



The National Estuary Program: a Community-Based, Whole-System Approach to Restoring U.S. Estuaries

Laura Perry

Program Description

Introduction

The National Estuary Program (NEP) was created in 1987 by amendments to the Clean Water Act and is administered by the U.S. Environmental Protection Agency (EPA). The primary goals of the program are to identify, restore and protect United States estuaries (U.S. EPA 1998(a)). Estuaries are partially enclosed bodies of water formed where freshwater streams and rivers flow into the ocean. Estuaries are highly productive environments that provide critical habitat to a diverse array of aquatic and terrestrial organisms (Zedler et al., 1992). Surrounding coastal communities rely on estuarine systems for income from fisheries industries and regional tourism. Estuarine wetlands improve water quality, absorb coastal flood waters, and stabilize shorelines. The NEP does not perform estuary restoration and management actions directly. Rather, the NEP is concerned with influencing the processes through which restoration planning and implementation occur. The NEP focuses on encouraging local participation in planning and restoration, facilitating collaboration and consensus-building among various stake-holders in estuaries, and coordinating the implementation of restoration activities.

Site Selection

To be included in the NEP, estuaries must be nominated by state governors and approved by the EPA. Nominations must:

- show that the estuary meets statutory definitions and describe the geography of the estuary,
- demonstrate that the estuary is worth protecting, by describing the economic, ecological, recreational, educational, and scientific values of the estuary,
- show how information gained from the estuary could be applied to other coastal systems, discussing in particular how the estuary and proposed management techniques differ from those already included in the program,
- identify and prioritize the major problems in the estuary based on sufficient existing data and discuss how these problems reduce the value of the estuary,
- list and evaluate existing institutions, regulations, policies, and programs that affect the estuary,
- identify members of the proposed local NEP and demonstrate that membership includes all required parties and is appropriate to the important issues identified,
- identify a state or local agency with the necessary infrastructure to oversee the program, and
- provide evidence of state and local political support as well as public support of the program

(U.S.EPA, 1994). Estuaries that have substantial economic and ecological value, that are likely to provide valuable information to national estuary restoration efforts, and that already receive conservation support from state and local agencies are given priority over other nominees.

There are currently 28 estuaries included in the NEP (Table 1). Twelve of the NEP estuaries are located in the northeast and mid-Atlantic states. Seven NEP estuaries have been established in the southeast states and six have been established on the Pacific coast. The remaining three are located in Texas and Puerto Rico. Many NEP estuaries are associated with major urban centers (e.g. New York-New Jersey Harbor; San Francisco Bay, CA), whereas others are in less densely populated areas (e.g. Buzzard's Bay, MA; Tillamook Bay, OR). NEP estuary watersheds range in area from 240 to 34,889 km² (Table 1).

Local Community Involvement

The NEP is designed to encourage the involvement of local communities in the conservation of estuarine systems and to facilitate cooperation and understanding among community members. Local NEPs formed by the NEP bring together the various "stake-holders" in the local community to form a "management conference." Management conference members include local, state, and federal government agencies, community residents, user groups, scientific and technical institutions, business and industry, and environmental groups (U.S. EPA 1998(a)). Members of the management conference work together as equal partners to develop and implement a "Comprehensive Conservation and Management Plan" (CCMP) for the estuary. Management conferences are administered by "management committees", consisting of a director, technical and outreach staff, scientific and advisory committees, and citizen advisory committees (U.S. EPA 1998(a)). Because estuaries are large, complex, often highly disturbed systems with numerous economic and social values, efforts to restore estuaries must be designed to address multiple large-scale issues. The NEP encourages community members to consider the whole estuarine system and to incorporate a wide array of ecological and social issues when developing their restoration and management strategies (U.S. EPA 1998(a)).

CCMP Development

In developing a CCMP, conference members begin by identifying and prioritizing the environmental problems in the estuary, and determining the causes of these problems (U.S. EPA 1998(a)). Because information on the nature and causes of problems in estuaries has often been incomplete or unavailable, many local NEPs have coordinated research by local university and state scientists to determine the key stressors influencing estuaries. Most NEP estuaries face similar major problems, including nutrient overloading, alteration of natural flow regimes, habitat loss and degradation, declines in fish and wildlife populations, and introduction of pathogens, toxic chemicals, and exotic species (U.S. EPA 1998(a)).

Once conference members have identified the major problems influencing the estuary and have reached a consensus on which problems are most important to address, they can begin to develop strategies to address those problems. The NEP requires that conference members develop quantifiable goals for improvement with regard to each identified major problem (U.S. EPA 1998(a)). Conference members then design action plans appropriate for meeting those goals

(Table 2). Action plans may be designed to address problems at the landscape-scale or within individual sites. CCMPs may include more than 500 action plans (e.g. Narragansett Bay NEP CCMP). Expected sources of funding must be identified with each action plan. Further, each action plan must include a fully developed program for monitoring the success of the plan at meeting the goal. For example, the Galveston Bay NEP is currently implementing a monitoring program using aerial photographs of seagrass communities in conjunction with water quality data to assess the effectiveness of their efforts to restore seagrass communities through revegetation and water quality improvement (Miksa, pers. communication).

The EPA provides 75% of the total cost of developing the CCMP. State governments are required to provide at least 25% in matching non-federal funds (U.S.EPA, 1994). Once the CCMP is completed, EPA funding is substantially reduced and covers only program overhead and the monitoring aspects of the action plans (Trenholm, pers. communication). State governments continue to provide at least 25% in matching non-federal funds (U.S.EPA, 1994). Funding for implementing the CCMP must come from sources found during the development of the CCMP and described with the action plans. Much of this funding comes from federal and state grants (Trenholm, pers. communication), from local government agencies (Yamaguchi, pers. communication), from existing restoration programs (Brierly, pers. communication), and from fines and court settlements associated with estuary conservation regulations (Mooney, pers. communication).

Because stake-holders often disagree on priorities and appropriate solutions to problems, consensus-building in collaborative management efforts can be very challenging. While local NEPs established before 1995 were given four to five years of EPA funding to complete a CCMP, more recently established local NEPs are expected to complete a draft CCMP in 12 to 18 months and must submit a final CCMP in three years (U.S.EPA, 1994). The EPA expects that, because estuaries appear to share so many problems, recently established local NEPs can draw on the earlier programs' work to develop CCMPs more quickly. Further, in 1995 the EPA changed the criteria for accepting estuaries into the NEP, essentially requiring local NEPs to be developed before they are nominated. As a result, estuaries that have already received considerable attention with respect to scientific research (identification of key problems, their causes, and potential solutions), legislative protection (regulations, policies, and existing conservation and restoration programs), and public support and involvement are now given priority over estuaries with less developed conservation programs. The purpose of this change is to shift the focus of the NEP from the need to conduct research on sources of environmental problems to the need to "facilitate collaborative, consensus-based management" (U.S.EPA, 1994). This change may also reduce the total cost to the EPA per estuary and may account for the increase in the number of accepted estuaries in 1995 (Figure 1).

CCMP Implementation

To date, 17 of the 28 local NEPs have completed a CCMP and are beginning to implement their action plans. Apparently, the transition from development to implementation of a management plan can be challenging. Because CCMP goals are broad and the action plans frequently involve large-scale long-term efforts, local NEPs require long-term, stable sources of funding and volunteers to successfully implement their plans. Keeping public interest and awareness high is

an important and time-consuming aspect of implementing the management plans. Ensuring consistent funding is also important.

Most actions taken thus far by local NEPs have involved public outreach and education programs (e.g. workshops, newsletters, school programs), and recommendations for changes in government regulations and policies relating to development and water quality control (see Corpus Christi National Estuary Program 1998 for an example of a local NEP annual progress report). The NEP has no legal regulatory power and can only make recommendations regarding government policy. However, because local NEPs consist of so many members of the community, including government agencies, it is expected that local government responses to NEP recommendations will generally be positive (Trenholm, pers. communication).

Local NEPs have also provided funding for a number of demonstration projects, and for ecological research and monitoring efforts. Frequently, information on the best ways to solve the problems in estuaries is unavailable (Zedler, 1992). During the early stages of implementation, much of the important work that the NEP can do is research identifying causes of environmental problems and experimenting with possible solutions. Recent demonstration projects have included eelgrass bed restorations (Delaware Inland Bays Program, Galveston Bay NEP), identification of non-point pollution sources in a small agricultural croplands watershed (Corpus Christi Bay NEP), and wetland construction to filter storm-water runoff pollutants (Corpus Christi Bay NEP).

NEP monitoring efforts to date have included water quality sampling (Gufstason, pers. communication), vegetation surveys (Miksa, pers. communication), and public surveys (Schultz, pers. communication). Data collected through monitoring programs are used to establish baseline information, assess changes in environmental conditions over time, and inform future management and restoration decisions (Miksa, pers. communication). Many local NEPs are creating WWW information clearinghouses to make monitoring data available to the public (e.g. Corpus Christi Bay NEP, Galveston Bay NEP). The extent of NEP monitoring efforts varies with the size of the local NEP. Monitoring programs for large local NEPs are often designed around a number of indicators, whereas smaller local NEPs may only monitor a few indicators to assess the success of their efforts. For example, the Galveston Bay NEP is currently coordinating 17 monitoring programs aimed at assessing changes in habitat quality, water and sediment quality, shoreline erosion, freshwater inflows, and public health and at identifying point and non-point pollution sources (Miska, pers. communication). In contrast, the monitoring program for the Sarasota Bay NEP, a smaller program, relies only on bi-yearly aerial photographs of seagrass populations and a single U.S.EPA water quality monitoring program (E-map monitoring) to evaluate changes in habitat availability and water quality (Gufstason, pers. communication).

Because the EPA provides relatively little funding for plan implementation, local NEPs generally rely on numerous pre-existing, pre-funded government agencies to implement the more expensive efforts called for in CCMPs (e.g. wetland revegetation) (Schultz, pers. communication). For example, habitat restorations called for by the Sarasota Bay NEP are performed by the Florida Department of Environmental Protection, the Southwest Florida Water Management District, the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, and the Surface Water Improvement and Management Program (Table 3). Monitoring programs

called for in CCMPs are also frequently funded and conducted by pre-existing, pre-funded agencies. For example, agencies involved in monitoring for the Galveston Bay NEP include the city of Houston, Harris County Pollution Control District, Galveston County Health District, Galveston Bay Foundation, Texas Natural Resources Conservation Commission, Texas Parks and Wildlife Department, Texas Water Division Board, the General Land Office, USEPA, USGS, NMFS, NOAA, and the U.S. Fish and Wildlife Service (Miska, pers. communication). When creating action plans for a CCMP, most local NEPs must work very closely with government agencies to ensure that the action and monitoring plans developed will be funded (Upton, pers. communication). Often, action plans in CCMPs call simply for the continuation or enhancement of current restoration and monitoring programs (Brierly, pers. communication). As a result, rather than performing restoration and management actions directly, local NEPs tend to be mainly responsible for consensus-building, public relations, and program coordination. With so many agencies and programs involved, local NEP management committees often need to develop institutional arrangements with state organizations or establish non-profit organizations to coordinate the agencies' efforts and ensure that implementation of management plans occurs efficiently. Some local NEPs request annual progress reports from the agencies charged with implementing CCMP action plans (Mooney, pers. communication).

Program Evaluation

As a restoration program, the NEP focuses most funding on planning and organization of restoration efforts. Programs are forced to rely on other sources to fund the implementation of CCMP action plans. Limitations on funding for implementation may influence both which action plans are included in the final CCMP and which action plans in the CCMP are actually carried out. Certainly the innovative projects the NEP encourages local programs to design may be the most difficult to fund because there are no pre-existing programs with funding to implement them. Considering the array of pre-existing programs aimed at estuary restoration and conservation (see Table 3), the NEP's focus on planning and collaboration over implementation may be appropriate. However, this focus fosters a dependence on pre-existing programs and various potentially unstable funding sources and may affect the degree to which the CCMPs are truly "comprehensive." If important actions are not funded, the effectiveness of the overall management plan may be reduced.

Likewise, the EPA's decision to shorten the time allotted for the development of CCMPs may reduce the quality of the program developed. The consensus-building process is challenging (Upton, pers. communication), and three years may be inadequate to develop a complete plan based on educated decisions or to reach the level of trust and understanding necessary to ensure continued support and involvement from all members through the implementation stages.

To ensure that local NEPs can complete a CCMP in three years, the EPA gives estuaries that have already received considerable scientific and legislative attention priority when choosing estuaries to include in the program (U.S.EPA, 1994). By choosing estuaries that have received considerable attention, the NEP ensures that estuaries included are of significant local and scientific value, and that local NEPs will receive adequate support from the local community and government. The NEP may also provide incentives for states to fund the necessary research and conservation efforts in order to obtain NEP funding. However, by focusing on those estuaries

where problems have already been identified, the NEP neglects estuaries that may have substantial value but have not yet been the subject of adequate research.

Certainly, there is a trade-off between the number of estuaries included in the program and the quality and amount of support the local NEPs receive. To the degree that the NEP serves as a demonstration of an alternative to traditional "command-and-control" regulatory approaches to estuary management, it would be inappropriate for the NEP to fund the protection of all estuaries or to fund the basic research required for CCMP development or even to fund the implementation of the action plans developed, even if such funding were possible.

The collaborative management facilitated by the NEP is similar to alternative management practices forming in fisheries (Adaptive Environmental Assessment and Management) (McLain and Lee 1996 and Walters 1986), natural resources (Ecosystem-Based Management) (Grumbine 1994, 1997), and agriculture (Participatory Rural Appraisal) (Chambers 1994a, 1994b, 1994c). Because estuaries are large complex systems valued by so many different groups, for fisheries, recreation, aesthetics, conservation value, water purification, tourism, etc., collaborative management seems a particularly appropriate tool for developing restoration programs for estuaries (Ford et al., 1990). The interests and priorities of stakeholders often conflict, particularly when the stakeholders involved are numerous and diverse. The NEP's focus on collaborative management is an attempt to recognize and deal with such conflicts directly. The NEP was modeled in part after collaborative management efforts for the restoration of the Chesapeake Bay and the Great Lakes Basin (see Costanza and Greer, 1995, and Francis and Regier, 1995 for descriptions of these programs). Collaborative management was also apparently a successful method for developing restoration strategies for Biscayne Bay, FL, and was used as a model for restoration for two estuaries now included in the NEP, Tampa Bay and Indian River Lagoon (Thorhaug et al., 1990). By encouraging public participation in the development of restoration strategies, the NEP increases the likelihood of long-term public support and involvement in the program. By bringing together and coordinating the numerous pre-existing state restoration and management programs, the NEP ensures that state programs work in conjunction, rather than in opposition to one another, and prevents redundancy among programs (Schultz, pers. communication).

Current ecosystem restoration efforts are often performed without consideration of the surrounding landscape and the interactions between the numerous connected ecosystems within the landscape (Hobbs and Norton, 1996). Because the environmental condition of a single community within a landscape is often dependent on the environmental condition of the landscape, attempts to restore single sites may be ineffective. In estuaries in particular, single areas (e.g. wetlands) are subject to nutrient overloading, altered flow regimes, and introduction of toxics, pathogens, and exotic species, from outside sources. Altered ecosystem processes and community dynamics in these systems will not necessarily improve in response to the removal of one or even several of these disturbances. In such systems, a "whole-system" approach to restoration is likely to be more effective. By encouraging the development of comprehensive strategies for the restoration of whole estuaries, the NEP addresses the whole range of environmental problems and increases the likelihood of restoration success. Further, the collaborative management encouraged by the NEP is a particularly appropriate tool for whole-system restoration.

Monitoring the success and failure of restoration efforts is critical to the development of appropriate restoration strategies, but is an aspect of the restoration process that is also frequently neglected (Hobbs and Norton, 1996). One of the major goals of the NEP is to develop and demonstrate alternative approaches to solving problems in estuarine systems. Successful methods can then be adopted by other programs, including non-NEP programs, that are attempting to solve similar problems in similar systems. Although the NEP may not currently provide adequately for implementation of CCMPs, the NEP does provide funding for monitoring programs. Further, the NEP requires that monitoring programs be included in the CCMPs. These monitoring programs are designed to determine whether CCMP action plans are effective for reaching the quantifiable goals agreed upon by the management conference. By funding local NEP monitoring of restoration successes and failures, the NEP is able to demonstrate which restoration strategies are effective and how they might be improved. By designing monitoring programs in reference to quantifiable goals, the NEP ensures that "successes" and "failures" are clearly defined.

Conclusion

Eleven years after the program was established, it is still early to discuss the effectiveness of the NEP as a restoration program. Even those local NEPs that have completed CCMPs have had little time to make progress solving the large scale, multi-dimensional problems affecting U.S. estuaries. Further, many lack the information required to proceed in meeting their goals. Many of the current plans involve recommendations for research to inform yet-to-be-designed action plans. Certainly, the NEP has improved the organization and thoughtfulness of estuary restoration efforts by facilitating collaboration among stakeholders, developing comprehensive management plans, and encouraging monitoring of restoration success. The long-term influences of the program on the success of estuary restoration efforts will be interesting to observe.

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Table 1. Names, locations, dates of establishment, and watershed areas of the 28 local NEPs (U.S. EPA, 1998 (c)).

Estuary Program	Location	Year Established	Watershed Area (km²)
Albermarle-Pamlico Sounds	NC	1987	34,889
Barataria-Terrebone	LA	1991	9819
Barnegat Bay	NJ	1995	3525
Buzzards Bay	MA	1987	1554
Casco Bay	ME	1995	2965
Charlotte Harbor	FL	1995	12,653

(Lower) Columbia River Estuary	OR	1995	14,491
Corpus Christi Bay	TX	1992	25,998
Delaware Estuary	DE, NJ, PA	1988	17,462
Delaware Inland Bays	DE	1988	642
Galveston Bay	TX	1988	11,516
Indian River Lagoon	FL	1990	3072
Long Island Sound	NY	1987	18,975
Maryland Coastal Bays	MD	1995	729
Massachusetts Bays	MA	1990	11,078
Mobile Bay	AL	1995	12,550
Morro Bay	CA	1995	242
Narragansett Bay	RI	1987	3488
New Hampshire Estuaries	NH	1995	2578
New York – New Jersey Harbor	NJ, NY	1988	21,208
Peconic Bay	NY	1992	1187
Puget Sound	WA	1987	20,178
San Francisco Estuary	CA	1987	17,131
San Juan Bay	PR	1992	240
Santa Monica Bay	CA	1988	1465
Sarasota Bay	FL	1988	733
Tampa Bay	FL	1990	6583
Tillamook Bay	OR	1992	1428

Table 2. Examples of local NEP action plans aimed at the seven major problems identified for U.S. estuaries: nutrient overloading, pathogens, toxic chemicals, habitat loss and degradation, introduced species, alteration of natural flow regimes, and declines in fish and wildlife populations. Information was obtained from U.S. EPA 1998(b). For more detailed descriptions, visit the local NEP web sites (links available from U.S. EPA 1998(d)).

Estuary Program	Action Plans
Stressor:	Nutrient Overloading
Albermarle-Pamlico Sounds	<ul style="list-style-type: none"> • expand funding for nonpoint source pollution controls through N.C.'s Agricultural Cost Share Program and develop a broader Water Quality Cost Share Program • strengthen enforcement in detecting and correcting water quality violations • strengthen forestry BMPs through education, technical assistance, and enforcement • strengthen regulatory requirements for the nutrient sensitive waters designation • implement a point/nonpoint source nutrient trading program (Tar-Pamlico Basin)
Buzzards Bay	<ul style="list-style-type: none"> • adopt a tiered nitrogen loading limit approach that accounts for bay volumes, bathymetry, residence time, and water quality classifications to determine whether embayments are over recommended nitrogen limits • rank embayments as to the effectiveness of management action and the value of resources and recreation threatened by nitrogen loading • provide staff and laboratory analysis for a citizens water quality monitoring program to develop baseline information regarding the nitrogen-related health of embayments
Charlotte Harbor	<ul style="list-style-type: none"> • establish a nutrient budget and historic trophic levels to support the setting of pollution reduction targets
Corpus Christi Bay	<ul style="list-style-type: none"> • review water quality standards, numerical criteria, and designated water uses • establish biological criteria as a component of water and sediment quality criteria • establish wastewater discharge permits on a watershed basis • develop a regulatory permitting process for mariculture operations
Long Island Sound	<ul style="list-style-type: none"> • establish interim targets for improving dissolved oxygen levels • freeze point and nonpoint nitrogen loadings in critical areas at 1990 levels • develop specific nitrogen targets for 11 geographic management zones and define an approach for meeting the targets
Massachusetts Bays	<ul style="list-style-type: none"> • identify embayments that are most at risk of eutrophication • monitor water quality to determine the need for management actions to reduce nitrogen loading

Morro Bay	<ul style="list-style-type: none"> • replace septic systems in Los Osos with a sewer system • remove nutrients through wetland treatment of effluent • improve riparian buffer areas in the watershed through fencing, flood plain restoration, and other best management practices • conduct a study to assess nutrient loading and recommend loading reduction goals
New York – New Jersey Harbor	<ul style="list-style-type: none"> • complete upgrades of municipal dischargers to secondary treatment
Peconic Bay	<ul style="list-style-type: none"> • modify permits to implement a nitrogen "freeze" on current point source dischargers • develop a total maximum daily load (TMDL) to reduce nitrogen inputs • develop a "water quality preservation" policy to include best management practices, land use controls, local "overlay districts," and site-specific mitigation in key sub-watersheds
Sarasota Bay	<ul style="list-style-type: none"> • require STPs to meet advanced wastewater treatment standards • replace septic tanks with central sewers • reclaim 50 mgd of wastewater through a regional wastewater reclamation system • perform a wet/dry atmospheric deposition study to determine the potential impact of NOx on the Bay and Gulf of Mexico
Tampa Bay	<ul style="list-style-type: none"> • form a Nitrogen Management Consortium with agriculture and key industry groups to develop a plan of action to offset the 17 ton per year increase in loading expected due to future growth
Stressor:	Pathogens
Albermarle-Pamlico Sounds	<ul style="list-style-type: none"> • set up nonpoint source teams in each of the state's 17 major river basins • provide descriptions of current nonpoint source management activities within a basin • conduct assessments of nonpoint source controls in targeted watersheds • prioritize waters for development and implementation of restoration strategies • encourage proper maintenance and annual inspections of onsite waste disposal systems • encourage maintenance and repair of sanitary sewer lines • eliminate direct unpermitted discharges of domestic waste • encourage proper management of livestock • encourage local health departments to routinely monitor waters known to be used for swimming • install pumpout stations at all marinas
Barataria-Terrebone	<ul style="list-style-type: none"> • produce a video and brochure regarding proper sewage disposal and maintenance of septic systems and individual treatment systems

Casco Bay	<ul style="list-style-type: none"> • provide technical assistance to monitor and open public swimming areas and train installers and pumpers of septic systems • adopt minimum standards for stormwater quality in state and municipal regulatory programs • require proof of legal waste disposal upon transfer of property
Corpus Christi Bay	<ul style="list-style-type: none"> • develop a coordinated database and networking system among public health professionals to facilitate exchange of information • develop an information clearinghouse to address public fears and misinformation through outreach efforts
Indian River Lagoon	<ul style="list-style-type: none"> • recommend the development and implementation of a program to inspect septic tanks on a periodic basis to ensure they are functioning properly and meet current design standards.
Long Island Sound	<ul style="list-style-type: none"> • continue regional management of the major sources of pathogens • develop and implement site-specific management plans for embayments and shellfish bed areas with attention to: combined sewer overflows, nonpoint source runoff, sewage treatment plant malfunctions, and vessel discharges
Morro Bay	<ul style="list-style-type: none"> • remove illegally moored boats adjacent to the oyster beds • develop regular inspection programs for sewage lift stations • establish a "no discharge zone" in the southern reaches of the bay • enforce live-aboard ordinances • install new and more accessible pump-out stations • replace on-site septic systems with centralized sewerage • fence cattle from direct access to creeks • form a Technical Advisory Committee to develop a bacteria monitoring plan
New York – New Jersey Harbor	<ul style="list-style-type: none"> • reduce or eliminate the discharge of raw or inadequately treated sewage due to sewage treatment plant malfunctions and illegal connections • establish marina pumpout facilities and no discharge zones • continue appropriate research, environmental monitoring, and modeling to identify remediation activities and support recovery of uses
Peconic Bay	<ul style="list-style-type: none"> • encourage stormwater runoff mitigation from roadways • improve hydrology and habitat at previously ditched marshes • coordinate development of the "no discharge zone" process and BMPs
San Francisco Estuary	<ul style="list-style-type: none"> • raise the effluent limit for total coliform to reduce the use of chlorine as a disinfectant • improve city and sanitary district systems operations to minimize leaks and spills

	<ul style="list-style-type: none"> designate Richardson Bay as a "No Discharge Area."
Santa Monica Bay	<ul style="list-style-type: none"> implement and finance an epidemiological study recommend that federal and state agencies review and revise existing water quality Standards and Criteria for contact recreation in marine waters revise a Beach Regulatory Protocol to include the posting of more strongly worded warning signs near flowing drains
Sarasota Bay	<ul style="list-style-type: none"> eliminate wastewater discharges and replace septic tanks with central sewers conduct a study to detect the presence of human pathogens in surface waters
Stressor:	Toxic Chemicals
Casco Bay	<ul style="list-style-type: none"> educate boaters about low impact practices, nontoxic boat products, and the need to protect sensitive habitats conduct pollution prevention audits for businesses and industries that affect Casco Bay develop a comprehensive management strategy for dredged material develop sediment quality criteria and discharge limits that apply to Casco Bay
Delaware Inland Bays	<ul style="list-style-type: none"> develop Total Maximum Daily Loads (TMDLs) and Waste Load Allocations (WLAs) for many of the toxic substances evaluate sources of PCBs from high volume low concentration sources
Long Island Sound	<ul style="list-style-type: none"> continue source control through NPDES permitting programs, pollution prevention, and watershed planning for nonpoint source runoff remediate contaminated harbors where feasible continue assessment of contamination levels, effects, and risks to improve management
Morro Bay	<ul style="list-style-type: none"> implement Best Management Practices and educational outreach to control pollution from boat yards and other urban sources
Narragansett Bay	<ul style="list-style-type: none"> initiate a Hazardous Waste Reduction Project to perform environmental audits at a wide range of industrial sites provide industries with recommendations on new, less toxic, and cost effective processes
New York – New Jersey Harbor	<ul style="list-style-type: none"> minimize the discharge of toxic chemicals from CSOs and non-point sources remediate identified solid and hazardous waste sites improve chemical/oil spill response and prevention establish consistent methodologies to assess risks

	<ul style="list-style-type: none"> • improve communication of fish advisories
Peconic Bay	<ul style="list-style-type: none"> • promote and enhance best management practices such as STOP ("Stop Throwing Out Pollutant") programs, road runoff, integrated pest management, and stormwater management at marinas, golf courses, and other commercial facilities
Puget Sound	<ul style="list-style-type: none"> • control sources through wastewater discharge permits and stormwater management • rank and cleanup sediment hot spots • manage dredging for navigation and shoreline development
San Francisco Estuary	<ul style="list-style-type: none"> • develop a Regional Monitoring Program (being financed by dischargers at over \$2 million per year) to understand and address contaminant issues • create a new interagency public/private coordinating committee to attack pesticide toxicity problems in urban runoff
Santa Monica Bay	<ul style="list-style-type: none"> • implement a regional coordinated monitoring program to assess the status and trends in loadings of 12 toxic pollutants of concern from various point and nonpoint sources
Sarasota Bay	<ul style="list-style-type: none"> • identify sources of contaminants to the Bay • promote the Florida Yards and Neighborhoods Program • conduct a study to evaluate the pesticide and nutrient removal rate of properties landscaped in an environmentally sensitive manner.
Stressor:	Habitat Loss and Degradation
Albermarle-Pamlico Sounds	<ul style="list-style-type: none"> • maintain accurate maps and records of wetlands, fisheries habitats, federal and state endangered species/habitats, natural areas, and natural communities • bring areas identified as having high priority for protection into public ownership • establish a mitigation program to compensate for unavoidable permitted wetland losses
Barataria-Terrebone	<ul style="list-style-type: none"> • implement wetland management/enhancement projects aimed at reducing the rate of vegetated habitat loss • evaluate activities being conducted in wetlands
Delaware Estuary	<ul style="list-style-type: none"> • hire a wetlands coordinator who will take an estuary-wide approach to wetland restoration and management
Galveston Bay	<ul style="list-style-type: none"> • promote beneficial uses of dredged material to restore and create wetlands

	<ul style="list-style-type: none"> • inventory degraded wetlands and fund remedial measures
Indian River Lagoon	<ul style="list-style-type: none"> • establish acquisition programs at the federal, state, and local level to purchase and protect lands that have been deemed ecologically valuable • purchase and install culverts and other equipment to implement improved marsh management and mosquito control strategies
Morro Bay	<ul style="list-style-type: none"> • establish conservation/mitigation banking as a method of reducing fragmentation and maintaining significant parcels of coastal dune scrub habitat • protect riparian and creek corridors through grazing management programs, development of conservation easements for buffer areas, and revegetation programs • integrate wetland restoration with stormwater and wastewater treatment facilities to increase habitat while improving water quality
Narragansett Bay	<ul style="list-style-type: none"> • work with RI CRMC to help educate the public on the need for control over impacts to the coastal zone • attempt habitat restoration through eelgrass transplants • pursue funds to allow for the identification and mapping of coastal natural resource areas on a high resolution scale
San Francisco Estuary	<ul style="list-style-type: none"> • develop non-regulatory approaches to wetlands protection with local landowners • streamline the permitting process for projects impacting wetlands • recommend to the S.F. Bay Regional Water Quality Control Board a "no net loss" policy, a wetlands alteration policy addressing wetlands fill and hydrologic modification, clarification of wetlands as "waters of the State," a mitigation policy, and a policy on the use of dredged material to restore wetlands • explore ways to maximize the beneficial reuse of dredged material, which may include efforts to use dredged material for wetland enhancement and restoration • encourage a commitment to protecting approximately 800 islands, which are home to fish, wildlife, wetland and riparian plants, and numerous special status species
Sarasota Bay	<ul style="list-style-type: none"> • prioritize sites for restoration • perform restorations continually as funding becomes available
Tampa Bay	<ul style="list-style-type: none"> • restore 12,350 acres of additional seagrasses baywide and 1,800 acres of low-salinity wetlands at a minimum rate of 100 acres every five years to "restore the balance" of wetland types • cap nitrogen discharges to the bay at existing levels through an equitable and cost-effective nitrogen management strategy to be developed by the Nitrogen Management Consortium
Stressor:	Introduced Species

Barataria-Terrebone	<ul style="list-style-type: none"> • develop brochures to educate citizens about the impacts of introduced plants and to encourage the use of native species when possible • monitor the influx of zebra mussels into the lower Mississippi River • encourage the development of a private fur corporation, to provide a continuous supply of nutria pelts in large numbers year-round • ban the sale of Chinese tallow trees • develop a noxious weed law for the state • designate areas of exotic infestation to demonstrate removal and replanting projects • encourage nurseries to grow native species for private landscaping • assess potential locations for zebra mussel settlement
Corpus Christi Bay	<ul style="list-style-type: none"> • educate ship owners/operators regarding the National Invasive Species Act • determine the risks posed by invasive species contained in vessels in Corpus Christi
Morro Bay	<ul style="list-style-type: none"> • assess the existing status of marine aquatic invasives • support closure of a major oil receiving terminal north of Morro Bay that represents a significant risk for invasive species introduction • develop recreational fisheries for introduced fish species • improve grazing management practices and roadside maintenance procedures to reduce nuisance thistle populations • develop methods to manage of hoary cress and german ivy
Tampa Bay	<ul style="list-style-type: none"> • provide seed money to a local homeowners association to develop a Brazilian pepper brochure, entitled "Beautiful but Bad", for distribution to other citizens with shoreline homes
Stressor:	Alteration of Natural Flow Regimes
Charlotte Harbor	<ul style="list-style-type: none"> • establish minimum flows and water levels for each water body resources
Indian River Lagoon	<ul style="list-style-type: none"> • develop partnerships between water management districts and local governments to offer grants for the establishment of stormwater utilities, promote the use of BMPs, and fund projects to upgrade older drainage systems • determine the feasibility of modifying federal drainage projects to reduce their impacts • develop pollutant load reduction goals (PLRG)
Morro Bay	<ul style="list-style-type: none"> • perform a flow study to provide a framework for making management decisions regarding fresh water flows • reclaim wastewater to supplement instream flows

Sarasota Bay	<ul style="list-style-type: none"> • construct a multi-jurisdictional regional wastewater reuse system
Tampa Bay	<ul style="list-style-type: none"> • re-establish adequate freshwater inflow from four impounded tributaries to 1,800 acres of low salinity habitats • convene a Minimum Flow Advisory Group to develop technically sound recommendations for determining ecological criteria necessary to set minimum flows on the two highest priority rivers
Stressor:	Declines in Fish and Wildlife Populations
Albermarle-Pamlico Sounds	<ul style="list-style-type: none"> • develop recovery objectives for depleted stocks • modify the existing marine fisheries license structure to improve data collection with respect to landings, demographics and fishing effort, and to generate increased revenues for fisheries management • continue development of bycatch reduction gear and practices • institute a cost share program for best fishing practices for commercial fishing gear
Morro Bay	<ul style="list-style-type: none"> • develop buffer areas around riparian corridors • develop mitigation and conservation banking programs for wetlands, riparian habitat, and coastal dune scrub • fund a bay habitat study to qualitatively describe the flora and fauna associated with various habitat types
San Francisco Estuary	<ul style="list-style-type: none"> • establish a federal-state "operations group" of export pump managers and scientists to make decisions about pumping to minimize negative environmental impacts • fund screens at water diversions associated with fish mortality
Sarasota Bay	<ul style="list-style-type: none"> • restore fisheries habitat • test, implement, and monitor fishery enhancement modules (artificial habitats) for juvenile and adult finfish, shellfish, and invertebrates
Tampa Bay	<ul style="list-style-type: none"> • increase allocations for marine law enforcement from existing saltwater fishing license revenues

Table 3. Examples of agencies involved in local NEP actions. Funding for listed actions is generally provided by the agency or agencies involved. Information was obtained from U.S. EPA 1998(b). For more detailed descriptions, visit the local NEP web sites (links available from U.S. EPA 1998(d)).

Estuary	Cooperative Agencies	Actions
Albemarle-Pamlico Sound	<p>The Tar-Pamlico Basin Assoc.</p> <p>North Carolina Division of Soil and Water Conservation</p>	<p>Implementing an experimental point/nonpoint trading strategy.</p> <p>Administers the Agriculture Cost Share Program, which provides incentives to farmers to install best management practices (BMPs).</p>
Barataria-Terrebonne	<p>Shellfish Challenge program</p> <p>LA DNR Coastal Zone Management Division</p> <p>U.S. Army Corps of Engineers</p> <p>LA Department of Fish and Wildlife</p> <p>LDFW and Louisiana Fur and Alligator Advisory Council</p> <p>LA Department of Environmental Quality (DEQ)</p> <p>The U.S. Coast Guard, USEPA, and LADEQ</p>	<p>Aims to increase harvestable oyster beds by ten percent.</p> <p>Evaluates activities being conducted in the wetlands to determine if the activity will have detrimental impacts.</p> <p>Studies and attempts to control introduced aquatic plants.</p> <p>Regulates harvesting of species and monitors populations to prevent depletion of the resources through overharvesting.</p> <p>Encouraging the development of a private fur corporation, to provide a continuous supply of nutria pelts.</p> <p>Monitors nutrient, bacteria, and toxic contaminant loads in waterbodies.</p> <p>Provide rules and regulations intended to prevent spills of petroleum and other oil field products and are responsible for responding to spills that do occur.</p>

Barnegat Bay	<p>NJ DEP</p> <p>Trust for Public Land</p> <p>NJDEP and the NJ Coastal Management Program</p>	<p>Developing more precise information on inland wetland locations.</p> <p>Acquires marsh islands still in private ownership.</p> <p>Developing a "Landscape Model" program.</p>
Charlotte Harbor	<p>Water Management Districts (WMD)</p> <p>Florida DEP and WMD</p> <p>The Florida Yards and Neighborhoods Program</p>	<p>Establishing minimum in-stream flows so that permitted water withdrawals do not adversely impact natural resources.</p> <p>Regulate groundwater withdrawal for water supply, agricultural, and industrial purposes.</p> <p>Educate members of residential communities to improve the quality of runoff and decrease water use for landscaping.</p>
Corpus Christi Bay	<p>U.S. Army Corps of Engineers, with NRCS, NMFS, USFWS, and SeaGrant</p>	<p>Developing alternative maintenance dredging schedules and techniques and new methods to create beneficial uses of dredged material</p>
Delaware Estuary	<p>USEPA, DRBC and the states of DE, PA, and NJ</p> <p>USFWS</p>	<p>Evaluating sources of PCBs from high volume low concentration sources</p> <p>Responsible for certain threatened and endangered species.</p>
Indian River Lagoon	<p>St. Johns River WMD and South Florida WMD</p>	<p>Provide funding for the purchase and installation of culverts and other equipment to implement improved marsh management strategies. Offer grants to establish stormwater utilities, promote the use of BMPs, and fund projects to upgrade older drainage systems</p>
Indian River Lagoon <i>cont..</i>	<p>U.S. Army Corps of Engineers</p>	<p>Performing a study determine the feasibility of modifying federal drainage projects to reduce their impact on the IRL.</p>
Long Island Sound	<p>USEPA, the states of NY and CT, New York City, USFWS, NMFS, New York Sea Grant, and Save the Sound</p>	<p>Developing a Bi-state Habitat Restoration Strategy</p>

Narragansett Bay	<p>RI CRMC</p> <p>Save The Bay, URI, USFWS, and NOAA</p> <p>Save The Bay and USFWS</p>	<p>Developing a regulatory framework to balance development pressures with some control over impacts to the coastal zone.</p> <p>Initiating several pilot projects to attempt habitat restoration through eelgrass transplants in certain areas of the Bay.</p> <p>Working to identify and map coastal natural resource areas.</p>
San Francisco Bay	<p>The Regional Water Quality Control Board</p> <p>The Bay oil industry</p> <p>Public-private Brake Pad Partnership</p> <p>Save San Francisco Estuary Association</p>	<p>Aims to raise the effluent limit for total coliform to reduce the use of chlorine as a disinfectant.</p> <p>Developing new methods for reducing selenium discharges.</p> <p>Reducing copper pollution of South Bay waters.</p> <p>Developing non-regulatory approaches to wetlands protection with local landowners in the North Bay.</p>
Santa Monica Bay	<p>The state of CA, Chevron Companies, private foundations, a local environmental group, and USEPA</p>	<p>Implementing and financing an epidemiological study.</p>

<p>Sarasota Bay</p>	<p>Manatee and Sarasota Counties, USEPA, NOAA, and Florida DEP</p> <p>Two state agencies, Manatee County, the City and County of Sarasota</p> <p>University of Florida and the County Cooperative Extension Service</p> <p>Florida DEP and the Southwest Florida WMD</p> <p>The U.S. Army Corps of Engineers</p> <p>USFWS</p> <p>Surface Water Improvement and Management Program</p>	<p>Performing wet/dry atmospheric deposition studies to determine the potential impact of NO_x on the Bay and Gulf of Mexico.</p> <p>Eliminating wastewater discharges and replacing septic tanks with central sewers. Conducting a study to detect the presence of human pathogens in surface waters.</p> <p>Conducting a study to evaluate the pesticide and nutrient removal rate of properties landscaped in an environmentally sensitive manner.</p> <p>Design and construct habitat restoration projects.</p> <p>Restores areas throughout the Bay which were created from Corps of Engineers dredge and fill activities.</p> <p>Funds restoration of intertidal wetlands.</p> <p>Provides technical assistance for habitat restoration projects.</p>
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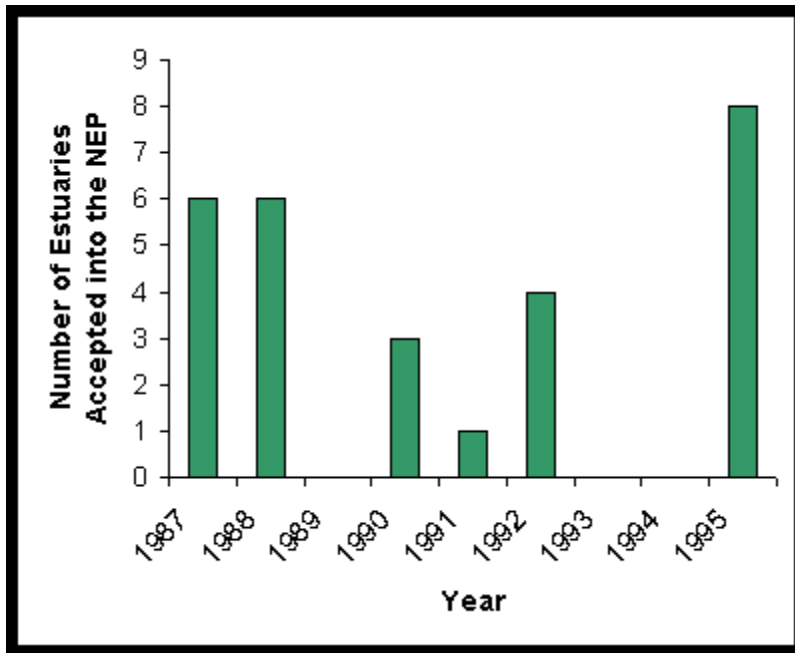


Figure 1. Number of estuaries accepted into the NEP annually since the program was established. Information was obtained from U.S. EPA 1998 (c).