastal and estuarine waters.	**Shellfish** ■ Achieve sustainable shellfish resources by tripling the area of shellfish beds that are classified open for harvesting to 75% of all beds, and tripling the quantity of harvestable clams and oysters. ■ Assure shellfish are fit for human consumption and are support a healthy marine ecosystem ■ Provide opportunities and strategies for restoration of shellfish communities and habitat. ■ Support coordination to achieve environmentally sound shellfish aquaculture activities.
Land Use/Habitat Protection & Restoration ■ Determine the status and trends of land use, development, and habitat protection in the Seacoast region of New Hampshire. ■ Determine the status and trends of critical species and habitats in New Hampshire's coastal and estuarine watersheds.	**Land Use/Habitat Protection & Restoration** ■ NH coastal watershed has development patterns that ensure the protection of estuarine water quality and preserve the rural quality of Great Bay. ■ Maximize the acreage and health of tidal wetlands. ■ Protect freshwater and tidal shorelands to ensure estuarine water quality. ■ Protect estuarine water quality by ensuring that groundwater impacts are minimized. ■ Allow no net loss of freshwater wetland functions. ■ Maintain habitats of sufficient size and quality to support populations of naturally occurring plants, animals, and communities.

Table 2: Program Objectives

WATER QUALITY - Bacteria

Monitoring Objective	Management Objective	Action Plans
Objective A: To determine if concentrations of fecal borne microbial contaminants are increasing with time.	Minimize beach closures due to failure to meet water quality standards for tidal waters (Enterococci levels not exceeding 104 counts/100 ml. in any one sample)	WQ-3, 4A, 4B, 4C, 5, 6, 7, 8, 13, 14 SHL-2, 5
Objective B: To determine the effects of human-borne fecal microbial contaminants on surface water quality in coastal NH.	Increase water bodies in the NH coastal watershed designated 'swimmable' by achieving state water quality standards (E. coli levels not exceeding 406 counts/100 ml in any one sample. For designated beaches, E. coli should not exceed 88 counts/100 ml.)	
Objective C: To determine if the incidence and concentrations of microbial pathogens are changing with time.	Reduce the number of known illicit connections in the NH coastal watershed by 50% by 2010.	
Achieve water quality in Great Bay and Hampton Harbor that meets shellfish harvest standards (14 counts of fecal coliform/100 ml) by 2010.	Achieve 50% reduction of known illegal discharges into Great Bay, Hampton Harbor and the tributaries by 2010.	

WATER QUALITY - Toxic Contaminants

Monitoring Objective	Management Objective	Action Plans
Objective A: To determine if toxic contaminant concentrations in seafood species from NH coastal waters are increasing with time.	Develop baseline of toxic impacts on ecological and human health by tracking toxic contaminants in water, sediment, and indicator species: blue mussels (Gulfwatch); tomcod, lobsters and winter flounder (Coastal 2000).	WQ- 2, 4B, 6, 7, 11, 12A, 12B, 15
Objective B: To determine if concentrations of toxic contaminants in sediments, water, and biota are increasing with time.	Long-term: Reduce toxic contaminants levels in water, sediment and indicator species so that no levels persist or accumulate according to: ■ FDA guideline levels ■ State water standards in Ws 1700 ■ Sediment levels below ER-M levels	
Objective C: To determine if toxic contaminants are causing increasingly prevalent toxic effects in marine and estuarine biota.		

WATER QUALITY - Nutrients and Eutrophication

Monitoring Objective	Management Objective	Action Plans
Objective A: To determine whether concentrations of dissolved and particulate nutrients are increasing as seacoast region development and population increases. Objective B: To determine whether concentrations of phytoplankton, measured by chlorophyll a, in NH tidal waters change over time. Objective C: To determine whether concentrations of suspended particulates, measured by TSS and particulate organic matter, turbidity, and secchi depth, in NH tidal waters change over time. Objective D: To determine whether the concentration of dissolved oxygen and percent oxygen saturaton in NH tidal waters change over time. Objective E: To determine whether nuisance macroalgae increase in abundance and area in intertidal and shallow subtidal areas of the NH estuaries. Objective F: To determine whether eelgrass decreases in abundance, density and biomass, and area in intertidal and shallow subtidal areas of NH estuaries. Maintain inorganic nutrients, nitrogen, phosphorous and chlorophyll a in Great Bay, Hampton Harbor and their tributaries at 1998-2000 NERR baseline levels.	Maintain organic nutrients in Great Bay, Hampton Harbor and their tributaries at 1994-1996 NERR baseline levels. Maintain dissolved oxygen levels at: > 4 mg/L for tidal rivers > 6 mg/L for embayments (Great Bay and Little Bay) > 7 mg/L for oceanic areas (Hampton Harbor and Atlantic Coast) Maintain NPDES permit levels for BOD at wastewater facilities in the NH coastal watershed.	WQ-1, 5, 6, 7, 8, 9, 10, 11, 15

SHELLFISH

Monitoring Objective	Management Objective	Action Plans
Objective A: To determine whether the abundance and population structure of molluscan shellfish in NH estuaries change over time. Objective B: To determine the status and trends of shellfish diseases. Objective C: To determine how much of each species of molluscan shellfish is harvested from NH waters. Objective D: To determine the effects of predation on shellfish populations in NH tidal waters. Objective E: To determine the effect of restoration on shellfish populations in NH tidal waters.	Maintain an approved National Shellfish Sanitation Program supported by the State. Increase soft shell clam beds in Great Bay, Little Bay, and Hampton Harbor that are open for harvest to 2500 acres by 2010. Survey each major oyster and soft-shell clam bed at a minimum of every 3 years for dimensions, density and population structure. Achieve water quality in Great Bay and Hampton Harbor that will meet shellfish harvest standards by 2010. Shellfish Acreage: No net decrease in acreage of oyster beds from 1997 amounts for Nannie Island, Woodman Point, Piscataqua River, Adams Point, Oyster Squamscott and Bellamy Rivers. Shellfish density: A) Oysters: No net decrease in oysters (>80 mm) / square meter from 1997 amounts at Nannie Island, Woodman Point, Piscataqua River, Adams Point, and Oyster River. B) Clams: No net decrease in adult clams (>50 mm) / square meter from the 1989-1999 10-year average at Common Island, Hampton River, and Middle Ground. Restore 20 acres of oyster habitat in Great Bay and its tidal tributaries. Ensure that aquaculture practices do not adversely impact water quality or ecological health of NH's estuaries.	SHL- 1, 2, 3, 4, 5, 6, 7, 8, 9A, 9B, 9C, 9D, 15

LAND USE AND HABITAT PROTECTION

Monitoring Objective	Management Objective	Action Plans
Objective A: To determine if the rate of land use change increases as human population and development increase in coastal NH. Objective B: To determine if acreage of permanently protected important habitats increases as human population and development increase in coastal NH. Objective C: To determine if the rate of sprawl increases as human population and development increase in coastal NH.	Minimize the amount of impervious surfaces and assess the impacts to water quality by: 1) Keeping the total impervious surface in each sub-watershed below 10% of the total land area, 2) Reducing stormwater runoff from future development in all sub-watersheds, especially where impervious surfaces already exceed 10%. Determine existing acres of permanently protected land in the NH coastal watershed in the following categories: tidal shoreland, large contiguous forest blocks, wetlands with high habitat values, freshwater shorelands, rare and exemplary natural communities, by 2005. Increase acreage of protected land containing significant habitats in the NH coastal watershed, through fee acquisition or conservation easements by 2010. Allow no new impervious surfaces or major disturbances of existing vegetation (except for water-dependent uses) in NH coastal watershed. In addition to state Shoreland Protection Act regulations, encourage additional reductions of shoreland impacts by 2010. Allow no new establishment or expansion of existing contamination sources (such as salt storage, junk yards, solid waste, hazardous waste, etc.) within the shoreland protection area as tracked by the Department of Environmental Services. Increase use of buffers around wildlife areas and maintaining contiguous habitat blocks in the NH coastal watershed by 2010. Minimize the total rate of land consumption in the NH coastal watershed (as measured by acres of developed land per capita). Encourage 43 coastal watershed municipalities to actively participate in addressing sprawl.	LND-1, 2, 3, 4, 5, 6, 6A, 6B, 6C, 6D, 6E, 6F, 13, 14, 15, 16, 17, 26, 27, 28, 29, 32, 33, 34, 35, 36

CRITICAL SPECIES, HABITAT AND RESTORATION

Monitoring Objective	Management Objective	Action Plans
Objective A: To determine trends in wetland degradation and restoration.	Allow no loss or degradation of 6200 acres of tidal wetlands in the NH coastal watershed and restore 300 acres of tidal wetlands degraded by tidal restrictions by 2010.	LND-4, 7, 8A, 8B, 9A, 9B, 10, 11, 12, 18, 19, 20, 21, 22, 23, 24, 25, 25A, 25B, 25C, 25D, 30, 31
Objective B: To determine whether populations of resident and migratory finfish species change over time.	Determine indicators for freshwater wetland functions.	
Objective C: To determine the quantity and quality of groundwater entering estuarine and coastal waters.	Establish state and municipal regulatory framework necessary to prevent introduction of untreated stormwater into tidal and freshwater wetlands by 2010.	
Objective D: To determine trends in designated uses of water bodies.	Increase use of buffers around wetlands in NH coastal watershed.	
Objective E: To determine the status and trends in assemblages of benthic macroinvertebrates.	Determine the extent of groundwater resources and their contaminant load to Great Bay and Hampton Harbor by 2005.	
	Reduce and eliminate groundwater contaminants based on outcome of Objective 1 by 2010.	
	Support completion of state biomonitoring standards and increase the miles of rivers and streams meeting those standards by 2010.	

RELATIONSHIP TO OTHER MONITORING PROGRAMS

Existing Monitoring Programs

An abundance of background information, baseline data, and monitoring programs is already available to help determine environmental problems and trends in the New Hampshire Seacoast. Tables 3-5, see pp. 11-33 to 11-35 summarize ongoing monitoring activities in coastal and estuarine New Hampshire that generate or will generate information needed to answer the monitoring questions. Some monitoring and research programs are not included in Tables 3-5, primarily because of geographic scope, small number of sample sites, limited parameters, and/or likelihood of being discontinued in the near future.

Data/Information Gaps

Gaps in information or data not covered by existing monitoring programs were identified. These information gaps were examined to determine which gaps can realistically be filled within the time and resource limits of the NHEP and its partners. A series of new monitoring activities to be funded with NHEP implementation funds were selected by a committee, based on the relevance of those information gaps to NHEP goals and the economic feasibility of filling the gaps. (See Table 6, p. 11-36.) The NHEP monitoring program will coordinate with existing monitoring efforts, and build on them by collecting data on additional components.

MONITORING PLAN IMPLEMENTATION

Data Synthesis and Management

It is necessary to effectively manage the large volume of existing information as well as new information that will be developed through the NHEP monitoring program. Information now exists in multiple formats in a variety of places. Existing monitoring programs are designed to meet the missions of the various implementing organizations. The organizations use different procedures and protocols for data collection, analysis and storage. Coordination of data management among organizations is limited.

In order to measure environmental changes in New Hampshire's estuaries and use that data to manage the quality of the state's estuarine and coastal waters, the NHEP Monitoring Plan establishes a full time Coastal Scientist position to coordinate, synthesize and interpret data.

The position will be funded jointly with the NH Department of Environmental Services (75% NHEP, 25% NH DES), and housed in the NH Department of Environmental Services. This Coastal Scientist position will require the ability to synthesize and integrate data sets related to water quality, shellfish quality, land use, seasons, weather/hydrography, river input, sediment quality, biotic parameters, etc. The goal of the synthesis and integration is to discern status, temporal and spatial trends, relationship, causality, and effects. To support the efforts of the Coastal Scientist, the NHEP will

establish a Technical Advisory Committee, with representatives from NH DES, NH Fish & Game, UNH Jackson Laboratory, CICEET, NHCP, and others.

The Coastal Scientist's management responsibilities for the NHEP monitoring program will include:

- Implement, evaluate, and update the NHEP Monitoring Plan.
- Coordinate coastal environmental quality data collection, management, and interpretation across multiple programs and agencies, and facilitate a technical advisory committee.
- Interpret and synthesize environmental data from numerous sources to accomplish comprehensive assessments and trend analyses of coastal environmental quality, and provide annual reports on findings.
- Design and conduct complex analysis and modeling of water quality data to determine water quality trends, evaluate and allocate pollutant loads, and develop recommendations for watershed-based actions to maintain and improve water quality.

Monitoring Coordination

The Coastal Scientist will coordinate information generated by both existing and the new/enhanced monitoring activities outlined in the Monitoring Plan. A list of the new monitoring activities that will be initiated through the NHEP monitoring program in 2001 is found in Table 6. Tables 7-12 give a comprehensive view of existing and new monitoring activities by listing: the monitoring component, existing monitoring efforts, identified gaps in monitoring, recommended monitoring activities, new monitoring activities proposed by NHEP, and the responsible party for each existing and new/enhanced monitoring activity, see pp.

A number of steps are required between recording measurements and synthesizing interpreted data.

1. The 'Responsible Party' identified for each monitoring activity in Tables 7-12 will be responsible for management, quality assessment and control, and reporting of data collected, on a schedule and in a format determined by the NHEP Coastal Scientist. Data collected by volunteers will be used.
2. The Coastal Scientist will be responsible for compiling databases from raw data, and archiving the data in an appropriate relational database such as File Maker Pro, Oracle, or Access. NH DES will assist the Coastal Scientist with maintaining data as necessary.
3. The Coastal Scientist will conduct statistical analyses, and make results available in electronic and GIS formats. Analysis will be performed on an ongoing basis, although some time lag is likely between field seasons and analysis.

4. An annual synthesis report to the NHEP Management Conference will include data analysis that incorporates GIS presentation, to the greatest extent possible, and will be used in NHEP program evaluation.

5. Data will be interpreted to inform stakeholders of current conditions and trends. Synthesized products, and potentially raw data, will be made available to the scientific and resource management community electronically on the web. NHEP outreach staff will help communicate interpreted data to the public.

Monitoring Plan Assessment

Evaluating the effectiveness of the Monitoring Plan is critical to the viability and relevance of the NHEP monitoring strategy. Selection of the new/enhanced monitoring activities to be initiated by NHEP was based on the existence of significant data gaps and the recognition that modifications to the monitoring strategy will be needed as existing and new information is processed, as trends become apparent, or as management needs change.

The success of the monitoring strategy will be assessed in the annual report provided by the Coastal Scientist. In addition, the Monitoring Plan and the monitoring strategy will be assessed every two years as part of the National Estuary Program biennial review process. A comprehensive review of the Monitoring Plan will conducted by the NHEP and its monitoring partners at a minimum of every five years.

Monitoring Plan Outline

The NHEP Monitoring Plan is outlined here in six sections: Bacteria and Disease-causing Organisms; Nutrients and Eutrophication; Toxics; Shellfish; Land Use and Habitat Protection; and Critical Species and Habitats. Each section includes:

- Monitoring goal;
- Background description of the issue;
- Monitoring recommendations;
- Specific objectives, indicators, monitoring activities, and timeframe.

Within each section under 'Recommendations' and 'Objectives', monitoring activities are categorized as 'New/Enhanced Monitoring' – for new initiatives coordinated or funded through NHEP, 'Ongoing Monitoring,' – for existing programs, or 'Suggested Monitoring' – for components that could be monitored if additional funds become available or monitoring priorities change.

SECTION 1:
BACTERIA AND DISEASE-CAUSING ORGANISMS

MONITORING GOAL

Determine the status and trends of the sanitary quality (bacteria and other disease-causing organisms) of shellfish-growing and recreational waters.

BACKGROUND

Despite reductions of pollution of air, water, and land resources since the first environmental protection legislation was passed in the early 1970s, uses of many surface waters remain restricted, largely due to unacceptable levels of microbial contamination. Because microbial contaminants that can cause disease (pathogens) can be water-borne, exposure to contaminated surface waters is a public health issue.

Water-borne pathogens include a wide variety of bacteria, viruses, protozoan parasites, and other microorganisms. Bacterial and protozoan pathogens can be of human origin, as well as from natural flora and fauna in surface water environments. Human enteric viruses are the suspected cause of most water-borne disease.

Fecal bacteria are found throughout New Hampshire's estuaries, originating from a variety of sources including faulty septic systems, overboard-marine toilet discharges, wastewater treatment facility overflows, and illicit connections between sanitary sewers and stormwater systems. Although coliform (an indicator of fecal bacteria) counts in tidal rivers have declined dramatically since 1960, water quality sampling tracks a pattern of elevated counts from urban runoff and wastewater treatment plants throughout the Great Bay Estuary. Bacterial concentrations in New Hampshire estuaries are highest during or immediately after rainfall, indicating that much of the bacterial pollution comes from contaminated stormwater runoff.

The variety of types and sources of pathogens complicates assessment of the sanitary quality of surface waters. Microbial indicator analysis is the accepted strategy, but no ideal indicator meets all needs. For example, microbial indicators of fecal contamination do not address issues related to nonfecal-borne pathogens. Using a suite of indicators that address different issues is the best sampling and analytical approach.

Important factors in understanding the status and trends of microbial contamination in New Hampshire surface waters include:

- Identification of sources of microbial contaminants;
- Determining the fate of contaminants as affected by seasonal factors such as rainfall frequency, evapo-transpiration, migratory bird presence, wind speed and direction, temperature, tidal exposure, algal blooms, activities of indigenous organisms, regrowth of pathogens and indicators, and sunlight;

- The relationships between microbial fecal indicators and pathogens, and between fecal indicators and non-fecal pathogens;
- The relationship between human health risks and concentrations or incidence of pathogens and indicators.

RECOMMENDATIONS FOR MONITORING FOR BACTERIA

Existing monitoring programs incorporate much of what is needed to classify all coastal waters for shellfish harvesting and recreational uses. However, a comprehensive program requires additional measurements of some indicators, increased frequency of sampling for some programs, and some expansion of sites.

New/Enhanced Monitoring

The existing Seacoast-wide routine monitoring for fecal coliforms by the NH DES will be continued, but will include analyses for Escherichia coli in some freshwater sites with financial assistance from NHEP.

A routine monitoring program involving microbial source tracking will be initiated in the major coastal areas of New Hampshire with financial assistance from NHEP, and will include more intensive pollution source identification studies.

Suggested Monitoring

Periodic (seasonal) assessments of New Hampshire coastal waters for microbial pathogens, including viruses, fecal-borne bacteria, indigenous bacterial pathogens, and algal biotoxin-producing species should be initiated when resources are available.

Events associated with potentially more severe microbial contamination – including storm/runoff events, WWTF failures, warm weather-associated acceleration of indigenous bacterial and toxin-producing algal growth, and high-density bather populations at coastal beaches, should be monitored as resources are available.

MONITORING OBJECTIVES FOR BACTERIA

Monitoring Objective 1A:	To determine if concentrations of fecal-borne microbial contaminants are increasing with time.
Indicators:	Fecal Coliform, Enterococci and Escherichia coli are well-established indicators of fecal contamination and are designated state standards for classifying different types of coastal waters. Both fecal coliforms and enterococci should be measured in tidal waters, and E. coli measured in freshwater areas of coastal watersheds.
New/Enhanced Monitoring:	NH DES will restructure both its freshwater and saltwater ambient sampling programs to include fecal coliform and E. coli. at additional sites. Existing monthly programs provide the spatial intensity necessary to classify most coastal waters, but new sites may be needed in freshwater tributaries.
Initiate:	2001

Monitoring Objective 1B:	To determine the effects of human-borne fecal microbial contaminants on surface water quality in coastal New Hampshire.
Indicator:	Echerichia coli
New/Enhanced Monitoring:	Microbial source tracking will differentiate between human and non-human sources of bacteria. Monthly sampling as conducted for Objective A can provide samples. DNA source tracking will identify pathogen origin and assist management decisions regarding pollution source identification and elimination.
Initiate:	2001

Monitoring Objective 1C:	To determine if the incidence and concentrations of microbial pathogens are changing with time.
Indicators:	Bacterial, viral, protozoan, and algal pathogens
Suggested Monitoring:	Seasonal sampling (4 times/year) in areas of highest concern to establish baseline of incidence and concentration. Supplemental sampling to target events (heavy rainfall/runoff, WWTF failure, high densities of bathers at beaches, warm weather for vibrios).
Initiate:	To be determined

SECTION 2: NUTRIENTS AND EUTROPHICATION

MONITORING GOAL

Determine the status and trends of eutrophic conditions in New Hampshire coastal and estuarine waters.

BACKGROUND

Nutrient-driven eutrophication is one of the major agents of ecosystem alteration in shallow estuarine and coastal areas. Indicators of eutrophic conditions include high concentrations of phytoplankton (measured by high concentrations of chlorophyll a) and associated turbidity; high abundance of epiphytic algal growth on submerged aquatic vegetation; proliferation of nuisance or opportunistic macroalgae; and elevated concentrations of water column nutrients.

As concentration or abundance of these indicators increases, submerged aquatic vegetation can be lost due to shading by suspended particulates and epiphytes. Depressed dissolved oxygen (hypoxia and anoxia) results from the dark phase respiration and decay of phytoplankton and macroalgae. Hypoxia and anoxia can have serious consequences for highly valued estuarine biota, and can impair human uses such as fishing, shellfishing, swimming, and boating.

Indicators of eutrophication in New Hampshire's estuarine and coastal areas have been monitored at varying degrees of spatial and temporal coverage and continuity since the early 1970s. Review of the data related to nutrient-driven eutrophication indicates that the Great Bay Estuary exhibits moderate symptoms of eutrophication in limited geographic areas. The limited amount of data available for Hampton-Seabrook Harbor, Little Harbor and Rye Harbor and the Atlantic coast, indicates no expression of eutrophic conditions at any of those locations at the present time.

With the population of the New Hampshire Seacoast growing rapidly, nutrient loading can be expected to increase and conditions worsen. However, measures to reduce nutrient inputs—such as nitrogen and phosphorus removal from municipal wastewater, installation of stormwater Best Management Practices, and advanced technologies for on-site treatment—could improve conditions. A properly designed comprehensive monitoring program will detect changes in both directions.

MONITORING RECOMMENDATIONS

An effective monitoring program for nutrient-driven eutrophication should include spatial and/or temporal expansion of some existing programs, continuation of others that have expired or will expire, and initiation of some new activities.

New/Enhanced Monitoring

The Great Bay National Estuarine Research Reserve (GBNERR) monthly sampling and analysis for nutrients, chlorophyll, total suspended solids, and particulate organic matter will be expanded spatially with financial assistance from NHEP. The expanded program will be coordinated with NH DES monthly ancillary sampling at selected shellfish monitoring sites in Great Bay, Hampton and Little harbors, with analyses performed by UNH JEL or NH DES. All samples will also be measured for dissolved inorganic nitrogen.

The NH DES ambient program will be enhanced to provide at least monthly data on dissolved oxygen at critical freshwater sites with financial assistance from NHEP.

Ongoing Monitoring

The GBNERR continuous in-situ monitoring will be continued, with some financial assistance from NHEP for operations and maintenance. Because these monitoring stations are the only source of high temporal-intensity data for dissolved oxygen, chlorophyll a, temperature, salinity, pH and turbidity, they are the only way to effectively monitor frequency and duration of phytoplankton blooms and depressed oxygen conditions.

The Great Bay Coast Watch program should continue, and after a review of sampling sites, possibly add more measurements.

Sampling sites at the 18 National Pollution Discharge Elimination System (NPDES) permitted wastewater treatment plants.

Suggested Monitoring

In-situ monitoring could be enhanced by expanding the UNH/NOAA Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) Remote Contaminant Monitoring System (RECOMS) project. Additional instruments may be added as funds are available for purchase and maintenance.

The NPDES program should be enhanced by requiring weekly sampling for biological oxygen demand and nutrients (nitrogen and phosphorus) at the 18 wastewater treatment plants in the coastal watershed. This will provide accurate data on point source nutrient loading, which has been determined to contribute more than 40% of the nitrogen input to Great Bay. This activity may be undertaken during the next permit cycle.

Airborne remote sensing and image analysis to measure macroalgae and eelgrass should be conducted annually as resources are available. Cooperative efforts can be pursued with the NH Coastal Program, CICEET, and aircraft of opportunity (e.g., NOAA Coastal Geodetic Survey) to acquire images.

MONITORING OBJECTIVES FOR NUTRIENTS

Monitoring Objective 2A:	To determine whether concentrations of dissolved and particulate nutrients are increasing as Seacoast region development and population increases.
Indicators:	Dissolved nutrients (high priority), particulate nitrogen and particulate phosphorous (lower priority).
New/Enhanced Monitoring:	A) NHDES will restructure both its freshwater and saltwater ambient sampling programs to address additional parameters and spatial coverage. Additional sites for the above indicators will be sampled in the Oyster, Bellamy, and upper Piscataqua rivers, southeast Great Bay, and upper Little Bay by the NH DES shellfish and ambient programs. Existing sampling sites will be used in Hampton and Little harbors. B) NHEP will contribute funds for ongoing operation and maintenance expenses of the in-situ, real-time data loggers.
Initiate:	2001

Monitoring Objective 2B:	To determine whether concentrations of phytoplankton (as measured by chlorophyll a) in NH tidal waters change over time.
Indicators:	Chlorophyll a
New/Enhanced Monitoring:	A) NH DES ambient and shellfish programs will collect samples for Chlorophyll a on the restructured sampling regime used for bacteria and nutrients. Monitoring stations will be established in Hampton and Little harbors, and the spatial array of stations expanded in Great Bay to develop baseline data. B) Support for in-situ data loggers will provide another source of data on chlorophyll a.
Initiate:	2001

Monitoring Objective 2C:	To determine whether concentrations of suspended particulates (as measured by total suspended solids and particulate organic matter, turbidity, and secchi depth) in NH tidal waters change over time.
Indicators:	Total suspended solids (TSS), particulate organic matter, and turbidity
New/Enhanced Monitoring:	TSS will be added to the restructured NH DES monitoring

program for saltwater stations, including establishing monitoring stations in Hampton and Little harbors and expanding spatial array of stations in Great Bay. Existing baselines can be used to determine changes in concentrations resulting from no action, or from implementation of reduction measures.

Initiate: 2001

Monitoring Objective 2D: To determine whether the concentration of dissolved oxygen and percent oxygen saturation in NH tidal waters change over time.

Indicators: Dissolved oxygen, biological oxygen demand

New Enhanced Monitoring: BOD will be added to the restructured DES monitoring effort for freshwater stations and DO sampling continued in both fresh and salt water monitoring. Establish monitoring stations in Hampton and Little harbors; expand spatial array of stations in Great Bay to develop baseline data. Compare data with benchmarks for hypoxia, anoxia, and biologically critical saturation percentage.

Initiate: 2001

Monitoring Objective 2E: To determine whether nuisance macroalgae (opportunistic green algae) increase in abundance and area in intertidal and shallow subtidal areas of the NH estuaries.

Indicator: Macroalgae

Suggested Monitoring: Establish baselines for entire Great Bay Estuary, Hampton-Seabrook Harbor, and Little Harbor using aerial imaging.

Initiate: To be determined

Monitoring Objective 2F: To determine whether eelgrass decreases in abundance (density and biomass) and area in intertidal and shallow subtidal areas of NH estuaries.

Indicator: Eelgrass

Suggested Monitoring: Establish baseline of geo-spatial cover for tidal tributaries, Little Bay, Piscataqua River, Portsmouth Harbor and Back Channel area, and Little Harbor, using aerial imaging

Initiate: To be determined

SECTION 3: TOXIC CONTAMINANTS

MONITORING GOAL

To determine the status and trends of toxic contaminants in water, sediment, and biota of coastal New Hampshire.

BACKGROUND

Despite significant reductions in pollution of air, water, and land resources since the early 1970s, many contaminants persist in the environment. Historical pollution combined with present-day contamination results in exposure of humans and other biota to a variety of toxic contaminants in marine and estuarine environments. Contaminants that persist and accumulate in ecosystems are of special concern, since even low-level chronic exposure to some of these chemicals can cause toxic effects.

A wide range of toxic contaminants are of concern, including inorganic (trace and heavy metals) and organic contaminants. Toxic inorganic contaminants include a wide range of chemicals—mostly either exclusively human-made or produced in much greater quantities through human activities—that are not susceptible to breakdown, and persist in the environment. Biological and chemical processes can change the forms of these contaminants and affect their toxicity, availability, and mobility in the environment.

Although virtually all organic compounds are susceptible to breakdown by microorganisms, many toxic organic compounds persist in marine and estuarine ecosystems where conditions limit these processes. Persistent toxic organic compounds of concern in the marine environment include polychlorinated biphenyls (PCB), polyaromatic hydrocarbons (PAH), and chlorinated pesticides.

The many types, sources, and sinks of toxic contaminants present a challenge for environmental assessments in coastal surface waters. No single indicator can take the place of analyzing samples for the full range of contaminants. The high cost of initial analyses to determine the presence of toxic contaminants often limits further studies needed to determine toxic effects once the presence and concentrations of toxic contaminants have been assessed for sediments, water, and biota.

MONITORING RECOMMENDATIONS FOR TOXIC CONTAMINANTS

New/Enhanced Monitoring

Soft-shell clams and oysters will be monitored for toxic contaminants with financial assistance from NHEP. Sampling will rotate between beds, and compared to mussel data from the Gulfwatch program.

Monitoring of predatory fish for toxic contaminants will be researched in 2001 and implemented thereafter with financial assistance from NHEP.

Suggested Monitoring

Include monitoring for effects of toxic contaminants on marine and estuarine biota in existing programs that measure bio-exposure, to complement and

augment those measurements. Continue sediment toxicity assays using model organisms (Coastal 2000), and expand assays to target shellfish and higher trophic-level species.

Continue existing monitoring programs, including Coastal 2000 and Gulfwatch, beyond currently planned schedules which end after 2001. Annual sampling of a subset of sites rotated on a 3-year basis is recommended for monitoring of sediments and blue mussels.

Modify existing programs to allow for iterative pollution source identification monitoring.

MONITORING OBJECTIVES FOR TOXICS

Monitoring Objective 3A:	To determine if toxic contaminant concentrations in seafood species from NH coastal waters are increasing with time.
Indicators:	Inorganic (trace and heavy metals) and organic contaminants
New/Enhanced Monitoring:	A) Oysters and clams will be tested for contaminant exposure as part of the NHEP Monitoring Program. Sampling will be annual at a different subset of sites with a three-year rotation for revisiting sites in order to develop temporal trend analysis. B) Monitoring of toxic contaminant exposure in predatory fish will be researched and implemented.
Initiate:	2001

Monitoring Objective 3B:	To determine if concentrations of toxic contaminants in sediments, water, and biota are increasing with time.
Indicators:	Inorganic (trace and heavy metals) and organic contaminants
Suggested Monitoring:	Fish and shellfish (biota), water, and sediment sampled annually and compared with previous sampling results over time.
Initiate:	To be determined.

Monitoring Objective 3C:	To determine if toxic contaminants are causing increasingly prevalent toxic effects in marine and estuarine biota.
Indicators:	Inorganic (trace and heavy metals) and organic contaminants
Suggested Monitoring:	Use Coastal 2000 sampling sites for sediment toxicity to determine temporal toxicity trends for sediments. Compare survival in toxic sediments and control sediments to determine mortality rates.
Initiate:	To be determined.

SECTION 4: SHELLFISH POPULATIONS

MONITORING GOAL

Determine the status and trends of shellfish populations in New Hampshire's coastal and estuarine waters.

BACKGROUND

The estuaries and coastal areas of New Hampshire are ideal habitat for a number of molluscan shellfish species. The Great Bay Estuary, including Little Harbor and the Back Channel area, supports populations of the eastern oyster (Crassostrea virginica), the European flat or Belon oyster (Ostrea edulis), softshell clam (Mya arenaria), the blue mussel (Mytilus edulis), the razor clam (Ensis directus), and the sea scallop (Placopecten magellanicus). Hampton-Seabrook Harbor supports abundant populations of the softshell clam and intertidal populations of the blue mussel. Near-shore coastal areas support populations of surf clams (Spisula solidissima), ocean quahogs (Acrtica islandica), and blue mussels.

Molluscan shellfish in New Hampshire's estuarine and coastal areas are economically important because they support important recreational fisheries and have tremendous potential as aquaculture species. They are excellent bio-indicators of estuarine condition because they are relatively long-lived, and integrate their environment over time. As filter-feeders, they play an important role in nutrient-cycling, improving water clarity, and removing significant quantities of nitrogen and phosphorus from the water column by consuming phytoplankton and organic detritus.

Bottom-dwelling shellfish such as mussels, oysters, and scallops provide valuable habitat for rich assemblages of invertebrates and fish, while large infaunal bivalves oxygenate soft sediments with their burrowing activities. Many estuarine ecologists consider oysters a 'keystone species,' and oyster beds in temperate estuaries are considered the equivalent of coral reefs in tropical seas. Many studies have shown that species density, diversity, and biomass are significantly greater in oyster beds than on equivalent bottom without oysters.

Effective management of these ecologically and economically important shellfish resources requires an understanding of the geographic location of the resource, population size and structure, coverage area, habitat condition, harvest pressure, and other factors that influence shellfish populations.

Molluscan shellfish abundance and population structure have been surveyed with varying degrees of consistency and thoroughness over the past several decades. With a few exceptions, such as softshell clams in Hampton-Seabrook Harbor, most databases are inadequate in temporal and spatial scale to determine current status or predict trends. Little or no data are available for some species.

Recent and reliable data are available for oysters in Great Bay and softshell clams in Hampton-Seabrook Harbor. Oyster populations in the Great Bay Estuary declined dramatically in the past decade. Clam populations in

Hampton-Seabrook Harbor have recovered from their mid-to-late 1980s decline, and have been stable for the past few years. Recent interest by commercial fishermen in the harvest of surf clams and ocean quahogs in near-shore coastal areas has alerted resource managers to the need to gather basic population data for these species.

Important shellfish monitoring needs include:

* Continued monitoring of clam and oyster populations;

* Monitoring of harvest pressure, predation, disease, and environmental factors that affect populations;

* Gathering baseline information on species for which there is little or no information.

MONITORING RECOMMENDATIONS FOR SHELLFISH

New/Enhanced Monitoring

Oyster and clam population studies will be conducted on an established schedule with financial assistance from NHEP, so that each major bed is sampled at minimum every three years. The sampling program will include a determination of bed acreage at each sampling.

Disease testing for MSX and Dermo in oysters will continue annually with financial assistance from NHEP.

Restoration monitoring will be implemented for any shellfish restoration efforts funded by NHEP. Restoration success must be clearly documented, and results distributed to appropriate parties.

Ongoing Monitoring

Normandeau Associates Inc. (NAI)/Seabrook Station monitoring program in Hampton-Seabrook Harbor for softshell clam populations, clam disease, green crab abundance, and mussel settlement should be continued.

Suggested Future Monitoring

Additional clam abundance monitoring sites in the Hampton-Seabrook Harbor tributaries, Great Bay, and Little Harbor should be conducted on an established schedule by NH Fish and Game or another qualified entity using the methods employed by NAI as resources are available.

Methods for determining harvest pressure should be formalized, and evaluated for effectiveness annually. Recreational harvesters could contribute significantly to this monitoring goal by providing valuable information on the amount of shellfish harvested, and on the presence of predatory snails on the state's most popular oyster beds.

If a commercial fishery commences, population studies should be initiated for sea scallops, and for surf clams and ocean quahogs

Additional sites for green crab trapping and clam disease diagnostics in Great Bay and Little Harbor should be monitored as resources are available.

MONITORING OBJECTIVES FOR SHELLFISH

Monitoring Objective 4A:	To determine whether the abundance and population structure of molluscan shellfish in New Hampshire's estuarine and coastal areas change over time.
Indicators:	Eastern Oysters, softshell clams, surf clams, ocean quahogs, sea scallops, and blue mussels
New/Enhanced Monitoring:	A) Rotational sampling every three years of oyster and clam beds for spatial dimensions, density, and population structure. B) Develop map of oyster and clam bed acreage annually.
Initiate:	2001
Suggested Monitoring:	Various techniques to determine location and acreage of surf clams, quahogs, sea scallops, and blue mussels. Conduct surveys of beds annually for most species to determine density and size distribution.
Initiate:	To be determined.

Monitoring Objective 4B:	To determine the status and trends of shellfish diseases.
Indicators:	MSX and Dermo for Eastern oysters, and Sarcomastic Neoplasia for softshell clams
NHEP Monitoring:	Oysters will be collected from 5 beds annually and analyzed for percentage occurrence, intensity levels, and mortalities attributed to MSX and Dermo
Initiate:	2001 (ongoing since 1997)
Suggested Monitoring:	Clams will be collected annually and analyzed for disease.
Initiate:	To be determined

Monitoring Objective 4C:	To determine how much (bushels, pounds, # of individuals) of each species of molluscan shellfish is harvested from NH waters.
Indicators:	Eastern Oysters, softshell clams, surf clams, ocean quahogs, sea scallops, and blue mussels
Suggested Monitoring:	Formalize methods for determining harvest pressure, such as voluntary reporting by recreational harvesters and required reporting for commercial license holders (when applicable).
Initiate:	To be determined.

Monitoring Objective 4D:	To determine the effects of predation on shellfish populations in NH tidal waters.
Indicators:	Green crabs (Carcinus maenus), and oyster drills (Urosalpinx cinerea)
Ongoing Monitoring:	Continue twice monthly sampling of green crabs in Hampton-Seabrook Harbor and initiate two sampling locations in Great Bay for green crabs.
Suggested Monitoring:	Establish a voluntary observational and reporting programs for oyster drills involving recreational oyster harvesters at the Nannie Island and Adams Point oyster beds.
Initiate:	To be determined

Monitoring Objective 4E:	To determine the effect of restoration on shellfish populations in NH tidal waters.
Indicators:	Shellfish species at an identified restoration site
Suggested Monitoring:	Select appropriate restoration sites which historically supported shellfish species, where the cause for absence of the resource is known and no longer exists, and where suitable environmental conditions exist. Utilize abundance measurements as detailed in Objective A to monitor species abundance over time.
Initiate:	As NHEP funds are applied to shellfish restoration projects.

SECTION 5:
LAND USE, DEVELOPMENT, AND HABITAT PROTECTION

MONITORING GOAL

Determine the status and trends of land use, development, and habitat protection in coastal New Hampshire

BACKGROUND

The Seacoast region of New Hampshire has a long history as an important center of commerce and industry in the state and region. The economy of the Seacoast is currently prospering, with high employment, and new development to accommodate housing needs and services is booming. The pleasing aesthetics of natural coastal scenery and a clean environment are part of what draws people to live in the Seacoast. As population and development have increased, so have expectations for improved water quality and safety of recreational waters. Yet increased population and development are almost inevitably accompanied by increased pollution, and habitat fragmentation and degradation. Marine resource-based industries depend on a clean environment, and are also a vital part of the local economy. Land use, development, and habitat protection are issues of increasing concern in the Seacoast.

Settlement of towns and cities, and clearing of forests for timber and to produce food, began the changes of land use in the Seacoast region. Road construction further fragmented habitat. Automobiles, the state highway system, and the Interstate Highway Act resulted in further fragmentation of forests and habitat, and opened more areas of the Seacoast to development. Human population and land development in the Seacoast have increased rapidly over the last 40 years. Increased stormwater runoff associated with increases in impervious surfaces from development are degrading water and habitat quality in the Seacoast. Development is also fragmenting habitat. Shoreline development has diminished the aesthetics and water quality of many areas, and drinking water supplies are running short.

Developable land is at a premium in the region, and development of areas outside urban centers has accelerated problems associated with sprawl. The costs of sprawl development include redundant infrastructure, more roads and impervious surfaces, longer service routes for emergency vehicles, etc., and growing needs for pollution control. Sprawl generally results in the decline of older cities and town centers, habitat fragmentation, increased taxes, and increased transportation costs for family budgets. For all these reasons, planning for further development should incorporate prevention of further environmental degradation, and protection of important habitats.

An effective land use, development, and habitat protection monitoring program requires:

- Annual updates of existing databases;
- Analysis of the data to assess rates of change in sprawl development;
- Analysis of the data to assess rates of change in impervious surface acreage;
- Analysis of the data to assess rates of change in habitat protection.

RECOMMENDED MONITORING FOR LAND USE

New/Enhanced Monitoring

Conduct Needs Assessment to research methods for monitoring land use change and develop recommendations for potential monitoring actions.

Suggested Monitoring

One agency, such as the UNH Complex Systems Research Center, should serve as a center for compiling all relevant data on human population, land use acreage changes, aerial and satellite imagery, housing construction, average forest patch size, etc.

Update land use change information annually for all coastal communities, and report results back to the municipalities.

Integrate data needed to assess impervious surface area and sprawl.

MONITORING OBJECTIVES FOR LAND USE

Monitoring Objective 5A:	To determine if the rate of land use change increases as human population and development increase in coastal New Hampshire.
Indicators:	Impervious area; human population; acreage of developed land
Suggested Monitoring:	Annual update of UNH/CSRS GIS data on land use and cover, using aerial and satellite imagery of all coastal municipalities and data from regional planning commission analyses of land use in specific municipalities. Include NH OSP data on human population changes in municipalities.

Monitoring Objective 5B:	To determine if acreage of permanently protected important habitats increases as human population and development increase in coastal New Hampshire.
Indicators:	Acreage of protected habitats; human population; acreage of developed land; average forest patch size; road density/road kills
Suggested Monitoring:	Annual updating of UNH Complex Systems Research Center (CSRC) GIS data on land use and cover, using data from regional planning commission analyses of land use in specific municipalities and land protection organizations. Include data from NH OSP on changes in human population in coastal municipalities and Society for Protection of NH Forests (SPNHF) analyses of forest patch size.

Monitoring Objective 5C	To determine if the rate of sprawl increases as human population and development increase in coastal New Hampshire.
Indicators:	Distance of residences from schools, police, fire, public water supply; human population; acreage of developed land; residential housing construction; average forest patch size
Suggested Monitoring:	Annual updating of UNH/CSRS GIS data on land use, land cover, and municipal service locations, using data from regional planning commission analyses of land use in specific municipalities, residential housing construction, and SPNHF analyses of forest patch size.

SECTION 6: CRITICAL SPECIES AND HABITATS

MONITORING GOAL

To determine the status and trends of critical species and habitats in New Hampshire coastal and estuarine watersheds.

BACKGROUND

Habitat is the setting in which plants or animals feed, find shelter, and reproduce. Plants and animals need specific types and quality of habitat to meet their particular needs. New Hampshire's estuaries and the surrounding upland regions provide a wealth of unique and productive habitats that support a diverse array of plant and animal populations, including threatened and endangered species.

The key to maintaining these diverse assemblages of species is protecting and restoring appropriate habitats. Pollution, impacts from development, and inappropriate human disturbances can degrade, fragment, and destroy habitat, as well as alter species composition. The location and extent of critical habitats must be ascertained, and consistent methods used to monitor change over time. Identifying plant and animal species that are indicators of habitat and overall ecosystem condition is important to assessing habitat trends.

A balance must be struck between human activities and protecting and restoring natural communities. Participants in the NHEP identified tidal and freshwater wetlands, shellfish habitat, shorelands and streambanks, and anadromous fish habitats as the highest priorities for protection and restoration. A review of existing monitoring and restoration activities found many programs that monitor some aspect of all the identified critical habitats.

A few gaps were identified, but this review showed that efforts to protect and restore critical species and habitats would benefit from:

- Better integration of the data collected by the diverse groups involved in monitoring, and
- Rigorous synthesis and widespread dissemination of the information.

RECOMMENDED MONITORING FOR CRITICAL SPECIES AND HABITATS

An effective program to monitor changes in critical species and habitats requires a few new activities. However, improving coordination, management, integration, and synthesis of the data generated by existing programs will be the major emphasis for monitoring critical species and habitats.

Enhanced Monitoring

Analysis of monitoring data will include creating relational databases with appropriate data collected by various monitoring activities. The Coastal Scientist funded by NHEP and NH DES will lead this activity.

Suggested Future Monitoring

Collect additional data on wetlands acreage and condition through use of opportunistic overflights and tracking by municipalities and the Regional Planning Commissions. Integrate all new data collected or generated into the Granit geospatial database.

Review benthic data generated by Coastal 2000 to determine whether the sites sampled for this program provide data that will enhance the overall understanding of benthic communities.

Initiate long-term monitoring of reptile and amphibian populations. Likely parties to be involved in such a program include EPA, Audubon Society of NH, NH Fish and Game, and the University of New Hampshire.

Review groundwater data generated by research and drinking water programs to identify issues and locations of concern. A monitoring program may need to be developed depending on the outcome of this review. This activity is associated with Action Plans, Land 18 and 19 in the NHEP Management Plan.

Determine the rate of increase in invasive wetlands plant species, particularly Phragmites. This information may be extracted form aerial imagery with the proper groundtruthing.

MONITORING OBJECTIVES FOR CRITICAL SPECIES AND HABITAT

Monitoring Objective 6A:	To determine trends in wetland degradation and restoration.
Indicators:	Plant species, fish usage, hydrology and acreage (tidal and freshwater)
Suggested Monitoring:	Encourage continuation of existing monitoring programs; increased monitoring by towns and RPCs to map small wetlands; and take advantage of overflights for other purposes to update wetlands maps. Encourage NH DES to follow up on permits.
Initiate:	To be determined

Monitoring Objective 6B:	To determine whether populations of resident and migratory finfish species change over time.
Indicators:	Anadromous fish, estuarine and coastal fish assemblages, game fish, and commercial species
Suggested Monitoring:	No new sampling activities recommended. Better data management, integration, synthesis, and reporting are needed. Create and analyze relational databases that integrate fish data with water quality and habitat information. Coordinated by Coastal Scientist.
Initiate:	To be determined

Monitoring Objective 6C:	To determine the quantity and quality of groundwater entering estuarine and coastal waters.
Indicators:	Groundwater quantity and quality
Suggested Monitoring:	No new sampling recommended at this time. All existing groundwater data generated from drinking water wells and research programs should be comprehensively reviewed to determine what types of monitoring activities are needed.
Initiate:	To be determined.

Monitoring Objective 6D:	To determine the trends in designated uses of waterbodies.
Indicators:	Specific indicators vary, but include bacterial indicators, tissue concentrations of toxic substances, turbidity, chlorophyll concentrations, and dissolved oxygen
Suggested Monitoring:	Continue inventory development for the 305 B reports
Initiate:	Ongoing

Monitoring Objective 6E:	To determine the status and trends in assemblages of benthic macroinvertebrates.
Indicator:	Benthic community structure, abundance of juvenile lobsters, horseshoe crabs
Suggested Monitoring:	Encourage continuation of existing programs, and improve data management, integration, synthesis, and reporting. Create and analyze relational databases that integrate invertebrate data with water quality and habitat information. Select several Coastal 2000 sites for continued annual monitoring after the program ends in 2001. Increase the frequency of NH DES stream biomonitoring.
Initiate:	To be determined.

Monitoring Objective 6F:	To determine the status and trends in wildlife populations.
Indicator:	Abundance of shorebirds, waterfowl, mammals, eagles, reptiles and amphibians.
Suggested Monitoring:	Continue existing bird and mammal programs and improve data management, integration, synthesis, and reporting. Create and analyze relational databases. Initiate long-term monitoring program for reptiles and amphibians.
Initiate:	To be determined.

Monitoring Objective 6G:	To determine the status and trends of invasive wetland plant species.
Indicator:	Acreage of Phragmites in salt marshes; amount of purple loosestrife in wetlands
Suggested Monitoring:	Use available aerial imagery and seek new imagery. Conduct ground-truthing.
Initiate:	To be determined.

Table 3: Pollution Monitoring Programs in Coastal New Hampshire

Program	Parameters	Frequency of Monitoring	Number of Sampling Sites	General Area Sampled	Comments
NH DES Ambient Program	*E. coli*, D.O, metals, temp., pH, conductivity	3 samples/station for most parameters	typically 40-50 stations in coastal watershed	Coastal watersheds (fresh-water only)	Samples not collected every year (done on watershed-rotation)
NH DES Shellfish Water (Routine) Program	fecal coliform, temp., salinity, pH	monthly, 9-12 samples/yr	60-75 sites	All tidal waters	
NH DES Shellfish Water (Ancillary) Program	TSS, % organic, DO, chlorophyll a nitrate	monthly, Apr-Oct	8 sites	Great Bay Estuary, Hampton-Seabrook Harbor	
NH DES Tidal Beach Program	enterococci	3 samp./visit; weekly visits (July-Aug)	9 beaches	Atlantic Coastal beaches	
NH DES Beach Program	*E. coli*	3 samp./visit; weekly visits (July-Aug)	9 beaches	Coastal watershed	
NH DES, NH F&G PSP/Red Tide Program	PSP toxin in mussel tissue	1-2 times/wk, Apr-Oct	1 site	Atlantic Coastal Water	Site located near Hampton-Seabrook Harbor
NH DES, UNH/JEL GulfWatch Program	heavy metals, toxic organics in mussel tissue	1 sample per 3 yrs (6-7 sites per year	20 sites	Great Bay Estuary, Rye Harbor, Hampton-Seabrook Harbor	
NPDES Permit Monitoring	Varies by permit. Usually BOD5, TSS, chlorine, bacteria, pH, whole effluent toxicity (WET); sometimes metals, nutrients.	Varies with permit. Typically one effluent sample/week for most parameters.	18 municipal and 13 industrial WWTFs in the coastal watershed	Coastal Watershed	NHDES inspectors inspect the WWTFs each year and sample them at least once every 5 years for most parameters.
NH DES Groundwater Quality (Water Supply) Monitoring	nitrogen, VOC, pesticides, metals, radiological, pH, bacteria	variable; 1 samp/ month, quarter, year, 3 yrs, or 6 yrs	289 wells (does not include "transient systems")	Coastal Watershed	Approx. 40% run tests after corrosion treatment; some water samples blended from multiple wells
GBNERR, UNH/JEL, NHCP Ambient Program	salinity, temp., pH, TSS, bacteria, nutrients, D.O, chlorophyll a	2 samples per month (H and L tide)	4 sites	Great Bay Estuary	Sites in Squamscott, Lamprey, Piscataqua Rivers, and Adams Point
GBNERR/JEL Datalogger Program	salinity, depth, conduc, temp., pH, turbidity, D.O, chlor a	30 min interval, non-winter months	2 sites (Great Bay and Squamscott River)	Great Bay Estuary	Instruments removed periodically for servicing
CICEET Datalogger Program	salinity, depth, conductiv., pH, turbidity, DO, chlorophylla	30 min interval, non winter months	1 site (Lamprey River)	Great Bay Estuary	2 additional sites to be added in Oyster and Bellamy Rivers
CICEET Nutrient Monitoring	dissolved nutrients	variable	3 sites (Oyster, Salmon Falls, Lamprey, rivers)	Great Bay Estuary	3 year project to end in summer of 2000
Great Bay Watch (Base Program)	fecal coliform, temp., salinity, pH, D.O., secchi	high/low tide sampling twice/month, April-Nov.	20 sites	Great Bay Estuary	
PNSY Sampling Program	metals, PAHs, PCBs, dioxin, pesticides	bimonthly	—	Great Bay Estuary (Portsmouth Harbor only)	Sediment, mussels, juvenile lobsters sampled
NHCP Marine Debris Program	marine debris	annual cleanup	25-30 sites	All tidal waters	Results of debris type and tonnage tracked each year
UNH Atmospheric Deposition Monitoring	mercury (wet & dry), other metals, aerosol nitrogen	variable (some continuous monitoring)	1 site	Coastal NH	Site at USCG station, New Castle, NH
Coastal 2000 Program	WQ, sediment & tissue toxicity, fish populations, habitat indicators	one sample	up to 50 sites	Great Bay Estuary, Hampton-Seabrook Harbor	One-time sampling (to begin summer of 2000) to establish baseline conditions
NH Open Ocean Aquaculture Datalogger	temp, salinity, depth, turbidity, currents	continuous	1 site, 2 depths	Atlantic Ocean	
UNH Open Ocean Aquaculture Water Program	nutrients, TSS & % organic, chlorophyll a	monthly at 2 depths	3 sites	Atlantic Ocean	

Table 4: Finfish and Shellfish Resource Monitoring Programs in Coastal New Hampshire.

Program	Parameters	Frequency of Monitoring	Number of Sampling Sites	General Area Sampled	Comments
GBNERR/JEL Estuarine Resource Program	variety of estuarine resources	annual program	variable; dependent on parameter	Great Bay Estuary	Shellfish, macroalgae, eel-grass, plankton, etc. on annual-rotating basis
NH F&G Oyster Disease Testing	MSX and Dermo	1 sample per year	4 sites	Great Bay Estuary	Sites at Adams Pt, Nannie Island, Pisc. and Squamscott Rivers
NH F&G Shellfish Harvest Survey	recreational clam and oyster harvest	sporadic for oysters	Hampton Harbor (clams)	Great Bay Estuary; Hampton Harbor	Oyster info collected via mail survey; clam info by count of harvesters on selected days
NH F&G Oyster Resource Program	Oyster density, spatfall, size	annually Oct-Nov	6 sites	Great Bay Estuary	By SCUBA; sites at Pisc. River (Sprague Cove), Ports. Harbor (Peirce Is.), and New Castle
NH F&G Juvenile Lobster Survey	juvenile lobster	monthly, Apr to Jan	3 sites	Great Bay Estuary; Coastal water	By SCUBA; sites at Adams Pt, Woodman Pt., Nannie Island, Pisc. and Squamscott Rivers
NH F&G Lobster Sea Sampling Program	lobster	monthly, Jun-Oct	2 sites	Pisc. River and Atlantic Ocean	Sites in Piscataqua River and at Isles of Shoals
NH F&G Estuarine Juvenile Fish Survey	winter flounder, river herring, shad	monthly Jun-Nov	10 in GBE, 4 in Hampton Harbor	Great Bay Estuary, Hampton Harbor	Seine hauls
NH F&G Coastal Shad Restoration Program	shad (counts of return-ing adult spawning shad)	daily Apr-June	1 site (Exeter River fish ladder)	Great Bay Estuary	
NH F&G River Herring Restoration Program	herring (counts of returning adult spawn-ing fish)	daily during spring runs	6 rivers	Great Bay Estuary, Hampton Harbor	Sites in Cocheco, Exeter, Lamprey, Oyster, Taylor and Winnicut Rivers
NH F&G Atl. Salmon Restoration Program	salmon	spring - fall	Cocheco and Lamprey Rivers	Great Bay Estuary	Adults trapped at fish lad-ders spring & fall; elec-trofishing to evaluate growth in fall
NH F&G Sea Run Trout Creel Surveys	sea run brown trout harvest	during fishing season	N/A	Berrys Brook	Done by mail/survey card
NH F&G Striped Bass Creel Surveys	striped bass harvest	during fishing season	N/A	All Tidal Waters	Done by written annual reports of catch
NH F&G Marine Recreational Fishing Statistical Survey	striped bass, cod blue-fish, pollock, mackerel, winter flounder	during fishing season (at peak times)	N/A	All Tidal Waters	Done by phone and dock-side interview
NH F&G 1997 Scallop Survey	scallops	July-December	9 sites	coastal waters	One-time assessment
NH F&G Rainbow Smelt Program	rainbow smelt (adults and eggs)	winter months (eggs in March)	5 sites	Great Bay Estuary	Angler interviews and egg counts; sites on Bellamy, Oyster, Lamprey, Winni-cut, & Squamscott Rivers
NH F&G Logbook Programs	catch and effort for species taken by net, seine, trap, etc. (incl. Lobster)	monthly logbooks	N/A	All coastal waters	Logbooks req'd for all holders of netters license, req'd for some lobster license holders
Seabrook Station Shellfish Program	softshell clam spat, adults, disease, preda-tors	clams and disease: 1/yr; predators: 2 times/month	clams: 5 flats, preda-tors: 3 sites	Hampton Harbor	—
Seabrook Station Finfish Program	finfish species	monthly, Apr-Nov	3	Hampton Harbor	Sampling by seine haul, data from 1975 to present

Table 4: continued

Program	Parameters	Frequency of Monitoring	Number of Sampling Sites	General Area Sampled	Comments
UNH Estuarine Lobster CPUE Program	lobster catch per unit effort (CPUE)	April-Oct	5	Great Bay Estuary	—
UNH Atlantic Coast Lobster CPUE Program	lobster catch per unit effort (CPUE)		6	Atlantic Coast	Sites range from New Castle, Wallis Sands, and 4 other (summer only) sites
NMFS Commercial Fishing Catch Data	commercial catch (lbs) for 33 fish species, 11 invert. species	variable	comm. fish piers	All tidal waters	—
Coastal 2000 Program	WQ, sediment & tissue toxicity, fish populations, habitat indicators	one sample	up to 50 sites	Great Bay Estuary, Hampton Harbor	One-time sampling (to begin summer of 2000) to establish baseline conditions

Table 5: Other Natural Resource Monitoring Programs in Coastal New Hampshire.

Program	Parameters	Frequency of Monitoring	Number of Sampling Sites	General Area Sampled	Comments
NH DES Biomonitoring Program (prelim.)	macroinvert, fish, habitat assess.	Sites sampled once	10 sites	Coastal Watershed	Program began in 1995 and is still evolving.
GBNERR/JEL Estuarine Resource Program	variety of estuarine resources	Annual program	variable; dependent on parameter	Great Bay Estuary	Shellfish, macroalgae, eelgrass, plankton, etc. on annual-rotating basis
GBNERR/ASNH Winter Bird Survey	population of waterfowl, other species	One survey/count per year	numerous	Coastal Watershed	Survey also conducted in other areas of the state
Land Use Mapping Updates (RPCs)	land use	Ongoing	all towns	All Coastal Watersheds	Towns updated each year varies
USGS Stream Gauging	stream flow	Continuous	5 sites	Oyster, Exeter, Lamprey, Cocheco, Salmon Fall Rivers	—
NHCP Restored Salt Marsh Monitoring	soil salinity, vegetation, other bio. indicators	Seasonal pre- and post restoration	8 sites	Coastal NH	Post-restoration monitoring every 2 yrs; more sites in future
NHPA Mitigation Monitoring Program	eelgrass, mudflat, salt marsh	—	—	Piscataqua River	—
Coastal 2000 Program	WQ, sediment & tissue toxicity, fish populations, habitat indicators	One sample	up to 50 sites	Great Bay Estuary, Hampton Harbor	One-time sampling (to begin summer of 2000) to establish baseline conditions
UNH Open Ocean Aquaculture Benthic Program	benthic comm. & sediment texture	Monthly	8 sites	Atlantic Ocean	—
UNH Open Ocean Aquaculture Epibenthic Program	epibenthos (by video)	Monthly (3-4 hr video per month)	2 sites	Atlantic Ocean	—

Table 6: NHEP Monitoring Activities 2001-2002

	Responsible Party	2001	2002		
Monitoring Plan Coordination and Implementation					
Maintain Coastal Scientist position	NHEP/DES (DES 25%)	$78,000	$78,000		
Data Coordination and Management	Coastal Scientist	✔	✔		
Establish Technical Advisory Committee	NHEP	✔			
Develop Baseline of Environmental Conditions	Coastal Scientist	✔			
Annual Synthesis Report	Coastal Scientist	✔	✔		
Monitoring Plan review, evaluation, update	Coastal Scientist & Tech Adv Com	✔	✔		
Monitoring Activities					
Restructure NH DES freshwater and salt water ambient sampling programs to include additional sampling stations and parameters	DES	$13,000	$13,000		
Contribute to operational costs for maintaining the in-situ real time data loggers.	Jackson Lab, GB Research Reserve	$10,000	$10,000		
Microbial Source Tracking to routinely monitor surface water samples using DNA identification.	Jackson Lab	$20,000	$20,000		
Clam and oyster contaminant exposure testing: Monitor beds on rotational basis.	Jackson Lab	$5,000	$5,000		
Predatory fish contaminant exposure: Investigate monitoring in year 2001 and conducting monitoring in 2002.	DES	✔	TBD		
Population assessments for clams and oysters: bed dimensions, density, and population structure. Sample beds on rotational basis every 3 years.	NH F&G	$4,000	$4,000		
Map shellfish bed dimensions from using GIS.	UNH Complex Systems	$4,000	$4,000		
Oyster disease testing for MSX and Dermo at five beds annually.	NH F&G	$5,000	$5,000		
Land Use/Habitat Metadata Analysis	UNHComplex Systems, NHCP	✔	TBD		
Total Annual Cost to NHEP	**$119,500**				

✔ Denotes no additional cost to NHEP

Table 7: Existing and Proposed Monitoring Programs for Bacteria and Disease-causing Organisms

Monitoring Component	Existing Long-Term Programs	Monitoring Gaps	Recommended Actions	Responsible Party	NHEP Monitoring
1. Fecal Indicator Bacteria					
a. Fecal coliforms	GBNERR/JEL, NHCP Ambient Monitoring Program (Four sites in Great Bay Estuary sampled once monthly at high and low tides)	Limited spatial coverage in Great Bay Estuary.	None	GBNERR/JEL	
	NHDES-Shellfish program (Monthly sampling at 60-75 sites at low tide; 9-12 samples/yr)	Does not include enterococci in warm weather (recreational use)		NH DES	
	Great Bay Coast Watch (Monthly sampling at 22 sites April-November)	Only fecal coliforms and not in Hampton/Seabrook Estuary		GBCW	
	NPDES (Occasional and routine analysis at limited number of WWTPs)	No consistent database on WWTP contaminant discharges		WWTP operators	
b. Enterococci/E. coli	GBNERR/JEL, NHCP Ambient Monitoring Program (Four sites in Great Bay Estuary sampled once monthly at high and low tides)	Limited spatial coverage in Great Bay Estuary.	weekly sampling in estuarine areas used for swimming; late June-August	Sample collection-DES Analysis-JEL or DES	Restructure DES ambient and shellfish sampling programs fora spatial coverage and E. coli in freshwater samples.
	NHDES-Beach Program (Weekly sampling at 9 coastal and 9 freshwater public beaches)	No coordination of sample location and timing with other programs		NHDES	
	NPDES Permit Monitoring (Mostly routine weekly analysis at some WWTPs)	No consistent database on WWTP contaminant discharges		WWTP operators	
	NHDES Ambient Program (3 samples/site at ~ 40-50 sites)	Samples not collected every year; monitoring not designed to assess public health in recreational water		NHDES	
2. Microbial Pathogens					
a. Bacteria	none	Historical monitoring as part of research projects discontinued	Routine monitoring of oysters in GB late May-June, September	JEL	
			1-2 samples/week at popular swimming areas	NHDES sampling JEL/NHDES analysis	
b. Viruses	none	No monitoring, only research	Monthly monitoring for enteric viruses at shellfish program sites	NHDES sampling UNH/Micro analysis	
c. Protozoa	none	No monitoring, only research	Monthly monitoring for protozoa pathogens at shellfish program sites	NHDES sampling UNH/Micro analysis	
3. Microbial Source Tracking	NHDES/JEL Pilot Monitoring (~every 2 weeks & during rain events in Varney Bk (Bellamy R.) and Hampton/Seabrook Estuary)	Applied, one-time research and pilot monitoring project; no routine monitoring	a. Routine source identification Monthly monitoring for E. coli at Shellfish Program sites b. Specifc source location tracking Iterative identification and elimin-ation of specific sources of concern	NHDES sampling UNH/JEL analysis NHDES sampling UNH/JEL analysis	Use microbial source tracking to monitor samples for routine source identification and specific source location tracking.
4. Harmful Algal Blooms					
a. PSP toxin	NHDES/NHF&G PSP/ Red Tide Program (1-2 samples/week, April-October at two sites)	Limited number of sites and only testing in blue mussels	1-2 samples/week at more sites, Apr-Oct, include surf clams off coast	NHDES/NHF&G	
b. HABs	NHOSP/GBCW (Weekly during late spring-early fall at one site)	Limited # of sites, no specific HABs targeted, observation of presence only	monthly/weekly sampling on coast Apr-Oct	GBCW sampling expert observation	

Table 8: Existing and Proposed Monitoring Programs for Eutrophic Conditions.

Monitoring Component	Existing Long-Term Programs	Monitoring Gaps	Recommended Actions	Responsible Party	NHEP Monitoring
1. Dissolved and particulate nutrients; Chlorophyll a; suspended particulates; DO	GBNERR/JEL Monitoring Program:	Limited spatial coverage in	Collect additional samples (5 sites)	Sample collection-DES	Restructure DES ambient and
	Three sites in Great Bay Estuary sampled once monthly at high and low tides: dissolved inorganic N and P, chlorophyll a, TSS, POM, DO, % saturation	Great Bay Estuary.	in conjunction with NHDES shellfish waters sampling program (once monthly, 10 months)	Sample analysis-JEL	shellfish sampling programs for spatial coverage and additional parameters.
		No long term sites in Hampton or Little Harbors	Collect additional samples (4 sites HH; 2 sites LH) in conjunction with NHDES shellfish waters sampling program (once monthly, 10 months)	Sample collection-DES Sample analysis-JEL	(same as above)
	DES Ambient 40-50 stations in coastal watershed 3 samples/station annually - DO	Samples not collected every year	Sample consistently at strategic freshwater locations as determined by existing database.	NHDES	(same as above)
	DES Shellfish (ancillary): 8 sites in GB and HH, monthly Apr-Oct, DO, TSS, chlor a, nitrate, % organic				
	CICEET RECOMS Five sites in Great Bay Estuary; automated fluorometry measured every half hour April -December: Chlor a, turbidity, DO, % saturation,	Two sites supported by GBNERR Funding for sites in Lamprey, Oyster and Bellamy ends 12/2000	Establish one or two additional sites with NHEP funds	UNH JEL	Maintenance and operation of existing in-situ instruments.
		No sites in Salmon Falls, Cocheco Upper Piscataqua, or Little Bay	Provide support operational for three to five sites with NHEP funds	UNH JEL	
		No sites in Hampton or Little Harbors			
	NPDES Occasional nutrient analysis, TSS, and BOD at some WWTP's;	No consistent database on WWTP nutrient inputs	Routine weekly analysis of WWTP effluent	WWTP operators	
	Great Bay Coast Watch (Twenty sites sampled twice per month at high and low tides) Turbidity, BOD	Choice of sites may not be optimal	Re-examine site locations partial NHEP support for program	Great Bay Coastwatch	
2. Proliferation of nuisance macroalgae	GBNERR/JEL Monitoring program (Selected sites monitored every five years)	Inadequate spatial and temporal coverage	Annual or semi-annual overflights in August, using thermal infrared photography or hyperspectral imaging. Funding provided by NHEP	Imaging-contractor Image analysis- UNH Complex systems	
3. Seagrass areal cover	No consistent program	Inadequate spatial and temporal coverage	Annual or semi-annual overflights in August, using thermal infared photography or hyperspectral imaging. Funding provided by NHEP	Imaging-contractor Image analysis- UNH Complex systems	

Table 9: Existing and Proposed Monitoring Programs for Toxic Contaminants.

Monitoring Component	Existing Long-Term Programs	Monitoring Gaps	Recommended Actions	Responsible Party	NHEP Monitoring
1.Spatial/temporal trends of toxic contaminants					
a. Sediments	USEPA/NHDES/JEL Coastal 2000 (40 sites/year for 2000 & 2001 sampled once each year)	limited longevity of program (at present, will end after 2001)	Continuation of Coastal 2000 after 2001; annual sampling of subset of sites	UNH sampling contract lab analysis	
	PNSY Sampling Program	Portsmouth Harbor only			
b. Tissue	USEPA/NHDES/JEL Coastal 2000 (40 sites/year for 2000 & 2001 sampled once each year)	limited species and longevity of program (ends after 2001)	expand NH-Gulfwatch; incl. oysters/clams	NHDES/UNH-JEL	Clam and oyster contaminant exposure, sample beds on 3-year rotation
			expand C2K; incl. bluefish/striped bass	NHDES/UNH-JEL	Predatory fish contaminant exposure
	GOMC/NHDES/JEL Gulfwatch (6-7 sites/y for 2000 & 2001; rotate through 20 sites in 3 years)	limited spatially and by species; blue mussels only	extend C2K and Gulfwatch beyond 2001	NHDES/UNH-JEL	
			Coordinate with other agencies: Audubon	NHDES & Audubon	
	NOAA NS&T Mussel Watch Program (2 sites every 2 years)	limited sites and only mussels		NOAA	
	PNSY Sampling Program	Portsmouth Harbor only; mussels and juvenile lobsters only		PSNY	
c. Water	NPDES Permit Monitoring (some toxic metals occasionally at some WWTFs)	no routine monitoring of effluent discharge quality	Dry/wet weather monitoring at WWTFs	NHDES/permitees	
		iterative identification of sources, especially stormwater	Dry/wet weather monitoring at stormwater outfalls	NHDES/UNH-JEL sampling NHDES/UNH-analyses	
d. Air	Mercury Deposition Network (weekly monitoring of mercury at New Castle and Laconia, NH)	mercury only		NH DES	
	UNH AIRMAP Monitoring Program				
	NHDES Air Quality program (VOCs in Portsmouth)			NH DES	
2. Effects of Toxic Contaminants on Biota	Coastal 2000 (Acute toxicity tests on sediments from 40 sites/yr)	program not supported after 2001	Extend C2K and Gulfwatch beyond 2001	EPA	
		limited stormwater monitoring	Dry/wet weather monitoring at stormwater outfalls	NH DES	
	NPDES Permit Monitoring (whole effluent toxicity tests occasionally at some WWTFs)	no routine monitoring of effluent discharge quality	Dry/wet weather monitoring at WWTFs	WWTF operators	
		Ecosystem components not monitored	develop capacity for methods and initiate monitoring using best new approaches	UNH-R&D NHDES	

Table 10: Existing and Proposed Monitoring Programs for Molluscan Shellfish.

Monitoring Component	Existing Long-Term Programs	Monitoring Gaps	Recommended Actions	Responsible Party	NHEP Monitoring
1. Shellfish populations					
a. American Oysters	NH Fish and Game (All major beds in Great Bay sampled for abundance and size.)	Inconsistent frequency, does not include changes in bed size	Implement a long-term monitoring program for population structure, abundance, and area covered for all Great Bay Oyster Beds. Conducted annually on a rotational basis to monitor each bed every three years at a minimum.	Surveys-NH Fish and Game	Oyster population assessment to include bed dimensions, density, and population structure Sample beds rotationally.
	UNH/JEL population studies (Areal cover, abundance, size and spatfall)	Inconsistent frequency, no long-term database			
			Update/create geospatial datalayers	Datalayers- UNH CSRC	Develop data layers for oysters
b. Softshell clams	Seabrook nuclear power plant monitoring program (NAI) (Major flats in Hampton Harbor sampled annually for abundance and size)	Tidal rivers and creeks not sampled	Initiate annual sampling in the tidal rivers/creeks that includes population structure, abundance and area covered	Surveys-NH Fish and Game	Clam population assessments to include bed dimensions, density, and population structure Sample beds rotationally.
			Update/create geospatial datalayers	Datalayers- UNH CSRC	
	NH Fish and Game monitoring (Variable abundance sampling in Great Bay)	Inconsistent frequency, inadequate for establishing status and trends	Implement a long-term monitoring program for population structure, abundance, and area covered for all Great Bay clam beds. Conducted annually on a rotational basis to monitor each bed every three years at a minimum.	Surveys-NH Fish and Game	(same as above)
	UNH/JEL population studies (Areal cover, abundance, size and spatfall in Great bay and Little Harbor)	Inconsistent frequency, no long-term database, inadequate for establishing status and trends			
			Update/create geospatial datalayers	Datalayers- UNH CSRC	Develop data layers for oysters
c. Blue mussels	None	No consistent database at any location	None recommended	NA	
d. Sea Scallops	NH Fish and Game scallop studies (Variable abundance and size sampling at Portsmouth Harbor and near coastal locations)	Inconsistent frequency, inadequate for establishing status and trends	Implement annual monitoring program in Portsmouth Harbor and coastal areas; create geospatial datalayers	Surveys- NH Fish and game Datalayers- UNH CSRC	
	UNH/JEL population studies (Areal cover, abundance, size and spatfall in Portsmouth Harbor)	Inconsistent frequency, no long-term database, inadequate for establishing status and trends			
e. Surf clams	None	No consistent database at any location	Develop a Sea Sampling Program with local fishermen to generate abundance population and locational data Create geospatial datalayers	NH Fish and Game Datalayers- UNH CSRC	
f. Ocean quahogs (mahogany)	None	No consistent database at any location	Develop a Sea Sampling Program with local fishermen to generate abundance population and locational data Create geospatial datalayers	NH Fish and Game Datalayers- UNH CSRC	

Table 10: Existing and Proposed Monitoring Programs for Molluscan Shellfish (continued).

Monitoring Component	Existing Long-Term Programs	Monitoring Gaps	Recommended Actions	Responsible Party	NHEP Monitoring
g. European oysters (Belon)	None	No consistent database at any location	None recommended	NA	
h. Razor clams	NH Fish and Game Estuarine Monitoring program (Some data available for 1980-1981)	Inconsistent frequency, inadequate for establishing status and trends	None recommended	NA	
2. Harvest Pressure					
a. Oysters	None 1997 F&G survey 1990 UNH Harvest survey	Inconsistent frequency, inadequate for establishing status and trends	Establish harvest reporting system for recreational harvesters	NH Fish and game	
b. Softshell clams	NH Fish and Game surveys (Variable on days flats are open in Hampton Harbor - # of recreational harvestors assuming harvest = legal limit	Does not account for illegal take, only includes Hampton Harbor	Establish harvest reporting system for recreational harvesters	NH Fish and game	
c. All other species	None	No consistent database at any location	Establish harvest reporting system for recreational and commercial harvestors of sea scallops, surf clams and ocean quahogs	NH Fish and game	
3. Disease Monitoring					
a. Oyster disease	NH F&G MSX and Dermo Once or twice per year at 3-5 locations	Not all locations sampled every year	Sample a minimum of five locations each year, Contract analyses to Rutgers or Maine	NH Fish and game Contract lab	Sample 5 beds of oysters annually for MSX and Dermo
b. Clam disease	Seabrook station (neoplasia monitoring annually at five clam flats)	No data for Great Bay or Little Harbor	Establish a baseline for Great Bay and Little Harbor	NH F&G	
c. All other species	None	No consistent database at any location	None recommended	NA	
4. Predation pressure	Seabrook station (Green crab trapping twice monthly at two sites)	No data for Great Bay or Little Harbor, No data on oyster drills	Initiate green crab and oyster drill surveys	NH Fish and Game	
5. Effects of restoration					
a. Eastern oyster	NH F&G conducted one restoration project in the 1980's and monitored for one year	Insufficient to evaluate long-term benefits	Initiate a program to return cultch to recreational beds	NH Fish and Game	
			Initiate a bed cultivation program	NH Fish and Game	
	UNH CICEET restoration project in Salmon Falls River, annual monitoring planned	No long-term funding after 2002	Include this bed in population surveys	NH Fish and Game	
b. Softshell clam	NH F&G conducted one year restoration project in Hampton Harbor, no clams survived	Insufficient to evaluate long-term benefits	Encourage/support community restoration efforts and implement monitoring	NH Fish and Game	
c. All other species	None	No consistent database at any location	None recommended	NA	

Table 11: Existing and Proposed Monitoring Programs for Land Use, Development, and Habitat Protection.

Monitoring Component	Existing PrograM	Monitoring Gaps	Recommended Actions	Responsible Party	NHEP Monitoring
1. Growth indicators		Maintenance of related databases and Integration and interpretation of all related data	Establish central repository; establish criteria of database formats; develop framework to integrate and interpret data	CSRC & NHOSP, GBNERR, NHEP	A Needs Assessment will be conducted in 2001 to explore methods and costs for monitoring land use, development, and habitat protection.
(Impervious surfaces)	None	Need means of quantifying impervious surfaces	Test developing methods in Seacoast	CSRC & NHOSP	
(Land use and cover; Developed/undeveloped land)	Land Use Mapping Updates (RPCs) for all coastal communities, ongoing	Ensure consistent annual updates from all towns	Acquire land use info from towns Acquire and interpret aerial images	towns/RPCs & CSRC/NHOSP NOAA/CSRC/NHOSP/NHEP	
		Update and establish monitoring based on NHEP Critical Lands Analysis	Establish central repository for all related databases; establish criteria for consistent database formats	CSRC & NHOSP, GBNERR, NHEP	NHEP Coastal Scientist coordinate
(Human population)	NHOSP/US Census Bureau	None			
(Building starts; school enrollment construction permits)	Municipal database updates (ongoing for building starts and school enrollment)	Ensure consistent annual updates; and data consistency	Establish central repository; establish criteria of database formats; develop framework to integrate and interpret data	CSRC & NHOSP, GBNERR, NHEP	NHEP Coastal Scientist will coordinate
2. Permanently Protected Habitats					
(Protected lands & Important habitats)	SPNHF/ UNH CSRC (all coastal municipalities, annually)	Need common regional approach and definition for protected lands & important habitats	Define & establish quantification method	NHEP & NHOSP	
		Establish long-term monitoring program because not always comprehensive	Acquire, interpret & update databases for important habitats	towns/RPCs & CSRC/NHOSP NOAA/CSRC/NHOSP	
		Need integrated database with info on protected lands & habitat	Integrate protected land and important habitat databases	CSRS, SPNHF, NHEP	
		Maintenance of related databases and Integration and interpretation of all related data to assess changes in acreage of protected habitats.	Establish central repository; establish criteria of database formats; develop framework to integrate and interpret data	CSRC & NHOSP, GBNERR	NHEP Coastal Scientist will coordinate
3. Sprawl	None	Need regional definition and quantification method for sprawl	Determine common definition & establish quantification method	CSRC, NHOSP, NHEP	
		Establish long-term monitoring program	Acquire land use info from towns Acquire human population data	towns/RPCs & CSRC/NHOSP NHEP/CSRC/NHOSP	
		Separate databases for population & land development in densely and sparsely populated areas population density	Modify existing databases for land development and population to differ between areas varying in	NHEP, NHOSP, RPCs, CSRS	
		Maintenance of related databases and Integration and interpretation of all related data to assess changes in acreage of protected habitats.	Establish central repository; establish criteria of database formats; develop framework to integrate and interpret data	CSRC & NHOSP, GBNERR	NHEP Coastal Scientist will coordinate
	NHOSP/US Census Bureau (human population monitoring)	Need population densities in developed and less-developed areas		NHOSP	

Table 12: Existing and Proposed Monitoring Programs for Species and Habitats.

Monitoring Component	Existing Long-Term Programs	Monitoring Gaps	Recommended Actions	Responsible Party	NHEP Monitoring
1. Trends in wetland degradation and loss					
a. Tidal Wetlands	National Wetlands Inventory (All wetland tidal and fresh mapped one time)	No plans to conduct additional surveys	Take advantage of any aerial image capture, See Monitoring Goal # III	NH DES	A Needs Assessment will be conducted in 2001 to explore methods and costs for monitoring habitats and critical species.
	Natural Resources Conservation Service (USDA) (All tidal wetlands with tidal flow restrictions)	No plans to update by NRCS,however, inventory of restriction removal maintained by NH Coastal Program	Encourage NH CP to continue with restoration inventory	NHCP	
	NH Coastal Program Restoration (Inventory of tidal wetlands that are ditched or filled)	Program in Development	Encourage NH CP to continue with restoration monitoring	NHCP	
	NH DES (Inventory wetland alteration permits subtracts impacted areas from total, adds restored areas to total.)	Baseline acreage may not be accurate No follow-up on permits	See 1.a. above Follow up on permits to verify actual acreage disturbed and restored	NH DES	
	NH Port Authority (Monitors NHPA mitigation sites annual)	Limited to NHPA sites	Integrate into DES database	NH DES	
b. Eelgrass	See Monitoring Goal #III				
c. Macroalgae	See Monitoring Goal #III				
d. Freshwater wetlands	NH DES (Inventory wetland alteration permits subtracts impacted areas from total, adds restored areas to total.)	Baseline acreage may not be accurate No follow-up on permits, does not include stormwater treatment systems that may function as wetlands	More accurate delineation of small wetlands Follow up on permits to verify actual acreage disturbed and restored	Towns and RPC's NHDES	
			Identify SW treatment systems that become functional wetlands (swales, ponds, etc.)	NHDES	
	Municipal Prime wetlands mapping (Location and frequency varies)	May not be included in NH DES/Granite database	Integrate information into DES database	RPC's and DES	
2. Trends in resident finfish populations	NH F&G anadromous fish monitoring (All fish ladders monitored during annual spawning run - Oyster, Cocheco, Exeter, Lamprey, Taylor, and Winnicut Rivers)	Data not widely distributed	Better data management, integration and distribution	NH F&G	
	NH F&G estuarine fish survey (10 sites in Great Bay, 4 sites in Hampton, sampled monthly Jun-Nov)	Seine hauls only-does not sample fish from deep water	Initiate trawl surveys or continue at selected Coastal 2000 sites	NH F&G	
	Coastal 2000 (40 sites in Great Bay)	No consistent long-term funding	See above		
	NH F&G Shad restoration (Daily monitoring of spawning run Apr-June at Exeter River)	Other tidal rivers not monitored	No action recommended until success of shad restoration program verified	NH F&G	
	NH F&G Atlantic salmon restoration (Annually, spring and fall, at Cocheco and Lamprey Rivers)	NA	No action recommended until success of salmon restoration program verified	NH F&G	
	NH F&G voluntary creel surveys (Catch of sea run brown trout and striped bass in all tidal waters.)	Data not widely distributed or integrated	Better data management, integration and distribution	NH F&G	

Table 12: Existing and Proposed Monitoring Programs for Species and Habitats (continued).

Monitoring Component	Existing Long-Term Programs	Monitoring Gaps	Recommended Actions	Responsible Party	NHEP Monitoring
2. Trends in resident flnfish populations (continued)	NH F&G recreational fishing surveys (Catch of striped bass, cod, bluefish, pollack, mackerel, winter flounder)	Data not widely distributed or integrated	Better data management, integration and distribution	NH F&G	
	NH FF&G rainbow smelt program (Annual angler interview and egg counts on spawning grounds in Bellamy, Oyster, Lamprey, Winnicut, and Squamscot Rivers.)	Data not widely distributed or integrated	Better data management, integration and distribution	NH F&G	
	NH F&G logbook program (Catch effort for all species taken by seine and trap, reported monthly)	Data not widely distributed	Better data management, integration and distribution	NH F&G	
	Seabrook Station finfish monitoring (Monthly trawls at 3 coastal stations, monthly seine hauls 3 estuarine stations for all species)	None	Better integration of data	NHEP	
3. Trends in groundwater quality	Some project /site related monitoring supplies	No comprehensive program for contaminated wells, drinking water	Examine available groundwater data to Need to integrate existing data	NHDES determine monitoring needs	
4. Trends in Meeting designated uses	NH DES 305b report (All surface water bodies reported every two years)	Unknown	Continue 305b reporting, improve data dissemination and integration	NHDES	
5. Trends in water suitability for aquatic life					
a. Benthic macroinvertebrates	NHPA mitigation monitoring (5 tidal mitigation sites monitored annually)	Limited geographic coverage	Coordinated data analysis for all benthic monitoring programs, synthesize and disseminate data	NH F&G and NHEP	
	UNH Open Ocean Aquaculture Benthic monitoring (Benthic infauna at 8 sites one mile south of Isles of Shoals, monthly)	Limited geographic coverage	See above	UNH	
	UNH Open Ocean Aquaculture epibenthic monitoring (Video surveys of bottom fauna)	Limited geographic coverage	See above	UNH	
	NAI/Seabrook Station macrobenthos monitoring program (6 coastal sites for all flora and fauna, 3 times per year)	Limited geographic coverage	See above	NAI/Seabrook Station	
	NAI/Seabrook Station epibenthic crustacean monitoring program (Lobster larvae @ 3 sites, 15 lobster at 2 sites, crab larvae @ 2 sites, crabs @ 2 sites with lobster)	Limited geographic coverage	Integrate with Fish and Game data; synthesize and disseminate data	NH F&G and NHEP	
	NH F&G juvenile lobster monitoring (SCUBA surveys of juveniles at 2 Great Bay and 1 coastal site, monthly Apr-Dec)	Data not widely distributed	Integrate with NAI data; synthesize and disseminate data	NH F&G and NHEP	
	NH DES stream biomonitoring (10 freshwater stream sites sampled one time for macroinvertebrates and fish)	Inadequate frequency	Establish bienniel schedule	NH DES	

Table 12: Existing and Proposed Monitoring Programs for Species and Habitats (continued).

Monitoring Component	Existing Long-Term Programs	Monitoring Gaps	Recommended Actions	Responsible Party	NHEP Monitoring
	Coastal 2000 (Benthic infauna at 40 sites, sampled once annually 2000 and 2001)	No continuation planned	Continue at selected sites if appropriate Sample every 3-4 years	NHEP/Contract	
	GBNERR horseshoe crab monitoring program (Observational data by volunteers, annually during spawning)	Status for continuation unknown	Encourage Continuation	GBNERR	
c. Wildlife	NH F&G/Audubon tern monitoring (Nesting pairs and hatchlings at White Island)	Limited geographic coverage	Encourage Continuation, include Great Bay if appropriate, synthesize and disemminate data	NH F&G and Audubon	
	Audubon winter eagle surveys (Frequent observational data, Nov-Apr)	None	No new action recommended		
	NH F&G/Aububon shorebird surveys (Observational data, spring to fall for all estuarine waters)	Data not widely distributed or integrated	Better disemmination of synthesized data	NH F&G and NHEP	
	NH F&G/Audubon waterfowl surveys (Observational data throughout coast)	Data not widely distributed or integrated	Better disemmination of synthesized data	NH F&G and NHEP	
	F&G hunting and trapping permits (mammals) (Variable with season)	Data not widely distributed or integrated	Better disemmination of synthesized data	NH F&G and NHEP	
d. Reptiles and amphibians		No current comprehensive monitoring	Initiate reptile and amphibian monitoring	EPA and NH F&G	
e. Phytoplankton	See Monitoring goal #III				
f. Large bivalves	See Monitoring goal #IV				
g. Eelgrass	See Monitoring goal #III				
h. Macroalgae	See Monitoring goal #III				
	NAI/Seabrook Station macrobenthos monitoring program (6 coastal sites for all flora and fauna, 3 times/year)	Limited geographic coverage	See Monitoring goal #III for intertidal macroalgae		
h. Stream flow	USGS Stream Gauging (Continuous at 5 sites - Oyster Exeter, Lamprey, Cocheco and Salmon Falls Rivers)	None	Integrate USGS data into other databases (e.g. freshwater fish, anadromous fish, pollutant loading, etc.)	NHEP	
6. Wetland Restoration					
a. Tidal wetlands	See 1.a above				
b. Freshwater wetlands	See 1.d above				
7. Invasive wetlands species		No current comprehensive monitoring	See monitoring goal#III re: remote sensing and vegetation mapping	UNH CSRC & NHEP	

QUESTIONS TO BE ADDRESSED BY A COMPREHENSIVE MONITORING PLAN

Questions for Water Quality/ Bacteria and Other Disease Causing Organisms

- Do NH tidal waters meet fecal coliform standards of the National Shellfish Sanitation Program for 'approved' shellfish areas?
- Do NH surface freshwaters meet the state *Escherichia coli* standard of < 126/100 ml?
- Do NH designated freshwater beaches meet the state *Escherichia coli* standard of < 47/100 ml?
- Do NH tidal waters, including swimming beaches, meet the State enterococci standards of < 35/100 ml?
- Do NH tidal waters contain disease-causing and biotoxic organisms (pathogenic bacteria, viruses, harmful algal blooms)?
- Have fecal coliform, enterococci, and *Escherichia coli* levels changed significantly over time?
- Has dry weather bacterial contamination changed significantly over time?
- Has wet weather bacterial contamination changed significantly over time?

Questions for Water Quality/Impacts of Toxic Contaminants

- Do NH tidal waters and sediments contain heavy metals, PCBs, PAHs, chlorinated pesticides, dioxins/furans, and other toxic contaminants that are harmful to humans, animals, plant, and other aquatic life?
- Are shellfish, lobsters, finfish, and other seafood species from NH coastal waters fit for human consumption?
- Is there evidence of toxic effects of contaminants in estuarine biota?
- Have the concentrations of toxic contaminants in sediment and estuarine biota significantly changed over time?

Questions for Water Quality/Effects of Nutrients and Turbidity

- Have levels of dissolved and particulate nitrogen and phosphorus significantly changed over time?
- Have levels of phytoplankton (chlorophyll a) in NH tidal waters significantly changed over time?
- Do any surface freshwaters exhibit chlorophyll a levels that do not support swimming standards (20-30 mg/l: partially support; >30 mg/l: does not support)?
- Do any surface tidal or freshwaters show less than 75% saturation of dissolved oxygen? For what period of time?
- Do any surface tidal or freshwaters show a significant change in Biological Oxygen Demand?

- Is there evidence of proliferation of nuisance species associated with elevated nutrient loading?
- Have surface tidal or freshwaters shown a significant change in turbidity (total suspended solids or nephalometric turbidity units) over time?

Questions for Sustainability of Shellfish Resources

- Are 75% of all shellfish (oyster; soft-shell clam) beds open for harvesting?
- Has the number of harvestable clams and oysters in NH estuaries tripled from 1999 levels?
- Are NH shellfish healthy, growing, and reproducing at sustainable levels?
- Are NH shellfish being harvested at sustainable levels?
- Has the incidence of shellfish diseases significantly changed over time?
- Have restoration efforts resulted in a significant increase in the acreage and/or density of soft-shell clam and oyster beds?

Questions for Land Use, Development, and Habitat Protection

- Has the rate of creation of new impervious surfaces in coastal NH watersheds significantly changed over time?
- Has there been a significant change over time in the number of coastal NH watersheds (first or second order) that exceed 10% impervious cover?
- Has the rate of urban sprawl in coastal NH watersheds significantly changed over time?
- Has the acreage of permanently protected important habitats (tidal shorelands, wetlands, rare and exemplary natural communities, large contiguous forest tracts, wetlands with high habitat value, freshwater shorelands) significantly changed over time?
- Has the acreage of privately owned lands managed to benefit wildlife and natural communities significantly changed over time?

Questions for Restoration of Critical Species and Habitats

- Has there been any significant net loss or degradation of tidal or freshwater wetlands in NH?
- Has the abundance, biology, and species composition of resident finfish changed significantly over time?
- Has the quality of groundwater entering NH estuaries significantly changed over time?
- Have the miles of rivers and streams meeting high quality biomonitoring standards significantly changed over time?
- Has the acreage of waters supporting designated uses (fishing, swimming, shellfishing, etc.) significantly changed over time?

- Do the following indicators show that water quality is suitable for aquatic life: aquatic insects/invertebrates, wildlife, fish, diatoms/algae, large bivalves, eelgrass, marshes?
- Have restoration efforts resulted in a significant increase in the acreage of tidal or freshwater wetlands?
- Has the acreage of invasive species (*Phragmites*, purple loosestrife) in NH salt marshes and wetlands significantly changed over time?
- Have restoration efforts resulted in a significant increase in the acreage/density of shellfish beds (soft-shell clams and oysters)?

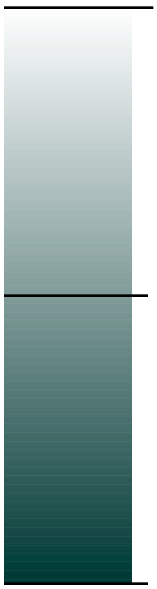
SUMMARY OF RECOMMENDED ACTIONS

12

This chapter summarizes all the Action Plans proposed in this *Management Plan* according to their priority ranking. Suggestions for how citizens can help improve and protect the environment of the estuarine region by being conscientious in their homes and daily lives follow the prioritized list of Action Plans. The checklist of suggestions is titled "What's Your Pollution Prevention Quotient?"

All Actions presented in this *Plan* are important to successful management of the estuaries, but setting priorities is necessary to guide future NHEP work plans and ensure *Plan* goals are met. The Action Plans are listed here in the order of priority rankings assigned by consensus of the NHEP Management Committee and Project Teams. Participants considered the potential contribution of each action to the success of the *Plan*, and its overall contribution to the management, protection, and enhancement of estuarine resources.

The ranking system includes three levels: Highest Priority, High Priority, and Priority. In the ranking process, NHEP participants were asked to assign a priority of High, Medium, or Low to each Action Plan. Action Plans receiving approximately equal votes of High and Medium, or Medium and Low priority, were assigned a High to Medium, or Medium to Low priority ranking to reflect the group consensus. When votes were mixed but clearly weighted in favor of one designation, final priority was recorded with the majority ranking first – resulting in Medium-High and Low-Medium designations. The result was a continuum of seven possible priority rankings in the DRAFT *Management Plan*: High, High to Medium, Medium to High, Medium, Medium to Low, Low to Medium, and Low. For purposes of proceeding with implemenation and developing workplans, the ranking system was simplified for this final *NHEP Management Plan*.



Highest Priority

Critical to achieving *Plan* goals; to be pursued by the NHEP in the first four years of implementation.

High Priority

Less critical to achieving *Plan* goals; to receive less emphasis in the first four years of implementation.

Priority

To be pursued as time and resources allow.

HIGHEST PRIORITY

WQ-4A	Establish ongoing training and support for municipal personnel in monitoring storm drainage systems for illicit connections.
WQ-4B	Assist Seacoast communities in completing and maintaining maps of sewer and stormwater drainage infrastructure systems.
WQ-4C	Eliminate illicit connections in Seacoast communities.
WQ-5	Conduct shoreline surveys for pollution sources.
WQ-7	Provide incentives to fix or eliminate illegal direct discharges such as grey water pipes, failing septic systems, and agricultural runoff.
WQ-8	Research the effectiveness of innovative stormwater treatment technologies for existing urban areas in New Hampshire, and communicate the results.
WQ-10	Research the use and effectiveness of the *Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire*. Revise, publish, and promote the *Handbook*.
WQ-13	Provide septic system maintenance information directly to shoreline property owners, and to other citizens of the Great Bay and coastal watersheds to help improve water quality.
WQ-16	Find funding sources for key strategies.
WQ-19	Stormwater Awareness: Support and expand stormdrain stenciling programs.
LND-1	Prepare a report of current and future levels of subwatershed imperviousness for the New Hampshire coastal watershed.
LND-2	Implement steps to limit impervious cover and protect streams at the municipal level.
LND-5	Revisit/revise municipal decision-maker land-use planning outreach methods and develop an educational effort modeled after the successful University of Connecticut Cooperative Extension "Non-point Education for Municipal Officials" (NEMO) program.
LND-6	Minimize urban sprawl in coastal watersheds.
LND-6A	Develop a regional smart growth pilot partnership to create a smart growth vision among towns and regional planning commissions in a single estuarine watershed.
LND-6F	Aggressively assist communities that embrace a strong smart growth philosophy to conduct comprehensive reviews, identify sources of funding, provide public education, and implement new land-use tools.
LND-9A	Reduce the quantity, improve the quality, and regulate the timing of stormwater flow into tidal wetlands through policy changes at the NH DES Wetlands Bureau.
LND-9B	Reduce stormwater impacts to tidal wetlands through changes to the NHDES Site Specific Program.
LND-12	Pursue restoration funding from the DOT, NRCS, US F&WS and other sources.
LND-14	Develop and implement an outreach program to encourage and assist communities in developing and adopting land use regulations to protect undisturbed shoreland buffers.
LND-15	Support land conservation efforts in shoreland areas.

LND-16	Improve enforcement of the state Comprehensive Shoreland Protection Act and other applicable shoreland protection policies through outreach efforts to local officials and shoreland property-owners.
LND-18	Locate and quantify quantity and quality groundwater inflow to the estuaries.
LND-19	Locate, reduce or eliminate, and also prevent groundwater contaminants.
LND-25B	Provide training and project assistance for towns interested in utilizing the *Method for the Comparative Evaluation of Non-tidal Wetlands in New Hampshire.*
LND-26	Support implementation of state and federal land protection programs (e.g., Conservation and Reinvestment Act, Land and Community Heritage, Teaming With Wildlife, Land and Water Conservation Fund, Coastal Initiative Program, Farmland Preservation Program).
LND-27	Support efforts of Great Bay Resource Protection Partnership.
LND-28	Encourage towns to dedicate current-use change tax penalties to conservation commissions for the purpose of natural resource acquisition, easements, restoration, and conservation land management.
LND-32	Encourage municipalities to incorporate wildlife habitat protection into local master plans by promoting NH Fish and Game's *Identifying and Protecting Significant Wildlife Habitat: A Guide for Towns* and other activities.
LND-33	Develop a model local planning approach to encourage the identification and maintenance of contiguous habitat blocks.
LND-35	Maintain current-use program.
LND-36	Encourage conservation easements.

SHL-1	Implement National Shellfish Sanitation Program guidance to develop an FDA-certified shellfish program.
SHL-4	Enhance funding to maintain a comprehensive shellfish program.
SHL-5	Regularly collect and monitor water quality to identify sources and reduce or eliminate contaminants.
SHL-6	Periodically collect and monitor shellfish tissue samples as appropriate for toxins and biotoxins.
SHL-7	Maintain an ongoing shellfish resource assessment program.
SHL-8	Develop and implement a plan for shellfish resource enhancement and habitat restoration.
SHL-10	Provide information regarding public access to shellfish beds through distribution of maps/booklets.
SHL-14	Provide for direct citizen involvement in NH shellfish management decisions.
SHL-15	Evaluate and address barriers to aquaculture and promote environmentally sound aquaculture practices.

RST-1	Develop and implement a plan for shellfish resource enhancement and habitat restoration activities to achieve a sustainable resource contributing to a healthy environment.
RST-3	Continue to restore the restorable tidal wetlands listed in the Natural Resources Conservation Service report, *Evaluation of Restorable Tidal Marshes in New Hampshire.*
RST-6	Pursue restoration funding from the NH Department of Transportation, US Department of Agriculture/National Resources Conservation Service, US Fish and Wildlife Service, and other sources.
EDU-3	Establish a Technical Assistance Grant Program to help implement the *NHEP Management Plan*.
EDU-5	Support volunteer organizations active in water quality, habitat, or other estuarine natural resource issues.

HIGH PRIORITY

WQ-1	Evaluate how Wastewater Treatment Facility effluent affects estuarine water quality, and seek practical options at the state level for secondary and tertiary or alternative treatment where appropriate.
WQ-2	Evaluate the suitability of UV alternatives to chlorine in wastewater post-treatment for the Seacoast communities.
WQ-3	Prioritize and then upgrade Seacoast wastewater treatment facilities to reduce bacterial pollution from hydraulic overloading.
WQ-6	Promote collaboration of state and local officials (conservation commissions, health officers, building inspectors, et al.) to locate and eliminate illegal discharges into surface waters.
WQ-9	Ensure that water quality and quantity impacts from new development or redevelopment are minimized to the maximum extent practical at the planning board stage of development.
WQ-12B	Enhance oil spill clean up efforts through pre-deployment infrastructure and high speed current barriers.
WQ-14	Encourage the use of innovative alternative technologies for failing septic systems to help improve water quality.
LND-3	Conduct research in coastal NH watersheds to examine the relationship between percent impervious cover and environmental degradation.
LND-6B	Conduct a comprehensive review of the 43 towns within the estuaries and coastal watershed area to determine land-use polices that affect sprawl.
LND-6C	Develop and maintain a comprehensive database or library of new smart growth funding programs.
LND-6E	Actively participate and contribute to the development of new smart growth planning tools with particular emphasis on provisions that protect estuarine water quality.
LND-7	Complete rulemaking and begin implementation of the *Recommended New Hampshire Wetland Mitigation Policy for NH DES,* prepared by the Audubon Society of NH and the Steering Committee on Wetlands Mitigation.

LND-10	Using the Coastal Method and other techniques, identify and restore additional restorable tidal wetlands.
LND-11	Create a list of potential wetland restoration projects that could be used for wetland mitigation projects, and distribute the list to state agencies and Seacoast municipalities.
LND-13	Provide a framework specific and appropriate to the New Hampshire Seacoast for defining and delineating urban and non-urban shoreland areas.
LND-17	Provide incentives for the relocation of grandfathered shoreland uses.
LND-20	Develop and implement a wetlands buffer outreach program for planning boards.
LND-21	Prevent the introduction of untreated stormwater to freshwater wetlands by enacting legislation giving NH DES authority to regulate stormwater discharge to wetlands.
LND-22	Prevent the introduction of untreated stormwater to wetlands by strengthening municipal site plan review regulations.
LND-24	Work with NH DES to encourage adoption of a state wetlands mitigation policy.
LND-25	Encourage municipal designation of Prime Wetlands and 100-foot buffers (or equivalent protection).
LND-25C	Work with local planning boards and conservation commissions on regulatory approaches to wetlands conservation.
LND-25D	Create and/or enhance local land conservation programs, with emphasis on high value wetlands and buffers.
LND-29	Provide technical assistance in land protection and management to regional land trusts and municipal conservation commissions.
LND-30	Develop and encourage use of biomonitoring standards to evaluate water quality.
LND-31	Use biomonitoring and water quality monitoring to prioritize watershed areas for protection and remediation.
LND-34	Encourage appropriate buffers around important wildlife areas and rare or exemplary natural communities.
RST-2	Using the Coastal Method and other techniques, identify and restore additional restorable tidal wetlands.
RST- 4	Identify and implement habitat restoration projects in other important non-tidal habitat areas, such as uplands and freshwater wetlands.
RST-5	Create a list of potential wetland restoration projects that could be used for wetland mitigation projects, and distribute the list to state agencies, US Fish & Wildlife Service, and Seacoast municipalities.
EDU-1	Use existing media to enhance educational efforts.
EDU-4	Maintain and expand the New Hampshire Estuaries Project's shoreline property-owner database.

PRIORITY

WQ-11	Revise state industrial discharge permit criteria in response to new processing technology, and re-evaluate existing permits.
WQ-12A	Acknowledge and support the oil spill prevention and response activities of the Piscataqua River Cooperative.
WQ-15	Support efforts to reduce deposition of atmospheric pollutants through eliminating loopholes in current laws, encouraging the construction of more efficient power plants, and encouraging energy conservation.
WQ-17	Coordinate public tours of wastewater treatment facilities.
WQ-18	Support and coordinate stormwater technical workshops.
WQ-20	Conduct estuarine field day for municipal officials.
LND-4	Prevent the introduction of untreated stormwater to wetlands by supporting the development of NH Minimum Impact Development Guidelines.
LND-6D	Develop a science-based handbook and video on the nature, causes, and remedies of sprawl for audiences in the coastal New Hampshire watershed area.
LND-8A	Strengthen enforcement and effectiveness of the state tidal buffer zone (TBZ) through outreach to local officials and tidal shoreland property-owners.
LND-8B	Amend state tidal buffer zone (TBZ) regulations to include regulation of deck construction.
LND-23	Prevent the introduction of untreated stormwater to wetlands through an increased understanding of stormwater impacts on wetland ecology.
LND-25A	Create a traveling Prime Wetlands display.
SHL-2	Identify sources of and reduce or eliminate contaminants in the New Hampshire estuaries watersheds.
SHL-3	Institute land use practices in estuarine watersheds that improve water quality and shellfish habitat.
SHL-9A	Decrease shellfish resource depletion and increase productivity with stricter state penalties for illegal harvesting.
SHL-9B	Increase outreach and education about methods to control shellfish predators.
SHL-9C	Explore alternative recreational shellfish harvest methods.
SHL-9D	Increase productivity by discouraging the harvest of immature shellfish.
SHL-11	Establish *Bounty of the Bay* shellfishing field education program.
SHL-12	Develop and maintain a shellfisher license information database for use in outreach activities.
SHL-13	Update materials and improve distribution of shellfish-related information.
EDU-2	Work with the Seacoast Newspapers to establish a monthly newspaper column on coastal natural resource issues.
EDU-2A	Develop an agreement with Strafford County UNH Cooperative Extension to enable the NHEP Outreach Project Team to contribute coastal natural resource information to the UNH Cooperative Extension column in Foster's Daily Democrat.

APPENDICES

ACRONYMS AND GLOSSARY

A1

ACRONYMS

ACOE	U.S. Army Corps of Engineers
ASNH	Audubon Society of New Hampshire
BPA	Base Program Analysis (Regulation and Management of New Hampshire's Estuaries)
CAA	Clean Air Act
CDBG	Community Development Block Grant
CICEET	The Cooperative Institute for Coastal and Estuarine Environmental Technology
CSPA	Comprehensive Shoreland Protection Act
CSRC	(UNH) Complex Systems Research Center
CWA	Clean Water Act
ECOSTAFS	Estuarine Contaminant Status and Forecasting System
EPA	U.S. Environmental Protection Agency
FDA	Food and Drug Administration
GBNERR	Great Bay National Estuarine Research Reserve
GBRPP	Great Bay Resource Protection Partnership
GBC/W	Great Bay/Coast Watch
GPAC	Global Programme of Action Coalition
GRANIT	Geographically Referenced Analysis and Information Transfer System (the NH State Geographic Information [GIS] System)
GSDI	Granite State Designers and Installers
HUD	U.S. Department of Housing and Urban Development
ISSC	Interstate Shellfish Sanitation Conference
JEL	(UNH) Jackson Estuarine Laboratory
LCIP	Land Conservation Investment Program
LWCF	Land and Water Conservation Fund
MFCMA	Magnuson Fisheries Conservation and Management Act
MPO	Seacoast Metropolitan Planning Organization (MPO) regional transportation planning group
NAI	Normandeau Associates, Inc.
NEMO	Non-point Education for Municipal Officials
NEP	National Estuary Program
NHCP	New Hampshire Coastal Program
NHDAMF	New Hampshire Department of Agriculture, Markets and Food
NH DES	New Hampshire Department of Environmental Services
NH DHHS	New Hampshire Department of Health and Human Services
NH DOT	New Hampshire Department of Transportation
NH DRED	New Hampshire Department of Resources and Economic Development
NHEP	New Hampshire Estuaries Project
NH F&G	New Hampshire Fish and Game Department
NH OSP	New Hampshire Office of State Planning
NHTOA	New Hampshire Timberland Owners Association
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration, U.S. Department of Commerce
NPDES	National Pollutant Discharge Elimination System
NRCS	U.S. Department of Agriculture Natural Resources Conservation Service
NROC	Natural Resource Outreach Coalition
NSSP	National Shellfish Sanitation Program
RCCD	Rockingham County Conservation District
RPC	Rockingham Planning Commission
SCCD	Strafford County Conservation District
SPACE	Statewide Program of Action to Conserve our Environment
SPNHF	Society for the Protection of New Hampshire Forests
SRLF	State Revolving Loan Fund
SRPC	Strafford Regional Planning Commission
SSCA	State Shellfish Control Authority
TEA-21	Transportation Equity Act for the 21st Century
UNH	University of New Hampshire
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USDOT	U.S. Department of Transportation
USGS	U.S. Geological Survey

GLOSSARY

Administrative Rule
State of New Hampshire regulations that more specifically describe the implementation of a state statute.

Ambient
Refers to overall, general conditions of place. For example, ambient water quality monitoring programs are designed to measure overall water quality.

Anadromous Fish
A species, such as salmon, alewives, or bluebacks, that is born in freshwater, spends a large part of its life in the sea, and returns to freshwater rivers and streams to reproduce.

Aquaculture
The cultivation of aquatic organisms such as fish or shellfish in a natural or artificial growing area.

Aquatic Macroinvertebrate
Organisms which lack a backbone and spend part or all of their life in lakes, streams, ponds, marshes and puddles. These organisms help maintain the health of the water ecosystem by eating bacteria and dead, decaying plants and animals, and are often used as an indicator of the health of a water body. Examples include stoneflies, mayflies, caddisflies, and other insects.

Atmospheric Deposition
The transport of pollutants such as nutrients or toxins from the air onto land or water. Atmospheric deposition can be “dry” deposition (simple settling of the pollutant) or “wet” deposition (transport of pollutants by means of precipitation).

Base Program Analysis
An NHEP-sponsored study of existing estuarine management programs, focusing on local and state regulatory and non-regulatory programs. Results of the study were used to guide the development of the *NHEP Management Plan*.

Benthic
Associated with the bottom, or substrate, of a waterbody.

Best Management Practices (BMPs)
Methods for preventing or reducing the pollution resulting from an activity. BMPs can be structural (e.g., construction of a detention basin) or non-structural (e.g., periodic street sweeping) in nature.

Biochemical Oxygen Demand (BOD)
A measure of the organic material that can be readily oxidized through microbial decomposition, consuming oxygen dissolved in water. BOD is often used to assess the effects of a discharge, especially sewage.

Biodiversity
The number and abundance of species found within a common environment.

Biomonitoring
A type of environmental monitoring that utilizes the presence and abundance of organisms as an indicator of environmental quality, as opposed to more traditional physical and chemical measurements. Aquatic insects are commonly used in freshwater (stream) biomonitoring programs.

Biota
All living organisms that exist in a region.

Biotoxin
A poisonous compound produced by plants and animals, including microorganisms. Biotoxins produced by marine microorganisms often accumulate in various species of fish and shellfish.

Combined Sewer Overflow (CSO)
A pipe that during storms discharges untreated wastewater from a sewer system that carries both sanitary wastewater and stormwater. The overflow occurs because a system does not have the capacity to transport and/or treat the increased flow caused by stormwater runoff.

Conservation Commission
A municipal body concerned with the proper utilization and protection of the natural resources of a city or town. Conservation commissions undertake research projects of local land and water areas, and compile indexes of all open space, wetlands, and natural, aesthetic or ecological areas within the city or town. Conservation commissions often comment on development applications to state and/or local regulators for work in sensitive natural areas.

Critical Lands Analysis
An NHEP-sponsored study designed to identify lands in the 19 coastal towns with high natural resource value that may also be threatened by future development. This GIS study 1) identified vacant, potentially developable lands; 2) assessed vacant lands' favorability for development; 3) identified lands with multiple natural resource value, and 4) identified "high value" vacant lands that also exhibited favorable development characteristics.

Depuration
A process of reducing the pathogenic organisms in shellfish by using a controlled, purified aquatic environment as a treatment process.

Drainage Basin
The land that surrounds a body of water and contributes freshwater, either from streams, groundwater, or surface runoff, to that body of water.

Dredging
The removal of sediments from a river, stream, or estuary, typically done for navigation purposes.

Escherichia coli (E. coli)
A type of bacteria used to determine the quality of surface waters in the State of New Hampshire. State law (RSA 485-A:8 (II)) stipulates that "Class B" waters (which include all tidal waters) shall contain not more than either a geometric mean based on at least 3 samples obtained over a 60-day period of 126 *Escherichia coli* per 100 milliliters, or greater than 406 *Escherichia coli* per 100 milliliters in any one sample. Designated beach areas shall contain not more than a geometric mean based on at least 3 samples obtained over a 60-day period of 47 *Escherichia coli* per 100 milliliters, or 88 *Escherichia coli* per 100 milliliters in any one sample, unless naturally occurring.

Ecosystem
The collection of organisms and their non-living environment in a given place, each influencing the other and both necessary for the maintenance of life.

Eelgrass
A flowering, grass-like marine plant that grows in sand and mud. Eelgrass beds are an important habitat and nursery for fish, shellfish, and waterfowl.

Effluent
The outflow of water, with or without pollutants, usually from a pipe.

Enterococci
A type of bacteria used to determine the quality of tidal surface waters in the state of New Hampshire. State law (RSA 485-A:8(V)) stipulates that tidal waters utilized for swimming purposes shall contain not more than either a geometric mean based on at least 3 samples obtained over a 60-day period of 35 enterococci per 100 milliliters, or 104 enterococci per 100 milliliters in any one sample, unless naturally occurring.

Estuary
A semi-enclosed embayment where freshwaters from rivers and streams mix with salt water from the ocean. Estuaries are extraordinarily productive and diverse environments because of a unique set of conditions that create unusually nutrient-rich, protected waters. Many biologists consider estuaries among the most productive environments on earth.

Eutrophication
The process of nutrient enrichment in aquatic ecosystems. In marine systems, eutrophication results principally from nitrogen inputs from human activities such as sewage disposal and fertilizer use. The addition of nitrogen to coastal waters stimulates algal blooms and growth of bacteria, and can cause broad shifts in ecological communities present and contribute to low dissolved oxygen levels and fish kills.

Fecal Coliform
Bacteria that are present in the intestines and feces of warm-blooded animals and that are often used as indicators of the sanitary quality of water. This type of bacteria is used to determine the sanitary quality of shellfish growing waters in the State of New Hampshire.

Geographic Information Systems (GIS)
A computer system capable of assembling, storing, manipulating, and displaying/mapping geographically referenced information (i.e. spatial data). Examples of information stored in a GIS would be locations of roadways, waterbodies, wetlands, pollution sources, town boundaries, public parks, and many others.

Habitat
The setting in which a particular plant or animal lives, feeds, finds shelter, and reproduces.

Harmful Algal Blooms
An event of rapid growth of certain species of algae and other microbes which can be harmful to marine life and to humans under certain conditions. Some kinds of red tides are examples of harmful algal blooms.

Head-Of-Tide
The landward limit of tidal flow. In coastal New Hampshire, the head of tide on most major rivers is marked by a dam.

Heavy Metals
A group of elements that is present in the environment from natural and anthropogenic sources and can produce toxic effects. This group includes mercury, copper, chromium, cadmium, zinc, and arsenic.

Illicit Connections
Sanitary sewer lines that are connected to stormwater drainage pipes, resulting in the discharge of untreated sewage to surface waters.

Impervious Surface
A surface such as asphalt, concrete pavement, or rooftops that cannot be easily penetrated by water.

Invasive Species
Especially competitive and prolific non-native, introduced species of plants or animals. Invasive species reduce the overall biodiversity of an ecosystem, and may cause complete displacement of native species.

Leach Field
A shallow sewage disposal area, often constructed of stone and pipe and covered with topsoil, designed for the final disposal of septic tank effluent in the underlying soil.

Macroalgae
Large, multicellular algae which often attach themselves to rocks or other substrates in the marine environment. Examples include kelp and rockweed.

Master Plan
A report or set of statements and land use and development proposals with accompanying maps, diagrams, charts, and descriptive matter designed to show as fully as is possible and practical a municipal planning board's recommendations for the desirable development of the territory legally and logically within its planning jurisdiction. The contents of a master plan are described in RSA 674:2.

National Estuary Program (NEP)
A state grant program within the U.S. Environmental Protection Agency established to designate estuaries of national significance and to assist local stakeholders in the preparation of a *Comprehensive Conservation and Management Plan* for the designated estuaries.

National Pollutant Discharge Elimination System (NPDES)
A requirement in the federal Clean Water Act for dischargers to obtain permits, which place limits on the levels of pollutants that may be discharged.

Natural Resources Outreach Coalition
A group of outreach and education specialists committed to helping local decision makers integrate the principles of natural resource-based planning into their planning processes. The Coalition develops a coordinated outreach effort tailored to the natural resource and growth issues and needs of each interested community, and provides access to more technical natural resource management and planning resources. Coalition members include: UNH Cooperative Extension, and Cooperative Extension/Sea Grant; New Hampshire Coastal Program; NH Fish and Game Department - Great Bay National Estuarine Research Reserve; NH Department of Environmental Services; Rockingham Planning Commission and Strafford Regional Planning Commission; Rockingham and Strafford County Conservation Districts; and the New Hampshire Estuaries Project.

Non-Point Source Pollution
Pollution that is generated over a relatively wide area and dispersed rather than discharged from a pipe. Common sources of non-point pollution include stormwater and agricultural runoff, and failed septic systems.

Nutrients

Essential chemicals needed by plants and animals for growth. Excessive amounts of nutrients – nitrogen, and phosphorus, for example – can lead to degradation of water quality and growth of excessive amounts of algae. Some nutrients can be toxic at high concentrations.

Paralytic Shellfish Poisoning (PSP)

A life-threatening syndrome caused by eating shellfish that are contaminated with toxins produced by certain kinds of microscopic algae. Symptoms include tingling, numbness, giddiness, drowsiness, fever, rash, staggering, and others. Not all cases are fatal, but the most severe cases result in respiratory arrest within 24 hours of consumption of the toxic shellfish. PSP is prevented by large-scale proactive monitoring programs to assess toxin levels in shellfish and rapid closure to harvest of suspect or demonstrated toxic areas.

Pathogen

Any organism, but particularly bacteria and viruses, that causes disease. For example, human pathogens in shellfish can cause hepatitis and intestinal disorders.

Performance Standards

Federal, state, or local codified specifications that condition development activities to limit the extent to which a structure or activity may affect the immediate environment.

Petroleum Hydrocarbons

The mixture of hydrocarbons normally found in petroleum; includes hundreds of chemical compounds.

Point Source Pollution

Pollution originating at a particular place, such as a sewage treatment plant, outfall, or other discharge pipe.

Polycyclic Aromatic Hydrocarbons (PAHs)

A class of complex organic compounds, some of which are persistent in the environment and cause cancer. PAHs are commonly formed by the combustion of petroleum products such as gasoline, and often reach waterbodies through atmospheric deposition or roadway runoff.

Polychlorinated Biphenyls (PCBs)

A series of hazardous compounds used for a number of industrial purposes. PCBs are toxic to some marine life in very low concentrations and are known to cause skin diseases and even death in humans at higher concentrations. PCBs do not decompose easily in the environment, and they can concentrate through the food chain as larger animals eat a number of smaller animals that are contaminated.

Primary Treatment

Physical processes used to substantially remove floating and separable solids in wastewater. This process can include screening, grit removal, and sedimentation.

Pumpout Facility

A fixed or mobile system or device used to remove sewage from holding tanks in boats.

Red Tide

A phenomenon where certain species of microscopic marine plants with reddish pigments grow very fast and “bloom” into dense, sometimes visible patches near the surface of water. The microscopic plants associated with red tides are often harmless to humans; however, a small number of species produce potent neurotoxins that can be harmful or fatal. A harmful red tide that often occurs off New England coastal waters causes Paralytic Shellfish Poisoning (PSP).

Relay
The process of transferring shellfish from polluted growing areas to clean water areas for the purpose of reducing pathogens or poisonous or deleterious substances from the shellfish, using the ambient environment as the treatment process.

Revised Statutes Annotated (RSA)
New Hampshire state laws.

Riparian
Of, on, or pertaining to the bank of a river, or of a pond or small lake.

Runoff
The part of precipitation that travels overland and appears in surface streams or other receiving water bodies.

Salt Marsh
A type of wetland whose vegetation, hydrology, and soils are influenced by periodic inundation of tidal waters. Salt hay and salt cordgrass are common on NH salt marshes.

Sanitary Survey
A written evaluation report of all environmental factors, including actual and potential pollution sources, which have a bearing on the water quality in a shellfish growing area.

Secondary Treatment
The process used to reduce the amount of dissolved organic matter and further reduce the amount of suspended solids and coliform bacteria in wastewater.

Septic System
Any sewage disposal or treatment system, other than a municipally-owned and operated system, which receives either sewage and/or other wastes. A typical septic system in New Hampshire would include a septic tank and a leach field.

Septic Tank
A watertight settling unit, often made of concrete, that receives the discharge of sewage from a building. Septic tanks are designed to substantially remove all separable solids so as to permit the retention of scum and sludge, digestion of the organic matter, and discharge of the liquid portion to a leach field.

Sewage
Liquid or solid waste that is transported to a wastewater treatment plant for processing, or is transported to a septic system for treatment.

Site Specific Program
A program within the NH Department of Environmental Services, established by RSA 485-A:17, which regulates projects that significantly alter the characteristics of the terrain in such a manner as to impede the natural runoff or create an unnatural runoff.

Storm Drain
A system of gutters, pipes, or ditches used to carry stormwater from surrounding lands to streams, ponds, estuaries, or other low-lying areas. Storm drains carry a variety of pollutants such as bacteria, sediment, oil, and antifreeze which enter the system through runoff, deliberate dumping, or spills. This term also refers to the end of the pipe where the stormwater is discharged.

Stormwater
Precipitation that is often routed into drain systems in order to prevent flooding. Large expanses of roadways, parking lots, rooftops, and other impervious surfaces can result in large amounts of stormwater during a rainstorm.

Suspended Solids
Organic or inorganic particles that are suspended in and carried by the water. The term includes sand, mud, and clay particles as well as organic solids in wastewater.

Swales
Vegetated areas used in place of curbs or paved gutters to transport stormwater runoff. They also can temporarily hold small quantities of runoff and allow it to infiltrate into the soil.

Technical Characterization Document
NHEP-sponsored study and summary of existing environmental data on the state's estuaries, focusing on outlining status and trends of estuarine water quality and natural resource condition. Results of the study were used to guide the development of the *NHEP Management Plan*.

Tertiary Treatment
The wastewater treatment process that exceeds secondary treatment; may include nutrient or toxic removal.

Tidal Buffer Zone (TBZ)
An area extending landward 100 feet from the highest observable tide line. Certain activities in this area require a permit from the NH Department of Environmental Services Wetlands Bureau.

Total Maximum Daily Load (TMDL)
Method used by EPA and state agencies to analyze and reduce pollutants discharged into impaired water bodies.

Toxic
Poisonous, carcinogenic, or otherwise directly harmful to life.

Toxin
A substance which is poisonous, carcinogenic, or otherwise directly harmful to life.

Ultraviolet (UV) Disinfection
A method to disinfect wastewater treatment plant effluent. The process involves irradiating effluent with ultraviolet light to kill pathogenic organisms. This method is often used as an alternative to chlorine disinfection.

Wastewater
Water that has come into contact with pollutants as a result of human activities and is not used in a product, but discharged as a waste stream.

Wastewater Treatment Facility (WWTF)
Treatment facility or group of treatment devices which treats domestic or combined domestic and industrial wastewater through alteration, alone or in combination, of the physical, chemical, or bacteriological quality of the wastewater and which dewaters and handles sludge removed from the wastewater.

Watershed
The land that surrounds a body of water and contributes freshwater, either from streams, groundwater, or surface runoff, to that body of water.

Wetlands
Areas that are inundated or saturated by water at a frequency and duration sufficient to support a prevalence of vegetation adapted to such conditions. Examples of wetlands include both freshwater and salt marshes, swamps, and bogs.

MANAGEMENT PLAN DEVELOPMENT AND PUBLIC INVOLVEMENT

A2

ORGANIZATION OF THE NHEP AND SELECTION OF ISSUES

In **July 1995**, the US Environmental Protection Agency accepted the nomination of New Hampshire Estuaries for inclusion in the National Estuary Program. Work on the New Hampshire Estuaries Project began in the **fall of 1995** when a cooperative agreement for project start-up was developed and signed. In **November 1995** the NHEP Management Committee was formed and charged with running the project and developing the *Management Plan*.

One of the Management Committee's first tasks was to review the nomination submitted by the state of New Hampshire. The nomination proposed a focus on shellfish resources as an indicator of water quality for developing the *Management Plan*. Committee members thought shellfish would be a useful and sensible indicator, but that the *Management Plan* should focus more on water quality in order to appeal to a broader audience and more stakeholders.

NHEP staff held a series of four public forums, attended by more than 40 people, in Durham, Portsmouth, Seabrook, and Concord in **January 1996**. The purpose of these forums was to gather input on NHEP's proposal to focus on water quality and use shellfish as an indicator of environmental quality. Attendees generally agreed that in the interest of accomplishing environment benefits the project should limit its focus, and that focusing on water quality and shellfish made sense. With that endorsement the Management Committee and NHEP staff began work on formulating a work plan for the project's first year.

The Management Committee developed the draft work plan during the **spring of 1996**. This work plan was distributed to interested organizations and individuals in preparation for the NHEP's first Public Estuaries Conference in **June 1996**, held at the Seacoast Science Center and attended by almost 100 people. The purpose of this conference was to gather more public input on the project's proposed focus on water quality and shellfish, and to gather input on the NHEP Year One work plan, proposed organizational structure, and other issues. After much discussion, a majority of those in attendance approved of the project's focus on water quality and shellfish.

After the June 1996 conference the Management Committee amended the draft Year One work plan and formulated a Conference Agreement document describing three years of milestones and activities for *NHEP Management Plan* development. The NHEP became official in **July 1996**, when state and federal officials signed the Conference Agreement.

Following the advice received at the June 1996 Conference, the NHEP Conference Agreement called for Advisory Teams to be formed for the topics of water quality, shellfish/living resources, natural resource regulation/land use, and public outreach. The main functions of the Advisory Teams were to oversee specific NHEP projects, assist in *Management Plan* development, and advise the Management Committee. In the **fall of 1996** interested organizations and individuals were invited to join these teams, and membership on NHEP project teams remained open to anyone interested for the duration of the NHEP's three years of planning. New members were continually solicited through newsletter articles, various meetings with Seacoast municipal officials and environmental groups, Great Bay Estuary Boat tours for state/local officials in July 1998 (83 in attendance), and at NHEP public events such as meetings of the NH

Environmental Network Conference (November 1997, 68 in attendance; January 1999, 67 in attendance).

Throughout **winter and spring of 1997** the NHEP staff, project teams, and Management Committee worked to implement the various activities in the Year One work plan. Many activities in the work plan involved gathering new information about the estuaries needed to develop or refine the project's list of priority environmental issues to be addressed in the *Management Plan*. In the spring of 1997 project participants began formulating a Year Two work plan. In **June 1997** the Management Committee and Project Teams held a joint work session to refine the priority issue list and the Year Two work plan. The Year Two work plan, submitted to EPA in **July 1997**, outlined a process to develop the *Management Plan* and continue collecting information about the environmental condition of the estuaries. However, implementation was delayed while the Management Committee discussed the priority issues list and content of the *Management Plan*. The Committee and EPA reached agreement on these issues in **October 1997**. The agreement stipulated that while the main focus of the NHEP and the *Management Plan* would continue to be on the issues of water quality and shellfish resources, the *Management Plan* would also summarize information and key actions for other environmental issues such as wildlife habitat and land conservation. The Year Two work plan was revised to reflect the agreement, and implementation of the Year Two work plan and development of the *Management Plan* began in the **winter of 1998**.

MANAGEMENT PLAN DEVELOPMENT

In January 1998 the NHEP hired the UNH Program on Consensus and Negotiation to facilitate development of the *NHEP Management Plan*. Initial tasks included having the NHEP Project Teams formulate lists of goals and objectives for the themes of water quality, land use, shellfish resources, and public outreach and education. To formulate goals, participants were asked to envision the estuaries in the most desirable possible condition by the end of the NHEP's planning horizon of the year 2005. The parts of this "vision" were grouped into categories, and a goal developed for each. The agreed-upon goals were further refined into specific objectives. These goals and objectives were presented in **June 1998** at a public conference held at the Seacoast Science Center in Rye (attended by 96 people).

With suggestions gathered from the June 1998 public meeting, the Project Teams brainstormed specific strategies to achieve each objective. These strategies were presented at another public conference in **November 1998** at the Seacoast Science Center in Rye (attended by 52 people), where small groups worked to amend the strategies and choose those most likely to achieve the intended goals and objectives. These priority strategies were then reviewed and amended by the Project Teams through **winter 1999**. Once a list of key strategies was agreed to, the Project Teams began preparing detailed action plans describing the "who, what, where, when, why, and how much" needed to implement the key strategies. During this period the NHEP also hired the Audubon Society of New Hampshire to work with interested organizations to develop goals, objectives, and strategies for the topics of wildlife habitat and land conservation. Members of the public were invited to comment on this work at a public meeting held in **May 1999**. Comments from the 33 people attending were incorporated into the development of action plans for these issues.

By the **spring of 1999** the Project Teams completed draft action plans for the key strategies. Over **the summer of 1999** the Management Committee completed a review of all 98 action plans. The revised Action Plans were then incorporated into the first draft of the *NHEP Management Plan*.

The release of the draft *Management Plan* in **December 1999** marked the conclusion of the primary planning phase of the project. Two public hearings were held in January, 2000 at the Seacoast Science Center in Rye and at the New England Center in Durham. The public was notified through press releases, legal notice, direct mail and Great Bay Radio. State senators and local officials received direct mailings. Public comments were accepted until 2/1/00. This final *Management Plan* was revised following public comment and review. After approval, the final *Management Plan* will move into the implementation phase. The Management Committee will work to initiate, oversee, track, evaluate, and update implementation of the Action Plans.

RESULTS OF NHEP PLANNING PROCESS

A3

This Appendix documents the results of the NHEP's planning efforts to develop *Management Plan* goals, objectives, and strategies for the themes of water quality, shellfish resources, land use, habitat protection and restoration, and outreach. (The planning process itself is described in Appendix 2.)

Goals are general statements describing the NHEP's 'vision' for the estuaries in 2005. **Objectives** state the steps needed to reach the goals. **Strategies** are specific actions that could or should be taken to achieve the objectives. This Appendix records all the ideas that were considered for inclusion in the *Management Plan*. Goals, objectives, and strategies are presented as either Key or Other.

Key Goals, Objectives, and Strategies are those that received a large number of votes at NHEP public meetings and/or were deemed critical by the NHEP Management Committee and project team members. **Other Goals, Objectives, and Strategies** represent ideas that were considered, but did not receive a high number of votes at public meetings and/or were not deemed critical by the NHEP Management Committee and team members. The Action Plans included in the main body of the *Management Plan* were developed from the Key Strategies. The Key Objectives are those which will be used to measure the effectiveness of the Action Plans. To see the list of Key Goals, Objectives, and Strategies, see pp. 3-7 to 3-17. The Other Goals, Objectives, and Strategies are included in this appendix and may be reviewed and incorporated at the time of the 5-year *Management Plan* evaluation.

WATER QUALITY GOALS, OBJECTIVES AND STRATEGIES

KEY GOAL A

Ensure the New Hampshire estuarine waters and tributaries meet standards for pathogenic bacteria, including fecal coliform, *E. coli*, and Enterococci:

Key Objective A1

Achieve water quality in Great Bay and Hampton Harbor that meet shellfish harvest standards (14 counts of fecal coliform/100 ml) by 2010.

Key Objective A2

Minimize beach closures due to failure to meet water quality standards for tidal waters (Enterococci levels not exceeding 104 counts/100 ml. in any one sample).

Key Objective A3

Increase water bodies in the NH coastal watershed designated 'swimmable' by achieving state water quality standards (E. coli levels not exceeding 406 counts/100 ml in any one sample. For designated beaches, E. coli should not exceed 88 counts/100 ml).

Key Objective A4

Reduce the number of known illicit connections in the NH coastal watershed by 50% by 2010.

Key Objective A5

Achieve 50% reduction of known illegal discharges into Great Bay, Hampton Harbor and the tributaries by 2010.

KEY GOAL B

Ensure that New Hampshire estuarine waters, tributaries, sediments, and edible portions of fish, shellfish, other aquatic life, and wildlife meet standards for priority contaminants such as, metals, PCBs, PAHs. And oil and grease.

Key Objective B1

Develop baseline of toxic impacts on ecological and human health by tracking toxic contaminants in water, sediment, and indicator species: blue mussels (Gulfwatch); tomcod, lobsters and winter flounder (Coastal 2000).

Long-term:

Reduce toxic contaminants levels in water, sediment and indicator species so that no levels persist or accumulate according to:

- FDA guideline levels
- State water standards in Env-Ws 1700
- Sediment levels below ER-M levels

For copies of specific standards, see the following references:

FDA guidelines:

"Action Levels, Tolerances and Other Values for Poisonous or Deleterious Substances in Seafood," found at www.issc.org. Look under NSSP Program, "Guide for the Control of Molluscan Shellfish", "Guidance Documents Chpt.4."

Env-Ws 1700:

Found at www.des.state.nh.us. Look under "Administrative Rules."

Sediment ER-M levels:

NOAA. 1989. Standard Analytical Procedures of the NOAA National Analytical Facility. NOAA Tech. Mem. NMFS F/NWC-92, 1986-89. National Status and Trends Program, National Oceanic and Atmospheric Administration, NOAA N/OM32, 11400 Rockville Pike, Rockville, MD 20852. 2nd ed.

Other Objective B2

No levels that are injurious or inimical to plants, animals, humans, or aquatic life.

KEY GOAL C

Ensure the New Hampshire estuarine waters and tributaries meet standards for organic and inorganic nutrients, specifically nitrogen, phosphorous, chlorophyll A (freshwater), dissolved oxygen, and biological oxygen demand (BOD):

Key Objective C1

Maintain inorganic nutrients, nitrogen, phosphorous and chlorophyll a in Great Bay, Hampton Harbor and their tributaries at 1998-2000 NERR baseline levels.

Key Objective C2

Maintain organic nutrients in Great Bay, Hampton Harbor and their tributaries at 1994-1996 NERR baseline levels.

Key Objective C3

Maintain dissolved oxygen levels at:

> 4 mg/L for tidal rivers
> 6 mg/L for embayments (Great Bay and Little Bay)
> 7 mg/L for oceanic areas (Hampton Harbor and Atlantic Coast)

Key Objective C4

Maintain NPDES permit levels for BOD at wastewater facilities in the NH coastal watershed.

Other Objective C5: Nitrogen

Total Kjeidal Nitrogen (TKN):	No increase
Nitrate Nitrogen:	No increase
Ammonia nitrogen:	Freshwater acute: 23.84 mg/l
	Freshwater chronic: 2.05 mg/l
Nitrate:	Water and fish ingestion: 10 mg/l

Other Objective C6: Phosphorus

Total phosphorus - No increase
No discharge that would encourage eutrophication

Other Objective C7: Chlorophyll a (freshwater)

Greater than 30mg/L: Does not support swimming
Between 20 and 30 mg/L: Partially supports swimming

Other Objective C8: Dissolved oxygen

Should exceed 75% as an indicator of biological activity

Other Objective C9: Biological Oxygen Demand, or BOD (localized)

No increase

OTHER GOAL D

Ensure that New Hampshire's estuarine waters and tributaries will exhibit no further degradation in any aspect of water quality:

Other Objective D: Recreation

Water quality should be suitable for fishing, swimming, and other recreational uses.

Other Objective D2: Aquatic Life

Water quality should be suitable for aquatic life. Use indicators for: aquatic insects/invertebrates, wildlife, fish, diatoms and algae, large bivalves, eelgrass, marshes

Other Objective D3: Disease-causing agents

Viruses, harmful algal blooms

Other Objective D4: Physical Characteristics

No settling of harmful deposits
No floating foam, scum, oil, etc.
No pollutants that result in the dominance of nuisance species
No objectionable odors
No increase in debris

Other Objective D5: Disposal of Untreated Sewage or Waste

Other Objective D6: Water Clarity

Turbidity not to exceed naturally occurring conditions by more than 10 NTUs
Total suspended solids (measured in mg/L)

Other Objective D7: Sediment

Reduce the amount of human-caused sediment entering the estuaries and associated tributaries.

- Institute land use practices that reduce erosion and sedimentation
- Use agricultural best management practices
- Use best management practices at construction sites

- Reduce road sand entering the estuary
- Reduce sediments entering through road culverts
- Create and enforce “no wake” zones in susceptible areas

Other Objective D8: Water Quantity (localized problem)

- Avoid over pumping of aquifers
- Reduce withdrawal of water from the Oyster and Lamprey Rivers
- Encourage water conservation

STRATEGIES FOR SPECIFIC POLLUTION SOURCES

WASTEWATER TREATMENT PLANT ROUTINE DISCHARGE
(sanitary and industrial waste)

Key Strategies

VOTES	STRATEGY
9	Use secondary and tertiary wastewater treatment with the possibility of wetlands being employed in the effort.
1	Investigate alternatives to chlorine in wastewater post-treatment.

Other Strategies

VOTES	STRATEGY
4	Reduce allowable levels of industrial contaminants regulated by the NPDES permits.
3	Promote water conservation and pollution prevention.
3	Reduce WWTF discharge to the lowest practical level/volume.
1	Conduct education programs for the operators.
0	Consider combining the outflow from some/all WWTFs for discharge father offshore.
0	Implement water quality monitoring downstream of WWTFs as a permit condition.

ILLICIT CONNECTION PROBLEMS IN URBAN AREAS

Key Strategies

VOTES	STRATEGY
—	Review the current plan to eliminate illicit connections in urban areas. Develop a plan for cities and towns to monitor storm drainage systems for illicit connections.
—	Develop a plan to map out infrastructure systems (sewer and stormwater drainage) for each coastal community.
—	Eliminate illicit connections in coastal communities.

ILLEGAL DIRECT DISCHARGES

Key Strategies

VOTES	STRATEGY
7	Conduct sanitary surveys in shellfish growing areas, and shoreline surveys in non-growing areas.
5	Establish a locally-based (conservation commissions, health officers, etc.) program for reporting illegal discharges into surface waters.
4	Provide incentives to fix/eliminate illegal direct discharges such as grey water pipes, failing septic systems, and agricultural runoff.
1	Find funding sources for key strategies.

Other Strategies

VOTES	STRATEGY
1	Enforce current laws to eliminate discharges, especially fines.

STORMWATER

Key Strategies

VOTES	STRATEGY
9	At the planning board/development stage, ensure that post-development runoff does not exceed pre-development runoff for new development.
6	Research the most effective means of treating and reducing the volume of stormwater before it discharges to surface water, especially in urban areas.
5	Develop a plan to encourage the development and use of innovative stormwater Best Management Practices technologies.
5	Develop and implement a plan to educate users of the *Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire*. Work with the Department of Environmental Services to review the current level of enforcement of erosion and sedimentation Best Management Practices use and determine if additional resources are necessary.

Other Strategies

VOTES	STRATEGY
3	Preserve wetlands in their natural state to maintain their filtering and absorption functions.
1	Develop a program that encourages the reporting of violations by citizens.
1	Preserve or replant shoreland buffers to protect water quality.
0	Enforce erosion and sedimentation controls at construction sites.
0	Enforce erosion and sedimentation controls during forestry harvesting.
0	Encourage the implementation of agricultural best management practices.
0	Establish and enforce “pooper scooper” laws.
0	Reduce the pesticides and herbicides that run off into the water courses.

WASTEWATER TREATMENT PLANT OVERLOADING IN STORM EVENTS (including pump station overflows and CSOs)

Key Strategies

VOTES	STRATEGY
9	Alleviate bacterial pollution from hydraulic overloading of wastewater treatment plants

Other Strategies

VOTES	STRATEGY
5	Investigate alternative treatment techniques.
0	Add storage into waste treatment systems (pipes, ponds, lagoons, etc.).

PERMITTED DIRECT DISCHARGES

Key Strategies

VOTES	STRATEGY
—	Restructure industrial discharge permit criteria in response to new processing technology. Re-evaluate existing permits.

Other Strategies

VOTES	STRATEGY
14	Implement incentive for toxicity and BOD loading reductions by requiring high permit fees relating to pollutant load.
8	Reduce allowable permit levels in compliance with the Clean Water Act.
1	Support stronger enforcement of NPDES discharge violations.
0	Increase the monitoring of NPDES discharges.
0	Support a non-profit organization to publish a “Good, Bad, and Ugly” list of dischargers.
0	Consider third party monitoring of NPDES discharges.

PREVENTING AND CLEANING OIL SPILLS

Key Strategies

VOTES	STRATEGY
8	Support oil spills response activities
—	Enhance oil spills clean up efforts through pre-deployment infrastructure and development of high speed current barriers.

PREVENTING AND CLEANING OIL SPILLS (continued)

Other Strategies

VOTES	STRATEGY
5	Encourage oil recycling at transfer stations.
5	Support on-going marina education and BMPs.
4	Support the Gulfwatch program.
1	Monitor/prevent intentional dumping of oil.
1	Ensure standard for ships.
0	Support the Piscataqua River Cooperative.
0	Review and improve, where necessary, the NH certified pilot and mooring attendant training.
0	Encourage storm drain stenciling.
0	Prevent highway spills.
0	Support the development of innovative remediation technologies.
—	Support outreach efforts to educate residential oil users of best management practices.

SEPTIC SYSTEMS

Key Strategies

VOTES	STRATEGY
8	Encourage the use of innovative/alternative technologies for septic systems to help improve water quality.
6	Provide information to citizens of the coastal watershed related to septic systems.

Other Strategies

VOTES	STRATEGY
6	Upgrade all systems to code when a home/business is bought/sold.
5	Institute a grant program or low interest loan to repair or replace failed systems.
4	Train health officers to identify failed systems.
1	Increase the septic system setback from surface water.
0	Monitor old, unused systems.

ATMOSPHERIC DEPOSITION

Key Strategies

VOTES	STRATEGY
8	Reduce deposition of atmospheric pollutants through eliminating loopholes in current laws, encouraging the construction of more efficient power plants, and encouraging energy conservation.

Other Strategies

VOTES	STRATEGY
10	Increase public transportation.
6	Encourage better standards/statewide testing of vehicle emissions.
4	Support advocacy efforts.
3	Support the construction of additional Park 'n Rides.
2	Reduce emissions from 2-cycle engines, particularly boat motors.
0	Reduce emissions from diesel engines.
0	Develop and promote the use of bike paths.
0	Recycle batteries (mercury).

OTHER POLLUTION SOURCES TO CONSIDER

VOTES	STRATEGY
6	Dredging
4	Landfill leachate
3	Dam breaching/removal
2	Automobiles (exhaust and leaks)
2	Boat waste/ballast water/bilge water
2	Cumulative effects
1	Naval shipyard and other superfund sites
0	Automobile repair facilities
0	Hospitals (incinerators)
0	Transformers

SHELLFISH GOALS, OBJECTIVES, AND STRATEGIES

KEY GOAL A

Triple the acreage of open shellfish beds (to 75% of all beds) and triple the number of harvestable clams and oysters in New Hampshire's estuaries.

Key Objective A1:

Maintain an approved National Shellfish Sanitation Program supported by the State.

Key Objective A2:

Increase acreage of shellfish beds in Great Bay, Little Bay, and Hampton Harbor that are open for harvest to 2500 acres by 2010.

Soft-shell Clams

Hampton-Seabrook Estuary	Now	2005	
Total acres	242	242	
Acres classified	110	242	
Acres "approved"	60	200	
Harvestable clams (bushels)	4,800	14,400	

Little Harbor and Back Channel	Now	2005	
Total acres	400	400	
Acres classified	100	400	
Acres "approved"	0	200	(seasonal)
Harvestable clams (bushels)	0	1000	

Great Bay Estuary and Tributaries	Now	2005	
Total acres	2,725	2,725	
Acres classified	1,200	2,725	
Acres "approved"	700	2,100	
Harvestable clams (bushels)	2,800	8,400	

Rye Harbor	Now	2005	
Total acres	2	2	
Acres classified	2	2	
Acres "approved"	0	2	(seasonal)
Harvestable clams (bushels)	0	100	

TOTAL SOFT-SHELL CLAMS (all areas)	Now	2005
Total acres	3,369	3,369
Acres classified	1,412	3,369
Acres "approved"	760	2,502
Harvestable clams (bushels)	7,600	23,900

Eastern Oysters

Great Bay Estuary and Tributaries	Now	2005
Total acres	66.7	100
Acres classified	47.9	100
Acres 'approved'	47.9	75
Bushels of harvestable oysters	50,000	150,000

Key Objective A3: Shellfish Acreage

No net decrease in acreage of oyster beds from 1997 amounts for Nannie Island, Woodman Point, Piscataqua River, Adams Point, Oyster Squamscott and Bellamy Rivers.

Nannie Island/Woodman Point	43.9 acres
Piscataqua River	12.8 acres
Adams Point	4.0 acres
Oyster River	1.8 acres
Squamscott River	1.7 acres
Bellamy River	1.5 acres

Key Objective A4:Shellfish density

A) Oysters: No net decrease in oysters (>80 mm) / square meter from 1997 amounts at Nannie Island, Woodman Point, Piscataqua River, Adams Point, and Oyster River.

Nannie Island	50/sq meter
Woodman Point	63/sq meter
Piscataqua River	20/sq meter
Adams Point	38/sq meter
Oyster River	20/sq meter

B) Clams: No net decrease in adult clams (>50 mm) / square meter from the 1989-1999 10-year average at Common Island, Hampton River, and Middle Ground.

Common Island	6.9/sq meter
Hampton River	4.41/sq meter
Middle Ground	14/sq meter

Key Objective A5: Shellfish Assessment

Survey each major oyster and soft-shell clam bed at a minimum of every 3 years for dimensions, density and population structure.

Key Strategies

VOTES	STRATEGY
8	Identify sources of and reduce or eliminate contaminants in the New Hampshire Estuaries watersheds (See Water Quality Goals for New Hampshire's Estuaries.)
6	Create a coordinated, effective shellfish program and continue the multi-agency partnership for monitoring and classifying water quality in shellfish beds ■ Review and consider opening additional shellfish beds under specific conditions ■ Review and consider revising conditions under which open beds are temporarily closed (e.g., amounts of rainfall)
6	Devise and implement a shellfish habitat protection plan, and, for those habitats determined to be degraded, a restoration and enhancement plan.
4	Institute land use practices in the New Hampshire estuaries watersheds that improve water quality and shellfish habitat in the estuaries (See "Land Use Goals for New Hampshire's Estuaries").
2	Enhance the amount and reliability of funding for the strategies and actions to increase the acreage of open shellfish beds.
2	Devise and implement a plan to decrease mortality and increase productivity: ■ Remove flow restrictions that negatively impact salinity and temperature ■ Institute increased settlement rate strategies ■ Increase implementation of poaching penalties (court) ■ Encourage the recreational harvesting of mature beds ■ Institute predator protection strategies ■ Explore other recreational harvest methods ■ Research the possibility of a management program based on shellfish size.
1	Continue and expand population and spatial assessments to develop date and indices. Re: the presence, abundance, and diversity of species.

Other Strategies

VOTES	STRATEGY
0	Devise and implement a coordinated information/educational campaign that: ■ Promotes the value of shellfish species and shellfish associated communities as indicators of water quality (e.g., blue mussels, razor clams, ribbed mussels, other shellfish species). ■ Provides information regarding how shellfish communities contribute to creating desired water quality (see "Water Quality Goals for New Hampshire's Estuaries"). ■ Provides information regarding public access to shellfish beds through the distribution of maps/booklets to eliminate confusion and unnecessary destruction of beds. ■ Provides outreach to show proper digging techniques.

KEY GOAL B

Assure that shellfish are fit for human consumption support a healthy marine ecosystem. (Note: Several strategies for Goal A are also applicable to Goal B.)

Key Objective B1:

Achieve water quality in Great Bay and Hampton Harbor that will meet shellfish harvest standards by 2010.

Key Strategies

VOTES	STRATEGY
4	Regularly collect and monitor water quality to identify sources and reduce or eliminate contaminants.
—	Periodically collect and monitor shellfish tissue samples as appropriate for toxins and biotoxins.

Other Strategies

VOTES	STRATEGY
0	Determine and apply standards and measures for health, growth rates, and productivity of selected shellfish species (considering natural fluctuations).
0	Consider a plan for establishing a relay process (moving contaminated shellfish to clean water in the estuary for a period) as a means of harvesting shellfish in contaminated areas.

KEY GOAL C

Provide opportunities and strategies for restoration of shellfish communities and habitat.

Key Objective C1:

Restore 20 acres of oyster habitat in Great Bay and its tidal tributaries.

KEY GOAL D

Support coordination to achieve environmentally sound shellfish aquaculture activities.

Key Objective D1:

Ensure that aquaculture practices do not adversely impact water quality or ecological health of NH's estuaries.

Key Strategies

VOTES	STRATEGY
4	Bring the shellfish program to FDA commercial compliance standards.
3	Evaluate publicly perceived institutional barriers to aquaculture and promote environmentally sound aquaculture practices.

Other Strategies

VOTES	STRATEGY
5	Restore populations of oysters in the tributaries if/where feasible.
3	Introduce ribbed mussels to restored salt marshes.
1	Consider various species (e.g., Belon oysters, surf clams, scallops, quahogs) as commercial aquaculture possibilities and conduct population and spatial assessments and/or habitat suitability assessments for these species.
1	Introduce seed to increase population densities.
0	Protect natives species and allow introduction of disease-resistant strains of native species (within the state rules for the importation of non-native species). [NOTE: May already be addressed by State/Federal regulation.]

LAND USE AND HABITAT PROTECTION GOALS, OBJECTIVES, AND STRATEGIES

KEY GOAL A

The New Hampshire coastal watershed has development patterns that ensure the protection of estuarine water quality and preserve the rural quality of the watershed.

Key Objective A1

Minimize the amount, and water quality effects, of impervious surfaces:

1) Keep the total impervious surface in each subwatershed below 10% of the total land area, and
2) Reduce runoff in all subwatersheds, especially where impervious surfaces already exceed 10% (Note: the 10% threshold is based on best available information, but may need to be researched/revised for application in New Hampshire).

Key Strategies

VOTES	STRATEGY
10	Create an effective and enforceable watershed-wide intermunicipal agreement re: impervious surface lot coverage. a) Gather information using appropriate "buildout" analyses, to include the following steps: ■ Define and delineate subwatersheds ■ Sample lot coverage by land use categories to determine realistic estimates for actual impervious surface coverage. ■ Project maximum land use buildout by land use category for each subwatershed, (after removing from consideration unbuildable areas [wetland, protected lands, etc.]). ■ Create a database that indicates minimum required percentage of green space by zoning district ■ Apply regulatory lot coverage (zoning) standards to maximum possible land use in each subwatershed to determine worst case impervious surface percentage. ■ Apply current land use lot coverage estimates to maximum possible land use in each subwatershed to determine likely total impervious area percentage after buildout. b) Use results of buildout analysis [from a)] to develop an intermunicipal agreement to control impervious surface lot coverage
9	Apply best management practices (as contained in the publication *Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire*), and utilize innovative design, to minimize the impact of non-point sources of stormwater (e.g., parking lots). ■ Update and adopt best management practices ■ Use building standards to improve mitigation of runoff [quantity and quality] within new development sites (e.g., drainage ponds on site) ■ Reduce the quantity/improve quality of runoff in existing developed areas

Other Strategies

VOTES	STRATEGY
1	Maximize the use of existing maintained road frontage
0	Consider controlling the width of new roads where possible to reduce impervious cover

Key Objective A2

Minimize the total rate of land consumption in each of the NH coastal watershed (as measured by acres of developed land per capita).

Key Objective A3

Encourage 43 coastal watershed municipalities to actively participate in addressing sprawl.

Key Strategies

VOTES	STRATEGY
—	Work closely with the State committee focusing on limiting sprawl
13	Pursue results-oriented land protection and conservation programs for lands identified in previous prioritization efforts (e.g., Great Bay Partnership, Regional Environmental Planning Program, NHEP Critical Lands Mapping, Society for the Protection of New Hampshire Forests Coastal Initiative).
11	In zoning ordinances for commercial/industrial planning and development encourage increased density/intensity of development in already developed areas: ■ Create an effective transfer development rights (TDR) system in the estuarine watersheds that will help facilitate more concentration of growth in urban areas and land protection in rural areas. ■ Encourage the use of existing sites and buildings wherever possible rather than creating new ones ■ Remove barriers and provide other incentives to increase density of development
9	Protect current use law
6	In zoning ordinances for residential planning and development: ■ Use cluster development wherever appropriate and possible ■ Reduce or eliminate requirements and incentives for low density development
6	Focus new development in areas where infrastructure (water, sewer, and transportation) already exists while preserving urban greenspace and overall “livability.”
1	Concentrate new infrastructure development in targeted growth zones ■ Designate areas for growth
—	Encourage towns to return 100% of current use change tax to conservation commissions
—	Conduct a study of historic population growth vs. growth of impervious surfaces

Other Strategies

VOTES	STRATEGY
3	Develop tools for growth control based on scientific analysis
3	Promote the concept that preserving/acquiring open space has a positive impact on economic development.
2	Promote village development in rural areas that are experiencing growth
1	Develop population projections for each coastal New Hampshire watershed
0	Maximize the use of existing maintained road frontage
0	Develop a measurement or indicator of sprawl (such as calculating the current acres of developed land per capita on a town by town basis, if feasible)
0	Consider the impact of rail corridor development/redevelopment on land consumption in the watersheds

KEY GOAL B

Maximize the acreage and health of tidal wetlands in the New Hampshire coastal watershed.

Key Objective B1

Allow no loss or degradation of 6200 acres of tidal wetlands in the NH coastal watershed and restore 300 acres of tidal wetlands degraded by tidal restrictions by 2010.

Key Strategies

VOTES	STRATEGY
12	Complete rule-making for and begin implementation of the New Hampshire wetlands mitigation policy entitled "A Recommended New Hampshire Wetland Mitigation Policy for NH DES by the Audubon Society of NH and the Steering Committee on Wetlands Mitigation." ■ Any impairment to tidal wetlands functions should be mitigated. ■ Consider including the acquisition of buffers as mitigation. ■ Cumulative and secondary impacts should be considered in determining the need for mitigation. ■ Required mitigation projects should be monitored for completion.
11	Strengthen and consistently enforce the State tidal buffer zone.
10	Reduce the quantity, improve the quality, and regulate the timing of stormwater flow into tidal wetlands.
8	Delineate and evaluate all tidal wetlands using the Coastal Wetlands Method.

Other Strategies

VOTES	STRATEGY
11	Protect, using all appropriate conservation techniques, tidal wetlands and buffer areas (e.g., conservation easements).
1	Assist planning boards and conservation commissions in exchanging information and developing inter-municipal agreements regarding shared tidal wetlands.

KEY GOAL C

Protect freshwater and tidal shorelands to ensure estuarine water quality.

Objective C1

Allow no new impervious surfaces or major disturbances of existing vegetation (except for water-dependent uses) in NH coastal watershed. In addition to state Shoreland Protection Act regulations, encourage additional reductions of shoreland impacts by 2010.

Non-urban, freshwater areas: establish a buffer of 100 feet from surface waters, or the width of the 100 yr. floodplain, whichever is more restrictive.

Note: 1) The state Comprehensive Shoreland Protection Act calls for a 150 foot buffer, but allows some cutting of vegetation. This Objective calls for 100 foot water quality buffer with no cutting of vegetation.

2) To preserve wildlife habitat, wider buffers are desirable.

Urban, freshwater areas: establish a buffer of sufficient width to result in no negative water quality impacts. Buffer zones of natural vegetation are recommended; engineered solutions that produce equivalent water-quality results are also acceptable.

Non-urban, tidal areas: establish a buffer of 300 feet from tidal waters at high tide or within the 100 year floodplain, whichever is more restrictive.

Urban, tidal areas: establish a buffer of 100 feet from tidal waters at high tide (or an engineered solution that produces equivalent water quality results).

Note: The state Comprehensive Shoreland Protection Act calls for a 150 foot buffer, but allows some cutting of vegetation. This Objective calls for 100 foot water quality buffer with no cutting of vegetation.

Key Strategies

VOTES	STRATEGY
17	Encourage and assist each community to develop and adopt zoning regulations to create undisturbed shoreland buffers, including buffers for smaller order streams (May want to use Office of State Planning model ordinance and/or Office of State Planning's buffers guide entitled *Buffers for Wetlands and Surface Waters: A Guidebook for NH Communities*).

12	Establish and maintain natural buffers rather than engineered solutions to achieve desired water quality.
8	Investigate tax incentives to encourage buffers.
6	Strengthen the Comprehensive Shoreland Protection Act (RSA 483-B).
6	Provide a framework that helps each community define and delineate urban and non-urban areas.
6	Protect, using all appropriate conservation and land protection techniques, shorelands and buffers.
3	Improve and facilitate the code enforcement process by: ■ Provide funding for additional training and reporting for coastal issues ■ Make the code enforcement process simpler ■ Promoting consistent enforcement by code enforcement officers
—	Provide information about the benefits of using natural buffers rather than engineered solutions to achieve desired water quality.
—	In urban areas, pursue engineered solutions that produce water quality results equivalent to vegetated buffers.

Other Strategies

VOTES	STRATEGY
5	Issue a moratorium on new impervious surfaces adjacent to surface waters.

Key Objective C2

Allow no new establishment or expansion of existing contamination sources (such as salt storage, junk yards, solid waste, hazardous waste, etc.) within the shoreland protection area as tracked by the Department of Environmental Services.

Key Strategies

VOTES	STRATEGY
—	Enforce the 250-foot setback
—	Educate and inform code enforcement officers
—	Provide incentives for the relocation of grandfathered uses
—	Encourage and assist in the development of land use codes to protect water quality

KEY GOAL D

Protect estuarine water quality by ensuring that groundwater impacts are minimized.

Key Objective D1

Determine the extent of groundwater resources and their contaminant load to Great Bay and Hampton Harbor by 2005.

Key Objective D2

Reduce and eliminate groundwater contaminants based on outcome of Objective 1 by 2010.

Key Strategies

VOTES	STRATEGY
—	Locate and quantify groundwater inflow to the estuaries
—	Locate and reduce or eliminate groundwater contaminants

KEY GOAL E

Allow no net loss of freshwater wetlands functions in the NH coastal watershed.

Key Objective E1

Determine indicators for freshwater wetland functions.

Key Objective E2

Establish state and municipal regulatory framework necessary to prevent introduction of untreated stormwater into tidal and freshwater wetlands by 2010.

Key Objective E3

Increase use of buffers around wetlands in NH coastal watershed

Key Strategies

VOTES	STRATEGY
15	Complete rule-making for and begin implementation of the New Hampshire wetlands mitigation policy entitled *A Recommended New Hampshire Wetland Mitigation Policy for NH DES by the Audubon Society of NH and the Steering Committee on Wetlands Mitigation:* ■ Any impairment to freshwater wetlands functions should be mitigated. ■ Consider including the acquisition of buffers as mitigation. ■ Cumulative and secondary impacts should be considered in determining the need for mitigation. ■ Required mitigation projects should be monitored for completion.
15	Encourage all communities to designate Prime Wetlands in accordance with RSA 482-A:15 and create 100 foot buffers around them, or encourage the creation and enforcement of municipal policies that achieve the same goal of protecting prime wetlands. ■ Encourage and assist all communities in evaluating and categorizing their freshwater wetlands.
8	Encourage and assist all communities to adopt buffer requirements for all freshwater wetlands commensurate with the functions that they are trying to protect.
6	Protect, using all appropriate land conservation techniques, freshwater wetlands and buffers.

Other Strategies

VOTES	STRATEGY
1	Provide educational materials and training to code enforcement officers.
0	Encourage towns to make use of the Rockingham County Conservation District's inexpensive wetlands delineations for building lots, and encourage Strafford County to develop a similar program.

KEY GOAL F

Maintain adequate habitats of sufficient size and quality to support populations of naturally occurring plants, animals, and communities.

Key Objective F1

Determine existing acres of permanently protected land in the NH coastal watershed in the following categories: tidal shoreland, large contiguous forest blocks, wetlands with high habitat values, freshwater shorelands, rare and exemplary natural communities, by 2005.

Key Objective F2

Increase acreage of protected land containing significant habitats in the NH coastal watershed, through fee acquisition or conservation easements by 2010.

Key Strategies

VOTES	STRATEGY
13	Support implementation of state and federal land protection programs (e.g., Land and Community Heritage Program, US F&W's Teaming With Wildlife Program, Land and Water Conservation Fund).
8	Support efforts of Great Bay Resource Protection Partnership.
7	Implement protection of priority lands identified in TNC conservation plan for the Great Bay region and the Great Bay Resource Partnership Habitat Protection Plan.
6	Encourage towns to return 100% of current use change tax to conservation commissions for the purposes of protection, acquisition, easements, restoration.
6	Provide incentives for land protection (through easement, sale, or donation) by private landowners.
4	Support land conservation efforts in shoreland areas.
4	Overall Land Management Group/Plan
3	Provide technical assistance to regional land trusts and municipal conservation commissions.
2	Support towns, etc., in creating conservation trusts for designated land (ie, make sure land is used for purpose designated).
1	Identify priority wetlands for protection.
1	Encourage towns to use timber tax revenues to purchase town forest land.

1	Citizen Involvement
—	Establish guidelines for the management of biodiversity on conservation lands.
—	Implement biodiversity management guidelines on two conservation tracts per year.

Key Objective F3

Support completion of state biomonitoring standards and increase the miles of rivers and streams meeting those standards by 2010.

Key Strategies

VOTES	STRATEGY
11	Use results of biomonitoring and water quality monitoring to prioritize watershed areas for protection and remediation.
4	Develop and encourage use of biomonitoring standards and water quality monitoring to evaluate water quality.
8	Provide a plan to towns for dealing with cumulative impacts.
7	Setbacks/buffers
6	Encourage municipalities to consider cumulative impacts on water quality when making land use decisions within local watersheds.
4	Education re: biomonitoring
1	Ensure pesticide use does not damage habitat (state law).

Key Objective F4

Increase use of buffers around wildlife areas and maintaining contiguous habitat blocks in the NH coastal watershed by 2010.

Key Strategies

VOTES	STRATEGY
18	Encourage municipalities to incorporate wildlife habitat protection into local master plans.
14	Encourage zoning that maintains contiguous habitat blocks.
13	Encourage increased extent of buffers around important wildlife areas.
8	Provide assistance to regional planning commissions and municipalities in identification and analysis of important habitats.
6	Encourage and assist all communities to adopt buffer requirements for all freshwater wetlands and vernal pools commensurate with the functions that they are trying to protect.
6	Establish greenways (eg, Britain); fed & state laws.
3	Prevent urban sprawl by having comm/industrial zoning ordinances encourage increased density/intensity and mixed use of development in already developed areas.

3	Prevent urban sprawl by concentrating new infrastructure development in targeted growth zones.
3	Encourage and assist each community to develop and adopt zoning regulations to create undisturbed shoreland buffers, including buffers for smaller order streams.
2	Prevent urban sprawl by having residential zoning ordinances use cluster development wherever appropriate and possible, and reduce or eliminate requirements and incentives for low density development.
2	Prevent urban sprawl by focusing new development in areas where infrastructure (water, sewer, and transportation) already exists while preserving urban greenspace and overall "livability."
2	Encourage all communities to evaluate and designate Prime Wetlands in accordance with RSA 482-A:15 and create 100 foot buffers around them, or encourage the creation and enforcement of municipal policies that achieve the same goal of protecting prime wetlands.
2	Investigate tax incentives to encourage buffers.

Other Objective F5

Through voluntary measures, increase acreage of privately owned lands managed to benefit wildlife and natural communities.

Key Strategies

VOTES	STRATEGY
14	Maintain Current Use Program
6	Encourage conservation easements

Other Strategies

VOTES	STRATEGY
11	Provide private landowners with technical assistance and training on ways to benefit native wildlife and natural communities through land management activities. Include removal of invasive species.
6	Provide incentives for landowners to benefit native wildlife and natural communities through land management activities (e.g., tax incentives).
3	Apply moneys from the "Current Use" program penalty tax for natural resource management.
2	Ideas for smaller tracts, including cooperative efforts.
1	Involve young people.

OTHER GOAL G

Protect current and future water supply aquifers

OTHER GOAL H

Protect the aesthetic values of the estuaries by preserving the important views from both land and water.

HABITAT RESTORATION
GOALS, OBJECTIVES, AND STRATEGIES

KEY GOAL A

Maintain habitats of sufficient size and quality to support populations of naturally occurring plants, animals, and communities.

Key Objective A1

Increase the acreage of restored estuarine habitats by 2010.

Salt marsh: Restore 300 acres of salt marsh with tidal restrictions.

Eelgrass: Restore 50 acres of eelgrass in Portsmouth Harbor, Little Bay, and the Piscataqua, Bellamy and Oyster rivers.

Shellfish habitat: Restore 20 acres of oyster habitat in Great Bay and the tidal tributaries.

Key Strategies

VOTES	STRATEGY
13	Identify, via the Coastal Wetlands Method and observation, and restore additional restorable tidal wetlands (including tidal freshwater wetlands).
9	Continue to restore the restorable tidal wetlands listed in the Natural Resource Conservation Service's "Evaluation of Restorable Wetlands" (including tidal freshwater wetlands).
3	Identify other habitat areas that are important to restore (eg., upland, etc.).
7	Encourage state and federal agencies to provide technical and financial assistance for salt marsh restoration.
7	Encourage adoption in state law of a state mitigation policy that places high priority on restoration projects.
7	Pursue salt marsh restoration funding from the Department of Transportation (via regional transportation authorities), the Natural Resources Conservation Service, and other sources
3	Identify and implement opportunities for eelgrass restoration.
3	Improve anadromous fish access
2	Encourage state and federal agencies to provide technical and financial assistance for eelgrass restoration.
0	Provide information to and develop long-term agreements with the New Hampshire Department of Transportation and other State agencies re: available salt marsh mitigation projects.

Other Objective A2

Restore all restorable tidal wetlands in New Hampshire.

Key Strategies

VOTES	STRATEGY
17	Continue to restore the restorable tidal wetlands listed in the *Natural Resource Conservation Service's Evaluation of Restorable Wetlands* (including tidal freshwater wetlands).
12	Provide information to and develop long-term agreements with the New Hampshire Department of Transportation and other State agencies re: available mitigation projects.
3	Identify, via the Coastal Wetlands Method and observation, and restore additional restorable tidal wetlands (including tidal freshwater wetlands).
3	Pursue restoration funding from the Department of Transportation (via regional transportation authorities), the Natural Resources Conservation Service, and other sources.

Other Strategies

VOTES	STRATEGY
0	Use offsite and alternative mitigation where appropriate.

OUTREACH GOALS, OBJECTIVES, AND STRATEGIES

GOAL A

Communities, government agencies, organizations, and individuals are aware of the importance of, and participate actively in responsible use of, New Hampshire's estuaries.

Strategies

Focus on specific groups and constituencies (more than the public at large)

Focus on issues and spurring action more than general awareness

Take a positive solution-based approach

Emphasize success stories and hope

Make strategies friendly (e.g., shellfish demonstration projects)

Coordinate with other organizations to create widespread awareness of a variety of "key messages" related to New Hampshire's estuaries:

The overall need for environmental quality

- The estuaries as important resources
- Public ownership of and responsibility for the estuaries
- The current condition of the estuaries
- The necessity for a watershed approach to the estuaries
- Historical, artistic, and other connections to the estuaries
- The priority issues: shellfish, water quality, land use and habitat, and outreach as related goals contained in the New Hampshire Estuaries Project action plans

GOAL B

Communities, government agencies, organizations, and individuals participate actively in achieving shellfish-related goals for New Hampshire's estuaries.

Strategies

Work with the following constituencies to achieve shellfish-related goals:

- Recreational shellfishers
- State agencies
- Communities in which shellfish are located
  - – Selectmen and councilors
  - – Planning Boards
  - – Conservation Commissions
- Volunteers
- Educators
- Researchers/scientists
- Shoreline property owners

Provide additional educational materials with shellfishing licenses.

GOAL C

Communities, government agencies, organizations, and individuals participate actively in achieving water quality-related goals for New Hampshire's estuaries.

Strategies and Target Audiences for Addressing Specific Contamination Sources

Sources of Bacteria and Other Disease-causing Agents

Storm water/wastewater treatment plants overloading in storm events; combined sewer overflows, pump station overflows

- Children and youth (Educational activities for awareness)
- Conservation Commissions (Direct contact, Assn. of Conservation Commissions newsletter)
- Educators (Seminars, Workshops, Training, Community action)
- Elected officials (Direct contacts by NHEP Management Committee members; through shellfishers; through property-owners)
- Environmental groups (Direct contact, Newsletters)
- Planning Boards (Attend their meetings; Through Office of State Planning; Through Regional Planning Commission meetings)
- Public Works departments
- Shellfishers (Through license application process; Posters at shellfishing areas; Through "Clamline" 800 number; Through "Borderline Shellfish")
- Shoreline property owners (Via mail using NHEP data base; Newsletters; Through river associations; Newspaper)
- State agencies (Direct contacts by NHEP Management Committee members; Internet)
- Recreational users (Political support; Volunteer activities)
- University of New Hampshire (Have more organizations approach UNH re: point and non-point hazardous waste
- Waste water treatment plant operators [seven plants] (Direct contact; through professional associations; through NH Department of Environmental Services)

Animal Issues

- Livestock [cattle, horses, sheep, etc.]: One-on-one discussions with owners; Work through animal-control officers; NH Department of Agriculture, Markets, and Food; UNH Cooperative Extension; 4-H Clubs; Conservation Districts; Seminars; Literature; Conservation Commissions; NH Coalition for Sustaining Agriculture; Regulation (use sanitary survey data);
- Dogs: "Pooper-scooper" laws; Provide information via license process; Provide information via dog training classes; Animal control officers
- Pigeons/geese/ducks/ other birds: Get information to individuals who feed them inappropriately, e.g., via signage; NH Fish and Game; US Fish and Wildlife Service; Local communities
- Wildlife: NH Fish and Game; US Fish and Wildlife; Local communities; Animal-control officers
- Rats

Agriculture

Through Conservation Districts, NH Department of Agriculture, Markets, and Food, and UNH Cooperative Extension (encourage the use of "best management practices"); One-on-one discussions with farmers; Cooperative Extension; 4-H; Conservation Districts; Seminars; Literature; Conservation Commissions; NH Coalition for Sustaining Agriculture; Regulation (use sanitary survey data)

Illicit Connections in Urban Areas

- Local officials
- Public works departments
- Department of Environmental Services
- Installers/contractors via their licensing process

Septic Systems

- Property-Owners (Offer state support, e.g., SRLF)
- Commercial and business (Use database, include renters and lessees)
- Conservation Commissions (Direct contact; Assn of Conservation Commissions newsletter)
- Planning Boards (Attend their meetings; through Office of State Planning; Regional planning commission meetings)
- Local health officers
- State agencies (Direct contacts by NHEP Management Committee members; cooperate with their ongoing education programs; encourage enforcement through NH Department of Environmental Services
- Elected officials (Direct contacts by NHEP Management Committee members; through shellfishers, property-owners, riparian property owners
- Environmental groups (Direct contact, newsletters)
- Recreational users
- Zoning Boards of Adjustment
- Granite State Designers and Installers
- UNH Cooperative Extension/NH Department of Environmental Services (Use their materials for educational programs)
- Direct discharges (through local health officers, NPDES, state agencies, environmental/conservation groups, e.g., shoreline surveys)

Boat Waste

- Recreational users
- New Hampshire boaters (Through Propeller Club, Power Squadron, Marine Trades Association)
- Seven marinas/yacht clubs
- Charter boat operators
- Fishing boat operators
- Tourists (Through boat shows and boating magazines)
- Coast Guard
- Harbor Masters
- Port Authority
- State agencies (Direct contacts by NHEP Management Committee members; NH Department of Safety, NH Fish and Game)
- EPA (Clean Vessel Act)

Sources of Metals, PCBs, and PAHs

Stormwater, WWTF Routine Discharges, Pump Station Overflows, Combined Sewer Overflows

See outreach strategies above.

Atmospheric Deposition

- Department of Environmental Services Air Quality Division (Do more education; newsletter)
- Clean Water Action (doing air quality work)
- New Hampshire Lung Association

- Department of Transportation (Transportation study; Buses, trains)
- Fishing groups (Information at fishing sites; Mercury advisory)
- River associations
- Information via various licensing processes
- Media (Need tie-in to sources)

Landfill Leachate

- NH Department of Environmental Services
- Communities

Hospitals (mercury and dioxin)

- Hospital associations
- State agencies (permit process)

Automobiles and Automobile Repair Facilities

- EPA (program in the Air Division)

Metals in Existing Sediments

- Avoid resuspension due to human activity (e.g, dredging)
- Watch for resuspension due to change in river course, etc. (removal not practical)

Industrial contaminants released to sewage system

- Navy Yard (lead)
- EPA (currently working with Navy)

Boat yards/marinas (copper based paints)

- Great Bay Marine
- Other rail outhauls
- EPA voluntary program

Sources of Nutrients

Stormwater runoff, WWTF Overflows, Pump Station Overflows
WWTF Routine Discharges

Solution: tertiary treatment with citizen support and EPA funding
Illicit connections
Direct discharges
Septic systems
Fertilizers
Golf courses
ChemLawn, Bio-Spray, etc.
Use existing outreach outlets re: non-point pollution
Shoreland homeowners

Agriculture

Boat waste

Atmospheric deposition

Landfill leachate

GOAL D

Communities, government agencies, organizations, and individuals participate actively in achieving land use related goals for New Hampshire's estuaries.

Strategies

Work with the following constituencies to achieve land use goals

- Elected officials
- Planning boards
- Zoning Boards
- Conservation Commissions
- Department of Transportation
- Local highway departments
- Regional planning commissions
- Volunteers

Provide better specific information to towns
re: how development will affect water quality

- Impervious surfaces
- Siting criteria
- Use data from "Critical Lands Project" to provide specific town data

Outreach Strategies and Actions for Targeted Constituencies

Children and Youth

Desired actions/attitudes:

Be environmentally active
Appreciation for resource
Involved as volunteers

Strategies to create desired actions/attitudes:

Field trips
Newsletter for all watershed schools
Internet

Commercial and business Interests
(utility companies, fishing industry, shipping industry, tourism industry, developers)

Desired actions/attitudes:

Input to planning process
Understand and cooperate in *Management Plan*
Be environmentally active
Appreciation for resource
Report pollution sources
Light impact on resources (Sustainable practices)
Involved as volunteers
Voluntary careful shoreline development
Stewardship ("backyard" and political level)
Estuaries' connection to economic viability
Make their public outreach vehicles available

Strategies to create desired actions/attitudes:

Direct contact by Management Committee members
Work with local Chambers of Commerce to reach smaller businesses
Information/presentations at events, fairs, etc.
Targeted presentations
Education programs for developers

Conservation Commissions

Desired actions/attitudes:

Input to planning process
Understand and cooperate in *Management Plan*
Look at current rules for appropriateness
Create regulation where necessary
Promote enforcement of appropriate rules
land use planning and estuarine impact
Identification of local shellfish/living resources
Estuarine access
Give presentations on behalf of the NHEP

Strategies to create desired actions/attitudes:

Provide support
Provide education
Direct contact by Management Committee members

Educators

Desired actions/attitudes:

Input to planning process
Understand and cooperate in *Management Plan*
Understanding of watershed approach, connecting upland to estuaries
Understanding of non-point pollution
Land use issues and their relationship to water quality degradation

Strategies to create desired actions/attitudes:

Provide curriculum materials
Provide opportunities for estuarine education through the Coastal Education Initiative (NHCP)
Promote the estuaries as a laboratory for a variety of social and science topics
Field trips

Elected Officials

Desired actions/attitudes:

Input to planning process
Understand and cooperate in *Management Plan*
Provide funding
Look at current rules for appropriateness
Create regulation where necessary
Promote enforcement of appropriate rules
Land use planning and estuarine impact
Identification of local shellfish/living resources
Estuarine access
Economic development
Give presentations on behalf of the NHEP

Strategies to create desired actions/attitudes:

Educate elected officials and candidates
Direct contact by Management Committee members
Provide base-program analysis results and implications
Provide NHEP/GIS land use planning tools
Provide technical assistance expertise and funding
Provide "State of the Estuaries" report
Invite to all NHEP-sponsored events, conferences, and workshops
Letters to newspapers
Field trips

Environmental Groups

Desired actions/attitudes:

Input to planning process
Understand and cooperate in *Management Plan*
Non-point pollution impacts
Access issues
Land use impacts on water quality
Creation of information/resource networks
Partnership re: implementation of management initiatives
Volunteers for NHEP activities (e.g., data collection, appearances at public events, materials distribution, event coordination)
Invite to NHEP-sponsored activities

Strategies to create desired actions/attitudes:

Technical assistance
Presentations to the assembled membership
Newsletters

Planning Boards

Desired actions/attitudes:

Input to planning process
Understand and cooperate in *Management Plan*
Look at current rules for appropriateness
Create regulation where necessary
Promote enforcement of appropriate rules
Land use planning and estuarine impact
Identification of local shellfish/living resources
Estuarine access
Economic development
Give presentations on behalf of the NHEP

Strategies to create desired actions/attitudes:

Direct contact by Management Committee members
Field trips

Public at Large

Desired actions/attitudes:

Input to planning process
Understand and cooperate in *Management Plan*
Broad based name recognition for the NHEP
Report pollution sources
Be environmentally active
Appreciation for resource
Talk with neighbors
Involved as volunteers
Individual responsibility for water quality
Watershed approach:connecting upland to estuaries
Non-point pollution
Understand shellfish as an indicator or overall estuarine health

Strategies to create desired actions/attitudes:

Use television, radio, and print media
Letters to newspapers
Field trips
Issues oriented approach

Recreational Estuarine Resource Users

Desired actions/attitudes:

Input to planning process
Understand and cooperate in *Management Plan*
Report pollution sources
Speak up to businesses that cause contamination
Be environmentally active
Appreciation for resource
Light impact on resources
Involved as volunteers
Stewardship (backyard and political level)

Strategies to create desired actions/attitudes:

Provide training in how to approach polluters, etc.
Provide information re: the impact of pollution on their activities
Field trips
Letters to newspapers
Provide information and issue-specific signs at site of the recreational activity
Information in newsletters
Invitations to NHEP-sponsored activities

Boaters

Desired actions/attitudes:

Smaller motors
Boat waste

Strategies to create desired actions/attitudes:

Information at boat ramps, marinas, yacht clubs
Information at their association or yacht club meetings
Include information with registration materials

Finfishers

Desired actions/attitudes:

Catch and release
Smaller motors

Strategies to create desired actions/attitudes:

Information at boat ramps, popular shoreline fishing locations, tackle shops
Provide information through local angler groups

Shellfishers

Desired actions/attitudes:

Sustainable shellfish catch
Concern re: closures of beds/advocacy re: opening them

Strategies to create desired actions/attitudes:

Information at boat ramps, parking locations
Include information with registration materials

Regional Media

Desired actions/attitudes:

Input to planning process
Understand and cooperate in *Management Plan*
Appreciation for resource
Report pollution sources
Publicize NHEP issues, actions, etc.
Consulting help/advice re: how to get messages out

Strategies to create desired actions/attitudes:

Provide appealing, newsworthy material capable of engaging the media
Provide exciting material capable of engaging the public to the media
Field trips
Present solutions to water quality issues
Present shellfish as an indicator of overall estuarine health
Promote opportunities for public involvement
Invite to NHEP sponsored activities
Consulting help/advice re: how to get messages out

Shoreline Property Owners

Desired actions/attitudes:

Input to planning process
Voluntary careful shoreline development; retain shoreline vegetation
Create easements
Report pollution sources; speak up to businesses that cause contamination
Be environmentally active
Appreciation for resource
Talk with neighbors
Stewardship ("backyard" level and political level) and volunteer involvement
Non-point pollution impacts
Estuarine access issues
Land use impacts on water quality
Septic system maintenance

Strategies to create desired actions/attitudes:

Provide information re: the impact of environmental quality on property values
Provide training in how to approach polluters, etc.
Field trips
Direct mail and media insertions
Targeted public presentations
Invite to all NHEP sponsored events, conferences, and workshops.

State Agencies

Desired actions/attitudes:

Input to planning process
Understand and cooperate in *Management Plan*
Provide funding
Look at current rules for appropriateness; create regulation where necessary
Promote enforcement of appropriate rules
Land use planning and estuarine impact studies
Identification of shellfish/living resources
Estuarine access
Economic development
Presentations on behalf of the NHEP

Strategies to create desired actions/attitudes:

Direct contact by Management Committee members

Tourists

Desired actions/attitudes:

Appreciation for resource
Light impact on resources
Involved as volunteers

Strategies to create desired actions/attitudes:

Guided walks,Field trips
Signs, Brochures

COORDINATION WITH FEDERAL PROGRAMS

A4

The National Estuary Program (NEP) was established by Section 320 of the Clean Water Act. Purpose 7 under Section 320 directs all estuary projects to review federal assistance programs and federal development projects for consistency with the goals of their Comprehensive Conservation and Management Plan (CCMP). The *New Hampshire Estuaries Project Management Plan* is the NHEP's CCMP. The consistency review is an important tool to help states ensure that federal actions do not interfere with the objectives of the estuary project. This appendix summarizes the consistency review conducted for the NHEP, and proposes a process for conducting future consistency reviews.

Several similar review procedures already exist in the State of New Hampshire. Under Executive Order 12372 (issued by the Reagan Administration in 1982), state and local governments are to develop a coordination procedure to review federal programs before assistance decisions are made. Through a formal, centralized process, this process is designed to improve the level of oversight and review of federal actions by state and local governments. In addition, consistency review procedures are contained in the Coastal Zone Management Act and the non-point source provisions of the Clean Water Act. These programs provide authority for states to comment on federal actions that are inconsistent with state or local goals. Federal agencies must then work to resolve the issues or, in some cases, explain why the action should continue over the state or local objection.

Individual NEPs are directed to examine federal actions covered under Executive Order 12372 for consistency with the CCMP. The review should also include all programs listed in the most recent Catalog of Federal Domestic Assistance, regardless of whether or not they are included in the state's E.O. 12372 program. Lastly, other non-assistance federal actions (for example, permitting programs) may be included in the review insofar as they are addressed informally.

The Federal Consistency Review for the planning phase of the NHEP involved three parts: an inventory of programs and activities that could potentially affect the goals of the CCMP; an assessment of the inventory's programs and activities regarding their consistency with the provisions of the *NHEP Management Plan*; and development of a procedure for identifying and resolving future inconsistencies. A summary of these three elements is presented below.

BACKGROUND: NHEP GOALS AND OBJECTIVES

In its 1996 Management Conference agreement with EPA, the New Hampshire Estuaries Project (NHEP) established general goals focused on identifying and resolving non-point sources of pollution, restoring and protecting shellfish and other estuarine habitats, improving land-use planning and shoreland protection, increasing water quality monitoring, and expanding outreach and public education. Through a variety of public forums, and building on baseline ecological and policy studies, the NHEP has refined these goals and developed Action Plans for meeting those goals. These goals and objectives are listed in Appendix 3.

Inventory

The Federal Consistency Review provisions under the National Estuary Program specify that the Management Conference should:

> review all Federal financial assistance programs and Federal development projects in accordance with the requirements of Executive Order 12373, as in effect on September 17, 1983, to determine whether such assistance program or project would be consistent with and further the purposes or objectives of the plan prepared under this section.

In addition to the review of E.O. 12372 actions, the Clean Water Act also stipulates that the review:

> may include any programs listed in the most recent Catalog of Federal Domestic Assistance which may have an effect on the purposes and objectives of the plan prepared under this section.

The inventory of federal programs compiled for the NHEP Consistency Review includes the E.O. 12372 programs, as well as additional programs under the Catalog of Federal Domestic Assistance (CFDA). The few programs eligible for E.O. 12372 review but not included on New Hampshire's list were also considered. For this inventory, consideration was given to priority problems in the estuary watersheds, specific activities with a role in the priority problems identified through the Base Program Analysis, non-point source issues identified through the state's non-point source programs, and specific goals, objectives, and action plans identified through the NHEP. Both the state Coastal Zone Management Program and the state clearinghouse under E.O. 12372 monitor an extensive list of federal programs and actions, many of which have uncertain or indirect effects on the state.

Executive Order 12372

Executive Order 12372 was developed as a means of fostering intergovernmental cooperation and improving federal accountability to state and local governments. The Order encourages states to develop a coordinated review procedure that facilitates state and local review of proposed federal financial assistance and federal development programs and directs federal agencies to use this procedure to identify and address state and local concerns with the proposed actions. Federal agencies are required to either accommodate state and local concerns (by either accepting the recommendations or negotiating a solution) or explain the basis for not doing so.

The process for implementing E.O. 12372 varies from state to state but generally involves an existing state agency acting as a clearinghouse through which state, regional, and local government entities can transmit concerns about proposed

federal actions. In New Hampshire, the Office of State Planning (NH OSP) conducts the Intergovernmental Review Process. NH OSP receives abstracts of applications for federal assistance covered by the Executive Order and distributes them to appropriate state and local agencies for review and comment on their consistency with state or area goals and programs. Discrepancies and inconsistencies are generally addressed through discussions between the reviewing agency and the applicant. Comments are then consolidated by NH OSP and sent to the responsible federal agency.

NH OSP also offers to coordinate notification of other federal activities. For example, Environmental Impact Statements (EISs) are distributed through the clearinghouse. NH OSP maintains a database of federal funds received by the state, produces an annual report, and provides information on the availability and use of federal funds. In addition to the E.O. 12372 programs, NH OSP has assumed the role of reviewing the Congressional Federal Register to extract information of interest to state and local governments and other agencies concerning federal regulatory and grant programs.

For the purposes of the NHEP consistency review, the complete list of E.O. 12372 programs reviewed by New Hampshire was obtained and amended. These amendments include:

- Programs that no longer exist were deleted.
- Programs clearly unrelated to the NHEP goals and objectives were deleted.
- Programs only applicable to other geographic regions of the country (e.g., the NOAA Marine Fisheries Initiative program that applies only to states south of Virginia) were deleted.
- Programs for which the NHEP region would likely not qualify (e.g., programs for severely economically distressed regions) were deleted.
- The few additional programs covered by the Executive Order but not on the NH list were added.
- Catalog of Federal Domestic Assistance (CFDA) programs not covered by the Executive Order but related to NHEP Goals and Objectives were added.

In addition to the federal assistance activities listed in the Catalog of Federal Domestic Assistance, a variety of other federal actions have the potential to conflict with the goals and objectives of the NHEP. Direct activities of federal agencies, offshore lease activities, and federally sponsored licenses or permits may conflict. Under the NH Coastal Program's federal consistency process, federal licenses and permits constitute the majority of consistency determinations. Thus it is important to consider these other kinds of activities when conducting a consistency review.

One Time Assessment

The second step in the federal consistency review for the NHEP is an assessment of the consistency of the programs identified in the inventory. This assessment is intended to identify where inconsistencies lie in the federal assistance programs.

No inherent inconsistencies were found among the programs in the inventory. The primary focus of the goals and objectives of the NHEP concerns land use and development-related problems. Non-point source pollution, problems with septic and wastewater treatment systems, development impacts, sprawl, habitat loss and degradation, and similar issues are the key problems thus far identified. None of the programs identified in the inventory directly contributes to these problems.

Nonetheless, a wide range of programs have objectives that overlap with the action plans of the NHEP. Many programs are consistent with, or supportive of, the NHEP goals, objectives, and Action Plans. However, a number of other programs, for instance those under the Department of Housing and Urban Development, the Department of Transportation, or the Rural Development Administration of the Department of Agriculture, have the potential to conflict with the goals of the NHEP. These potential conflicts lie in the individual proposals for assistance rather than in the programs themselves. For example, rural development programs provide assistance to low and moderate income regions for assistance with public service development. Where that assistance is used to provide wastewater treatment facilities, the programs support the goals of the NHEP. Should the assistance contribute to habitat loss, expansion of impervious surfaces or sprawl, that particular action would conflict with the NHEP.

Even where potential inconsistencies with proposed uses of federal assistance exist, the benefits from the assistance may well outweigh the costs. For example, federal assistance used to provide wastewater treatment facilities might lead to increased development density in shoreland areas. But the increase in shoreland development should be balanced against the benefits of improved wastewater treatment. Therefore each proposed project needs to be reviewed in the context of a wide range of goals and objectives in order to determine consistency.

FUTURE REVIEW STRATEGY

As required by the Clean Water Act, the NHEP will need to continue to review federal activities for the life of the project. This review will identify potential conflicts and minimize inconsistencies and redundancies. At minimum this review will need to focus on federal assistance programs as listed in the Catalog of Federal Domestic Assistance. These programs include those listed for E.O. 12372 review, as well as specific other CFDA programs identified in this report. In order to comply with this requirement, the Management Conference must develop a strategy for this continuing review. This section proposes a strategy for review based on the needs of the NHEP and the existing state infrastructure.

Criteria for Review

Criteria for review of federal assistance programs and associated projects are contained in the goals, objectives and action plans of the NHEP. Goals and objectives were developed taking into account priority problems in the Seacoast area, non-point source pollution issues identified in the state's non-point source assessment and management plan, and problems identified in the Base Programs Analysis. The NHEP has conducted numerous public meetings for feedback on the goals and objectives, and working groups have used that feedback to clarify and expand them. Action plans based on those goals and objectives have been developed using the same process. Future review should revolve around these goals, objectives, and action plans.

Review Procedures

The consistency review under the NEP is not a regulatory program, and because other review procedures already exist in the state, the proposed NHEP Consistency Review procedure is built around these existing infrastructures. In particular, the NHEP consistency review strategy will be coordinated with the NH Coastal Program's consistency review procedure.

The NHEP and NH Coastal Program work together closely and are housed in the same state agency, the Office of State Planning. The state has made a significant commitment to maintaining its Coastal Program. As a result, coordination of both programs' consistency reviews is a logical goal. The NHEP geographic coverage extends throughout the coastal watersheds, although its primary area of focus, similar to that of the NH Coastal Program, lies within those municipalities bordering or near tidal waters. Nevertheless, the NHEP interest in outlying municipalities is focused on activities that have an impact on estuarine water quality, natural resources, etc. These same activities can be considered under the purview of the Coastal Program to the extent that they influence that program's goals and objectives.

Future review should consist of three steps. First, the NHEP should develop working relationships with agency personnel through which potential inconsistencies can be identified and rectified before applications are submitted. Second, the NHEP consistency review should be incorporated into the NH Coastal Program review procedures. Finally, any additional programs that are not covered by other procedures (for example, assistance programs not covered by E.O. 12372) should be reviewed using informal direct discussions with the sponsoring federal agency. These three steps are described below.

a. Early Coordination

The NHEP can, and likely will, accomplish much of its federal consistency objectives by continuing to work closely with various federal agencies. The first step in ensuring consistency between proposed federal activities and the goals of the NHEP, therefore, should involve early coordination before projects and proposals are initiat-

ed. The purpose of early coordination is to resolve potential conflicts with NHEP goals and objectives before the state clearinghouse review, when project changes become more difficult.

Since the Management Conference for the NHEP includes several federal agencies (EPA, the USDA Natural Resources Conservation Service and the US Fish and Wildlife Service), significant coordination should occur directly as a result of this participation. Representatives from these agencies should act as liaisons, notifying the NHEP of proposed activities and transmitting Management Conference concerns back to the agencies. Every effort should be made through these kinds of informal mechanisms to resolve potential conflicts as early as possible.

To the greatest extent possible, the NHEP should also develop ongoing relationships with other federal agencies active in the Seacoast (both now and in the future) to discuss mutual objectives and seek solutions to conflicts. Informal or formal (i.e. Memoranda of Agreement, etc.) arrangements should be used to create a notification system whereby the NHEP becomes informed of relevant programs or projects. Also, focused outreach to federal agencies regarding NHEP goals and objectives would help maximize the utility of early coordination.

To the extent that such coordination prevents conflicts before applications are submitted, the subsequent review process is simplified and the workload for the state and local reviewers is reduced. New Hampshire currently encourages agency staff to develop working relationships with local, regional and federal agencies to accomplish early coordination of intergovernmental review. Such efforts should continue with the NHEP.

This early coordination should also foster ongoing review of federal assistance projects during both the application and implementation periods. As a result, programs not covered under E.O. 12372 would be reviewed following these coordination mechanisms.

b. Coordinate with New Hampshire Coastal Program

The consistency provisions of the Coastal Zone Management Act provide the New Hampshire Coastal Program (NHCP) with potent review authority over virtually all federal actions that conflict with the enforceable policies of the state Coastal Zone Management Program (CZMP). These enforceable policies are categorized into 16 **Coastal Management Policies** of the NHCP.

PROTECTION OF COASTAL RESOURCES

POLICY 1: COASTAL RESOURCE PROTECTION
Protect and preserve and, where appropriate, restore the water and related land resources of the coastal and estuarine environments. The resources of primary concern are: coastal and estuarine waters, tidal and freshwater wetlands, beaches, sand dunes, and rocky shores;

POLICY 2: FISH AND WILDLIFE MANAGEMENT
Manage, conserve and, where appropriate, undertake measures to maintain, restore, and enhance the fish and wildlife resources of the state;

POLICY 3: OFFSHORE/ONSHORE SAND AND GRAVEL REMOVAL
Regulate the mining of sand and gravel resources in offshore and onshore locations so as to ensure protection of submerged lands, and marine and estuarine life. Ensure adherence to minimum standards for restoring natural resources impacted from onshore sand and gravel operations;

POLICY 4: OIL SPILL PREVENTION AND CLEANUP
Undertake oil spill prevention measures, safe oil handling procedures and, when necessary, expedite the cleanup of oil spillage that will contaminate public waters. Institute legal action to collect damages from liable parties in accordance with state law;

POLICY 5: RARE AND ENDANGERED SPECIES
Encourage investigations of the distribution, habitat needs, and limiting factors of rare and endangered animal species and undertake conservation programs to ensure their continued perpetuation;

POLICY 6: UNIQUE NATURAL AREAS
Identify, designate, and preserve unique and rare plant and animal species and geologic formations which constitute the natural heritage of the state. Encourage measures, including acquisition strategies, to ensure their protection;

RECREATION AND PUBLIC ACCESS

POLICY 7: RECREATION FACILITIES
Provide a wide range of outdoor recreational opportunities including public access in the Seacoast through the maintenance and improvement of the existing public facilities and the acquisition and development of new recreational areas and public access;

MANAGING COASTAL DEVELOPMENT

POLICY 8: RURAL QUALITY OF GREAT BAY
Preserve the rural character and scenic beauty of the Great Bay Estuary by limiting public investment in infrastructure within the coastal zone in order to limit development to a mixture of low and moderate density;

POLICY 9: FLOODPLAIN PROTECTION
Reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to preserve the natural and beneficial value of floodplains, through the implementation of the National Flood Insurance Program and applicable state laws and regulations, and local building codes and zoning ordinances;

POLICY 10: AIR QUALITY PROTECTION
Maintain the air resources in the coastal area by ensuring that the ambient air pollution level, established by the New Hampshire State Implementation Plan pursuant to the Clean Air Act, as amended, is not exceeded;

POLICY 11: WATER QUALITY
Protect and preserve the chemical, physical, and biological integrity of coastal water resources, both surface and groundwater;

POLICY 12: ENERGY FACILITIES SITING
Ensure that the siting of any proposed energy facility in the coast will consider the national interest and will not unduly interfere with the orderly development of the region and will not have an unreasonable adverse impact on aesthetics, historic sites, coastal and estuarine waters, air and water quality, the natural environment and the public health and safety;

COASTAL DEPENDENT USES

POLICY 13: COASTAL DEPENDENT USES
Allow only water dependent uses and structures on State properties in Portsmouth-Little Harbor, Rye Harbor, and Hampton-Seabrook Harbor, at the State Port Authority, the State Fish Pier and State beaches (except those uses or structures which directly support the public recreation purpose). Allow only water dependent uses and structures over waters and wetlands of the State. Encourage the siting of water dependent uses adjacent to public waters;

POLICY 14: DREDGING AND DREDGE SPOIL DISPOSAL
Preserve and protect coastal and tidal waters and fish and wildlife resources from adverse effects of dredging and dredge disposal, while ensuring the availability of navigable waters to coastal-dependent uses. Encourage beach renourishment and wildlife habitat restoration as a means of dredge disposal whenever compatible;

PRESERVATION OF HISTORIC AND CULTURAL RESOURCES

POLICY 15: HISTORIC PRESERVATION
Support the preservation, management, and interpretation of historic and culturally significant structures, sites and districts along the Atlantic coast and in the Great Bay area;

MARINE AND ESTUARINE RESEARCH AND EDUCATION

POLICY 16: RESEARCH AND EDUCATION
Promote and support marine and estuarine research and education that will directly benefit coastal resource management.

Actions reviewed by the NHCP include direct federal activities (any function performed by or on behalf of a federal agency in the exercise of its statutory responsibilities, including planning, construction, land acquisition or disposal, etc.), federal financial assistance activities (such as those reviewed above), federally approved licenses and permits, and exploration, development and production activities carried out under the Outer Continental Shelf Lands Act. This authority applies regardless of where the actions occur, provided they affect the NH coastal zone.

Those engaged in the covered activities are required to provide a consistency determination that declares that the action will be carried out consistent with the state's enforceable policies. Federal agencies cannot approve proposed projects that are inconsistent with the enforceable policies of New Hampshire's coastal management program, except upon a finding by the Secretary of Commerce that the projects are consistent with the purposes of the CZMA or are necessary in the interest of national security. Similarly, no federal permit can be granted unless the state concurs with the certification and notifies the Secretary of Commerce and the Secretary of the Interior of the concurrence.

The Coastal Zone Management Act consistency review is stronger than that provided through Executive Order 12372, and applies to substantially more actions than those under the executive order. Although NHEP will not be adopted as a Special Area Management Plan under the Coastal Program, NHEP will have the ability to use NHCP power in its consistency review to the maximum extent possible. The NHCP has reviewed the NHEP goals for consistency with the NHCP's 16 enforceable policies. Based on this review, the NHCP federal consistency coordinator determined there is no need to amend the NHCP's federally-approved coastal management program. According to the consistency coordinator, "The statutes and administrative rules which comprise the Enforcement and Enhancement sections of each NHCP Policy adequately protect the NHEP Goals." In the event that NHCP amends its policies, NHEP will have the ability to comment on NHCP enforceable policies during the public hearing.

A list of NHEP Goals and the correlated NHCP Policy number is presented below:

NHEP Goal	NHCP Policy #
Water Quality Goals	11
Land Use, Development, and Habitat Protection Goals	1, 5, 6, 7, 8, 9, 11, 12, 13, 14
Shellfish Resource Goals	1, 2
Habitat Restoration Goals	1, 5, 6
Education and Outreach Goals	16

The NHCP consistency program is willing to accommodate to the greatest extent possible NHEP's consistency review procedure. When a project comes through NHCP for review, the NHCP consistency coordinator will forward the project to the NHEP Director for comment. NHEP, in itself, will not have the ability to object. However, NHCP will enforce by its own objection NHEP comments or objections that are supported by statute. Any comments NHEP may raise will likely also be raised by NHCP, due to the commonality between NHCP's enforceable polices and the NHEP goals. Coordination of the consistency review process will be streamlined since both NHCP and NHEP are housed in the Office of State Planning, and the Director of the Office of State Planning is a member of the NHEP Management Committee and will continue to be a member of the Governing Board.

Because NHCP policies and NHEP goals are so similar and conflict is extremely unlikely to occur, the NHCP consistency coordinator does not recommend developing a strategy to minimize inconsistencies between the two programs. The only issue to address is one of degree. In each consistency determination NHCP must weigh the policy in question against the rest of its 16 enforceable policies. For example, a consistency determination regarding shellfish resource protection will be weighed against the policy for coastal dependent uses. This balancing may result in a lesser degree of promotion of a NHEP Goal than the NHEP would like. Utilization of the NHCP federal consistency review process is still beneficial to NHEP because even in the event of such balancing of policies, the NHCP's authority exceeds what could be accomplished under a NHEP federal review program.

c. Additional Reviews

Early coordination and review through the NHCP should address most, if not all, of consistency problems as envisioned under Purpose 7 of the National Estuary Program. Any activities and programs not covered will need to be reviewed directly with the sponsoring agency through the informal mechanisms and agreements discussed above.

Finally, the NHEP should also review Draft Environmental Impact Statements (DEISs) prepared under the National Environmental Policy Act (NEPA) for consistency, and comment accordingly. For this review, the EPA participant on the NHEP Management Conference should act as a conduit and notify the NHEP of relevant NEPA reviews. Once again, the NHCP already reviews EISs and should coordinate the review for the NHEP. Coordination mechanisms developed to assist in consistency review should also be used in EIS review.

d. Endangered Species Act

Section 7(a)(2) of the Endangered Species Act directs federal agencies, in consultation with the Fish and Wildlife Service and the National Marine Fisheries Service, to ensure that actions they authorize, fund or carry out are not likely to jeopardize listed species or their designated critical habitat. Section 7(a)(2) consultation may be required of NHEP during Management Plan implementation where federal agencies authorize, fund, or carry out an activity that may affect listed species. Each federal agency must determine if consultation is necessary on a case-by-case basis.

e. National Historic Preservation Act

NHEP will coordinate with appropriate agencies under section 106 of the National Historic Preservation Act. Federal agencies that fund, permit, license, approve, or carry out certain actions in the Management Plan may be required to consult the State Historic Preservation Office to determine if a site is listed in or is eligible for listing in the National Register of Historic Places. If a site is listed or eligible for listing, then the agency must determine if there is a potential for adverse effects to the site as a result of the proposed action.

Resolution of Disagreements

In the event of Management Conference disagreements on consistency recommendations, existing resolution mechanisms within the Management Conference should be used. When no resolution is possible, “majority” and “minority” comments should be submitted.

Time Line for Review

For those programs and activities covered under the NHCP, deadlines for reviews are already established through the authorizing legislation. For federal licenses or permits, NH OSP-NHCP has six months from receipt of the applicant’s letter and accompanying information in which to concur or object. If the NHCP fails to respond within six months, concurrence is presumed. For other direct federal activities, the state has 45 days to respond (and may request an additional 15 days if needed).

Time lines for E.O. 12372 reviews also exist under the state’s clearinghouse process, and those should be adopted by the NHEP to whatever extent the NHEP directly participates in that portion of consistency review.

Management Conference Point of Contact

The Management Conference Point of Contact should be the state’s NHEP Project Director.

GRANTS AND ACTION PLAN DEMONSTRATION PROJECTS FUNDED BY THE NHEP

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LOCAL GRANTS

Design of a Walkway to Improve Salt Marsh Education on the Odiorne Farm Portion of Odiorne State Park
(Friends of Odiorne Point State Park)
This project resulted in the planning and design of a handicapped-accessible walkway, with viewing platforms. When constructed, the walkway will provide an 'outdoor classroom' for marsh educational programs at the Seacoast Science Center.

Edmond Avenue Wetland Restoration Project
(City of Portsmouth Public Works Department)
This project involved developing a comprehensive long-term stormwater management plan for the Edmond Avenue freshwater wetland system, and implemented temporary steps to relieve wetland degradation from stormwater inputs to the wetland.

Reclamation of a Gravel Pit Located in the Fork of the Confluence of the Branch River and Jones Brook to Protect and Enhance the Riparian Buffer and Wetland
(Town of Milton Planning Board)
This project involved protection riparian buffers and wetlands along tributaries to the Salmon Falls River by correcting various shoreline erosion problems that resulted from past mining activities on the site.

Natural Resource Inventory, Evaluation, Mapping, and Outreach in Newmarket, NH
(Town of Newmarket Conservation Commission)
This project was designed to finish a wetland evaluation project in the town of Newmarket, and to develop natural resource maps to make environmental information more accessible to town officials and citizens.

Fairhill Salt Marsh Restoration Project
(Town of Rye Mosquito Control Commission)
This project restored the hydrologic and ecological functions of a degraded salt marsh.

Cains Brook and Mill Creek Watershed Study
(Town of Seabrook Conservation Commission)
This project focused on locating, mapping, and sampling stormwater drainage outlets in the Cains Brook Watershed in an effort to identify sources of bacterial and other pollution.

A Listing of Agricultural Producers in Strafford County
(Strafford County Conservation District)
This project was designed to update a database of agricultural producers in Strafford County. The digital database will be useful in targeting non-point pollution prevention programs and other forms of technical assistance.

Public Outreach Education in the Cocheco River Watershed
(Strafford Regional Planning Commission)
This project conducted various educational activities in the Cocheco River Watershed to foster the development of an informed citizenry to make decisions about the watershed's environmental quality.

State of the North Mill Pond, Portsmouth, NH
(Advocates for the North Mill Pond)
This project was designed to identify pollution sources and document the natural resources around the North Mill Pond in downtown Portsmouth.

Riverside Drive Restoration Project
(City of Dover Community Services Department)
This project was designed to correct the effects of severe stormwater erosion in a natural drainage way in close proximity to the Piscataqua River.

Odyssey School: Hampton Storm Drain Outflow Report
(Odyssey House, Inc.)
This project evaluated fecal contamination from five stormwater outflows in the Hampton-Seabrook Estuary

Implementing Effective Land Stewardship Programs
(Audubon Society of New Hampshire)
This project provided educational opportunities and technical assistance to coastal municipalities on how to develop and implement effective land stewardship and monitoring programs.

Epping's Lamprey Watershed Program
(Town of Epping)
This report documents the results of water quality monitoring of the Lamprey River in Epping, and describes the involvement of Epping school staff, students, and community members in the project.

Northwood Wetland Inventory and Prime Wetland Designation Project, Northwood, NH
(Town of Northwood)
This project documents the assessment of wetlands in the town of Northwood, NH, and describes the process that will be used to revise town wetland ordinances as a result of the findings of the wetland evaluation.

Little River Marsh Restoration and Landowner Education Project
(Town of North Hampton)
This project, part of a larger effort to restore the Little River salt marsh, involves some field work to prepare for physical restoration, as well as education on the need for marsh restoration targeted to landowners along the marsh boundary.

Spur Road Sewer Extension, Dover, NH
(City of Dover)
This project extends sewer infrastructure to homes adjacent to the Bellamy River to alleviate current, and prevent future sources of pollution from failing septic systems.

Oyster River Watershed Smart Growth Plan
(Strafford Regional Planning Commission and Oyster River Watershed Association)
This project is designed to develop a regional anti-sprawl partnership in the Oyster River watershed. The project aims to develop consensus on goals for natural resource preservation, growth management, community and watershed character, collaborative partnerships, and shared resources. Consensus on these issues will be built through surveys and watershed visioning sessions. A planning document will be developed for the watershed describing the resulting goals, general policies, and recommend actions for the partners.

ACTION PLAN DEMONSTRATION PROJECTS

Action Plan Demonstraion Projects (APDPs) assist estuary projects in formulating and evaluating "action plans" for inclusion in the Management Plan. The NH Estuaries Project solicited APDP proposals in 1998 and 1999. The projects were designed to implement a strategy or activity to meet the NHEP goals of environmental quality improvement. 12 projects were funded over two years.

Installation of Agricultural BMPs at the Stuart Farm, Stratham, NH
(NH Department of Environmental Services)
This project is designed to reduce nutrient and bacterial contamination from barnyard and manure storage runoff at a dairy farm located adjacent to the Squamscott River.

Cross Beach Road Stormwater Drainage Project
(Town of Seabrook)
This project was designed to prevent salt marsh degradation by correcting stormwater drainage in the area of Cross Beach Road in Seabrook, NH

Edmond Avenue Stormwater Management/ Wetland Restoration Plan Implementation
(City of Portsmouth)
This project implements the stormwater management and wetland restoration practices recommended in a previously funded planning project.

Restoration of Clam Habitat in the Hampton-Seabrook Estuary
(UNH Sea Grant Cooperative Extension)
This project describes the restoration of clam habitat in the Hampton-Seabrook Estuary through the removal and relocation of mussels that had colonized the clam flat. The report includes documentation of clam flat condition before and after mussel removal.

Eliminating Bacteria Loads to Cocheco and Bellamy Rivers: Stormdrain/Sewer Separation, Phase I
(City of Dover).
This project is designed to identify and eliminate discharge of raw sewage to the Cocheco River. The project will result in the elimination of several previously identified sanitary sewer/storm sewer illicit connections.

Eliminating Bacteria Loads to the Lamprey River: Stormdrain/Sewer Separation
(Town of Newmarket)
This project is designed to identify and eliminate discharge of raw sewage to the Lamprey River. The project will result in the identification and elimination of sanitary sewer/storm sewer illicit connections in the downtown area of Newmarket.

Installation of Stormwater and Barnyard Best Management Practices at Jan-Mar Farm, Rochester, NH
(NH Dept. of Environmental Services)
This project will implement agricultural conservation measure to separate stormwater runoff from animal waste concentration areas, and to treat contaminated runoff. This grant will fund the first of three phases of work, stormwater separation.

Stormwater Control at the Allen School, Rochester, NH
(City of Rochester)
This project will, with the assistance of local volunteers and the Cocheco River Watershed Coalition, correct several stormwater-related problems at an urban site along the Cocheco River. The project includes the installation of low technology (pipe and swale) management practices, bank stabilization, and other measures.

Breeding Birds of the Piscassic River Focus Area
(NH Audubon/Great Bay Res. Protection Partnership)
Through this project NH Audubon and local volunteers will conduct breeding bird surveys in the Piscassic River (Exeter/Newfields/Epping) area. This data is deemed critical to receiving funding to permanently protect habitats identified as important in several habitat protection plans.

New Village Sewer Illicit Connection Elimination
(Town of Newmarket)
This project is designed to identify and eliminate sources of raw sewage discharge to the Lamprey River. Sources of discharge are suspected to be sanitary sewer/storm sewer illicit connections and/or broken sewer pipes.

Eliminating Bacteria Loads to Cocheco and Bellamy Rivers: Stormdrain/Sewer Separation, Phase II
(City of Dover).
This project is designed to identify and eliminate discharge of raw sewage to the Cocheco River. The project will result in the elimination of seven previously identified sanitary sewer illicit connections. It is estimated that four more illicit connections will be identified during the course of the work.

Charles Street Stormwater Management Project, Hampton, NH
(Hampton Conservation Commission)
This project is designed to manage stormwater flow and restore a degraded salt marsh by removing accumulated sediment, excavating shallow pools, and improving a tidal drainage ditch.

MANAGEMENT CONFERENCE MEMBERS A6

New Hampshire Estuaries Project Management Committee

Chair	
Jeffrey Taylor	New Hampshire Office of State Planning
Vice Chair	
Richard Langan	University of New Hampshire Jackson Estuarine Laboratory
Ron Alie	New Hampshire Fish and Game Department
Jennifer Brown	Sprague Energy Corporation
Russell Bailey	Town of Seabrook
Mike Basque	Town of Salisbury, Massachusetts
Jim Chase	NHEP Outreach Project Team, *Chair*
Ed Cournoyer	New Hampshire Fish and Game Department
Peter Dow	Town of Exeter/Rockingham Land Trust
Brian Doyle	University of New Hampshire Sea Grant
Richard Dumore	Public Service Company of New Hampshire
Taylor Eighmy	University of New Hampshire Environmental Research Group
Ward Fuert	USFWS/Rachel Carlson Refuge/ Great Bay National Wildlife Refuge
David Funk	Great Bay Stewards
Brian Giles	Strafford Regional Planning Commission
Tom Gillick	Town of Hampton
Glenn Greenwood	Rockingham Planning Commission
Sabin Guertin	New Hampshire Department Health & Human Services
Tom Howe	Society for the Protection of New Hampshire Forests
Mark Kern	US EPA Region 1
Natalie Landry	Water Quality Project Team, *Chair*
Wendy Lull	Seacoast Science Center
Sean Mckenna	Wentworth by the Sea Marina
Richard Moore	Audubon Society of New Hampshire
Chris Nash	NHEP Land Use Project Team, *Chair*
Dean Peschel	City of Dover
Chris Simmers	New Hampshire Department of Environmental Services
Brad Sterl	State of Maine
Peter Tilton Jr	Town of Hampton
Henry Veilleux	Business and Industry Association of New Hampshire
Ian Walker	Aquaculture Resource Development
Joyce Welch	New Hampshire Department Health & Human Services
Peter Wellenberger	New Hampshire Fish and Game Department
Vallana Winslow-Pratt	NHEP Shellfish Project Team, *Chair*

Water Quality Project Team

Chair

Natalie Landry	New Hampshire Department of Environmental Services
Jim Chase	Seacoast Science Center
Ted Diers	New Hampshire Coastal Program
Steve Jones	University of New Hampshire Jackson Estuarine Laboratory
Mark Kern	US EPA Region 1
Gerry Lang	USDA Natural Resources Conservation Service
Dave McDonald	US EPA Region 1
Joanne McLaughlin	New Hampshire Coastal Program
Mary Menconi	University of New Hampshire
Bambi Miller	Strafford County Conservation District
Dan Morris	Sierra Club
Chris Nash	NH Estuaries Project
Billy Palmatier	Interested Citizen
Steve Panish	Sierra Club
Dean Peschel	City of Dover
Dan Potashnick	Interested Citizen
Ann Reid	University of New Hampshire Sea Grant/Great Bay/Coast Watch
Linda Scherf	City of Dover
Fred Short	University of New Hampshire Jackson Estuarine Laboratory
Jerry Sotolongo	US EPA Region 1
Rob Swift	University of New Hampshire Mechanical Engineering Department
Jan Taylor	Great Bay National Wildlife Refuge
Vallana Winslow-Pratt	New Hampshire Department of Health and Human Services

Land Use Project Team

Chair

Chris Nash	New Hampshire Office of State Planning
Arnold Banner	US Fish and Wildlife Service /Gulf of Maine Project
Dave Burdick	University of New Hampshire Jackson Estuarine Laboratory
Steve Burns	Strafford Regional Planning Commission
Jim Chase	Seacoast Science Center
Rich Cook	Audubon Society of New Hampshire
Mary Currier	Rockingham County Conservation District
Ted Diers	New Hampshire Coastal Program
David Funk	Great Bay Stewards
Glenn Greenwood	Rockingham Planning Commission
Mark Kern	US EPA Region 1
Mimi Larsen Becker	University of New Hampshire Department Natural Resources
Cynthia Lay	New Hampshire Coastal Program
Billy Palmatier	Interested Citizen
Carl Paulsen	Interested Citizen
Fay Rubin	University of New Hampshire Complex Systems
Jeff Schloss	University of New Hampshire Cooperative Extension
Paul Schumacher	Southern Maine Regional Planning Comm
Fred Short	University of New Hampshire Jackson Estuarine Laboratory
Sharon Vaughn	Great Bay National Wildlife Refuge
Joyce Welch	New Hampshire Department Health and Human Services
Vallana Winslow-Pratt	New Hampshire Department Health and Human Services

Shellfish/Living Resources Project Team

Chair

Vallana W.-Pratt	New Hampshire Department of Health and Human Services
William Brindamour	Hampton Shuttle Service
Dave Burdick	University of New Hampshire Jackson Estuarine Laboratory
Jim Chase	Seacoast Science Center
Shanna Hallas	Great Bay National Wildlife Refuge
Steve Jones	University of New Hampshire Jackson Estuarine Laboratory
Mark Kern	US EPA Region 1
Richard Langan	University of New Hampshire Jackson Estuarine Laboratory
Clare McBane	New Hampshire Fish and Game Department
Joanne McLaughlin	New Hampshire Coastal Program
Chris Nash	New Hampshire Estuaries Project
Paul Raiche	New Hampshire Department Health and Human Services
Ann Reid	University of New Hampshire Sea Grant/Great Bay Coast Watch
Don Smart	Shellfish Harvester
Bruce Smith	New Hampshire Fish and Game Department
Peter Tilton Jr	Town of Hampton
Ian Walker	Aquaculture Resource Development

Outreach and Education Project Team

Chair

Jim Chase	Seacoast Science Center
Alice Briggs	Great Bay Coast Watch
Howard Crosby	Friends of Odiorne Point
Dick Delude	Dover Public Schools
Brian Giles	Strafford Regional Planning Commission
Ellen Goethel	Town of Hampton
Mike Gowell	Piscataqua Gundalow Project
Mark Kern	US EPA Region 1
Nancy Lambert	University of New Hampshire Cooperative Extension
Cynthia Lay	NH Coastal Program
Wendy Lull	Seacoast Science Center
Kelle Mckenzie	NH Fish and Game Department/Sandy Point Discovery Center
Sharon Meeker	University of New Hampshire Sea Grant
Chris Nash	New Hampshire Estuaries Project
Paul Nevins	Irving Oil Corp
Julia Peterson	CICEET/University of New Hampshire Sea Grant Extension
Ann Rodney	US EPA Region 1
Carol Spadora	Environmental Hazards Management Institute
Vallana Winslow-Pratt	New Hampshire Department of Health and Human Services

New Hampshire Estuaries Project Staff During Management Plan Production

Chris Nash	*Director*
Jim Chase	*Public Outreach Coordinator*
Natalie Landry	*Water Quality Specialist*
Lorraine Stuart Merrill	*Management Plan Writer and Editor (contractor)*
Patricia Miller	*Graphic Designer (contractor)*
Mary Power	*Executive Secretary*
Jim Varn	*Action Plan Facilitator (contractor)*
Vallana Winslow-Pratt	*Environmental Specialist*

Cynthia Lay	*Director*, New Hampshire Estuaries Project	May 2000 -

COMMENTS AND RESPONSES TO THE DRAFT MANAGEMENT PLAN

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The New Hampshire Estuaries Project *Draft Management Plan* was released for public review and comment on December 1, 1999. The public comment period extended 60 days until February 1, 2000. During this period the NHEP circulated 300 copies of the *Draft Plan*, and convened two public hearings to receive comment on the document.

Draft Plans were delivered to all NHEP Management Conference members, and made available at 12 locations in the region including eight public libraries, both regional planning offices, the NHEP/NHCP offices, and the Seacoast Science Center. The entire *Plan* was posted on the web at the NHEP website. Copies were mailed to each state senator representing communities in the Great Bay and coastal watersheds. Representatives from the region were notified by mail of the release of the document and copies were provided upon request. Town offices in each of the 43 communities of the NHEP study area received a copy of the *Plan*. Selectmen, planning staff and planning boards, and conservation commissions were notified by direct mail that the *Plan* was released and available at town offices. Press releases announcing the release of the *Draft Plan* and the public hearings were published by several local newspapers. Legal Notices of the public hearings were published in local newspapers three weeks prior to the hearings. Postcards announcing the release of the *Draft Plan* and the public hearings were sent to the 3,400-shoreline property owners on the NHEP shoreline property owner database.

The NHEP received a wealth of valuable comments from Management Conference members, state and federal agency representatives, environmental groups, municipal officials, and interested citizens. Comments ranged from typographical and editorial to observations on document scope, content, and structure. Appendix 7 summarizes the public comments received during and after the comment period and provides a response to those raised. All comments were evaluated and considered based on their feasibility and consistency with the goals of the Plan. The *NHEP Management Plan* Action Plans that address, support, or clarify the comments are referenced where appropriate.

Comments on Implementation

Has the Estuaries Project performed a cost/benefit analysis of the action plans?

Implementing the entire *NHEP Management Plan* will require substantial funding. Costs to fully implement just the Highest Priority actions include almost $876,000 in one-time costs (based on one salt marsh restoration project and nineteen shellfish bed restoration projects at an estimated $10,000 each), approximately $557,890 in annual costs, and approximately $77,500 in per-town costs (if extended to all 43 watershed towns, the total for this item would be $3,332,500).

Obtaining the necessary funding will be a challenge, given the current realities of public funding at the local, state, and federal levels, but the *Plan* was developed with this challenge in mind. Project participants recognized that much environmental protection, restoration, and outreach work is already occurring in and around the estuaries, and many of the Action Plans were designed to leverage and complement, rather than duplicate, these efforts.

Cost estimates are presented for each Action Plan in Chapters 4-8. Accurately predicting costs of many of the actions listed in the *Plan* is difficult. For example, the cost of remediating a stormwater outfall or restoring a salt marsh can only be accurately estimated after a detailed study of the site. Cost estimates included in the *Plan* are intended as a general guide of the required funding. Cost estimates will be refined as the NHEP Board selects individual Action Plans for implementation each year.

Each Action Plan has been assigned a ranking of Highest Priority, High Priority, or Priority. This ranking reflects the action's impact on the environmental condition of the estuaries in relation to the current priority issues, without regard to cost of implementation. In developing each annual work plan, Action Plan implementation opportunities are considered against available funds and possible shifts in priority issues. The NHEP governing Board will perform informal cost/benefit analysis in determining the annual work plan, using their collective knowledge of the state's estuarine resources, environmental condition, and existing or evolving management framework to advance projects that will provide the most critical environmental improvements with the available funds.

Recognize the importance of monitoring changes in behavior.

In the *Management Plan*'s *Chapter 8: Public Outreach and Education*, the NHEP acknowledges, "At some level, every environmental problem threatening New Hampshire's estuaries is related to human activities." The challenge for the NHEP is to raise awareness and promote changes in attitudes, local priorities, and planning processes. These changes are in large part behavioral and take time. Measuring behavioral change in the general population over the time scale of Action Plan implementation in this *Plan* is difficult. However, actual implementation of some Action Plans, such as those related to local land-use planning and habitat protection, will provide a subjective measure of changes in attitude. These actions require adoption of new natural resource- based planning paradigms. Water quality improvements attributed to reduced non-point source contamination will also provide an indirect indicator of changes in how people in New Hampshire's estuarine watersheds view and treat their water resources.

Need language regarding limits to accomplishing everything in the Plan.

The *NHEP Management Plan* represents an ambitious step toward protecting and preserving the character and natural resources of estuarine New Hampshire. As stated *in Chapter 10: Implementation and Finance*, "The *NHEP Management Plan* will be the basis for all NHEP implementation activities, although flexibility will be exercised to take advantage of all opportunities for improving the estuaries." The 45 Action Plans designated Highest Priority were deemed critical to achieving the goals and objectives of the *Plan*, and will be the main focus of the first four years of implementation. Still, completion of all Highest Priority Action Plans within the first four years of implementation is an unrealistic expectation. The NHEP is committed to implementing as many of these actions as time and financing allow. Costs of implementing the Highest Priority actions alone exceeds $4.5 million. The NHEP recognizes that much of environmental protection, restoration, and outreach work is already underway in the estuarine watershed. The NHEP crafted the *Plan* to build on, leverage, and complement – rather than duplicate – these efforts. This strategy will ensure the fullest possible implementation of the *Plan*.

Produce and distribute an executive summary of the plan

An executive summary of the *Plan* has been produced and will be widely distributed to municipal officials, state legislators, environmental organizations, and other interested stakeholder groups.

How and by whom was the decision made to not include certain ideas/positions in the final draft of the Plan?

Where should input about those decisions be channeled?

The NHEP Management Committee has ultimate authority on the content of the *NHEP Management Plan*. During the revision process, NHEP staff kept the Management Committee apprised of the most substantive editorial and content-related comments. The Management Committee was generally pleased with the draft *Plan*, its content, organization and layout. They urged the NHEP staff to press on with the editorial revisions and acknowledged that the *Plan* was a planning document subject to continual re-evaluation and updates as issues and environmental conditions change. Input on decisions should be channeled to project Director.

Are the implementation funds spread too thin?
Are there too many action plans included?

The NHEP cannot hope to implement all of the Actions presented in the *Plan* using US EPA National Estuaries Program implementation funds alone. This funding exists for the short term, while the region's environmental and growth issues will persist well into the future. Federal funds from sources other than EPA will be required to fund portions of the *Plan*. The NHEP will ultimately also have to look to both state and local sources of money to accomplish even the Highest Priority actions proposed in the *Plan*. The *Plan* has been crafted to work with the many natural resource planning, protection, restoration, and education projects underway in New Hampshire's estuarine watershed. This strategy maximizes opportunity for leveraged projects, and affords strong links with communities which may be able to provide valuable in-kind contributions in implementing many Action Plans. The NHEP Board and staff are responsible for researching and securing funding from outside the National Estuaries Program to help implement as much of the *Plan* as possible. The *Plan* was written with the intention of implementing all the Highest Priority Action Plans, in full or in part, by 2003. Opportunities to implement the High Priority Action Plans will be investigated and implemented where appropriate by 2003. Priority Action Plans will be funded and implemented as opportunities arise.

Include Maine more directly and explicitly in the plan.

Under the federal funding and administrative structure of the NHEP, the project was unable to spend money directly on projects in Maine. However, the State of Maine was represented on the Management Committee by Mr. Brad Sterl, formerly of the Maine Department of Marine Resources. Paul Schumacher of the Southern Maine Regional Planning Commission was kept informed of NHEP progress and of any specific issues requiring attention in the State of Maine.

Comments on Partners and Partnerships

What is the role of the regional planning commissions in plan implementation?

The Rockingham Planning Commission and the Strafford Regional Planning Commission have been instrumental partners of the NHEP in developing the *Plan*. Both organizations have been active participants on the NHEP Management Committee, helping to shape and guide the Project from the outset. The regional planning commissions (RPCs) have been active on subcommittee working groups and the Land Use project team. Other NHEP project teams, (Outreach, Shellfish, and Water Quality) received comments and contributions from the RPCs where appropriate.

Because of their extensive involvement in developing the Plan, the RPCs are identified as responsible parties and lead implementers throughout the document. Project participants recognized that much environmental protection, restoration, and outreach work is already occurring in and around the estuaries, and many of the Action Plans were designed to leverage and complement, rather than duplicate, these efforts.

Concern about the regional planning commissions having the capacity to implement the action plans in which they have been assigned a role.

Action Plans have been developed with existing agency and organizational missions in mind. This strategy helps maximize the opportunity for leveraging funds and work plans in a way that advances the implementation of the *NHEP Management Plan*. The regional planning commissions may use federal NHEP implementation funds to carry out some Action Plans. Recognizing that their roles in implementing Action Plans could place excessive burdens on existing RPC staff resources, many Action Plan cost estimates include full-time equivalent costs to support the needed increase in staff.

Working relationships among the various partners.

Much of the strength of the NHEP is derived from the working relationships forged between the members of the NHEP Management Conference, particularly those on the Management Committee. The list of NHEP Management Conference members at the beginning of this document testifies to the diverse and influential group involved in the project. The **Responsible Parties** identified in each Action Plan recognize the likely participants and their roles in implementing actions. As funds become available for Action Plans that do not identify a coordinating entity or lead implementer, the NHEP will convene a group of interested parties. NHEP will coordinate and facilitate the group convened, to assign work tasks as appropriate and develop the work plan detail necessary to carry out an action. Some actions without an identified coordinating entity will be implemented through a Request for Proposals. A lead implementor will be designated upon selection of a successful proposal.

How will the action plans be managed and the various implementing parties coordinated?

The NHEP tried to assign a lead implementer to each Action Plan as they were developed. Each lead implementer will be responsible for managing work activities. The NHEP will be responsible for tracking overall implementation of the *Management Plan*, and the Action Plans. The NHEP will coordinate the parties involved where appropriate. Many Action Plans will be implemented, in full or in part, in the normal course of the work of many NHEP Management Conference members. The NHEP will coordinate with the various agencies, environmental organizations, and local communities to track natural resource management, planning, and educational projects that may not originate with the NHEP, but may contribute to implementation of the *Management Plan*.

Add the Conservation District as a responsible party for some actions.

Both the Strafford and Rockingham County Conservation Districts have been added as responsible parties to several additional *Action Plans*. As each *Action Plan* is implemented, the NHEP and its partners will assess whether all appropriate implementers are aware of or involved in the activity. The NHEP is always open to new partners, and recognizes that people and organizations may be added to or removed from the lists of Responsible Parties.

Need to work with the Portsmouth Naval Shipyard, perhaps through their citizens' advisory committee.

The Portsmouth Naval Shipyard received and reviewed a copy of the *Plan*. As of May 2000 no comments had been received by the NHEP from the Naval Shipyard. The Naval Shipyard was identified in the NHEP Technical Characterization Report as at least a historic source of some toxic contaminants to the estuaries. Implementation of Action Plans that address issues of toxic contamination associated with the Naval Shipyard will be coordinated with shipyard authorities.

Comments on Prioritization

Need to keep flexibility on prioritization.

The NHEP Board will develop annual implementation workplans. In so doing, the Board will consider any changes in priorities, while striving to coordinate with the efforts and momentum of its partners. Flexibility is key to taking advantage of funding opportunities, to maximizing returns by fitting tasks into the work plans of partner organizations, and to addressing projects that become good opportunities because of timing, financial, or other developments.

Consider changing the wording regarding priorities because "low" implies unimportant whereas all action plans are important.

The priorities have been changed to Highest Priority, High Priority, and Priority. All actions in the Draft *NHEP Management Plan* ranked High or High to Medium have been reclassified Highest Priority. Action Plans ranked Medium to High, Medium, or Medium to Low, have been re-designated High Priority. Action Plans ranked Low to Medium, Low, or not ranked, have been re-designated Priority.

Need to rate the un-prioritized items.

Any Action Plans presented in the Draft *NHEP Management Plan* without a priority designation were re-designated as Priority actions until the NHEP Board has opportunity to prioritize these late-coming actions. This should be addressed in the next annual cycle as the Board considers the suggestions for additional Action Plans that came through the public comments on the Draft *Plan*.

Calls for Additional Action Plans

The NHEP Board will consider several additional Action Plans that were suggested in the public comment period for the Draft *NHEP Management Plan*. The dynamic nature of estuarine systems and resources compels the NHEP to re-evaluate priorities, Action Plans, and funding opportunities from time to time. The NHEP intends to implement its *Management Plan* flexibly, re-evaluating Action Plan priorities during the development of each yearly work plan.

Suggestions were received to develop an Action Plan:

1. That addresses oil spill prevention, response, and research. The Action Plan should include:
   - Oil spill response plans including preparation and training for sinking oil types and other hazardous materials brought into the estuaries.
   - A predictive model for oil spills.
   - More Action Plans regarding assessment of oil spill impacts.
   - Consideration of reimbursement by oil spill sources for damages and the cost of repairs.
   - Consideration of legislation requiring funding by oil spill sources for follow-up studies of the effects.
2. For bio-monitoring. Bio-monitoring may be one avenue to assess the cumulative impacts in addition to physical and chemical changes that may occur.
3. For the development of private landowner incentives for practices that protect wildlife, plants, and natural communities.
4. For instituting a routine Household Hazardous Waste Recycling program.
5. That addresses the impacts in terms of water quality and quantity for power plants on the Piscataqua River.
6. For agricultural issues: develop and implement nutrient management plans and Integrated Pest Management programs.
7. For fish habitat. Many of the estuarine habitats such as eelgrass, mud flats, and riparian areas should have action plans that address protection and restoration of these areas.
8. For the restoration of anadromous fish.
9. For invasive species control. Identify and control invasive plants within the project area that threaten important habitats.
10. To update the Strafford County soil survey.
11. For the problem of sites for septic haulers to dispose of waste that considers a regional solution.
12. That addresses the recommendations of the NHEP Base Program Analysis that were not covered in this document.

Comments on Land Use and Habitat Protection issues

Will the success of the project lead to higher property taxes (e.g., through the establishment of a water authority)?

It is not the intent of the NHEP to generate new legislation at the state or local level. From the beginning the NHEP has worked to effect positive environmental outcomes through education and the promotion of careful, natural resource-based planning at the state, community, and individual levels. If implementation of *Management Plan* succeeds in improving estuarine water quality, there is a chance of property tax increases resulting as property values near cleaner estuarine waters increase. It is not the desire of the NHEP to create tax increases through new assessments to support the water quality or other natural resource-based projects.

The review and possible revision of master plans, land-use policies, and zoning ordinances should be given a higher priority. More emphasis on achieving uniformity of regulations, etc. across the various communities (including in Maine) in the estuaries' watershed. Need a procedure for checking septic systems after they are built. Concern that stormwater systems are not being built as planned/approved.

Action LND-6B calls for a comprehensive review of the land use polices and regulations for all 43 towns in the NHEP study area with specific attention to regulations that might promote sprawl development and impair water quality. Action LND-6B is ranked High Priority in the final version of the *NHEP Management Plan*. While a thorough region-wide review would provide a valuable planning tool, smaller scale community-specific reviews may also be conducted as part of Actions LND-5, LND-22, LND-25C. Master plan reviews, community visioning and careful consideration of existing land-use policies and zoning ordinances are fundamental to the community-based outreach activities of Action LND-5.

The NHEP Base Program Analysis (BPA) examined the regulatory and management framework pertaining to growth, development, and natural resources in the Zone A communities (17 towns with tidal frontage plus Rochester and Somersworth). The BPA found wide variations in the comprehensiveness of local land-use and natural resource protection regulations. The BPA recommended improvements to resource protection regulations. These improvements focus on regulation of shorelands, tidal and non-tidal wetlands, stormwater management, erosion, and other non-point source controls. These issues are discussed in Actions LND-8A, LND-14, LND-16, LND-20, LND-22, LND-25, LND-25C, WQ-9, WQ-10.

A recurring theme of the BPA was that lack of implementation of existing regulations has as much influence on water quality and natural resources as the inconsistency of local regulations. This problem is usually attributed to tight municipal budgets, excessive workloads for largely volunteer board and commission members, and lack of time or money for needed technical training. The *NHEP Management Plan* presents a number of actions designed to address these funding and information gaps, and provide assistance for the review of local ordinances and regulations. (Actions WQ-4A, WQ-4B, WQ-6,WQ-8, WQ-9, WQ-10, WQ-17, WQ-20, LND-2, LND-5, LND-6A-F, LND-8A, LND-11, LND-14, LND-15, LND-16, LND-20, LND-22, LND-25A-D, LND-28, LND-29, LND-32, LND-33, LND-36, RST-5, EDU-3)

Should more action plans and implementation funds be targeted for land-related activities such as buying land and/or easements? Who will coordinate the management of purchased and easement lands around the estuaries?

The NHEP cannot use Federal Clean Water Act Funds to secure easements or purchase land for conservation. NHEP implementation funds may be used for the background natural resource evaluation and legal research required for purchases of land or conservation easements. Actions LND-27, LND-29, LND-31, LND-33, and LND-36 directly or indirectly support the purchase of lands or easements for conservation of natural resources and open space.

Conservation lands and easements in the Great Bay and coastal watersheds are held and managed by a variety of state, local, and nonprofit entities such as NH Fish and Game Department; NH Department of Agriculture, Markets and Food; conservation commissions; community land trusts including the Rockingham Land Trust and Seacoast Land Trust; Rockingham County Conservation District; the Great Bay Resource Protection Partnership; the Audubon Society of New Hampshire; the Nature Conservancy; the Society for the Protection of New Hampshire Forests; and others. These groups are loosely coordinated, but their collective holdings have been catalogued to some extent in the State of New Hampshire GRANIT Geographic Information Systems (GIS) database. Some community properties, smaller holdings, and lands not protected in perpetuity may not be included in the database.

Each land acquisition and conservation easement arises from a unique set of circumstances. These circumstances are reflected in the details of the land transfer arrangement and often document the specific intent of the landowner or previous landowner, and the mission of the governmental agency or conservation organization taking responsibility for the property or easement. The unique conditions surrounding each land transfer may make coordinated, blanket management strategies impractical. However, as the amount of permanently held conservation lands in the estuarine watershed increases, there may be instances where collaborative management will be required or advisable. To date, the region's conservation land managers have demonstrated the expertise and ability to address situations that arise. If the need for regional coordination is identified, state agencies such as NH Fish and Game and the NH Office of State Planning or nonprofit organizations such as the Nature Conservancy, the Society for the Protection of New Hampshire Forests or the Great Bay Resource Protection Partnership may be able to oversee such an effort.

The maps in Action LND-1 have not yet been produced. To produce them will increase the cost of this action plan significantly.

An additional $20,000 was added to the estimated cost of Action LND-1 to reflect the expense of producing maps of second order subwatersheds and impervious surfaces by subwatershed.

Create a composite digital tax map of the estuarine watershed from the ones already created for each community in the region.

Digital tax maps for each community in the estuarine watershed would be useful tools for local planning. Creation of these maps does present some technical challenges due to the state of many of the existing tax map archives. Overlapping and digitizing maps that have evolved over decades does not result in the precision required for use in site-specific planning or for comparing with the state GIS data layers that are generated at a much larger scale. However, the value of this type of planning tool is indisputable and the NHEP will look to promote this or similar tools through the implementation of Actions LND-6A through F.

Action Plan WQ-4B calls for a community-based GIS mapping effort to record the sanitary and stormwater sewer infrastructure in Seacoast communities. This information, generated and updated by municipal personnel trained by UNH educators, will be verified and maintained in databases at the regional planning commissions.

Comments on Water Quality issues

Plan should refer to specific areas of nitrogen pollution and eutrophication (e.g., North Mill Pond, South Mill Pond, head of tide areas just above dams, and areas near sewage treatment plant outfalls) and what to do about them (such as more natural flushing in the two mill ponds).

While nutrient contamination does not appear to be an immediate widespread threat to New Hampshire estuaries, continued growth and development will likely increase the threat of nutrient over-enrichment to estuarine waters. The *Plan* calls for ongoing nutrient monitoring in estuarine waters with particular attention to sensitive areas and specific locations already exhibiting effects of seasonal nutrient over-enrichment. More specific reference to the effects of nitrogen pollution in North and South Mill ponds in Portsmouth and in the impoundments behind the dams at the heads of tide on the Salmon Falls, Cocheco, Oyster, and Lamprey rivers has been added to *Chapter 4: Water Quality*.

Wastewater treatment facilities: Should dealing with the discharge from wastewater treatment plants be made a higher priority? Consider changing the location of the effluent discharge from wastewater treatment plants. Think about regulation that would allow smaller scale wastewater treatment facilities in certain situations.

The High Priority ranking for all wastewater treat facility (WWTF) Action Plans (Actions WQ-1, WQ-2, WQ-3) reflects the importance of wastewater treatment facility issues for the NHEP. Action Plans WQ-2 and WQ-14 call for the investigation and adoption of new and innovative technologies for wastewater treatment facilities and septic systems respectively. As these Action Plans are implemented, topics such as relocating WWTF discharges or combined effluent discharges will be considered along with other innovative technologies such as UV alternatives, micro-filtration, and small-scale WWTFs.

Need more research re: the nutrient loading of the estuaries via groundwater. The problem is exacerbated by an increasing number of septic systems.

Groundwater has been suggested as a significant source of nutrients and possibly dissolved toxics to the estuaries, and two Highest Priority Action Plans address this issue. First step in determining groundwater nutrient loading is to build a regional groundwater model, which is being developed (Action LND-18) as part of a UNH/CICEET project "Inflow and Loading from Groundwater to the Great Bay Estuary." Action Plan LND-18 acknowledges the CICEET project and suggests NHEP funding of an extension of the model to the Hampton-Seabrook Estuary. Action Plan LND-19 offers two strategies to eliminate and prevent groundwater contaminants. One strategy builds upon the CICEET model and identifies sensitive areas with respect to land use and preferential pathways. A second strategy utilizes existing information gathered by NH DES as they identify Source Water Protection areas in the Great Bay and coastal watersheds. With sensitive areas identified and contamination threats better defined, preventative and remedial actions may be taken.

GIS mapping of water and sewer systems is very difficult to keep up to date and properly maintained.

The NHEP has identified contaminated stormwater discharges and sanitary sewer/stormwater illicit connections as very high priority issues as they contribute pathogens, nutrients, and to a lesser extent, toxic contaminants to the estuaries. The sewer and stormwater infrastructure of the region has evolved over time with the growth of Seacoast communities. Infrastructure development often reflects the best available technology of the time, and extensions, repairs and routine maintenance have altered original designs and provided partial upgrades. Records of these activities span decades and survive in a variety of forms. GIS technology is a valuable new tool for organizing and managing water and sewer infrastructure information, but managing this data is difficult. Action Plans WQ-4A, WQ-4B, and WQ-6 all contribute to building the capability needed by municipalities, regional planning commissions, and the responsible state agencies to develop, maintain, and verify data layers documenting the water and sewer infrastructure throughout the Great Bay and coastal watersheds.

Comments on Outreach and Education issues

Work one-on-one with individual communities on an ongoing basis.

Municipal decision-makers were identified early on as perhaps the most important single audience for the NHEP. The NHEP is committed to working directly with the 43 communities within the estuarine watershed, with special emphasis on the 19 Zone A municipalities. The *NHEP Management Plan* presents numerous actions developed to deliver important natural resource, land-use planning, and water quality information and assistance through new and proven methods to local decision-makers in the region. (Actions WQ-4A, WQ-4B, WQ-6, WQ-8, WQ-9, WQ-10, WQ-17, WQ-20, LND-2, LND-5, LND-6A-F, LND-8A, LND-11, LND-14, LND-15, LND-16, LND-20, LND-22, LND-25A-D, LND-28, LND-29, LND-32, LND-33, LND-36, RST-5, EDU-3)

Comments on Shellfish Management and Resource issues

Some shellfish action plans are not prioritized.

Shellfish Action Plans identified in the final Plan as SHL-2, SHL-3, and SHL-9B-D were being revised late in the process of developing the Draft *NHEP Management Plan*, and could not be prioritized by the Management Conference in time. These Action Plans have been designated as Priority actions in this final version of the *Plan*, with the understanding that in the next annual NHEP cycle the NHEP Board will review their prioritization as they consider additional Action Plans suggested through the public review process.

Some shellfish action plans should be rewritten and/or combined.

While the language in some shellfish action plans has been modified to reflect the NH Fish and Game Department concerns regarding content and NH F&G's role in implementing some Action Plans, the NHEP Management Committee chose to let the existing shellfish Action Plans stand. The Management Committee felt that any necessary refinements could be made through the Request for Proposals and the contract process that will finalize many of the implementation agreements.

REPORTS AND PUBLICATIONS OF THE NHEP

A8

Planning Reports

1. Development of draft Comprehensive Conservation and Management Plan Chapters for Pollution, Coastal Natural Resources, Indicators of Environmental Quality, Recreational, and Economic Development Issues (Audubon Society of New Hampshire)
2. Regulation and Management of New Hampshire's Estuaries: A Base Program Analysis Summary Report (NH Fish and Game Department)
3. Regulation and Management of New Hampshire's Estuaries: A Base Program Analysis (NH Fish and Game Department/Great Bay National Estuarine Research Reserve)
4. NHEP Management Plan, Executive Summary (NHEP)
5. Critical Lands Analysis (UNH Complex Systems Research Center)
6. NHEP Monitoring Plan (UNH Jackson Estuarine Laboratory)
7. NHEP Implementation Strategy (UNH Program on Consensus and Negotiation)
8. Development of Priority Issues, Action Plans, and an Implementation Strategy for the NH Estuaries Project Management Plan (UNH Program on Consensus and Negotiation)
9. NH Estuaries Project Outreach Strategy (Seacoast Science Center, NHEP)
10. Draft Data Management and Access Strategy for NH Estuaries Project (UNH Jackson Estuarine Laboratory)

Natural Resource Reports

11. NH Estuaries Project Shoreline Habitat Condition Assessment (UNH Sea Grant Cooperative Extension)
12. Testing of Great Bay Oysters for Two Protozoan Pathogens (NH Fish and Game Department)
13. Natural Resource Inventory, Evaluation, Mapping, and Outreach in Newmarket, NH (Town of Newmarket Conservation Commission
14. Edmond Avenue Wetland Restoration Project (City of Portsmouth Public Works Department)
15. Testing of Great Bay Oysters for Two Protozoan Pathogens (NH Fish and Game Department)
16. Resource Protection Evaluation (NH Fish and Game Department)
17. Fairhill Salt Marsh Restoration Project (Town of Rye Mosquito Control Commission)
18. Development of a Shoreline Checklist for Volunteers Assisting in Sanitary Surveys (UNH Jackson Estuarine Laboratory)

19. Assessment of Clam (*Mya arenaria*) Populations in the Great Bay Estuary (UNH Jackson Estuarine Laboratory)

20. Northwood Wetland Inventory and Prime Wetland Designation Project, Northwood, NH (Town of Northwood)

21. Recreational Softshell Clam Harvest Survey (NH Fish and Game Department)

22. Resource Protection Evaluation (NH Fish and Game Department)

23. Reclamation of a Gravel Pit Located in the Fork of the Confluence of the Branch River and Jones Brook to Protect and Enhance the Riparian Buffer and Wetland (Town of Milton Planning Board)

24. Little River Marsh Restoration/Landowner Education Project (Town of North Hampton)

25. Cross Beach Road Stormwater Drainage Project (Town of Seabrook)

26. Assessment of Shellfish Populations in the Great Bay Estuary (UNH Jackson Estuarine Laboratory)

27. Great Bay Oyster Harvest Survey (NH Fish and Game Department)

28. Recreational Softshell Clam Harvest Survey (NH Fish and Game Department)

29. Restoration of Clam Habitat in the Hampton-Seabrook Estuary (UNH Sea Grant Cooperative Extension)

30. Edmond Avenue Stormwater Management/Marsh Restoration Project (City of Portsmouth)

31. Clam Population Assessment in Back Channel, Portsmouth (UNH Jackson Estuarine Laboratory)

32. Piscassic Breeding Bird Survey (Audubon Society of New Hampshire)

33. Shellfish Habitat Restoration Strategies for New Hampshire's Estuaries (UNH Jackson Estuarine Laboratory)

Water Quality/Pollution Reports

34. An Investigation of Water Quality in New Hampshire Estuaries (NH Department of Environmental Services)

35. Bellamy River and Little Bay Shoreline Survey: Fecal Coliform and pH Analyses (UNH Jackson Estuarine Laboratory)

36. Analysis of Water Quality Data for New Hampshire Shellfishing Waters (UNH Jackson Estuarine Laboratory)

37. Cains Brook and Mill Creek Watershed Study (Town of Seabrook Conservation Commission)

38. Odyssey School/Hampton Harbor Water Quality Assessment Project (Odyssey House, Inc.)

39. State of the North Mill Pond, Portsmouth, NH (Advocates for the North Mill Pond)

40. Riverside Drive Restoration Project (City of Dover Community Services Department)

41. Sanitary Survey for Lower Little Bay, Located in Newington, Dover, Madbury, and Durham (NH Department of Health and Human Services)

42. New Hampshire Estuaries Project Volunteer Shoreline Sampling and Habitat Survey (UNH Sea Grant Cooperative Extension)

43. Odyssey School: Hampton Storm Drain Outflow Report (Odyssey House, Inc.)

44. Water Quality and Rainfall Analysis Supporting Sanitary Surveys in Hampton Harbor and Great Bay (UNH Jackson Estuarine Laboratory)

45. NH Estuaries Project: Volunteer Shoreline Field Assistance and Data Management (UNH Sea Grant Cooperative Extension)

46. Pollution Source Identification in Coastal Watersheds (NH Department of Environmental Services)

47. Sanitary Survey of the Hampton-Seabrook Estuary (NH Department of Health and Human Services)

48. Water Quality Assessment of Stormwater Control Systems: Bacterial Phase Partitioning in Stormwater (UNH Dept. of Natural Resources)

49. Stuart Farm BMP Installation (NH Department of Environmental Services)

50. Newmarket Sewage Cross Connection Identification and Elimination (Town of Newmarket)

51. Dover Sewage Cross Connection Elimination (City of Dover)

52. Bellamy River Shoreline Status Report (NH Department of Health and Human Services)

53. Atlantic Coast Sanitary Survey (NH Department of Health and Human Services and NH Department of Environmental Services)

54. Elimination of Illicit Connection in Coastal New Hampshire Spurs Controversy (NH Department of Environmental Services)

55. Analysis of Physiochemical Water Quality Data for New Hampshire's Shellfishing Waters (UNH Jackson Estuarine Laboratory)

56. Water Quality Analysis Supporting Sanitary Surveys of New Hampshire's Atlantic Coast and Great Bay (UNH Jackson Estuarine Laboratory)

Education/Outreach Reports

57. 1997 Environmental Projects in New Hampshire's Estuarine Watersheds: NH Estuaries Environmental Network Conference, November 13, 1997 (NH Estuaries Project ; NH Coastal Program)

58. The Clam Hotline as a Shellfish Informational Resource for Public Outreach (NH Fish and Game Department)

59. Shoreland Outreach Activities (Seacoast Science Center)

60. Epping's Lamprey Watershed Program (Town of Epping)

61. State of the Estuaries Report (NHEP/Seacoast Science Center)

62. NH Estuaries Project Outreach Strategy (NHEP/Seacoast Science Center)

63. Design of a Walkway to Improve Salt Marsh Education on the Odiorne Farm Portion of Odiorne State Park (Friends of Odiorne Point State Park)

64. Implementing Effective Land Stewardship Programs (Audubon Society of New Hampshire)

65. A Listing of Agricultural Producers in Strafford County (Strafford County Conservation District)

66. Public Outreach Education in the Cocheco River Watershed (Strafford Regional Planning Commission)

67. New Hampshire Estuaries Project Public Outreach Activities for FY97 (Seacoast Science Center)

Administrative/Miscellaneous Reports

68. Progress Report on Graphics Production for the NH Estuaries Project (UNH Complex Systems Research Center)

69. A Technical Characterization of Estuarine and Coastal New Hampshire (UNH Jackson Estuarine Laboratory)

70. Federal Consistency Review (Carl Paulsen)

71. NH Estuaries Project Map Production: Final Report (UNH Complex Systems Research Center)

For copies of any of these reports, please contact the NH Estuaries Project at 603-433-7187.