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Information About Estuaries and Near Coastal Waters December 1999 - Issue 9.6

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Rising Seas, Coastal Erosion, and the Takings Clause: How to Save Wetlands and Beaches Without Hurting Property Owners

The Problem

In the next century, the majority of America's publicly owned tidal shorelines could be replaced by a wall, not because anyone decided that this should happen but because no one decided that it should not. Throughout the United States, housing developments are being built just inland of the marshes, swamps, muddy shores, and sandy beaches that collectively comprise the public trust tidelands. Because sea level is rising and most shores are eroding, the water will eventually reach these houses unless either the houses are moved or the sea is somehow held back.

The most common response has been to build a wall between the private upland and the public tidelands, saving the former but allowing the latter to erode away. Most states tacitly reward riparian owners who build these walls with sole custody of the public shore by allowing the owners to exclude the public from the area inland of the wall. Many beaches and tidelands have been made inaccessible to the public as a result. In Maryland alone, more than 300 miles of tidal shoreline have been armored in the last twenty years. This trend will accelerate as sea level continues to rise.

The problem of shoreline armoring is mostly confined to bays and other sheltered waters. Coastal communities recognize ocean beaches for their economic and recreational importance, and generally beach nourishment will be employed in densely populated areas or structures in lightly developed areas will be allowed to be removed by storms. Along estuarine shores, however, existing environmental programs provide only temporary relief, because they were designed as if shorelines and sea level were stable. These programs will have to be modified or they will ultimately fail, because eventually the wetlands that they protect will be underwater. Only by planning for the eventual landward migration of wetlands can their survival be ensured.

Possible Solutions

Land Use Planning

At the state and local level, a reasonable first step is to decide whether a significant fraction of natural shoreline should be maintained, and if so, which ones. State and local governments have enacted land use planning and zoning regulations that determine which private properties will remain as open space. In principal, it ought to be less controversial to decide which shorelines should retain their natural characteristics, since the shores in every state are either owned by the public or subjected to a public trust easement inherited from the common law. For land that has not yet been developed, the local government is in the position to ensure that future subdivisions are designed in a fashion consistent with the plan. For example, if the shore is going to retreat, a local government may require that near-shore homes are accessible by shore-perpendicular roads.

Setbacks

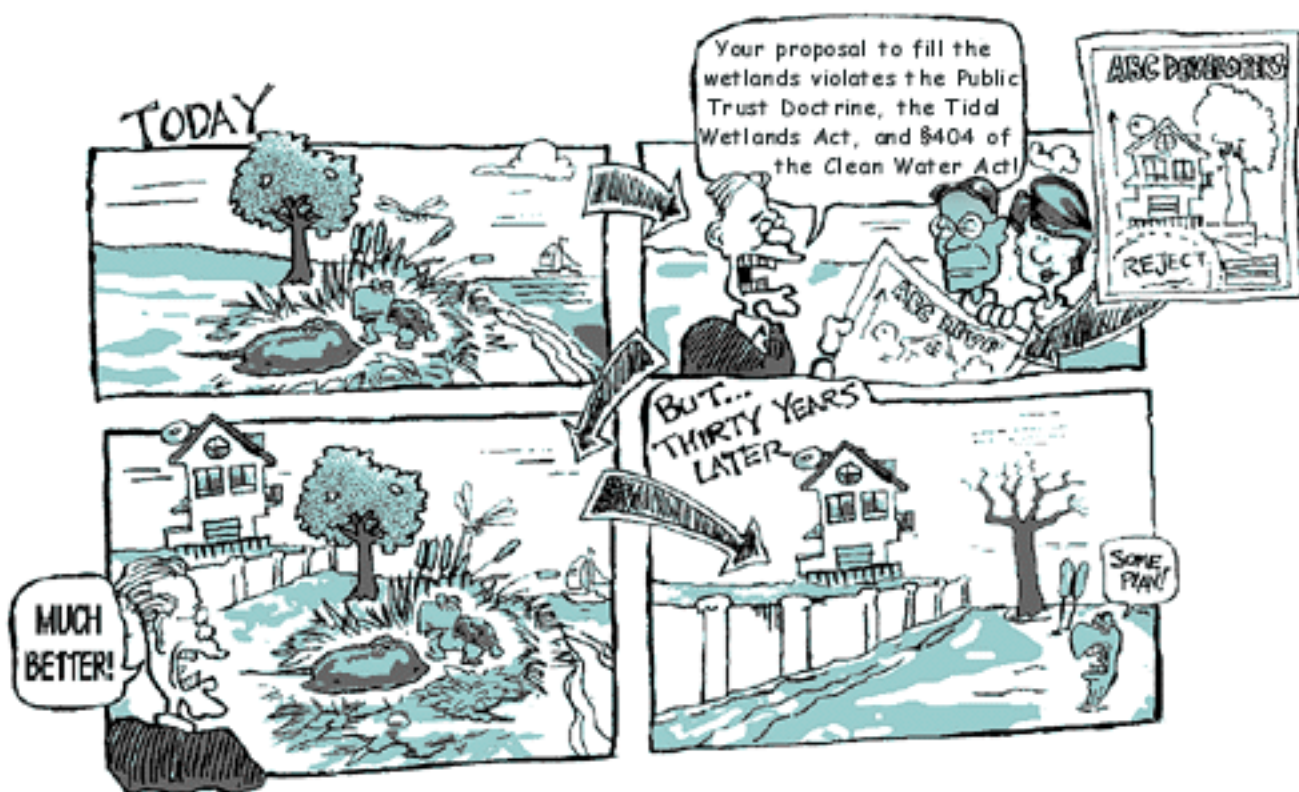
In areas with fairly steep slopes, it might be reasonable to simply set all development back to the 10- or 20-foot contour, which would provide flood protection and allow natural shores to survive for centuries. Such an approach would not, however, be feasible in the flat areas of the Mid-Atlantic and Southeast and may give rise to regulatory takings issues (see Coastlines Issue 9.4 for more information on takings).

Rolling Easements

Texas, Maine, Rhode Island, Oregon, South Carolina and Massachusetts have adopted the "rolling easement" approach along parts of their coasts. The term "rolling easement" refers to a broad collection of institutional mechanisms that ensure that naturally migrating shorelines have the right of way over the desires of private property owners to hold back the sea. To the private property owner, this approach is less draconian than a setback, because owners are allowed to develop, but only on the condition that the intertidal wetlands and beaches will not be eliminated. Rolling easement policies are not unconstitutional takings of private property because the state merely preserves its existing property interest in the shore. Nevertheless, political feasibility and—in some cases—simply fairness might prompt states to purchase these easements. The cost would tend to be only a small percent of purchasing a property outright, because the required abandonment of the property would be many decades hence.

Private parties can also play an important role. Conservation groups can purchase rolling easements or include no-armoring provisions in existing conservation easement purchases. Developers can propose to reserve rolling easements and donate them to a public or private conservation entity, as part of environmental mitigation programs needed to secure permits. Finally, individual owners of coastal property can donate rolling easements on their property to conservancies or public conservation entities and claim a tax deduction.

The federal government has two roles, as a property owner and as a permitting agency. Under existing statutes, the federal government has the authority to purchase high ground and rolling easements adjacent to federal lands. The federal regulatory program to protect coastal wetlands currently discourages the filling of coastal wetlands, but it has also issued a nationwide permit for constructing the very bulkheads that prevent wetlands from migrating inland. It is an open question whether this program can be reoriented to ensure that wetlands survive a rising sea without an amendment to the Clean Water Act. Simple reason suggests, however, that if the prospect of sea level rise is important enough to justify measures to reduce greenhouse gases, then it is important enough to implement the relatively inexpensive measures that it would take to ensure that the nation's shorelines survive.

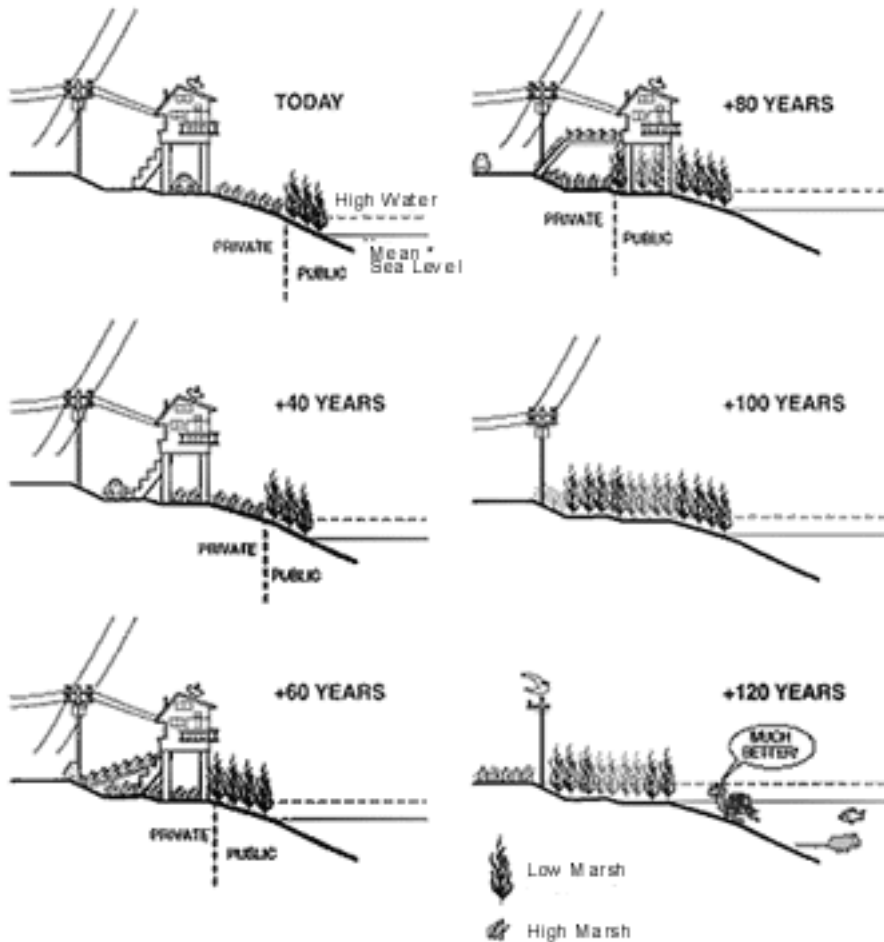


The Transitory Success of Current Tidelands Policies

The public trust doctrine and wetland-protection policies prevent people from filling wetlands and beaches. As a result, new construction is generally set back inland from the high water mark. Because these policies do not consider shoreline erosion, however, the shore will eventually erode up to the development, leaving us with the same situation that would have resulted had developers been allowed to

fill the wetlands in the first place.

Rolling Easement

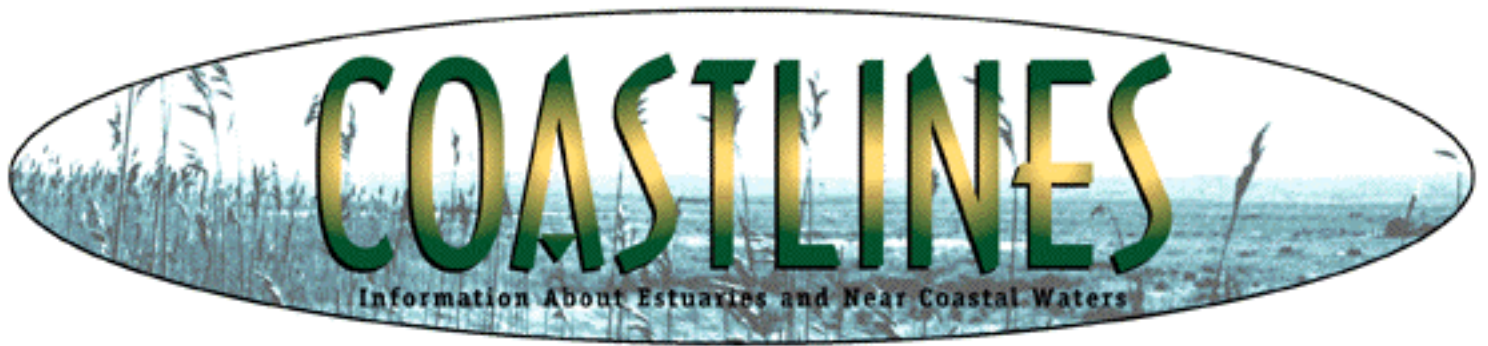


A rolling easement allows construction near the shore, but requires the property owner to recognize nature's right of way to advance inland as sea level rises. In this case, the high marsh reaches the footprint of the house 40 years hence. Because the house is on pilings, it can still be occupied (assuming that it is hooked to a sewage treatment plant). After 60 years, the marsh has advanced enough to require the owner to park the car along the street and construct a catwalk across the front yard. After 80 years, the marsh has taken over the entire yard; moreover, the footprint of the house is now seaward of mean high water and hence on public property. At this point, additional reinvestment in the property is unlikely, and the state might charge rent for continued occupation of the home. Twenty years later, the particular house has been removed, although other houses on the same street may still be occupied. Eventually, however, the entire area

returns to nature.

For further information, contact James G. Titus, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460, Phone: (202) 260-7821, FAX: (202) 260-6405 titus.jim@epa.gov

The opinions expressed herein are not the official views of the U.S. Government. This abstract is adapted from 57 Maryland Law Review 1279-1399 (1998), which is available electronically at <http://www.epa.gov/globalwarming/publications/index.html>



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Beach Management Planning in Maui

In Hawaii, beaches provide a setting for diverse cultural opportunities, such as religious activities and traditional ceremonies. Recreational activities are also tied to the beach, including windsurfing, surfing, sunbathing, beach combing, swimming, and picnicking. Such activities are central to Hawaii's thriving visitor industry, and support the local economy. Maui's sandy beaches also help to maintain pristine water quality and provide habitat for many marine, terrestrial and native Hawaiian organisms and plants.

Unfortunately, many sandy beaches in Maui have narrowed or even disappeared as a result of natural shoreline processes, development, hardening along the shoreline, and other human activities. Studies have shown that 62% of Maui's sandy shoreline is eroding at an average rate of 1.25 feet per year, and as much as 30% of Maui's shoreline has experienced beach loss or significant narrowing of beaches.

In 1997 a joint publication of Hawaii Sea Grant and the Maui County Planning Department was published entitled, the Beach Management Plan for Maui. The Beach Management Plan for Maui seeks to promote beach preservation and sustainable development of the coastal zone. It is intended to guide policy, rather than be adopted as formal law, although specific recommendations may best be implemented through revisions of existing rules and regulations.

The plan contains an overview of shoreline environments and beach processes and lists a number of

recommendations to better guide development and activities in the shoreline area. Concepts discussed include sediment budgets, erosion and accretion, response of the beach profile to different wave conditions, the role of dunes and the reef in buffering wave attack, the effect of seawalls and revetments on beach processes, sand production by the reef, and the effect of water quality degradation on reef ecosystem health.

More effective beach management practices are discussed, including identification of erosion hotspots and erosion watchspots, guidelines for shoreline protection measures, beach nourishment, dune preservation and restoration, protection of near-shore water quality, shoreline setbacks and coastal erosion hazard data, proactive development of coastal lands, inter-agency coordination, regulation of structures and activities within the shoreline area, beach management districts, public awareness needs, research needs, and potential funding mechanisms.

The Beach Management Plan for Maui was endorsed by the Maui County Council and the Maui Planning Commission in 1998. It is available to developers and consultants, individual coastal property owners, and the county and state agencies working on or reviewing shoreline projects. The plan recommends environmentally sound management of shoreline resources and has helped initiate a number of small-scale beach and dune restoration projects. It has also served as an important educational tool, since it allows readers to better understand coastal environments and processes and learn how to minimize human-induced impacts to beaches, dunes, and coral reef ecosystems.

Compliance with the plan is facilitated review of any proposed new development by the Maui Planning Commission. Most developments, anything larger than an individual single family home) along or near the coast are subject to review by the Maui Planning Commission. The planning commission has formally endorsed the plan and ensures that developments are consistent with the plan, or the commission will reject the proposed development or attach conditions to make it compliant.

For further information contact, Robert A. Mullane, Hawaii Sea Grant Extension Service, Maui Community College, 310 Kaahumanua Ave., Kahului, HI 96732;

Phone: (808) 984-3254, Fax (808) 242-8733,

E-mail: rmullane@soest.hawaii.edu

or Daren M. Suzuki, County of Maui, Department of Planning, 250 South High Street, Wailuku, HI 96793,

Phone: (808) 243-7735, Fax: (808) 243-7634

The *Beach Management Plan for Maui* is available online at

<http://www.soest.hawaii.edu/SEAGRANT/bmpm.html>.



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Coastal Erosion and Beach Loss on Maui

Sea level rise, waves, currents and sediment deficiencies drive coastal erosion. Sea level rise, which currently averages about 2.5 centimeters per decade on Maui, causes the beach system to shift landward by eroding the upland area—usually a coastal dune or the coastal plain. Coastal erosion has occurred for millennia as sea level has risen nearly 110 meters since the last ice age. The retreat of the shoreline is the natural response of the beach to rising sea levels. Coastal erosion is beneficial in that it builds beach elsewhere. However, when the overall rate of coastal erosion exceeds the rate of beach and dune formation, a net deficiency of sediment results.

Certain human activities create significant sediment deficiencies and aggravate coastal erosion. These include sand mining, dune and beach alteration (e.g. grading, building on dunes and beaches), construction of shoreline structures such as seawalls, revetments, and groins that prevent longshore transport of sand, degradation of coral reefs, and construction of harbors and navigational channels.

Armoring shorelines with revetments and seawalls halts coastal erosion in more limited areas, but refocuses the erosion onto the beach in front of the structure by directing wave energy onto the beach (see figure). This causes beach narrowing through a volumetric loss of sand from the active beach. Coastal armoring also can aggravate erosion in downdrift properties by decreasing the supply of sediment. Groins and jetties hinder longshore sediment transport which is often the primary source of sand to beaches.

Maui County and the State of Hawaii currently discourage the construction of seawalls and revetments along sandy shorelines because of their impacts on beaches. However, shoreline setbacks in Hawaii are typically only 40 feet, and alternative erosion mitigation options (e.g. beach restoration and dune nourishment) have not been widely utilized (Maui County determines shoreline setbacks with a formula based on 25% of the average lot depth up to a maximum of 150 ft. and minimum of 40 ft. or in rare cases 25 ft.). Maui County is also considering establishing more effective shoreline setbacks.

The site-specific history of coastal processes for a particular beach segment is the most effective guide to beach management practices. Certain management tools—beach nourishment and dune restoration, for example can counteract coastal erosion and beach loss. Other management tools such as requiring sufficient building setbacks and wiser construction codes—can delay or prevent the need to armor the shoreline to protect beachfront development.



Coastal erosion vs. beach loss. The beach in front of the armored revetment is much narrower than the beach in front of the unarmored segment, where greater shoreline setbacks have allowed more coastal erosion.

Determining the specific causes of erosion for each beach is time-consuming and costly, and solutions to address coastal erosion are often even more expensive. A sensible, interim strategy is to discontinue or reduce those activities that contribute to unnatural coastal erosion, and avoid the need to armor shorelines by adhering to an effective shoreline setback. At the same time, beaches should be studied in more detail to determine the specific causes of coastal erosion and to explore mitigation options.

Hawaii Sea Grant and the American Shore and Beach Preservation Association are organizing a conference on beach preservation, August 8-10, 2000 in Kaanapali, Maui. For further information visit the website: <http://www.soest.hawaii.edu/SEAGRANT/NBPC2000.html>



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Cape Hatteras: Relocating a Lighthouse and Preserving the Coast

This year, after almost two decades of planning and debate, a well known national historic landmark located on the Outer Banks of North Carolina, the Cape Hatteras Light Station, was relocated 2,900 feet inland from the spot on which it had stood since 1870. Barrier islands, like the Outer Banks, are physically dynamic, with beaches eroding and accreting as the tides and currents move sand along the coast. Due to a combination of rising sea level and erosional losses, the ocean was within 160 feet, of the lighthouse and its buildings in 1987. In 1998, it was within 120 feet of the lighthouse and closing in. The risk of losing this historic lighthouse was becoming ever greater and something had to be done or lose the lighthouse to the ocean forever.



Photo courtesy of National Park Service © Mike Booher

Numerous interim protective actions, including beach nourishment, sandbagging, and groin maintenance had been taken over the years to slow the erosion and save the lighthouse in place. The beach was nourished several times, most recently in 1973. Sandbags were placed near the base of the lighthouse, beginning in 1967 and continuing until 1996. An existing groin adjacent to the lighthouse, one of three built in 1969 to protect an adjacent Navy base, was maintained and extended landward several times as the shoreline moved inland.

Despite these efforts, the waves continued to break closer and closer to the lighthouse. National Park Service (NPS) policy and North Carolina state laws precluded additional temporary protective measures or armoring of the coast for long-term protection. In 1980, the National Park Service began planning for a long-term protective solution. During a three-year planning process that included many public meetings, several options were considered. Relocation was considered but discounted as impractical. The option finally selected and funded was a seawall revetment that would have protected the lighthouse in place; however, it would have eventually created an island as the coastline receded to the southwest, leaving the lighthouse isolated.

When concerns were raised that relocation had not been adequately assessed as a viable alternative, NPS re-examined all of the available alternatives. Due to the importance and cost, as well as the controversy surrounding the project, the Park Service contracted the National Academy of Sciences (NAS) to have a panel of experts consider all the options and recommend the best long-term solution to save the lighthouse.

The panel issued a report in 1988, *Saving Cape Hatteras Lighthouse from the Sea: Options and Policy Implications* (full text is available through the lighthouse move website at <http://www.nps.gov/caha>). The evaluation of options and policies led the committee to reject several options for the reasons stated below.

Options Considered	Reason for Rejection
Continuing Beach Nourishment	Excessive Cost
Constructing Artificial Reefs to Protect Against Wave and Storm Damage	Uncertain Effectiveness and Cost
Artificial Planting of Seagrass to Stabilize Sediments	Failure to Provide Protection for any Period of Time
Constructing Offshore Breakwaters and Rehabilitating the Groinfield	Violation of Various Coastal Policies
Rehabilitating the Groinfield Without Providing a New Revetment	Failure to Provide Short Term or Long Term Protection
Constructing a New Lighthouse	Failure to Preserve the Historic Lighthouse

The report recommended relocation as the preferred alternative and that the process used by the panel, evaluation of alternatives using predefined criteria, set an example for future decisionmaking involving sea level encroachment on human structures.

The review of the relocation project continued with various state and federal regulatory agencies. In 1996, North Carolina State University (NCSU) appointed an ad-hoc committee to review the National Academy of Sciences report. The NCSU report, *Saving the Cape Hatteras Lighthouse from the Sea*, was issued in January, 1997. It not only supported the NAS report but also recommended that "the National Park Service proceed as soon as possible with its present plans to obtain the financial resources necessary to preserve the lighthouse by moving it." Funding was appropriated by Congress beginning in fiscal year

1998. The relocation contract was awarded in November, 1998, and the project was finally underway.

Management decisions of this magnitude in national parks are made based on laws and regulations through a public planning process. The NPS followed the laws and regulations, including consultation with the State Historic Preservation Officer, Fish and Wildlife Service and the Army Corps of Engineers. The decision was a sound public policy decision based on the best science and engineering available. Private and local efforts to stop or change the project at the last minute through public relations and legal efforts were not successful, based in large part on the careful planning which had occurred.

On July 9, 1999, the Cape Hatteras Lighthouse reached its new home. Now safely 1,600 feet from the ocean, it should not be threatened by ocean waves for another 100 years.

For further information on the Cape Hatteras Lighthouse relocation, go to the website <http://www.nps.gov/caha>. For information on planning and policy issues contact Steve Harrison, Chief, Resource Management, National Park Service, Cape Hatteras Group, Route 1, Box 675, Manteo, North Carolina, 27954, Phone: (252) 473-2111 ext. 159, Fax: (252) 473-2595 E-mail: CAHA_Chief_of_Resource_Management@nps.gov



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Sea Level Rise - Response Planning in Maryland

The average rate of sea level rise along Maryland's coastline has been 3 to 4 millimeters per year, or approximately one foot per century. These historic rates are nearly twice those of the global average, and rates of sea level rise are expected to accelerate. Scientists predict that Maryland could experience as much as 2 to 3 feet of sea level rise by the year 2100. Coastal planners and property owners alike have cause to be concerned.

Given the diversity of Maryland's coastal environment, the impacts of sea level rise will vary accordingly. Rising sea levels threaten low-lying coastal plains and barrier islands, such as those located along Maryland's outer coast, its coastal bays, and the low-lying eastern shore, by increasing coastal flooding and erosion. Sea level rise also threatens to prolong erosion along the western shore of the Chesapeake Bay. Perhaps most dramatic is the threat of total submergence of many low-lying islands and extensive marsh systems within the Chesapeake Bay.

Over the years, multiple studies have focused on analyzing the impact of sea level rise along Maryland's coastline. The Chesapeake Bay, Maryland's Coastal Bays, and the Atlantic Coast have all been the focus of investigations into the impact of sea level rise. These studies have concentrated on assessing the impact of sea level rise on the coastal environment, and have offered only a moderate examination of policy response options.

Recognizing the crucial need for anticipatory planning, Maryland's Coastal Zone Management Program submitted a proposal to NOAA's Coastal Services Center for a post-graduate researcher, to assist the state in developing an adaptive sea level rise response strategy. Maryland was awarded a fellowship and the state is now in the midst of a substantive undertaking to develop a sea level rise response plan.

Maryland's framework for a response strategy is built around three components:

- A shoreline characterization,
- A policy analysis,
- And on-going public input and outreach.

Characterization of sea level rise impacts, categorized according to shoreline type and agency jurisdiction, will determine where and how to focus policy response efforts. An analysis of management programs and initiatives concerning resources and uses that could be impacted will identify avenues for better planning. And finally, facilitating a number of one-on-one interviews, issue forums, public presentations, and workshops with state and local agencies, and public and private interest groups, will provide public outreach and get public input.

Improved coastal decision-making, due to heightened awareness of sea level rise and its consequences has already begun. Successes include:

- The recently approved Comprehensive Conservation Management Plan for the Maryland Coastal Bay's National Estuary Program, encourages state and local agencies to work together on sea level rise issues.
- A Shore Erosion Task Force, recently appointed by
- the Governor, is charged with developing a comprehensive action plan to address shore erosion in Maryland. The establishment of the Task Force was due in part to concerns over global warming and issues related to sea level rise.
- Maryland's Coastal and Watershed Resources Advisory Committee sponsored a forum in May, 1999, on the impacts of climate change and sea level rise in the Chesapeake Bay watershed. Recommendations for including sea level rise issues into the Chesapeake Bay Agreement in the Year 2000 are currently under consideration.

The ultimate goal of the project is to develop an adaptive response strategy to address sea level rise. As the development of the adaptive sea level rise response strategy proceeds, public awareness and public consideration of sea level rise issues will increase.

For further information, contact Zoë Johnson, NOAA Coastal Management Fellow, Maryland Department of Natural Resources, Coastal Zone Management Division, Tawes State Office Building, E-2, Annapolis, MD 21401;
Phone: (410) 260-8986
E-mail: zjohnson@dnr.state.md.us.



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Funding Local Hurricane Costs Through a Risk-Based Assessment on Property

When a hurricane strikes, local governments can face substantial costs for disaster response and recovery not covered by federal or state disaster assistance programs, and many local governments do not have a dedicated fund to cover such costs. Most communities pay for response and recovery costs, as well as day-to-day emergency planning and management, through general tax revenues derived from property or sales taxes. In coastal jurisdictions, however, these costs are largely attributable to private development in areas subject to storm surge flooding, wave impacts, and intense winds that accompany hurricanes. Critics have argued that using general revenues for such costs is unfair--it amounts to subsidies for risky development paid by taxpayers who live and work in less hazardous areas.

Researchers at Florida State University have worked in collaboration with Lee County, Florida, to devise a risk-based tax mechanism that can be used to finance a hurricane contingency fund and to pay for ongoing costs of emergency management resulting from hurricane risks. The pilot project, funded by the National Sea Grant Program, will be readily adaptable to other coastal communities and also could be applied to other natural hazards that vary spatially within communities.

Researchers analyzed the local government costs associated with each of the five categories of hurricane severity, based on six hurricanes that struck Florida between 1979 and 1995. These costs, with and

without federal and state disaster assistance, are shown below. When these costs are adjusted for the annual probability of each storm category occurring in Lee County, the annualized cost of hurricane response and recovery for the county amounts to between \$496,000 and \$978,000. If these costs are added to the ongoing costs of emergency management, approximately \$720,000 in 1995, the total annualized cost for Lee County's government attributable to hurricane hazards is approximately \$1.2 to \$1.7 million.

**Estimates of Response and Recovery Costs
Lee County, Florida**

Hurricane Category	Estimated Local Government Costs of Response and Recovery	Local Share with 87.5% Federal and State Cost Sharing
1	\$4.9 - 10.7 million	\$0.6 - 1.3 million
2	\$12.4 - 22.1 million	\$1.6 - 2.8 million
3	\$27.8 - 53.2 million	\$3.5 - 6.7 million
4	\$66.5-197.8 million	\$8.3 - 24.7 million
5	\$207.1 + million	\$25.9 + million

If a community chooses to create a separate tax levy to finance its ongoing emergency management costs for hurricanes and a contingency fund for hurricane response and recovery, the amount of money it would need to raise each year would depend on how much money the community wished to accumulate in its contingency fund and how quickly. In Lee County, it would take about three years to accumulate sufficient reserves to cover the local response and recovery costs of a Category 2 hurricane and about seven years to cover the local costs of a Category 3 hurricane.

A special assessment offers an accepted method for assessing property owners for public services based on usage that could be used to finance such a fund. In most states, special assessments can be applied to a wide array of public services. While funding emergency management services would be a novel application of this means of raising revenues, other applications have included stormwater management and fire protection as well as more traditional services such as sidewalks, street lighting, and solid waste collection.

The assessment method devised by the Florida State researchers is based on two characteristics of a developed parcel: (1) its location and the resulting exposure of that parcel to the forces of coastal storms, and (2) the type of structure on the parcel and the resulting vulnerability of that structure to damage from coastal storms. Data from the Lee County Property Appraiser's Office were used to define the exposure of each developed parcel to storm surge flooding, wave action, and hurricane-force winds as well as first floor elevation and structure type. With these data, and estimates of probable damage and the likelihood of evacuation, risk indices were calculated for each of four cost categories for each developed parcel: (1)

costs of evacuation and other measures taken in anticipation of a hurricane, (2) costs of debris collection and disposal after a storm, (3) costs of damage to public facilities and infrastructure that service a given property, and (4) the continuing costs of emergency management necessitated by development of that parcel.

Applying these risk indexes to developed parcels in Lee County would result in new, risk-based, special assessments between \$0.01 and \$8,160 per parcel per year with a median assessment of \$8.14. The actual net tax increase for a parcel is lower, however, since these costs are currently covered by property taxes in Lee County. As in many other communities, ongoing costs of emergency management are covered by the annual budget, while response and recovery costs are taken from the general fund when disaster strikes. In Lee County, the median tax change across all developed parcels would be an increase of \$2.00 per year. Parcels ranked in the top 20% based on risk would experience a median tax increase of \$11.25 per year.

Interestingly, most properties less than one-eighth of a mile from the open coast would actually experience a reduction in their tax obligation because of high property assessments and the influence of state and local building codes on flooding vulnerability. Some of the largest tax increases would fall on properties between one-eighth and five-eighths of a mile from the coast, most of which have somewhat lesser assessed values, but even more importantly, are located outside the 100-year flood A-zones and velocity-zones within which flood elevation building standards apply.

A final report to the county is scheduled in early 2000. So far, no initiative has been taken to implement the special assessment, but the relatively low magnitude of projected tax increases suggests that political opposition may be relatively slight. Furthermore, Lee County has a track record of innovative financing of emergency management services, having previously created an "all-hazards protection district that funds hazard mitigation and disaster recovery through a straight ad valorem tax within designated municipal services taxing unit."

For further information, contact Robert E. Deyle, Associate Professor, Department of Urban and Regional Planning, Florida State University, Tallahassee, FL 32306-2280; E-mail: rdeyle@coss.fsu.edu



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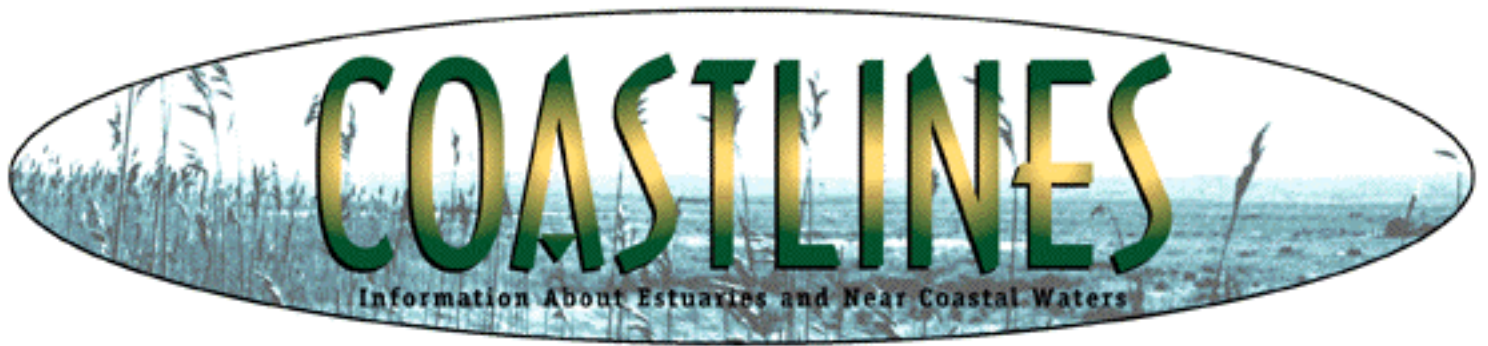
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Model Ordinances to Protect Water Quality

If you need some help developing a local ordinance to protect your water resources, a new reference tool recently developed by the U.S. EPA's Office of Water's Nonpoint Source Control Branch. The new website offers both model and real-life examples of ordinances that address the following topic areas:

- Aquatic Buffers
- Erosion and Sediment Control
- Open Space Development
- Stormwater Control Operation and Maintenance
- Illicit Discharges
- Post Construction Runoff Control

This site includes supporting materials such as examples of meeting notices, inspection checklists, and performance bonds. Local government officials can customize their existing or develop new ordinances using the examples on this web page located at <http://www.epa.gov/owow/nps/ordinance/>. If you have any comments or suggestions on the site please contact Rod Frederick, E-mail: frederick.rod@epa.gov or Robert Goo, E-mail: goo.robert@epa.gov.



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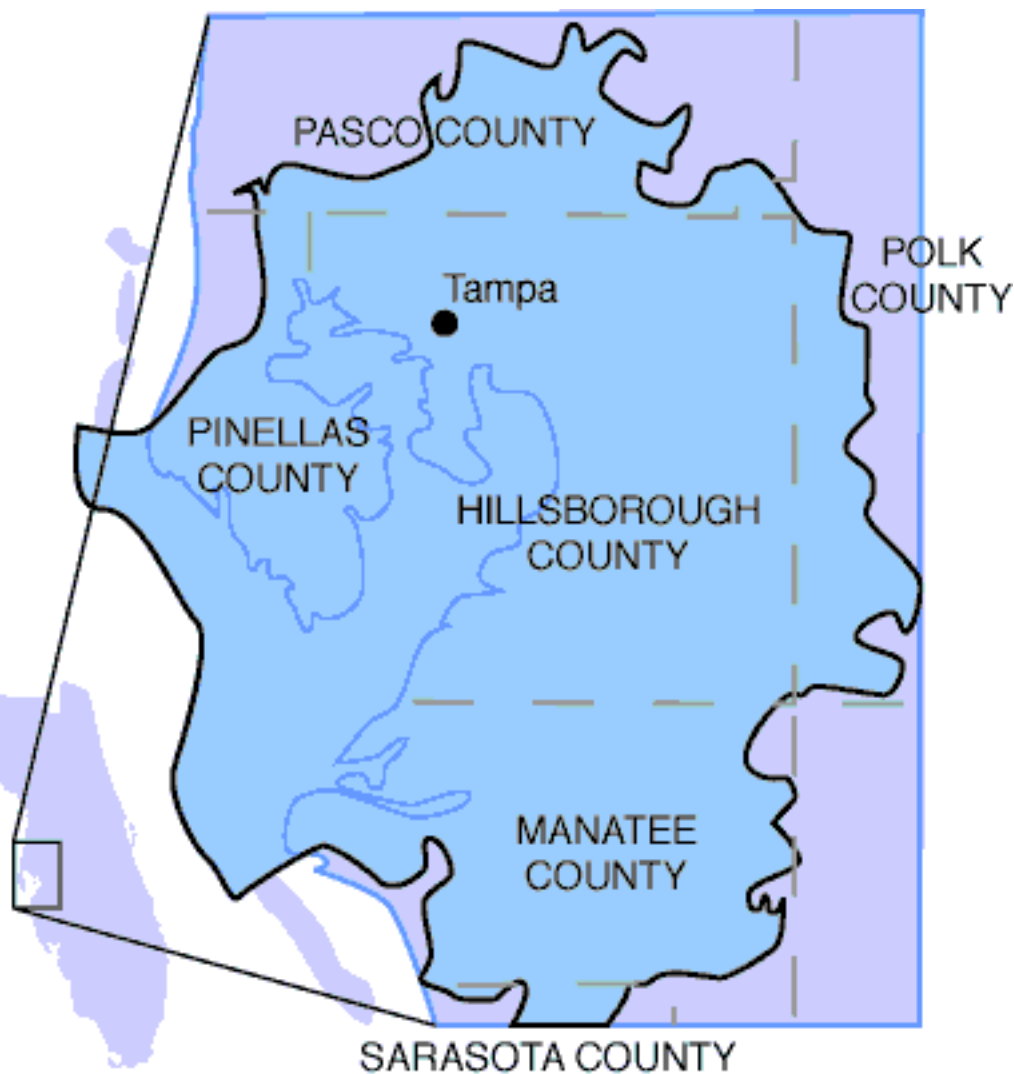
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The Tampa BayWatch High School Wetland Nursery Program

Tampa Bay Estuary Program

Characteristics

Located on Florida's central Gulf coast, the Tampa Bay estuary is Florida's largest estuary, encompassing 400 square miles of open water and associated salt marsh, islands, tidal creeks, and coastal wetlands. Estuaries like Tampa Bay, where salt and freshwater combine to form a coastal sanctuary are among the most diverse and productive ecosystems in the world. The blend of bay environments, ranging from



underwater meadows of seagrass to surrounding marshes and uplands, provides shelter and food for a multitude of diverse wildlife types. More than 85 percent of all fish, shellfish and crustaceans spend some part of their lives in the protected estuarine waters of coastal wetlands. Tampa Bay's islands support major bird breeding colonies where more than 40,000 breeding pairs belonging to some 25 bird species come to rear their young. The Tampa Bay system also serves as an important wintering ground or stopover for many migratory bird species traveling throughout South, Central and North America.

Salt or tidal marshes occur along the shoreline where wave action is minimal. These marshes, which periodically become submerged, support crabs, shrimp, snails, oysters, juvenile fish and a variety of birds. The pools and tidal creeks that wind through these marshes serve as primary habitats for sport and commercially important fish. Salt marshes serve as a vital link in the marine food web, stabilize sediments, buffer uplands from storms and filter pollutants that run off from the land.

Tampa Bay receives groundwater and surface water runoff from a large watershed of 2,300 square miles in area. The watershed has already been greatly altered by urban and industrial development and by agricultural activities. In this watershed, 2.4 million people live and work in several major cities, including Tampa, St. Petersburg, and Clearwater. The population in the three counties surrounding Tampa Bay, Hillsborough, Pinellas and Manatee counties, is expected to increase by 20 percent by the

year 2010. Tampa Bay faces the prospect of future impacts resulting from this population boom, as well as the impacts that have already affected its water, wetlands and natural resources.

The Problem

Today, after a century of intensive urban and industrial shoreline development, the character and ecology of Tampa Bay and its tributaries have been significantly altered. Coastal wetland losses have exacerbated shoreline erosion and contributed to poor or decreased water quality within the Tampa Bay ecosystem. Nearly half of all the mangrove forests and salt marshes that once existed in the Tampa Bay estuary have been destroyed. The loss of these coastal wetlands has resulted in major declines in fisheries and wildlife that depend on these habitats. Populations of economically important fish, shellfish, bait and food shrimp have dwindled to near-depletion. Scallop and oyster fisheries in the bay have collapsed.

The Project

The Tampa Bay community has responded to this tremendous loss of habitat and decline in estuarine conditions by undertaking numerous restoration, management, and permitting programs to facilitate the recovery of the bay. For example, the Tampa Bay Estuary Program funded a pilot salt marsh nursery program, through Tampa BayWatch. Tampa BayWatch, incorporated in 1993, is a non-profit environmental stewardship program for the Tampa Bay estuary, devoted exclusively to the scientific and charitable purpose of monitoring, restoring, and protecting the marine and wetland environments of the bay. Tampa BayWatch programs seek to build citizen awareness, concern, and participation through educational outreach.

Tampa BayWatch has established salt marsh nurseries within the bay region's high school ecology or science clubs. These student-constructed and maintained nurseries produce salt marsh grass available for transplanting into habitat restoration projects throughout Tampa Bay. The first high school wetland nursery was established in 1996. Currently, eleven school nurseries have been established, and three more are planned during the 1999/2000 school year. The fourteen nursery ponds will potentially be capable of producing a total of 70,000 to 140,000 plants, provided free of charge to local and state environmental agencies conducting habitat restoration projects. Ideally, enough salt marsh grasses will be grown to restore 14 to 20 new acres of salt marsh per year. This is a significant contribution to the long-term health and recovery of the community's greatest natural resource--the Tampa Bay estuary.

Project Objective

The goal of the Tampa BayWatch High School Wetland Nursery Program is to provide educational outreach to involve students in hands-on habitat restoration and protection activities. The High School Wetland Nursery Program will help to improve the long-term health of the estuary through a variety of mechanisms:

1. A consistent and inexpensive source of high-quality salt marsh grasses assists government

agencies in restoring habitat cost-effectively.

2. Student volunteer manpower allows more acreage of salt marsh to be planted.
3. Measurable improvements in habitat, water quality, fish and bird populations and recreational opportunities from these restoration activities.
4. Instilling in students an understanding and appreciation of the Tampa Bay estuary, the watershed, and the wildlife that depend on it, raising awareness of problems, and providing incentives to students to change behaviors that impact the bay. A student who has worked to restore bay habitat systems is more likely to become an enlightened bay user, as well as an outspoken advocate for the bay.



Implementing the Project

Once a school expresses interest in hosting a nursery program, they are evaluated for their long-term ability to provide space and staff to support a salt marsh nursery. After being selected to participate in the program, the nursery is constructed with the help of the students by enclosing a 16-foot by 16-foot area on the ground with wooden boards. Plastic pond liner material is placed on the ground to hold salt water. Native *Spartina alterniflora*, more commonly called smooth cordgrass, is planted in a beach sand, vermiculite and peat mixture and then placed in rooting trays within the nursery. A battery-operated timer system is used to control flooding with salty irrigation water to mimic natural conditions. After the original construction costs, the high school nurseries are self-sustaining with minimal yearly maintenance costs.

The salt marsh grass can be harvested after a six-to-eight month growing period. About half of the nursery plants will be transplanted into a local restoration project while the remaining portion will be used to restart the school nursery for another growing season. The transplanting site must be approved by a local environmental agency, and it must provide the appropriate tidal regime for the salt marsh grass to grow.



Success Stories

Tampa BayWatch's High School Wetland Nursery Program has been a very successful community project since its inception in 1996. Major achievements include:

- Transplantation of approximately 200,000 plants and restoration of approximately 17 acres of salt marsh,
- Establishment of nurseries at eleven schools, with other schools expressing interest in joining the program,
- School participation in nine habitat restoration events,
- Active cultivation of 18,500 plants for bay restoration projects,
- Involvement by approximately 1,000 students each school year in the nursery program,
- Development of a High School Wetland Nursery Program Operations Manual in 1997 to facilitate program expansion--Tampa BayWatch distributed this manual to school systems, environmental agencies and other non-profit organizations in the nation to serve as a model for hands-on bay restoration efforts nationwide,
- Creating networks between students, local scientists and the public agencies responsible for restoring and protecting Tampa Bay.

These habitat restoration efforts have won the program a number of environmental awards, including:

- The 1995 Tampa Bay Association of Environmental Professionals "Innovative Educational

Programsaward,

- The 1996 Society for Ecological Restoration "Project Facilitation Award,"
- In 1997 Governor Lawton Chiles and the Governor's Council for Sustainable Florida recognized the outstanding Environmental Education contribution of Tampa BayWatch's High School Wetland Nursery Program,
- The Tampa Bay Regional Planning Council's Future of the Region Environmental Award in 1998.

Lessons Learned

During the past six years, Tampa BayWatch has learned valuable lessons to help improve the program.

- Planning and implementing such a program can take time. Planning field trips to conduct salt marsh restoration, for example, can take up to a month or more. Experience has shown that one transplanting project per school during a school year is feasible.
- Tampa BayWatch has also discovered that the salt marsh plants grown in the school nurseries are much higher quality than plants purchased from a commercial nursery. This may be due to the fact that school nurseries are smaller than commercial facilities and the plants are given the utmost in care and attention. Problems can be detected sooner and taken care of more easily. The nursery plants are also allowed to grow longer in larger rooting trays, allowing a larger plant and root to form, making transplanting less stressful to the plants.
- Schools and plant nurseries alone cannot meet all of the demands of the number of regional restoration projects requiring a large number of salt marsh grasses.

For further information, contact

Sari Scholssberg, Environmental Specialist, Tampa BayWatch, Phone: (727) 896-5320 or E-mail: saris@tampabaywatch.org



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Narragansett Bay's Hypoxia Strike Team

A Collaborative Effort to Assess Dissolved Oxygen Problems in the Bay



Twice this summer a small flotilla of assorted research vessels with scientists on board converged on Narragansett Bay to assess dissolved oxygen levels. Representing state and federal environmental agencies, universities, environmental organizations and the private sector, the members of this "Hypoxia Strike Team" volunteered staff time, equipment, and the use of their boats in a collaborative effort to gain understanding of an elusive, but potentially devastating condition—hypoxia in Narragansett Bay. Hypoxia, or low dissolved oxygen, is often fatal to fish, shellfish, and other marine organisms.

In recent years, hypoxia has emerged as a potential threat to the ecological health of estuaries. Hypoxia (where dissolved oxygen (D.O.) is less than 2 parts per million) and anoxia (where D.O. is nearly zero), have been documented in large, poorly mixed estuaries around the world. Those estuaries with large freshwater sources and high levels of nutrient pollution, such as Chesapeake Bay, Long Island Sound, and the Baltic

Sea, are particularly vulnerable to hypoxic events. By contrast, scientists considered most of Narragansett Bay to be less susceptible, believing the system to be relatively well-oxygenated due to mixing by wind and waves, with modest freshwater inputs. But already the Hypoxia Strike Team is challenging this conventional wisdom.

The purpose of this first year of sampling was to establish baseline conditions for nocturnal D.O. distributions in Narragansett Bay. Therefore, the Team made no attempt to sample during the kind of weather most likely to trigger hypoxia. Nevertheless, sampling through the night hours, the Team found D.O. levels lower than expected for areas of the middle Bay. Next summer, the Hypoxia Strike Team intends to sample when the risk of hypoxia is greatest—still nights following periods of warm, wet weather, when nutrient loads are high and stratification of the water column is likely to occur.

Although hypoxia tends to occur under particular weather conditions, its root cause is nutrient pollution from sewage, agriculture and other sources of organic material. The decomposition of this extra organic matter uses up D.O. faster than it can be replaced naturally. The condition is deadly because, like terrestrial animals, fish and shellfish require oxygen to survive. As D.O. levels drop, marine animals that can respond behaviorally do so—fish generally swim away, while hard-shell clams "clam up." But a number of animals—like lobsters, some crabs and shrimp, and many other benthic, or bottom-dwelling, organisms—cannot escape or outlast even a relatively brief period of hypoxia. During hypoxic events, divers have observed lobsters "standing up" in a desperate attempt to reach water with slightly higher D.O. content, just off the bottom.

A hypoxic event of just a few hours can be lethal to marine creatures. Thus estuarine areas subject to periodic hypoxia—annual or even biennial hypoxic events—show greatly reduced benthic biodiversity, as only species that can tolerate or escape low-oxygen conditions persist. Since benthic invertebrates are an essential component of estuarine food webs, this reduced diversity has the potential to harm important species like flounder. But the transitory nature of hypoxia makes it difficult to measure, particularly in a system like Narragansett Bay where it seems relatively rare. As a result, very little is known about the frequency or distribution of hypoxic events in the Bay.

The Hypoxia Strike Team was coordinated and developed by Dr. Deacutis of the Narragansett Bay Estuary Program. Other team members include the Rhode Island Department of Environmental Management's Office of Water Resources, Save The Bay, the University of Rhode Island, Brown and Roger Williams Universities, Harvard School of Public Health, the Commonwealth of Massachusetts, the U.S. Fish and Wildlife Service, the U.S. Environmental Protection Agency, the Narragansett Bay National Estuarine Research Reserve, and the Narragansett Bay Commission, with private-sector contributions from Northeast Environmental Equipment, Inc. and YSI, Inc.

The project is one component of a collaborative monitoring program by a coalition of federal and state agencies and universities—the most comprehensive effort to date to understand Narragansett Bay's water quality. Other components are a monthly zooplankton survey of Narragansett Bay, using an advanced computer-controlled shuttle; continuous water-quality monitoring at seven stations in the Bay; and

sediment sampling for metals, nutrients, and organic contaminants. Broad objectives of the program are to detect long-term changes in the Bay ecosystem; assess the impacts of pollution, and improve understanding of the Bay's fisheries and ecology.

The results produced by the Hypoxia Strike Team are expected to provide information for managing nutrient pollution to Narragansett Bay from wastewater treatment facilities (WWTFs) and other sources. Nationwide, WWTFs are beginning to reduce their nutrient outputs in recognition of hypoxia and other impacts. In Rhode Island, a number of WWTFs are moving toward nutrient controls.

The level of scientific participation by the Bay Program's partners—public, private, academic and non-profit—demonstrates the importance of this problem. Perhaps most importantly, the Hypoxia Strike Team's results illustrate the power of collaboration—laying the groundwork for action to understand and eventually reduce the impacts of hypoxia on Narragansett Bay.

For further information, contact Thomas Ardito, Policy & Outreach Coordinator, Narragansett Bay Estuary Program, R.I. Department of Environmental Management, 235 Promenade Street, Providence, Rhode Island 02908, Phone: (401) 222-3961 ext. 7237, Fax: (401) 521-4230, E-mail: ardito@earthlink.net



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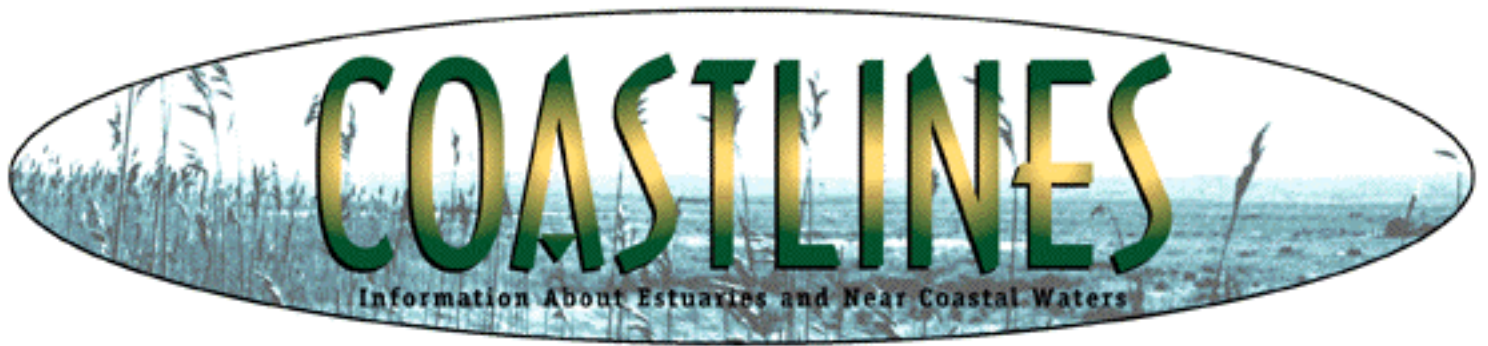
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New Handbook Helps Landowners Clean Up Brownfields

The Environmental Law Institute has published the first step-by-step handbook to help property owners bring "brownfields" back into productive use. This new guidebook can help property owners avoid the pitfalls as they realize the value and potential of their properties. It also identifies key agencies and funding sources that may support cleanup and redevelopment, and provide information and tips for redevelopment, working with communities and securing funding.

To get started, the Guidebook helps landowners determine whether they own a brownfield, then it explores the redevelopment options. Finally, the publication focuses on liability concerns and cleanup options. The guidebook is geared towards property owners but municipal leaders, real estate professionals and people living near a brownfield will also find the book useful.

Copies of the book are free, but there is a \$5.00 shipping and handling fee. To order, contact ELI publications at (800) 939-3844 or E-mail: orders@eli.org.



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Pollution from the Sky: Atmospheric Nitrogen Threatens Water Quality

Sources of Atmospheric Nitrogen

Recently, researchers in North Carolina estimated that nitrogen from the atmosphere accounts for at least 25 percent of the "new" nitrogen in estuarine waters. In coastal waters, from 33 percent to more than 50 percent of the "new" nitrogen may be deposited from the atmosphere. Most of this atmospheric nitrogen comes from man-made sources, such as fossil-fuel combustion, volatilized agricultural waste, chemical fertilizers and wastewater treatment plants. Burgeoning agricultural, urban and industrial emissions of nitrogen oxides could therefore pose a serious problem for water quality in the North Atlantic. In eastern North Carolina alone, atmospheric inputs of ammonia and ammonium have more than doubled since 1990, perhaps due to the rapid growth of the swine and poultry industries in the state.

Industries, such as swine and poultry farming, share the practice of storing animal waste in either shallow earthen lagoons or manure piles that are exposed to the sky. As the waste volatilizes or vaporizes, it releases large quantities of ammonia to the atmosphere. This compound poses a potential threat to estuaries and coastal waters, since algae and plants utilize these reduced forms of nitrogen most easily.

Such air-borne nitrogen is a hidden and potent nonpoint source of pollution, much more subtle than a

lagoon rupture or chemical spill. Carried by winds for long distances, the nitrogen can affect surface waters far from its source. It can be directly deposited from the atmosphere to ponds, lakes, streams, rivers, coastal water and open ocean, unfiltered by the soil-dwelling bacteria that protect streams and estuaries from nutrient-laden runoff.

While rainfall washes large quantities of nitrogen from the atmosphere, nitrogen also is deposited in surface waters through more chronic "dryfall," or the normal fallout from the atmosphere. This can result in both short-term and long-term elevations in nitrogen loading. The eutrophication that can result from this increased atmospheric deposition of nitrogen is far-reaching, and may prompt the growth of harmful algal blooms (HABs) and other water-quality problems across the North Atlantic ocean basin.

Global Consequences

Places of particular concern for increased HABs include the eastern Gulf of Mexico, the Atlantic coastal waters of the United States, and the North and Baltic Seas. All of these areas have experienced increased deposition of atmospheric nitrogen and more frequent HABs.

Off the west coast of Florida, where there are many outbreaks of the noxious red-tide dinoflagellate *Gymnodinium breve*, atmospheric nitrogen accounts for approximately a third of the new nitrogen input. Similar percentages of atmospheric nitrogen deposition are documented along the eastern seaboard, and toxic algal blooms occur more frequently along the coast. From 1987 to 1988, a bloom of *Gymnodinium breve* that began in Florida traveled all the way to North Carolina. While the mechanisms for such bloom expansion are the subject of considerable debate and study, the data suggest a spatial and temporal link between accelerating rates of nitrogen input and bloom expansion in this and other coastal regions.

HABs are not limited to United States waters. In coastal regions of Western Europe that are downwind of agricultural, industrial and urban emissions, atmospheric deposition contributes at least as much nitrogen to bloom-impacted waters as runoff does. The Baltic Sea, North Sea and western Mediterranean are affected most. Scientists estimate that atmospheric nitrogen deposition has increased 5- to 10-fold since pre-industrial times.

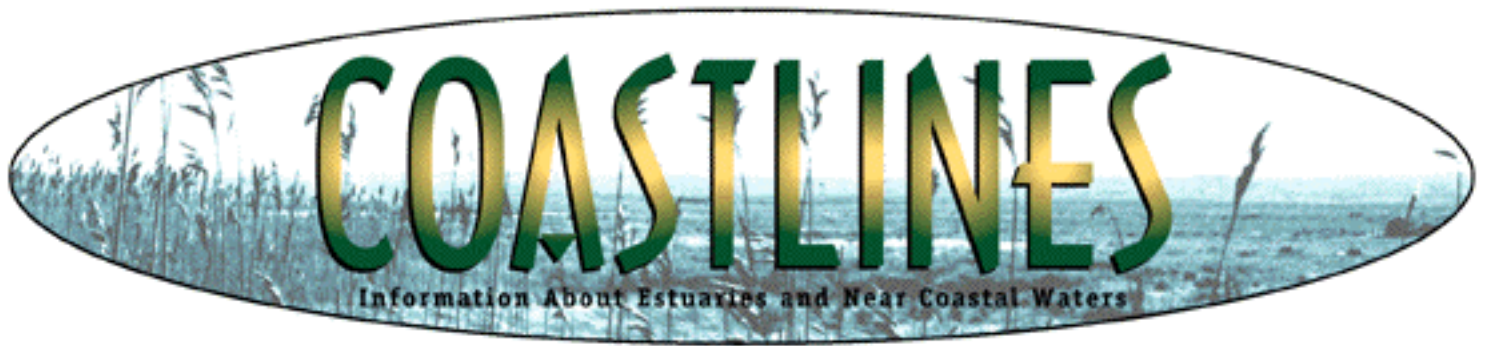
Since World War II, increased atmospheric nitrogen deposition in Europe has coincided with larger volumes of emissions and HAB expansion. Particularly worrisome impacts also include toxic blooms of dinoflagellates and prymnesiophytes, which are blooming with increased frequency and intensity. The Baltic Sea, in particular, has been plagued by HABs since the early 1900s.

Drawing Conclusions

Research suggests that atmospheric nitrogen deposition is a growing problem, and only further study can pinpoint the effects of atmospheric nitrogen. Though the North Atlantic basin contains only ten percent of the surface area of the world's oceans, it receives more than a third of the world's new nitrogen inputs. Approximately half of the new nitrogen entering the Atlantic Ocean comes from rivers, runoff or

groundwater; the other half originates in the atmosphere.

For more information on a recent study on atmospheric nitrogen deposition, see the journal article on which this story was based: Paerl, H.W., and Whiteall, D.R., 1999. "Anthropogenically-Derived Atmospheric Nitrogen Deposition, Marine Eutrophication and Harmful Algal Bloom Expansion: Is There a Link?" *Ambio* 28(4): 307-311, or contact Katie Mosher, North Carolina Sea Grant Program, Phone: (919) 515-9069 or E-mail: kmosher@unity.ncsu.edu



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Septic System Education Made Simple!

Sludge? Scum? Effluent? These words may not be part of your everyday vocabulary, but their impact on water quality is something that everyone should know about – particularly homeowners with on-site septic systems. If you've considered offering a septic education program in your area, then you'll want to check out the Septic Education Kit which is now being distributed by the U.S. Department of Commerce.



The Septic Education Kit was originally developed at the Padilla Bay National Estuarine Research Reserve in Washington State. Padilla Bay and the Washington Department of Ecology were awarded a grant by the National Oceanic and Atmospheric Administration (NOAA) to develop a curriculum for adults that addressed nonpoint source pollution. This curriculum was intended to be distributed to the 23 National Estuarine Research Reserves nationwide to educate homeowners and coastal communities about one aspect of nonpoint source pollution.

What resulted was one of the most innovative septic education programs in the country to date: the Septic Education Kit. The Kit functions as a toolbox which contains everything an educator needs to set

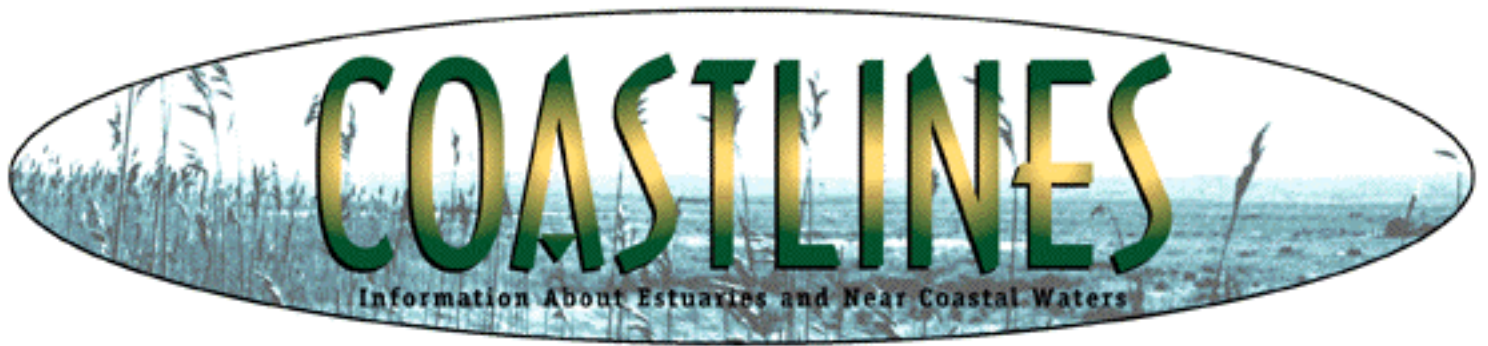
up and publicize a septic education program. In the Kit, you'll find user-friendly fact sheets that can be fine-tuned for your area, an entertaining slide show starring Henry Homeowner, comprehensive workshop outlines, two attention-grabbing publicity photos, clever marketing ideas, and tips on how to partner with other agencies. There are also article templates for quick submissions to local newspapers, a humorous color poster reminding homeowners to pump their tanks, compelling radio announcement scripts, creative newspaper ad and flyer samples, and more!

When a limited number of the Kits were originally released in 1997, and an article was printed in *Coastlines*, requests started coming in from all over the United States and as far away as Canada, Turkey, and the West Indies! It was obvious that there was a strong need for good education materials on septic systems.

To build a case for mass producing the Kits, a national evaluation, involving 30 government agencies, non-profit organizations, and environmental groups was conducted. The Kit received glowing reviews, along with some suggestions for revisions and the creation of additional materials. These suggested changes were subsequently implemented by the Padilla Bay Reserve.

Many agencies praised the Kit for being user-friendly, for having eye-catching publicity materials, and for being relevant to different ecosystems and locations. They also proclaimed that the Kit was easy to use, even for someone who was not an expert.

The Kit should be available by late October for \$99. To obtain an order form, please email orders@ntis.fedworld.gov or call 1-800-553-6847, order number: AVA20666KK0.



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Beach Nourishment - The Answer in Maine?

Beach Management Planning in Maine

In a 1997 report entitled *Improving Maine's Beaches*, the Maine Department of Environmental Protection, Maine Geological Survey and the Maine State Planning Office recommended that local, regional and state interests collaborate to develop regional beach management plans. The report also recommended that the stakeholders include beachfront landowners, business owners, environmental interests and municipal representatives.

In order to develop regional beach plans, the State Planning Office provided a matching grant to the Southern Maine Regional Planning Commission to hire a coastal planner. The five participating municipalities in southern Maine—Scarborough, Old Orchard Beach, Saco, Kennebunk and Wells--are providing the match to state funds. Funding from State Planning was guaranteed for three years, which allows for development of plans for three distinct beach systems: Saco Bay, Wells Bay and Scarborough beaches.

A Coastal Resources Steering Committee was assembled to guide the three-year beach management project. This steering committee consists of three professional planners and two elected representatives from participating municipalities. Each region will ultimately develop a locally driven planning

committee of stakeholders to develop beach management plans.

Beach Nourishment in Maine

Erosion of beaches due to sea level rise and coastal storms has had a considerable impact on some area beaches. Eroding beaches have reduced the recreational and economic value of beaches and caused considerable damage to coastal properties including buildings, public utilities and roads in Maine. Research and history have shown that efforts to stabilize beaches with so-called "hard" engineering structures such as groins, jetties, breakwaters, and seawalls have often compounded the problems by accelerating erosion rather than reducing it.

As a result of sea level rise predictions (see Table 1) and realization of the negative impacts of hard structures on the coast of Maine, state agencies have adopted a policy of retreat that discourages development of coastal areas prone to flooding and erosion. In particular, Maine's coastal sand dunes are protected by law under Maine's Natural Resources Protection Act. Agency rules under the Act prohibit additional structures such as seawalls, jetties, riprap revetments, etc., as a means of erosion control. In addition, the coastal dune rules prohibit new development in frontal dune areas adjacent to the beach, in order to allow natural beach processes to occur.

Table 1
Projected Shoreline Retreat Due to Sea Level Rise in Maine by the year 2100

Sea Level Rise	1.5 ft	3 ft	6.5 ft
Salt Marsh	10 — 115 ft.	26 — 164 ft.	56 — 328 ft.
Bluff	49 - 148	49 - 148	49 - 148
Beach	164 - 492	328 - 984	656 - 1968

Source: Maine State Planning Office, 1994

Note: This table is based on historic sea level rise of .08 inches per year and a prediction of accelerated sea level rise due to global warming of .26 inches per year.

These regulations have convinced coastal stakeholders and planners to seek alternative erosion control measures. The Saco Bay Planning Committee has provided draft recommendations to regularly nourish beaches in Saco Bay. The Committee has recommended that 25,000 cubic yards of sand be transported annually from areas of accretion that are adjacent to federal jetties to areas of high erosion. It is important to note that this is a short-term solution until the impacts of a federal jetty can be reassessed. The current configuration of the jetty has deprived Saco Bay of sand and accelerated erosion in the immediate vicinity. The costs identified for transporting such a relatively small amount of sand range from \$5.86 to \$17.67 per cubic yard.


Several states have committed considerable financial resources to more effective "soft" engineering

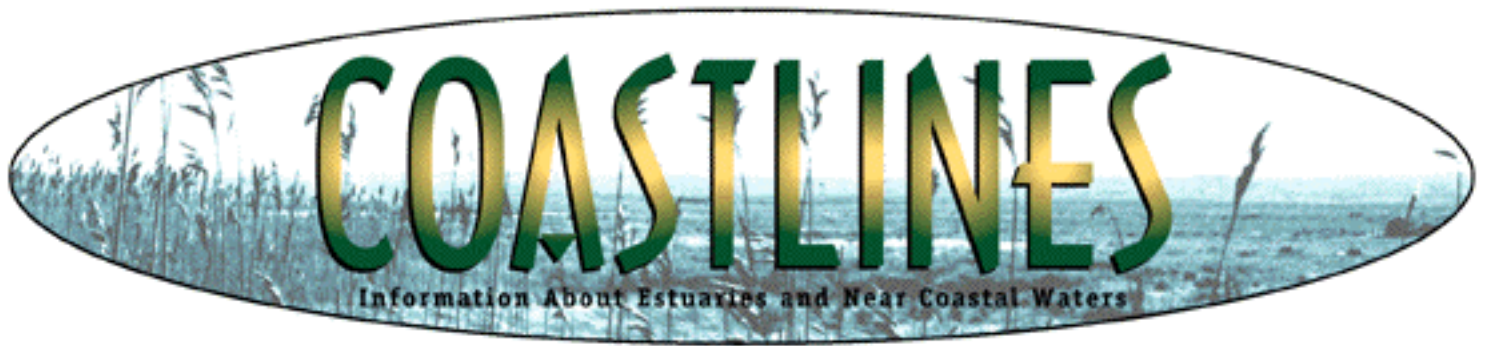
solutions such as beach nourishment. In addition to simply placing sand on eroding beaches, nourishment may include restoring dunes, including planting with native vegetation, to act as a "natural" buffer against the rising sea and coastal storms. Nourished beaches also provide increased opportunity for recreational activities, as well as habitat for wildlife such as the piping plover and least tern, both on Maine's endangered species list.

State	# of Projects	Total Volume Cubic Yards	Total Cost 1996 Dollars
Maine	15	649,818	\$6,778,180
New Jersey	123	57,433,750	\$312,720,819
Florida	141	86,271,699	\$443,204,832
Delaware	40	7,825,823	\$46,895,882
Total	319	152,181,090	\$809,599,713

The table above describes the beach nourishment histories for Maine, New Jersey, Florida, and Delaware. While some eastern seaboard states nourish their beaches with considerable amounts of sand at considerable cost, all of Maine's beach nourishment projects have been the result of federal navigation dredging activities by the US Army Corps of Engineers. Such dredging activities can be a source of beach nourishment materials, provided the sediment is clean.

Beach nourishment efforts in Maine are still in the infancy stage. Presently neither state nor federal resources are committed to beach nourishment in Maine. Nonetheless, communities have in the past supplemented the cost difference for Army Corps navigation dredging projects in order to place sand on eroding beaches rather than in offshore disposal areas. In Maine the question still remains: Is beach nourishment the strategy for coastal municipalities facing erosion, as an alternative to armoring or retreat?

For additional information about beach planning efforts in southern Maine, please contact Jon Kachmar at the Southern Maine Regional Planning Commission at (207) 324-2952, jkachmar@server.eddmaine.org, or <http://www.smrpc.maine.org/beachplan.html>. 



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Correction to Issue 9.4

An error was made in Coastlines Issue 9.4 on how to contact the Great BayWatch Program. To order an educational video that demonstrates fecal coliform sampling and analysis from the program contact the Great BayWatch, Phone: (603) 749-1565. We are sorry for any inconvenience this may have caused.

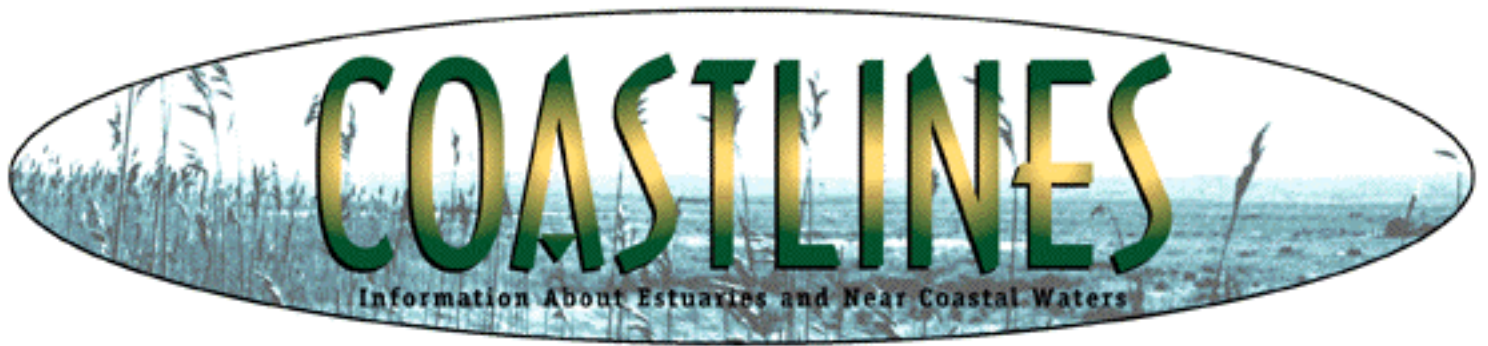


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Wetland Matters Newsletter

The inaugural issue of a wetlands newsletter, Wetland Matters, replaces Swamp Things, a publication of the EPA's Wetlands Division. The new newsletter is sponsored jointly by the Wetlands Division and the Association of State Wetlands Managers. For more information, please contact Peter Mali at (202) 260-0044 or subscribe to Peter Mali, 401 M Street SW (4502F), Washington DC 20460 E-mail: wetlands-hotline@epa.gov



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Internet Town Meeting on U.S. Coastal Issues

The National Ocean Service (NOS) of the National Oceanic and Atmospheric Administration (NOAA) is combining with a number of national organizations to conduct an ongoing national "town meeting" over the Internet on the future of America's coastal and ocean areas. The meeting can be found on-line at: http://www.nos.noaa.gov/websites/retiredsites/supp_futures2025retired.html. The Internet town meeting is an opportunity to share views on the future of America's ever-changing coasts.

The long-term purpose of the effort, is to contribute to an ongoing dialogue to create "a shared vision, Coastal Futures 2025. Participants will be able to "gain in-depth knowledge of past and projected trends that are shaping the coast, engage in dialogue with coastal stewards from around the nation, and share perspectives on visions for the future."

In the first six weeks of operation, more than 2,000 people visited the Internet town meeting. For further information, contact Charles Bookman, NOAA. Tel: (301) 713-3000, ext. 124



Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Disclaimer: The information in this website is entirely drawn from issues of newsletters published between 1994 and 2002 and these issues will not be updated since the original publication date. Users are cautioned that information reported at the time of original publication may have become outdated.

Wetlands Web Walk

The League of Women Voters of the United States has launched a wetlands web site that gives an overview of wetlands education projects developed and implemented by local Leagues of Women Voters across the U.S. The Wetlands Web Walk at <http://www.lwv.org/where/protecting/webwalk/> offers insights, ideas, and organizing techniques that can be applied to any local citizen participation project.