Coastal Wetlands Initiative: Mid-Atlantic Review

EPA United States Environmental Protection Agency

2010

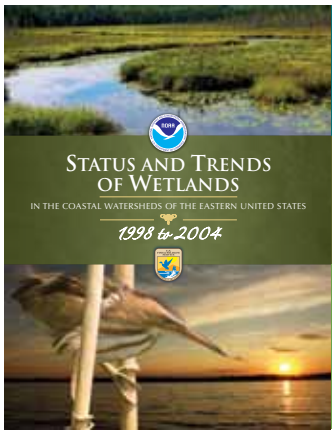
National Picture

Coastal wetlands provide important ecosystem services that are vital to the health and well-being of our nation. They serve as buffers, protecting property and infrastructure from storm damage and sea level rise. They are vital to the health of commercially and recreationally important fisheries resources, providing food and essential fish and shellfish habitat. Wetlands also serve as nesting and foraging habitat for birds and other wildlife. As "living filters," wetlands improve water quality by removing pollutants, nutrients, and sediments. Furthermore, coastal wetlands provide direct value to people in other ways, such as minimizing erosion of upland, and supporting the tourism, hunting, and fishing sectors of the economy.

There is a growing awareness of severe threats to coastal areas. One of the most significant is posed by climate change. Within the last year, the U.S. Army Corps of Engineers and the National Oceanic and Atmospheric Administration (NOAA) have both published frameworks to guide how they will consider the impacts of climate change, and in particular, sea level rise, as they implement programmatic activities, including activities in coastal wetlands (U.S. Army Corps of Engineers, 2009; NOAA, 2010a). Additionally, the devastation caused by hurricanes over the last decade and two recently published reports on wetland loss have prompted the U.S. Environmental Protection Agency (EPA) to examine the nation's coastal wetlands.

Consistent with other federal agencies, EPA is defining "coastal wetlands" as tidal and freshwater wetlands within HUC 8 watersheds that drain to the Atlantic, Pacific, or Gulf of Mexico. "Coastal wetland loss" is defined as "a decline in the areal extent and/or ecological integrity of wetlands in coastal watersheds" (Figure 2).

The first report, released in 2008 by the NOAA and the U.S. Fish and Wildlife Service (USFWS), found that 361,000 acres of coastal wetlands were lost in the eastern United States alone between 1998 and 2004 (Stedman and Dahl, 2008). This amounts to an average net decrease of 59,000 acres each year. The vast majority of the loss (82 percent) occurred in freshwater wetlands, both tidal and non-tidal. Nearly 60 percent of the total loss to coastal freshwater wetlands is attributed to "other development," which includes conversion of wetlands to unknown or undetermined land uses (Figure 1). There were also losses of saltwater tidal wetlands to open water (deeper than 2 meters), particularly in the mid-Atlantic region. The 2008 NOAA and USFWS Status and Trends report did not examine the loss of wetland condition or function. The second report, released by the Association of State Wetlands Managers (ASWM, 2009), recommends a national wetland and climate change initiative to reduce impacts to wetlands.



In response to these reports, EPA established a two-part Coastal Wetlands Initiative. The first part is the Coastal Wetlands Team, which is a joint effort between EPA's Wetlands Division and the Oceans and Coastal Protection Division. The team's goals are: 1) confirming wetland loss and better understanding contributing stressors; 2) identifying and disseminating tools, strategies, and policies to protect and restore coastal wetland resources; and 3) raising awareness of the functions and values of coastal wetlands, threats to these resources, and opportunities to protect and restore coastal wetlands.

To achieve its goals, the Coastal Wetlands Team intends to meet with stakeholders in the Mid-Atlantic, South Atlantic, and Gulf Coast Regions (see Figure 2 below). These on-site meetings, or Coastal Wetland Reviews (CWRs), will be expanded to other regions of the country if further funding becomes available. For each of the CWRs, the team will identify key stressors; examine regulatory and voluntary efforts at the federal, regional, state, and local levels to reduce or reverse coastal wetland loss; and assess whether successful strategies can be replicated elsewhere. The CWR findings will be captured in a report such as this one. The team also intends to share the results at a national conference, where participants will exchange information and discuss potential strategies to avoid future losses. The Coastal Wetlands Team's findings from the reviews could be used to help inform policy decisions, influence program direction, and develop projects to reduce or reverse coastal wetland loss nationally.

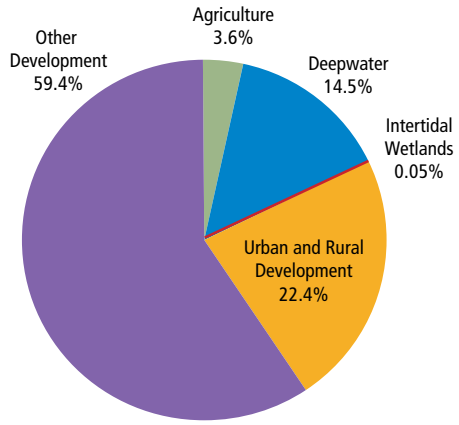


Figure 1. Causes of coastal freshwater wetland losses: Atlantic, Gulf of Mexico, and Great Lakes. *Source: Stedman and Dahl, 2008.*

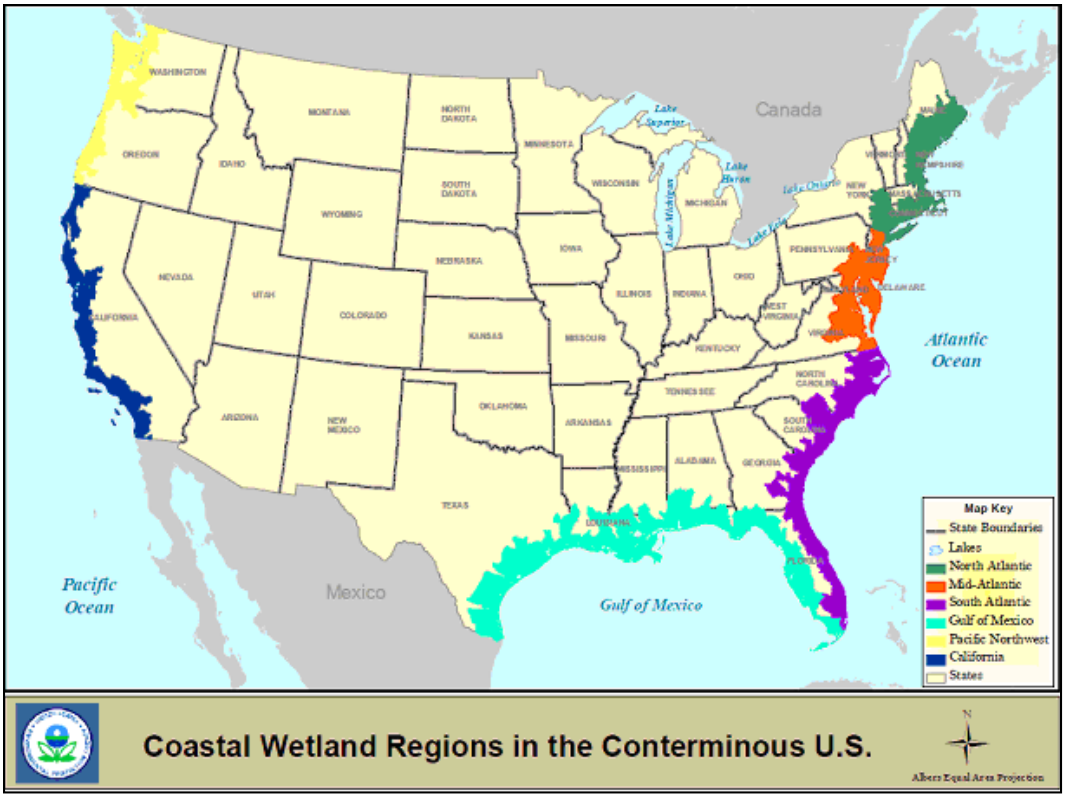


Figure 2. Coastal wetland regions identified in EPA's Coastal Wetlands Initiative.

The second part of the Coastal Wetlands Initiative is the federal Interagency Coastal Wetlands Workgroup, which is composed of members from EPA, NOAA, USFWS, the U.S. Geological Survey (USGS), the U.S. Department of Agriculture's Natural Resources Conservation Service (USDA-NRCS), the U.S. Army Corps of Engineers (USACE), and the Federal Highway Administration (FHWA). The Interagency Coastal Wetlands Workgroup serves in an advisory capacity to EPA's Coastal Wetlands Team by helping to identify CWR watersheds, participating in the CWR on-site discussions, and providing input on the report findings.

EPA Coastal Wetland Regional Reviews Effort

EPA intends to conduct these CWRs to identify and better understand the stressors on coastal wetlands and the strategies needed to protect and restore them. EPA's Coastal Wetlands Team is interested in identifying the cause(s) of losses in the areal extent of wetlands, as well as examining losses in ecological integrity of wetlands (function and condition). EPA will coordinate with the Interagency Coastal Wetlands Workgroup and stakeholders to gather information on available tools and strategies used to address wetland function and condition within the region(s) of interest. The reviews and the subsequent regional reports will not be used to evaluate specific wetland assessment tools or methodologies. Rather, the CWRs will help to identify which tools or approaches are being used, and discuss participants' experience and success in using them. EPA will use the regional reviews to gather on-the-ground input and to stimulate dialogue among stakeholders that will eventually lead to more coordinated, robust efforts to protect and restore coastal wetlands.

The purpose of the CWRs is to facilitate dialogue among stakeholders who share a vested interest in coastal wetland and resource protection such that continued local, regional, and national efforts to stem coastal wetland losses can be increasingly effective. They are not considered a commitment of future resources to address issues identified during the review process. Each CWR is intended to provide information on a particular focal watershed or region and should not be considered a final assessment of the study area. Instead, each review should be considered a baseline examination to aid in moving the entire Coastal Wetlands Initiative forward.

This report contains points raised during the course of the discussions with stakeholder groups. EPA affords participants an opportunity to review and comment on CWR notes and draft reports in order to ensure that stakeholder input is captured correctly. EPA also does its best to supplement these perspectives with documentation (e.g., relevant references, citations), but is not possible to completely do so for all comments provided. Thus, the information presented in this report cannot be considered the definitive presentation of issues within the region or within specific focal watersheds, but can be a solid starting point for identifying priority stressors, tools and strategies to address them, and key information and data gaps that need to be filled in order to reduce wetlands loss in the future.

The process for the coastal wetland reviews is intended to be flexible and encourage participation from a diverse and representative group of stakeholders in each of the focal watersheds. Five steps will be followed for each of the coastal wetland regional reviews:

1. Identify focal watersheds.

- USFWS has identified candidate watersheds for the CWRs based on the observed wetland loss in the USFWS/NOAA Status and Trends report. These are areas where the most wetland loss was due to development or other human actions, or (in the Mid-Atlantic) where losses were attributed to deepwater inundation or other coastal processes.
- The Coastal Wetlands Team further refines this larger candidate watershed to focus in on specific eight-digit HUC watersheds ("HUC 8 watersheds"). The focal watersheds selected for analysis are based on existing wetland condition assessments, available data, a variety of efforts to protect and restore coastal wetlands, and the willingness of stakeholders to collaborate with the team.

  The HUC 8 watersheds identified may correspond directly to National Estuary Program (NEP) study areas (the geographic boundary in which the NEPs work to improve estuarine health). In other words, the CWRs often occur in some of the same watersheds as the NEP study areas or a sub-set thereof.

Questions posed during stakeholder discussions:

1. **What are the root causes of coastal wetland loss in your area? Are there differences between fresh and saltwater stressors? Which are the top three stressors?**
2. **What are the current regulatory and non-regulatory protection and restoration tools being used to adapt to or mitigate wetland loss in your area?**
3. **What are the successful strategies being employed to protect and restore coastal wetlands in your area?**
4. **What information gaps would be most helpful to fill to address loss, and how can these gaps be addressed?**

NEPs are already employing a variety of efforts to protect and restore wetlands. NEPs can assist by: 1) convening the appropriate stakeholders to participate in the CWRs, 2) providing scientific data on wetland conditions in their study areas, and 3) providing a strong platform to engage in protection and restoration efforts to support the CWRs.

- NEPs are an effective mechanism to assist the CWRs in a few key ways. They consist of broad-based stakeholder groups that work in close partnership to protect and restore habitats in their study area. These groups represent a wide range of interests and expertise at the local, state, and federal levels (e.g., individuals from the general public, state natural resource agencies, academics, local governments, watershed groups). EPA can use stakeholder lists from the NEPs along with contacts provided by the Inter-Agency Coastal Wetlands Workgroup to invite participants to attend the CWRs.
- NEPs and their stakeholders create a management plan that is based on scientific characterization of the study area, and contains actions to address habitat loss and modification. This characterization is a collection of scientific information that includes an assessment of extent and condition of habitats such as wetlands. These data can help provide key information for the CWR assessments and reports. Also, NEPs and their partners have been implementing actions in their study areas to protect and restore wetland habitats, and in doing so can also provide key information strategies, tools, and techniques for the CWRs.

2. Complete a literature review of current, readily available information.

- The Coastal Wetlands Team reviews the literature on the selected watersheds to gather more specific existing information on coastal wetland loss, stressors contributing to coastal wetland loss, tools and strategies used to protect and restore coastal wetlands, and key information gaps that, if addressed, could help reverse the trend of wetland loss. This information is gathered from the Internet, reports provided by the "host" organization (see further below), and CWR invitees or participants in advance of the local stakeholder discussions.

3. Conduct stakeholder discussions.

- EPA seeks an entity to serve as the "host" of each review and to help identify a broad range of local stakeholders to participate in the discussions. The host organization (such as an NEP) helps to arrange the meeting logistics and use their partnerships to invite all the appropriate participants to that dialogue. Invited participants include a broad cross-section of business, environmental, academic, and government representatives. Invitee lists are collected from the organization hosting the event, as well as suggestions from the Inter-Agency Coastal Workgroup (which includes their regional representatives).
- The Coastal Wetlands Team convenes a stakeholder forum of these invitees in each selected focal watershed to examine existing tools and strategies used to identify stressors (e.g., conflicting land uses) and combat coastal wetland loss in the areas. These one- or two-day facilitated dialogues provide additional insights about on-the-ground (existing) condition of coastal wetlands within the focal watershed and growing pressures within the region; i.e., issues often best identified by those with the most vested interest in the outcome of such efforts. Attendees are encouraged to provide information on threats to coastal wetlands (including reduction in acreage as well as function and condition) and tools and techniques used locally to reduce or reverse wetland loss. EPA captures the discussion in meeting notes.
- To coincide with the stakeholder discussions, EPA schedules a visit to nearby wetland protection, restoration, or mitigation projects when feasible. This enables EPA to obtain a firsthand view of local stressors or approaches being employed to address wetland loss in that watershed. Collection and analysis of raw field data is outside the scope of these field visits.

4. Assemble a coastal wetland regional review summary.

- Once the notes from the stakeholder discussions are vetted with the participants, they are combined with the available data provided and collected to form the basis of a regional report. Although these reports are not exhaustive and only reflect the viewpoints of Interagency Coastal Wetlands Workgroup members and participating stakeholders, EPA believes they are a good indicator or snapshot of wetland issues based on the information gleaned from the focal watersheds.

5. Consolidate regional reports into a national report and conduct a national workshop.

- At the culmination of the CWRs, EPA intends to compile all the regional reports to form a national findings document which will be made available to the public electronically. In addition, EPA intends to hold a national workshop to: 1) disseminate the findings of the regional coastal wetland reviews conducted, 2) discuss how readily

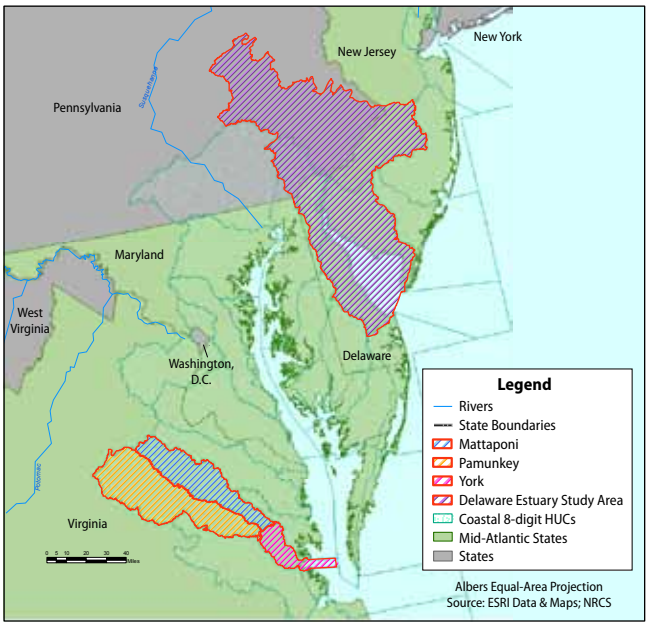


Figure 3. Delaware estuary and York River coastal watersheds. *Source: ESRI, NRCS.*

tools and strategies to measure and combat coastal wetland losses can be transferred and implemented elsewhere, and 3) examine the data gaps and identify approaches that will more effectively characterize the cause(s) of losses in the areal extent of wetlands and wetland function and/or ecological integrity, as well as identify potential means to address these losses.

Mid-Atlantic Review

Mid-Atlantic Focal Watersheds and Wetlands for Review

The Mid-Atlantic region hosts a wide variety of coastal wetlands due to variations in climate, hydrology, soils, vegetation, and other factors. The gradual transition from fresh to salt water supports freshwater wetlands including shrub and forested wetlands in the headwater areas, brackish marshes in the salt–freshwater transition zones, and salt marshes, mudflats, and beaches near the shore. Open water areas such as lakes and ponds are located throughout the Mid-Atlantic coastal watersheds. Together, this network of coastal wetlands provides important ecosystem services and is vital to the health of commercially important fisheries resources and other sectors of the economy. Tidal wetlands in particular are likely to provide more ecosystem services than any other habitat type in the region (Partnership for the Delaware Estuary, 2008).

The first Mid-Atlantic watersheds chosen for the review were in the Delaware Estuary (Figure 3 and Figure 6), in the states of Delaware, New Jersey, and Pennsylvania. The second review targeted the Pamunkey, Mattaponi, and York watersheds located along the York River in Virginia (Figure 3 and Figure 10). Based on previous work by the Interagency Coastal Wetlands Workgroup, the Delaware Estuary watershed was highlighted as an area experiencing significant coastal wetland loss. In contrast, the York River watershed (a tributary of the Chesapeake Bay) was selected because, despite the presence of stressors, wetland losses seemed disproportionately low. EPA chose to further examine this disparity, i.e., why losses were occurring in some areas but not in others, in the presence of similar stressors. The focal watershed reviews were conducted to help compile and validate baseline information and provide a more in-depth understanding of what is happening on the ground.

Mid-Atlantic Coastal Wetland Stressors

Historically, coastal wetlands in the Mid-Atlantic region have been subject to losses due to the effects of a variety of stressors from activities such as commercial, residential, and industrial development and associated infrastructure and conversion for agricultural uses. Coastal wetlands have also been affected by dredging projects (e.g., deposition of dredge spoils in wetlands), conversion of tidal wetlands to open water by construction of impoundments, and sea level rise (Tiner, 1987). For the 1998–2004 time period, losses of wetlands to open water were more significant than losses to upland in the Mid-Atlantic region (T. Dahl, personal communication, 2010).

The literature reviewed (see Appendix B), as augmented by discussions with stakeholders, revealed the following wetland stressors:

- Hydrologic alterations such as dredging, ditching, channelizing streams, mosquito control practices, stormwater runoff, impervious surfaces, and water supply withdrawals.
- Climate change and sea level rise which contribute to or exacerbate other stressors such as erosion, changes in salinity, sediment deficits, and conversion of vegetated wetlands to open water due to inundation (Figure 4).
- Conversion and filling of wetlands and/or adjacent riparian or upland buffers through construction of residential and commercial development and associated infrastructure.
- Degraded ecosystems due to invasive species, salt marsh die-back, habitat fragmentation, and lack of buffers.
- Point and nonpoint source pollution and associated impacts such as eutrophication, as well as emerging contaminants such as pharmaceuticals.
- Hardening structures along shorelines including seawalls, bulkheads, and other armoring responses which exacerbate erosion and prevent wetland migration.

Figure 4. Eroding wetland. *Source: Amie Howell, U.S. EPA Region 3.*

Table 1. Land Within 1 Meter Above High Water Along the U.S. Mid-Atlantic Coast

State	Area		
	Dry Land (acres)	Nontidal Wetlands (acres)	Tidal Wetlands (acres)
NY	40,772	2,471	36,819
NJ	67,954	42,502	242,163
PA	5,391	741	1,483
DE	31,135	7,907	88,217
MD	110,950	30,147	275,770
DC	988	0	247
VA	90,193	36,572	400,064
Total	347,924	120,340	1,044,762

Coastal areas at risk of inundation due to sea level rise. Source: Titus et al., 2009.

These stressors include both near-term and long-term issues, which will require a shift in response strategies. For example, residential and commercial development is an ongoing and immediate issue, whereas climate change and sea level rise are longer-term impacts. In this regard, the strategies employed to address these stressors must consider temporal variability. In fact, threats associated with sea level rise are receiving increased attention in the Mid-Atlantic region as a result of current (near-term) observations and longer-term projections. A recent report (CCSP, 2009) predicts that this region (as well as the Gulf Coast) will be particularly vulnerable to sea level rise over the next century. The Mid-Atlantic coast's vulnerability is attributed to a sandy shoreline, a high rate of erosion, a "sediment-starved" coast, localized sinking of the land surface, and the geomorphology of the coastal plain and the continental shelf. Over one million acres of coastal wetlands are at risk of inundation assuming a one meter rise in sea level along the mid-Atlantic coast (see Table 1). In Virginia, eighty-three percent of the losses of estuarine wetlands in southeast Virginia have already been attributed to submergence, most likely due to rising sea level (Tiner et al., 2005). The Virginia Governor's Commission on Climate Change (2008) expects sea level to rise between 2.3 and 5.2 feet over the next 100 years, which could inundate 50 to 80 percent of Virginia's tidal wetlands.

Hardening (or armoring) of shorelines is another example of an activity that is prevalent throughout the region, and can lead to a host of short-term and long-term adverse effects. Armoring of the coast has been a major issue in the Mid-Atlantic states due to some of the same factors that render the area vulnerable to sea level rise. In Maryland, 28 percent of the shoreline has been armored (CCRM, 2004); in New Jersey, 43 percent of the developed shoreline has been hardened. In Virginia alone, 220 miles of shoreline were hardened between 1993 and 2004, with an average rate of 18 miles of hard structures permitted by regulatory agencies each year (VIMS, 2005).

Mid-Atlantic Tools and Strategies

In the Mid-Atlantic, multi-faceted programs use a variety of tools to address stressors through wetland assessment, protection, mitigation, and restoration. They include non-regulatory programs such as land protection incentives, land acquisition or easements, public outreach and education, training and technical assistance, monitoring, assessment, mapping, and restoration projects. Regulatory

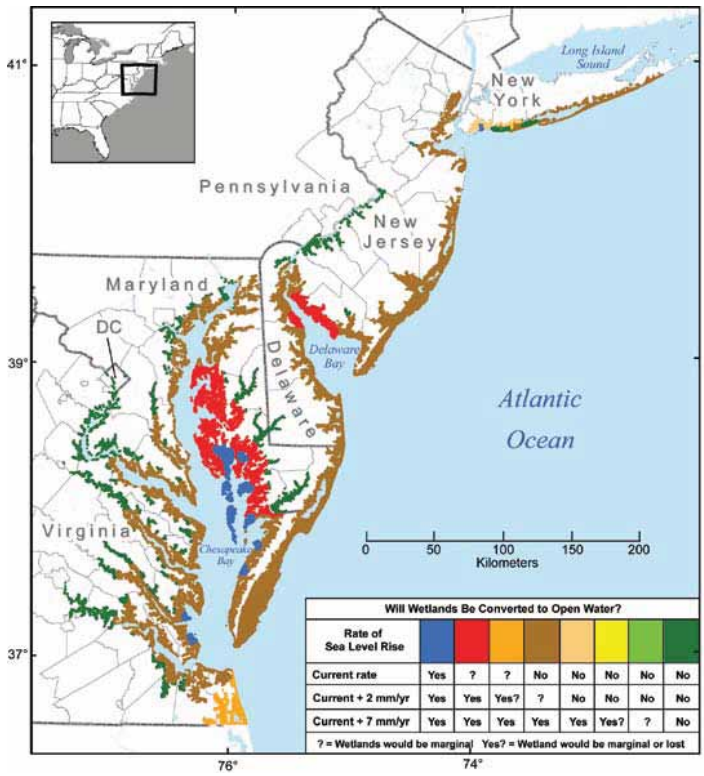


Figure 5. Areas where wetlands would be marginal or lost (i.e., converted to open water) under three sea level rise scenarios (in millimeters per year). *Source: CCSP, 2009.*

tools include permitting, compliance assistance and monitoring, site inspections, guidance, policies, wetland mitigation banks, in-lieu fee programs, and enforcement. "No net loss of wetlands" policies covering all jurisdictional wetlands (see Appendix C) have been adopted by EPA and all five of the coastal Mid-Atlantic states.

In the Mid-Atlantic region, the U.S. Army Corps of Engineers Regulatory Program is administered by approximately 160 regulators

EXAMPLE REGULATORY TOOL

Maryland State Programmatic General Permit 3 (MDSPGP-3) authorizes work in U.S. waters within the state of Maryland for activities that would cause no more than minimal adverse environmental effects, individually and cumulatively, subject to certain terms, conditions, and limitations. The MDSPGP-3 is designed to improve the regulatory process for applicants, reduce unnecessary duplicative project evaluations, and promote more effective and efficient use of U.S. Army Corps of Engineers resources while providing equivalent environmental protection for aquatic resources. This programmatic general permit has been developed in a cooperative effort with the Maryland Department of the Environment, which has regulatory authority over waters of the state of Maryland.

employed by the New York, Philadelphia, Baltimore, and Norfolk Districts that are responsible for implementing Section 404 of the Clean Water Act. The Corps' Regulatory Program has a programmatic goal of no net loss of wetlands and often requires compensatory mitigation for impacts authorized through its permits. Since the no net loss goal was established in 1990 (Executive Order 11990), the program has contributed to wetland protection in partnership with states that have legislation tailored to protect wetlands.

The roles and responsibilities of the federal wetland regulatory agencies differ in scope. The Corps administers day-to-day federal regulation (including individual and general permit decisions), conducts or verifies jurisdictional determinations, develops policy and guidance, and enforces Section 404 provisions. EPA develops and interprets policy, guidance, and environmental criteria used in evaluating permit applications; determines the scope of geographic jurisdiction and applicability of exemptions; approves and oversees state and tribal assumption; reviews and comments on individual permit applications; has authority to prohibit, deny, or restrict the use of any defined area as a disposal site (Section 404(c)); can elevate specific cases (Section 404(q)); and enforces Section 404 provisions. EPA also provides funding, guidance, and training for a variety of wetland programs and works closely with the states through its regional offices and the NEPs. Each state in this region has its own wetland laws and regulations that work in concert with Section 404 of the CWA; all states have wetland mitigation policies and/or guidance as well as some form of wetland banking programs.

An important strategic component of coastal wetland protection in the Mid-Atlantic region is the prevalence of regional partnerships, most notably the multi-state Chesapeake Bay Agreement and the Partnership for the Delaware Estuary (one of 28 NEPs). In addition, wetland monitoring and assessment tools are considered important aspects of the wetland protection programs in this region. Coordination occurs through the Mid-Atlantic Wetlands Workgroup, funded through a Wetland Program Development Grant from EPA to the Pennsylvania Department of Environmental Protection. The group consists of federal, state, and academic staff and scientists from Delaware, Maryland, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Virginia, and West Virginia. Collaboration also occurred to develop a Mid-Atlantic tidal wetland assessment method to assess the condition of coastal wetlands. The method was developed by the Delaware Department of Natural Resources and Environmental Control, the Maryland Department of Natural Resources, and the Virginia Institute of Marine Science (VIMS).

The Partnership for the Delaware Estuary and VIMS are two examples of groups providing scientific support for improved decision-making in this region. Both groups have developed strong collaborative relationships as well as valuable coastal wetland resources intended for local, state, and federal agencies to draw upon for priority setting as well as policymaking.

Mid-Atlantic Gaps and Needs

In addition to identifying tools and strategies, the Coastal Wetlands Team gathered baseline information related to needs and gaps to improve coastal wetland protection in this region. In general, there appeared to be a need for:

- Increasing coordination and collaboration between wetland regulators and stakeholders.
- Increasing resources (staffing and funding) to administer monitoring, assessment, and regulatory programs.
- Developing comprehensive and integrated databases using common temporal and geographic scales and standardized categorization methodologies.
- Increasing understanding of wetland condition, function, values, and emerging issues such as sediment budgets, sediment management strategies, and climate change impacts.

Focal Watershed Review: Delaware Estuary Watershed

Introduction

The Delaware Estuary watershed covers 13,611 square miles and includes portions of New York, New Jersey, Delaware, and Pennsylvania, and a very small portion of Maryland. The tidal river, one of the largest freshwater tidal estuaries in the world, runs through the fourth-largest U.S. urban center. It supports the world's largest freshwater port, the Port of Philadelphia, which generates more than $19 billion annually. The upper watershed is considered a relatively pristine recreational resource providing a portion of New York City's drinking water supply. The lower estuary is noted for its biological richness, with waterfowl (boasting the second-highest concentration of shorebirds in North America), fin and shellfish (oyster landings exceed $1.5 million), and the largest population of horseshoe crabs on the planet. It is easy to see why this resource gained distinction as home to one of the 28 NEPs—the only tri-state NEP (Partnership for the Delaware Estuary, 2006).

Periodic evaluations of coastal wetlands (tidal and non-tidal) of the Delaware Estuary watershed are conducted by the Partnership for the Delaware Estuary. The *State of the Delaware Estuary* report (Partnership for the Delaware Estuary, 2008) is a comprehensive assessment effort that tracks more than 20 indicators of overall estuarine and watershed health. The report measures progress as well as challenges associated with implementing the Delaware Estuary Comprehensive Conservation and Management Plan. For example, with respect to tidal marshes, the report concluded the following:

Figure 6. Delaware Estuary focal watershed (cross-hatched area).

> Much of our remaining wetlands appear to be considerably degraded and vulnerable to storms, erosion, and sea level rise. These marshes would normally move landward as sea levels rise. However, the "buffer" lands adjacent to them have long been developed in the Upper Estuary, and buffer loss in the Middle and Lower Estuary has escalated during the past decade. . . .
>
> . . . A 1992 to 2001 land cover data comparison (for both tidal and non-tidal wetlands combined) showed wetlands loss throughout the estuary, except along the New Jersey side of Delaware Bay where extensive marsh restoration may have offset this trend. . . .
>
> . . . Despite proactive laws protecting marshes, a growing awareness of their ecological value, and mounting restoration attention, marsh acreage and condition are still lost from human-caused impairments, land uses, and sea level rise. [See Figure 7.]

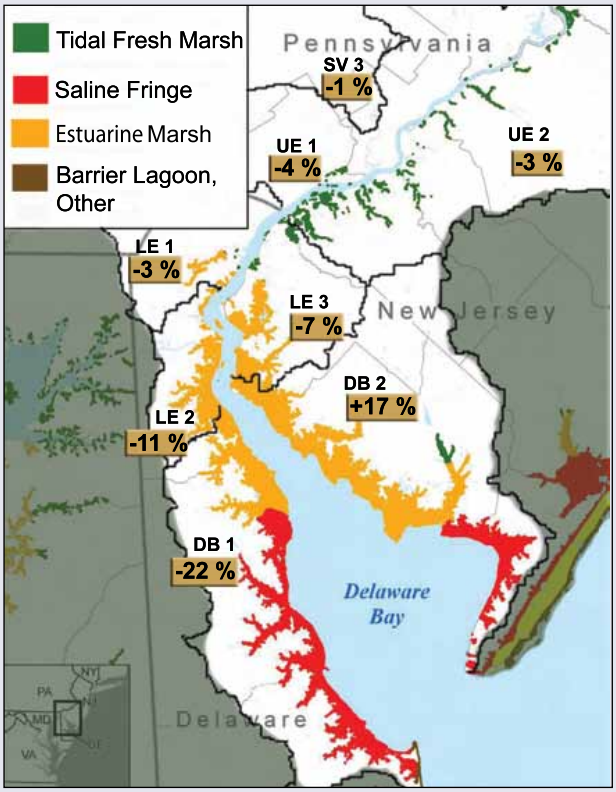


Figure 7. Relative change in tidal wetland acreage, 1992–2001.
Source: Partnership for the Delaware Estuary, 2008.

Data from NOAA's Coastal Change Analysis Program (C-CAP) were used to estimate losses of coastal wetlands for the Delaware Estuary (see Appendix C for more information on C-CAP methodology).

According to C-CAP estimates, the Delaware Estuary watershed lost approximately 7,500 acres of coastal wetlands between 1996 and 2006. This represented a loss of 1.5 percent of all coastal wetlands present in 1996. Losses were fairly evenly split between freshwater (approximately 52 percent) and saltwater (approximately 44 percent) wetlands, with some unconsolidated shore losses (approximately 4 percent). Wetland areas were lost to open water (approximately 47 percent), agriculture (approximately 28 percent), and development (approximately 19 percent), with approximately 6 percent lost to bare land (Figure 8). More than 75 percent of all the saltwater marsh losses were to open water.

These data are intended to provide a general indication of trends observed on a national level, and may be one of several important screening tools used in the identification of threatened areas, key stressors, and the identification and prioritization of conservation/restoration strategies. This "big picture" view is best supplemented by more detailed, field-based, state-level analysis. For example, C-CAP (consistent with many wetland mapping methodologies) only measures coastal wetland losses according to loss of wetland acreage. Some states are taking a more comprehensive approach and are beginning to measure both wetland acreage and condition. A notable example occurs within the state of Delaware, as described in the report, *Condition of Wetlands in the St. Jones River Watershed*, (Rogerson et al., 2010).

This report determined the condition of both tidal and nontidal wetlands and identified the presence of wetland stressors that are degrading wetlands. Wetland condition was measured using 15 metrics representing habitat characteristics (e.g., plant composition, invasives), hydrology (e.g., ditching, draining, fill, stormwater inputs), and condition of the wetland buffer (e.g., extent and intensity of surrounding development, barriers to landward migration). The information will be used to inform and improve future protection and restoration activities for Delaware's wetland resources.

The following pages discuss the St. Jones study in more detail.

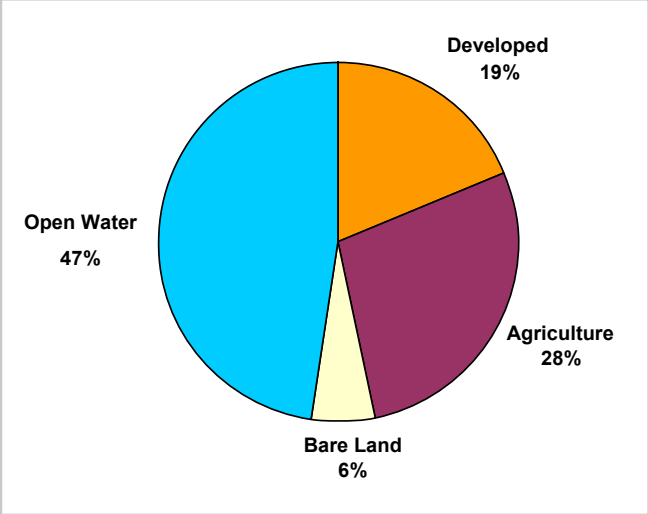


Figure 8. Delaware Estuary watershed wetland losses, 1996–2006.
Source: NOAA, 2010b.

Highlight: Analysis of Wetland Condition in the St. Jones River Watershed

The Delaware Department of Natural Resources and Environmental Control (DNREC), Wetland Monitoring and Assessment Program, recently released the results of a detailed study to examine the condition of wetlands in the St. Jones River watershed. The St. Jones River watershed drains 57,643 acres into the Delaware Bay and Estuary Basin. The study is part of a statewide effort by DNREC to assess the condition of wetlands on the watershed scale. The St. Jones study, summarized by Rogerson et al. (2010), examined both tidal and nontidal wetland condition, changes in overall wetland acreage, and stressors responsible for wetland degradation.

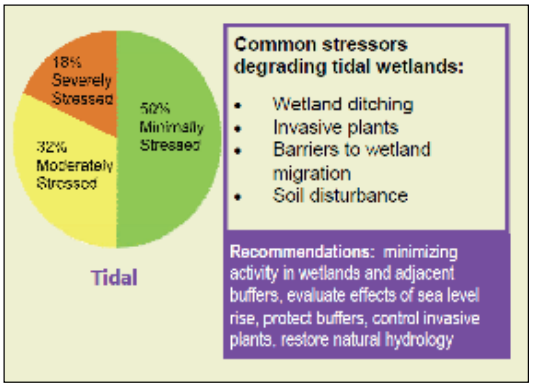
The study first looked at the change in wetland area in the watershed by comparing the 1992 Delaware state wetland inventory to historical wetland acreage based on hydric soils. Next, to assess the condition of wetlands and identify the prominent stressors, a rapid assessment method was applied to: 32 headwater wetland sites, 29 riverine wetland sites, five depressional wetland sites, and 50 tidal wetland sites, randomly chosen and located on both private and public land. Indicators of condition and stressors related to plant community, hydrology, and wetland buffers were evaluated for each site. A probabilistic sampling design allowed for extrapolation of sample results to overall wetland condition in the watershed.

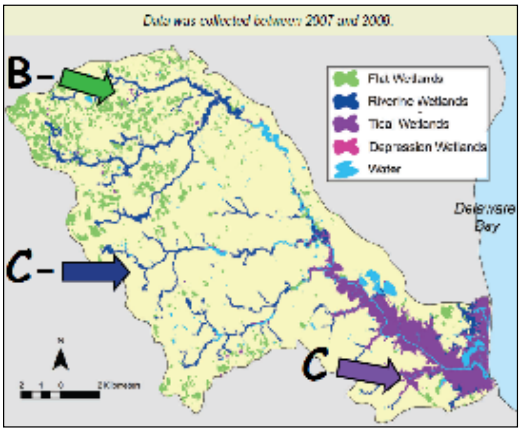
Since European colonization, the St. Jones watershed has lost approximately 47 percent of its wetland resources. Of the wetlands remaining, 50 percent of the wetland area is considered minimally stressed while 16 percent are severely stressed. Condition of wetlands varied by wetland type with headwater wetlands scoring a "B-," riverine wetlands a "C-," and tidal wetlands a "C." The St. Jones River watershed was similar in terms of wetland condition to the Murderkill watershed (also in the Delaware Estuary basin) but has more minimally stressed wetlands and fewer severely stressed wetlands than the nearby Inland Bays watershed.

This information will be used to guide protection and restoration efforts by the state. Protection resources will be focused on the types of wetlands with the highest risk for loss and degradation, and restoration efforts will be targeted on wetlands with the highest restorative value. The results of this study can also be used as baseline information to monitor future changes in the watershed. In collaboration with the Delaware National Estuarine Reserve, DNREC will use the information from this report to educate citizens and decision-makers on the health and importance of wetlands and actions that they can take to improve the condition of wetlands in the watershed.

The study recommendations included:

- Thoroughly tracking permitted impacts.
- Restoring and re-establishing degraded and fragmented flat wetlands to improve wetland services such as water quality, wildlife habitat, and native biodiversity.
- Improving tidal and nontidal wetland buffer regulations.
- Collaborating with partners to enhance education and outreach efforts and share coastal wetland information with professionals and decision-makers.
- Identifying restoration and protection priority areas.
- Ensuring that wetland functions are replaced before they may be destroyed or degraded by adopting assessment methods and monitoring results into the Army Corps of Engineers' review process and by strictly enforcing current guidelines.
- Controlling invasive plants to improve wetland condition, promote native communities, and improve biodiversity.





Findings: Stressors

The following major coastal wetland stressors emerged from the Delaware Estuary watershed review:

- **Limits of regulatory program effectiveness.** During discussions, stakeholders noted that there is confusion in the field among regulators and the regulated community over what is considered federally regulated waters pursuant to CWA Section 404 caused by recent Supreme Court decisions (*Rapanos v. United States*, 547 U.S. 715, 810 [2006]; see Appendix C). This confusion was cited as contributing to losses to coastal wetland resources within this focal watershed. For example, Delaware state officials noted increasing losses in the last decade, particularly because there is no state program protecting non tidal wetlands. Although state efforts may be showing more acres of mitigation than losses, there is uncertainty about long-term sustainability and the condition and functioning of the mitigation sites. According to review participants, early mitigation failures have led to more focus on ensuring replication of hydrology, but the ability to replicate hydrology is still in the trial phase. It was also noted that there are regulatory barriers (e.g., terminology used in regulations) to the adoption of alternative shoreline stabilization methods such as those contained in "Living Shorelines" guidance.
- **Cumulative losses through incremental filling.** This was a recurring theme throughout the Delaware Estuary watershed. A major concern is that small individual losses are adding up to significant impacts. For example, in Delaware the greatest wetland loss is occurring to non-tidal wetlands. These losses are often small losses (both permitted and unpermitted) that are being made on a site-by-site basis and not being put into a larger watershed or landscape context to understand the cumulative effects on ecosystem health and the reduction in the services the wetlands provide. Other states noted that incremental losses are occurring as older bulkheads are replaced with newer structures, and as landscaping (including lawns) encroaches into wetland and wetland buffer areas.
- **Hydrologic alterations.** Various natural and artificial factors have converged to modify the hydrology of the Delaware Estuary and its related hydrodynamics and sediment deposition patterns. For example, while dredging has historically resulted in direct wetland loss via deposition (fill) of dredge materials into nearby marshes, the recurrence of channel deepening events (from an average pre-project depth of 18 feet to a deepening of 40 feet) has led to numerous secondary effects on important hydrologic parameters, including increased tidal range, increased shoreline erosion, and upstream intrusion of saline waters. These effects are exacerbated by sea level rise (Sutton et al., 1996). In addition, stormwater runoff and impervious surfaces alter the hydrology of both nontidal and tidal wetlands by reducing natural recharge and increasing peak flooding.
- **Shoreline hardening.** Shoreline hardening impedes the ability of coastal wetlands to migrate landward in response to sea level rise (Figure 9). The *State of the Delaware Estuary* report tracks availability of tidal wetland buffers and notes that, in the lower estuary, buffers are lost and/or fragmented as agricultural lands are developed for residential and other uses. The report identified the Delaware side of the Delaware Bay as having the greatest potential for landward migration of tidal marshes, and therefore should be a priority for preservation.
- **Mosquito control practices.** Historical mosquito control ditching and other mosquito control activities are considered a common stressor of coastal wetlands. Open water marsh management for mosquito control, intended to reduce pesticide use, may be acting as a stressor because of changes associated with hydrology and species composition. The creation of open water areas often reduces the amount of wetland vegetation (including wildlife habitat), and may have secondary impacts associated with disturbance including the introduction or spread of invasive species (Strait and Balletto, 2005).

Figure 9. Armored shoreline. *Source: VA CZM, n.d.*

- **Salt marsh hay impoundments.** The historic practice of diking and impounding salt marshes for hay production has isolated wetlands from the estuary, reducing wetland productivity and other ecosystem functions.
- **Climate change and sea level rise.** Climate change, linked to increasing frequency and severity of storms and sea level rise, which affect coastal erosion, saltwater intrusion, and conversion of vegetated wetlands to open water. Secondary impacts include changes in species composition, and may possibly contribute to marsh dieback/browning.
- **Pollution.** Point and nonpoint sources of pollution from development and agriculture include stormwater runoff, higher sediment loads, wastewater discharges, and industrial discharges. Of particular concern are nutrients (e.g., nitrogen, phosphorous), bacteria, metals, organic compounds (e.g., pesticides), as well as emerging contaminants such as pharmaceuticals and endocrine disruptors.
- **Invasive species.** Disturbance (e.g., hydrologic alteration, land clearing) enables opportunistic species to invade and out-compete valuable endemic species. In particular, *Phragmites* (common reed) invasion is a significant stressor in this watershed.

Findings: Tools and Strategies

There are currently a number of effective tools and strategies in use or under development in the Delaware Estuary watershed to address the above stressors. The focal watershed review highlighted the following:

- **Mapping.** Accurate, current data and high-resolution wetland maps are essential tools to monitor and track changes in wetlands due to the above stressors.
- **Regulatory authority.** It is important to explore greater use of regulatory authority, potentially using the anti-degradation provision of the CWA (§ 303(d)) to increase wetlands protection from water quality impacts associated with activities such as dredging. The recently adopted federal mitigation rule (40 CFR 230) could improve compensation for impacts by addressing water quality and flooding issues.
- **Collaboration.** State and local agencies should collaborate in order to protect shared resources and reduce the adverse effects of the identified stressors through consistent regulation and outreach efforts. Inter-state collaboration can also be an effective tool, as shown by the efforts of the Partnership for the Delaware Estuary. This collaborative effort spans across the states of New Jersey, Delaware, and Pennsylvania in order to examine wetlands in the overall watershed context.
- **Land acquisition.** Acquisition of land and/or securing protective easements are critical for protecting wetlands and the buffer areas around them, allowing landward migration of coastal wetlands due to sea level rise. Examples of important programs discussed in the Delaware Estuary review included USFWS land acquisition projects and wildlife management areas, which have protected large amounts of bay shore areas in New Jersey, and the U.S. Department of Agriculture's use of Conservation Reserve Enhancement Program funds to purchase tidal wetland buffers. The state of Delaware and Gloucester County, New Jersey, both have active programs to purchase agricultural preservation easements on low-lying farmland (Craghan et al., 2010; Hudgens et al., 2010; Titus et al., 2009).
- **Public access.** Along parts of the Delaware Estuary, New Jersey public access regulations require that access to and along the shore be enhanced and preserved whenever permits are issued for more than two homes or a commercial land use (CCSP, 2009). Public access is also a key component of redevelopment along the Pennsylvania shore. Although public access does not directly increase habitat, it does facilitate people's enjoyment of the coastal environment, thereby enhancing public education and support for environmental quality.

Findings: What's Needed? What's Missing?

Despite the above array of tools and strategies to reduce stressors to coastal wetlands, there are still gaps that need to be addressed to enable more effective application of these tools and strategies in order to better protect and restore coastal wetlands:

- Sustained funds to understand wetland loss, including condition, function, and stressors, and also to implement outreach and incentive programs. Directed wetland development grants to focus on building state capacity.
- Better understanding of sediment budgets, hydrologic alterations, and their effects upon natural processes such as erosion and accretion.
- An integrated mapping, monitoring, and data collection system to inform decision-making, set priorities, and track progress for applications such as the *State of the Delaware Estuary* report.
- Improved National Wetland Inventory mapping for quality baseline data at a higher resolution. Light Detection and Ranging (LiDAR) technology is especially needed for coastal mapping because of the dynamic conditions associated with coastal processes.
- New tools to address emerging threats such as sea level rise and potential sediment deficits. Several states outside the Mid-Atlantic have rolling easement regulations to ensure that beaches migrate inland as sea level rises, but rolling easements have not been implemented along Mid-Atlantic estuarine shores (CCSP, 2009).
- Increased interagency collaboration and integration of tools/authorities/enforcement, especially bringing agencies together to prioritize coastal wetland management.
- Good information to educate the public and increase awareness.

Focal Watershed Review: York River Watershed, Virginia

Introduction

The Virginia coastal zone contains all 310,813 acres of Virginia's tidal wetlands and 909,097 acres (approximately 80 percent) of the state's non-tidal wetlands. Most of the historical non-tidal losses are attributed to agriculture, while most of the historical tidal wetland losses have been caused by commercial and residential development along the shoreline, shoreline hardening (VA DEQ and VIMS, 2001) and, potentially, sea level rise.

At 2,669 square miles, the York is among the smallest of Virginia's Chesapeake Bay watersheds. However, its population grew from 250,332 in 1994 to 372,488 in 2000, making it one of the Bay's fastest-growing watersheds (Commonwealth of Virginia, 2005; VA DCR, 2008). The 140-mile York River originates at West Point, where the Mattaponi and Pamunkey rivers converge, and continues to Yorktown where it drains into Chesapeake Bay. The watershed thus includes the drainage areas for the Pamunkey, Mattaponi, and York Rivers (Figure 10). Land use/land cover is predominantly rural, with approximately 73 percent forested, 19 percent in agricultural use, and 8 percent designated as urban (VA DCR, 2008).

Based upon C-CAP data, the York River watershed lost approximately 900 acres of wetlands between 1996 and 2006 (see Appendix C for more information on C-CAP methodology). This constituted a loss of 0.5 percent of all of the wetlands present in 1996. The losses were associated primarily with freshwater wetlands (approximately 95 percent), with the majority being forested wetlands. Approximately 3 percent, or 30 acres, of salt marsh wetlands were lost during the same time period. The losses experienced were primarily due to conversion of land for agricultural uses, including both cultivated crops and pasture areas (approximately 60 percent), but there was also significant loss to open water (approximately 24 percent), development (approximately 12 percent), and some loss to bare land (approximately 4 percent) (Figure 11).

Findings: Stressors

Discussion at the review focused on key issues contributing to coastal wetland loss. Overall, it was observed that inconsistent regulation/enforcement and regulatory exemptions may be the most common drivers of coastal wetland loss within the York River watershed, particularly with respect to agriculture and forestry practices within non-tidal wetlands. In addition, rapid urban development has been cited as a key contributing factor. These two issues, plus a third, constitute the most important stressors:

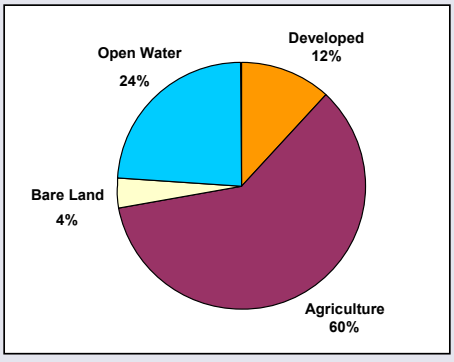


Figure 11. York River watershed wetland losses, 1996–2006. *Source: NOAA, 2010b.*

Figure 10. York River watersheds.

- **Inconsistency in wetland regulations and enforcement.** Several possible reasons for or examples of inconsistent regulation were noted:
  - The existence of two separate wetland protection programs may hinder watershed-wide wetland protection due to inconsistent policies and jurisdictional determinations: primary authority for issuing state non-tidal wetland permits and 401 certifications of Section 404 permits rests with the Virginia Department of Environmental Quality (VA DEQ). Tidal wetland permits are the purview of the Virginia Marine Resources Commission (VMRC) under the Tidal Wetlands Act. Local wetland boards have the option of regulating their own tidal wetlands with VMRC oversight (most wetland boards adopt the "model wetland zoning ordinance" set forth in Virginia Code Section 28.2-1302).
  - The non-tidal wetland program is viewed in some parts of the state as de facto zoning and land use control, which puts pressure on regulators and may contribute to inconsistency.
  - Project proponents may be using the fact that they have obtained local permits as entitlement to bypass "avoidance and minimization" requirements of the state and federal wetland regulations, arguing that additional restrictions would result in financial hardship.
  - Inconsistent wetland delineation practices: only one county requires wetland delineation before projects come into the plan approval process. This county could serve as a model for other counties in order to promote efficiency and greater consistency with state/federal requirements.
  - Local wetland boards administering the Tidal Wetlands Act are reluctant to deny shoreline-hardening proposals or require less damaging alternatives.
  - General permits issued for non-tidal wetlands impacting less than half an acre were cited as another possible source of

inconsistency, although it should be noted that the general permits in Virginia are designed to provide a streamlined process without reducing the level of protection.

- **Regulatory exemptions and loopholes.** Examples include:
  - » Virginia wetland laws exempt certain activities related to agriculture and silviculture, construction and maintenance of farm or stock ponds, and residential lawn care and maintenance. These activities, particularly the former, are cited as key contributors to coastal wetland loss or degraded conditions observed within the watershed.
  - » Virginia also exempts from regulation "isolated wetlands of minimal ecological value," which are defined as non-forested wetlands less than one-tenth of an acre located outside the 100-year floodplain and outside endangered species habitat, or other sensitive aquatic communities such as vernal pools. It is estimated that there are more than 180,000 acres of isolated wetlands statewide (VA DEQ, 2008; Wetlands Watch, 2006). These exempted and unmitigated impacts have resulted in significant losses on a cumulative basis (Wetlands Watch, 2006).
  - » There is at least anecdotal evidence that large wetland areas are being timbered and later converted to other uses, such as residential subdivisions. Speculating landowners may be taking advantage of their exempt status, installing permanent roads and bridges for access, felling trees, and then converting the land for development.
  - » Virginia's wetland programs do not consistently require avoidance of wetland impacts, and instead allow minimization and compensation schemes (Wetlands Watch, 2006).
- **Commercial and residential development.** Conversion of open space and agricultural lands to commercial and residential development is viewed as a major stressor in the York watershed. In addition to direct impacts associated with construction, this development requires supporting infrastructure along with its associated impacts (e.g., stormwater runoff from roads and impervious surfaces). Stormwater runoff was identified as a major stressor associated, generally, with growth and development.

As well as the "top three" listed above, other major stressors include:

- **Shoreline erosion and shoreline hardening.** Shoreline hardening is a major stressor in this watershed due to its adverse effects upon natural coastal processes, including sediment transport, water quality improvement, flood events, and wildlife habitat. As stated above, the Tidal Wetlands Act may not be working as well as it should because of pressures on local wetland boards. Armoring is a common response of coastal landowners to stabilize their waterfront properties. This aggressive response may be exacerbated by the prospect of sea level rise (Titus et al., 2009). Approximately 11 percent of the York River's shoreline has been armored and 7.5 percent of the York-Pamunkey-Mattaponi's collective shoreline has been armored.
  - » Studies by VIMS have shown significant ecological impacts of shoreline hardening. In one study, the placement of erosion control structures on the shoreline was associated with reduced fish community integrity. Fish community integrity was lowest along bulkheaded shorelines. In another study, the benthic index of biological integrity was found to be significantly reduced in circumstances where more than 10 percent of the shoreline was developed. Reduction in benthic invertebrates is directly related to the health of the fisheries community (Bilkovic et al., 2006; Bilkovic and Roggero, 2008).
- **Cumulative impacts.** Authorized loss of tidal wetlands from 1993 to 2004 is estimated to be 111 acres, not including additional losses due to the exemptions of impacts less than 1,000 square feet (Wetlands Watch, 2006). The Citizens Wetlands Advisory Committee reported in 1999 that hundreds of acres of non-tidal wetlands are lost to development annually in Virginia. The Wetlands Watch white paper on "no net loss" (2006) concluded that both temporary and permanent impacts are allowed without the tools necessary to consider the "cumulative impact" of decisions within watersheds and the state.
- **Climate change impacts.** Climate change impacts have been noted as a stressor, particularly in low-lying areas, and may not be receiving adequate attention or public visibility. Effects of climate change may include sea level rise, more severe coastal storms, salt water intrusion, and climate change's contribution and relationship to other stressors such as drought and increased demand for ground water withdrawals. It was noted that successful landward migration of coastal wetlands is likely to reduce the magnitude of climate change and sea level rise effects upon coastal populations and natural areas.

Findings: Tools and Strategies

The discussion of tools and strategies revealed a rich array of coastal wetland protection and restoration programs, technological applications, and outreach initiatives, many of which are directly linked to addressing major stressors in the watershed. A notable and productive partnership exists between the state's wetland programs and VIMS. VIMS is legislatively mandated to provide scientific assistance to the Commonwealth of Virginia's wetland regulatory and management programs, and has developed a number of assessment tools that have been implemented throughout the region.

- **Wetland monitoring and assessment strategy.** In 2000, the Virginia legislature amended the State Water Control Law by authorizing VA DEQ to implement a state non-tidal wetland program in support of a "no net loss of wetlands" policy. The program augments the state's 401 certification of 404 permits and includes protection of isolated wetlands (except those smaller than 1/10 acre). The range of responsibilities assigned to VA DEQ included a comprehensive monitoring and assessment strategy, which was adopted in 2005. VIMS, VA DEQ, and others are working in concert to implement the strategy by developing protocols and guidance and applying them in the field in order to answer the following questions (VA DEQ, 2005):
  - » What is the overall quality of wetlands?
  - » To what extent is wetland quality changing over time?
  - » What are the wetland problem areas and areas needing attention?
  - » What level of protection is needed?
  - » How effective are wetland programs in protecting wetlands?
- **Outreach and training.** Coastal wetland education, outreach, and training programs are innovative and strategic, targeting diverse user groups such as realtors, contractors, and school children. Some training sessions can be funded to a limited extent by fines from violators, who may be required to (anonymously) attend the training program as part of their penalties.
- **Roundtables.** Watershed-based discussion forums, called roundtables (e.g., the York River and Small Coastal Basin Roundtable and the York River Use Conflict Roundtable), are useful for stakeholder problem-solving, natural resource education, and technical training. Roundtables generally involve a diversity of participants, and their activities address common water quality and water resource concerns. Each major watershed in Virginia has a watershed roundtable (see http://www.dcr.virginia.gov/sw/wsheds.htm). The York River and Small Coastal Basin Roundtable website can be found at http://www.yorkwatershed.org.
- **Restoration.** Consistent with the Chesapeake Bay 2000 agreement, the state committed to aggressive wetland restoration goals. The wetland restoration program is a key component of the state's no net loss policy. The state recently updated its wetland restoration goals, which now call for restoration of more than 70,000 acres statewide, including more than 26,000 in the York River watershed alone. Stakeholders viewed these goals with a certain degree of skepticism, and cited the lack of a statewide wetland restoration tracking database.
- **Strong science base.** VIMS is a major asset for the state's wetland programs. Among other duties, staff at the Center for Coastal Resources Management (CCRM) reviews all tidal permit applications in Virginia's 22 tidewater counties, providing objective and scientific advice to permitting authorities.

Tool Highlight: Living Shorelines

Among the many tools and strategies available in this watershed, "Living Shorelines" holds great promise in addressing shoreline hardening, and has the potential for transferability to other states and regions. Living Shorelines is a scientific methodology that allows users to choose the most appropriate means of shoreline stabilization (Figure 12), and is intended to help implement shoreline management plans. The design methodology often allows for natural coastal processes to remain through the strategic placement of plants, stone, sand fill and other structural and organic materials.

The Living Shorelines model and guidance are used to determine the suitability of shoreline areas for various stabilization approaches, and range from no action to armoring, depending on a combination of risk factors. The model contains parameters such as fetch, water depth, vegetation, height of bank, and existing erosion condition, and produces the most effective shoreline stabilization method given a site's characteristics.

The Maryland Department of Natural Resources has been the primary user of this tool, having completed shoreline management plans for its entire Chesapeake Bay shoreline, but the tool is receiving the attention of coastal managers throughout the region. Maryland's regulations require the use of Living Shoreline model when permitting shoreline work. Local governments in Matthews County, Virginia, have piloted the tool, and local wetland boards are using the guidance. The state of Virginia is now considering ways to institutionalize this tool, such as training contractors and others who are in decision-making roles, providing incentives such as expedited/streamlined permit processes for projects following Living Shorelines guidance, and coordination across all regulatory programs in promoting the guidance early on in the planning process (VIMS, 2009a).

Figure 12. Newly planted marsh with fiber logs allow plants to establish root system and stabilize shoreline. *Source: VIMS, 2006.*

Focal Watershed Review: York River Watershed, Virginia (continued)

Tool Highlight: Non-Tidal Wetlands Condition Assessment: Wetlands Data Viewer

This online tool was developed to help VA DEQ meet its year 2000 amendments to inland wetland laws. The data viewer helps determine the quality/condition of non-tidal wetlands. Wetlands are categorized as high, medium, and low value for habitat and for water quality. The Virginia DEQ uses the data viewer to assist in permit review, develop mitigation ratios, and, in high-value wetlands, to discourage development. No performance standards currently exist for conditioning (or denying) permits based on the project design's ability to mitigate project impacts on the value of the wetlands as indicated in the data viewer. The data viewer is available for use now in non-tidal wetlands (VIMS website: http://ccrm.vims.edu/wetlands/nontidal_gis_products/index.html.). The tidal application is currently under development, with the York River watershed being the focus of initial assessment and mapping efforts.

Tool Highlight: Tidal Wetlands Inventory and Assessment Protocol

"Development of a Tidal Wetland Inventory and Assessment for the York River, Virginia Watershed" provides the basis for developing a Level I, II, and III wetlands assessment (O'Brien, et al., 2006). At present, a total of 2,188 tidal wetlands have been assessed in the York River watershed. The protocols developed under this study are transferable to other tidal watersheds in Virginia and beyond to other states of the Mid-Atlantic region. (VIMS website: http://ccrm.vims.edu/gis_data_maps/interactive_maps/disclaimer_yorktidalwetlands.html.)

Despite these and other valuable tools, stakeholders identified several gaps.

Findings: What's Needed? What's Missing?

- Improved coordination between state and federal regulatory agencies will be necessary in order to ensure reductions in coastal wetland loss and to secure additional protections for remaining coastal wetlands. It was noted that an interagency group had existed previously but dissolved because of lack of funding. Such an entity is needed to ensure a coordinated state-federal wetland protection program, and is a logical next step given the resources dedicated to wetlands inventory, assessments, and mapping within the state.
- Improved collaboration between agencies and VIMS, including more widely accepted use of their inventory, assessments, and mapping tools, is expected to benefit both permitting and enforcement programs through a more comprehensive and consistent approach.
- A centralized database and qualified support staff are needed to track wetland permitting, loss, and restoration to better identify where losses are occurring from the direct, indirect, and cumulative impacts of the stressors identified in this report. In 1999, the Citizens Wetlands Advisory Committee concluded that eight new regulatory staff and $1.2 million in annual funding would be required in order to meet the statewide no net loss goal.
- More consistent shoreline management plans are needed to address coastal erosion. The state of Maryland has developed management plans for its shorelines and is developing statewide regulatory maps that will designate where property owners can use hard shore protection structures and those areas where only nonstructural and living shoreline approaches will be allowed. By contrast, Virginia has developed plans for some select locations.
- Limitations to coastal development are needed to enable inland wetland migration and reduce the demand for shoreline hardening. Under its Critical Areas Act, the state of Maryland limits development to one home per 20 acres in Resource Conservation Areas, characterized by rural areas that were not developed prior to the mid-1980s. Two counties in the state of Delaware prohibit development in coastal floodplains (Hudgens et al., 2010). Virginia, by contrast, has no statewide restrictions for development along Cheseapeake Bay, and new septic regulations would allow development in areas where local health regulations had previously prohibited development.
- Stronger enforcement presence by federal agencies in tidal wetlands is needed in order to increase the effectiveness of regulatory programs. Participants suggested that a reduction in federal agency field presence is creating a "domino effect": when there is a strong, effective federal agency presence in the field, there is a disincentive to violate the wetland regulatory requirements—but with a reduced field presence, this disincentive is not there.
- Access to geographic information systems (GIS) tools is needed for displaying wetland losses, inventory, stressors, and condition, and to provide greater opportunity for retention and dissemination of institutional knowledge. In addition, better-quality, high-resolution LiDAR data are needed to assist with accurately determining elevations and topography, particularly for low-lying areas. These are essential tools that should be shared between state and federal regulatory permitting and enforcement agencies in order to better assess and protect coastal wetlands.

Conclusion

The Mid-Atlantic coastal wetlands review is the first in a series that the EPA Coastal Wetlands Team intends to conduct nationwide. The team has been able to gain a greater understanding of coastal wetland loss in the region, including important insights into the causes of these losses. Several common themes have emerged from the focal watershed reviews:

1. Development pressures continue to result in incremental direct and indirect impacts on coastal wetlands, and may lead to cumulatively significant adverse effects.

2. Consistent coordination between state agencies and federal regulatory agencies is necessary in order to ensure persistent reductions in coastal wetland loss and to secure additional protections for remaining coastal wetlands. Further, stronger enforcement presence by state and federal regulatory and resource agencies is needed in order to increase the effectiveness of wetland protection.

3. Coastal erosion, exacerbated by sea level rise, is a stressor that is likely to increase in the future and for which the region needs to develop new strategies such as allowing landward migration of coastal wetlands.

Given the major stressors identified in the preceding pages, the Coastal Wetlands Team found a number of tools and strategies that could effectively address these stressors and that have potential for transferability to other watersheds and regions:

- Incremental wetland losses. The ***State of the Delaware Estuary*** report is a good example of a tool that attempts to monitor and periodically assess the indicators of watershed health, including the health of coastal wetlands. While more detail would be desirable, this type of reporting system could be expanded to assess the effectiveness of existing programs and identify where adjustments are most critical. The **VIMS tidal wetland inventory and assessment protocol** is another tool that could be used to systematically assess coastal wetlands and measure incremental losses over time.

- Regulatory program coordination and strengthening. Collaborative strategies such as the **watershed roundtables** in Virginia, **the Mid-Atlantic Wetlands Work Group**, and the **Partnership for the Delaware Estuary** are all excellent examples of ways to enhance the effectiveness of regulatory programs. In addition, the **Wetlands Data Viewer tool**, developed by VIMS, promises to provide regulators with critical information about wetlands in which development is proposed, allowing more protection to be applied for wetlands exhibiting high values.

- The region has two potentially transferable strategies to address shoreline erosion. One is more conceptual in nature and the other is already being applied in the Mid-Atlantic region. The first is allowing **landward migration of coastal wetlands** in anticipation of sea level rise impacts. This strategy was highlighted in the Delaware watershed review. The second strategy is **"Living Shorelines,"** which is the preferred method for shoreline stabilization and is implemented throughout Maryland's coastline and in other parts of this region. This tool, along with the permitting incentives being contemplated to implement it (e.g., streamlining permit review), has high potential for transferability to other areas of the nation.

Key gaps were identified that need to be filled to reduce the stressors and more effectively use these tools and strategies. The most commonly cited among them include **funding, monitoring and assessment data** (both obtaining and managing the data), **higher-resolution imagery and elevation data, increased interagency collaboration**, and **increased public/stakeholder outreach.**

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APPENDIX A: Delaware Estuary Watershed and York River Watershed Participant Lists

MID-ATLANTIC FOCAL WATERSHED REVIEW PARTICIPANTS

Delaware Estuary Watershed Review Participants (June 2009)

Tom Belton, New Jersey Department of Environmental Protection

Dave Carter, Delaware Coastal Zone Program

John D'Agostino, New Jersey Coastal Zone Program

Martha Maxwell Doyle, Barnegat Bay National Estuary Program

Kathleen Drake, U.S. Environmental Protection Agency (EPA), Region 2

Dorina Frizzera, New Jersey Department of Environmental Protection

Heidi Hanlon, U.S. Fish and Wildlife Service (USFWS)

Kevin Hess, Pennsylvania Department of Environmental Protection

Kevin Holcomb, USFWS

Amie Howell, U.S. EPA Region 3

Amy Jacobs, Delaware Division of Natural Resources and Environmental Control

Danielle Kreeger, Partnership for the Delaware Estuary

Angela Padeletti, Partnership for the Delaware Estuary

Irene Purdy, U.S. EPA Region 2

Sam Reynolds, U.S. Army Corps of Engineers, Philadelphia District

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Bill Shadel, American Littoral Society

Ralph Spagnolo, U.S. EPA Region 3

Eric Vowinkel, USGS

Nate Weston, Villanova University

York River Watershed Review Participants (September 2009)

Marcia Berman, Virginia Institute of Marine Sciences (VIMS)

Harry Berquist, VIMS

Donna Bilkovic, VIMS

David Byrd, USFWS

Sharon Connor, Hanover-Caroline Soil and Water Conservation District

Dave Davis, Virginia Department of Environmental Quality (DEQ)

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Michelle Henicheck, Virginia DEQ

Carl Hershner, VIMS

Lewie Lawrence, Middle Peninsula Planning District Commission

Pam Mason, VIMS

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David O'Brien, National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service

Randy Owen, Virginia Marine Resources Commission

Walter Priest, NOAA

Scott Rae, Gloucester County

Willy Reay, VIMS

May Sligh, Virginia Department of Conservation and Recreation

Donald Smith, Virginia DEQ

Skip Stiles, Wetlands Watch

APPENDIX B: Background Documents

Document/Study Title	Author (Date)
MID-ATLANTIC AND CHESAPEAKE BAY	
Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region	U.S. Climate Change Science Program (2009)
Mid-Atlantic Wetlands: A Disappearing Natural Treasure	Tiner, R.W.—USFWS (1987)
Status and Recent Trends of Wetlands in Five Mid-Atlantic States: Delaware, Maryland, Pennsylvania, Virginia, and West Virginia	Tiner, R.W., and J.T. Finn—USFWS (1986)
Wetlands Status and Trends in the Conterminous United States: Mid-1970's to Mid-1980's	Dahl, T.E., and C.E. Johnson (1991)
Mid-Atlantic Wetlands State Profiles	U.S. EPA (2009) (website)
State Wetland Programs	ASWM (2004)
State Wetland Protection: Status, Trends, and Model Approaches; Appendix: State Profiles.	Environmental Law Institute (2008)
State Wetland Program Evaluation: Phase III	Environmental Law Institute (2007)
Status and Trends of Wetlands in the Coastal Watersheds of the Eastern United States: 1998–2004	Stedman, S., and T.E. Dahl (2008)
State of the Beach Report	Surfrider Foundation (2009)
Development Growth Outpacing Progress in Watershed Efforts to Restore Chesapeake Bay	Office of Inspector General (2007)
Draft Report on Chesapeake Bay Watershed Climate Change Impacts	U.S. Department of the Interior, U.S. Department of Commerce (2009)
Sea-Level Rise and Coastal Habitats of the Chesapeake Bay: A Summary	National Wildlife Federation (2008)
Common Reed Phragmites Australis Occurrence and Adjacent Land Use Along Estuarine Shoreline in Chesapeake Bay	Chambers, R.M., et al. (2008)
Chesapeake Bay Agreement—Preamble	Chesapeake Bay Program (2000)
Effects of Coastal Development on Nearshore Estuarine Nekton Communities	Bilkovic, D.M., and M. Roggero (2008)
Influence of Land Use on Macrobenthic Communities in Nearshore Estuarine Habitats	Bilkovic, D.M., M. Roggero, C.H. Hershner, and K.H. Havens (2006)
Recent Wetland Status and Trends in the Chesapeake Watershed (1982 to 1989)	Tiner, R.W.—USFWS (1994)

DELAWARE ESTUARY WATERSHED	
Delaware Wetlands Conservation Strategy	DNREC (2008)
Delaware Wetland Monitoring Strategy	DNREC (2008)
Delaware Wetlands Reserve Program	DNREC (website)
White Paper on the Status of Sudden Wetland Dieback in Saltmarshes of the Delaware Inland Bay	Bason, C., et al., Delaware Center for the Inland Bays (2007)
The Delaware Estuary: Discover Its Secrets: Management Plan for the Delaware Estuary	Delaware Bay Estuary Project (1996)
The Delaware Estuary: A Watershed of Distinction (fact sheet)	Partnership for the Delaware Estuary (2006)
State of the Delaware Estuary. Report #08-0	Partnership for the Delaware Estuary (2008)
Wetland Conservation and Restoration Along Delaware Bay: The Edge Effect	Strait, K., and J.H. Balletto (2005)
The Scientific Characterization of the Delaware Estuary. The Delaware Estuary Program (DRBC Project No. 321, HA File No 93.21)	Sutton, C.C., J.C. O'Herron II, and R.T. Zappalorti (1996)
Wetland Trends in Delaware (1981/2 to 1992)	Tiner, R.W., J. Swords, and S. Schaller—USFWS (1999)
Wetlands: Status and Recent Trends	Tiner, R.W. (2001) (prepared for DNREC, Watershed Assessment Section, Division of Water Resources)
Maryland Climate Action Plan Final Report	Maryland Commission on Climate Change, Maryland Department of the Environment (2008)
Wetlands of Maryland	Tiner, R.W, and D.G. Burke—USFWS (1995)
The Garden State in the Green House—Climate Change Mitigation and Coastal Adaptation Strategies for New Jersey	Princeton University, Woodrow Wilson School of Public and International Affairs (2007)
Pennsylvania's Wetlands: Current Status and Trends	Tiner, R.W.—USFWS (1990)
Wetlands of Pennsylvania's Coastal Zone: Wetland Status, Preliminary Functional Assessment and Recent Trends	Tiner, R.W., et al.—USFWS (2002)

YORK RIVER WATERSHED	
Created Versus Natural Wetlands: Avian Communities in Virginia Salt Marshes	DesRochers, D.W., J.C. Keagy, and D.A. Cristol (2008)
Recent Wetland Trends in Southeastern Virginia: 1994–2000	Tiner, R.W.—USFWS (2005)
2007 Virginia Outdoors Plan (Appendix J)	VA DEQ-DCR (2007)
2006–2010 Virginia Coastal Needs Assessment and Strategies (Enhancement Area Assessments)	VA DEQ-CZM (2005)
Zoning, Subdivision, and Site Planning: What Coastal Communities can do to Address Sea Level Rise (presentation)	Chesapeake Bay Foundation
Invasive Species in Virginia—News and Events	Commonwealth of Virginia (2008) (website)
Living Shores…The Natural Approach to Controlling Shoreline Erosion	VA DEQ-CZM
Virginia Invasive Species Management Plan	VA DEQ-DCR, Natural Heritage Program (2005)
Virginia Coastal Zone Management Program—Coastal GEMS	VA DEQ-CZM (2009)
Better Land Use Planning for Coastal Virginia	VA DEQ-DCR (2005)
Bay-Friendly Shoreline Solutions	Chesapeake Bay Foundation (website)
Coastal Manager's Toolbox	VIMS-CCRM (2004)
Local Wetlands Boards	VA DEQ-DCR (2005)
Restoring Virginia's Wetlands: A Citizen's Toolkit	VA DEQ and Alliance for the Chesapeake Bay (2005)
Salt-Tolerant Native Plants for Waterfront Landscapes: Outer Coastal Plain	VIMS-CCRM (website)
Assessing the Decision-Making Process in Wetlands Resource Management in Virginia	VIMS (2003)
Shoreline Erosion Problems? Think Green!	VIMS/DEQ/VMRC (2002)
Refinement and Validation of a Multi-Level Assessment Method for Mid-Atlantic Tidal Wetlands	VIMS-CCRM (2007)
Recommendations for Implementing the Tidal Wetlands Mitigation-Compensation Policy	VIMS-CCRM (2005)
Integrated Shoreline Management and the Wetlands Board (presentation)	VIMS-CCRM (2008)
Enhancement Area Assessments: Wetlands (2006–2010 Coastal Needs Assessment)	VA DEQ-CZM (2005)
Technical Report: Stormwater BMPs in VA's James River Basin: Assessment of Field Conditions and Programs	Center for Watershed Protection (2009)
Development of a Tidal Wetland Inventory Assessment for York River, Virginia Watershed	VIMS-CCRM (2006)
Technical Memorandum: Watershed Planning Needs Survey of Coastal Plain Communities	Center for Watershed Protection (2008)
Virginia Coastal Management Program—Chapter 6.6	VIMS (2008)
VA CZM Coastal Wetlands 309 Assessment	VA DEQ-CZM (2005)
Commonwealth of Virginia's Wetland Assessment and Monitoring Strategy	VA DEQ (2005)

YORK RIVER WATERSHED (continued)	
Local Watershed Management Planning in VA: A Community Water Quality Approach	DEQ-DCR (website)
State of Virginia's Coast	VA DEQ (2001)
Summary of Natural Resources/Shoreline Adaptation Strategy Recommendations of the VA Commission on Climate Change	Skip Stiles—VA Commission on Climate Change (2008)
Final Report: A Climate Change Action Plan	Virginia Governor's Commission on Climate Change (2008)
Virginia Coastal Zone Map	DEQ-CZMP (website)
Draft Tidal Wetlands Guidelines	VIMS-CCRM, NOAA (2008)
Laws of Virginia relating to the marine resources of the Commonwealth of Virginia	VIMS-CCRM (website)
The Virginia Wetlands Report (Fall 2006, Vol. 11, Num. 3)	VA DEQ, VIMS (1996)
Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the York River and Lower Coastal Basins	Commonwealth of VA (Chesapeake Bay Program) (2005)
Grant Status Report: On-going Development of Nontidal Wetland Inventory and Monitoring Strategy for Virginia	Commonwealth of VA (2009)
Virginia Wetlands Summary	VA DEQ (undated)
Progress Report: Assessing the Potential for Climate Driven Changes in VA's Shallow Water	NOAA Chesapeake Bay (2009)
VA Code Ch. 13 § 28 (local wetland ordinance development)	Commonwealth of VA (1992)
Watershed Profile: York River Watershed	VA DEQ-DCR (2004) (website)
Get the Facts, Wetlands in Virginia	VA DEQ (2008)
No Net Loss—A Pledge Unfulfilled	Wetlands Watch (2006)

APPENDIX C: Federal Wetlands Terms

404 Jurisdiction: Section 404 of the Clean Water Act establishes a permit program for discharges of dredge and fill material into navigable waters of the United States. In 1974, when the U.S. Army Corps of Engineers issued regulations to implement the Section 404 program, they limited the program's jurisdiction to traditionally navigable waters, including adjacent wetlands but excluding many small waterways and most wetlands. In 1977, the Corps issued final regulations and explicitly included "isolated wetlands and lakes, intermittent streams, prairie potholes, and other waters that are not part of a tributary system to interstate waters or to navigable waters of the United States, the degradation or destruction of which could affect interstate commerce." 404 jurisdiction with respect to adjacent and isolated wetlands has been further defined by Rapanos and related Supreme Court cases, as discussed in the link below.

(http://www.epa.gov/owow/wetlands/facts/fact12.html)

Mitigation rule: EPA's mitigation rule (Compensatory Mitigation for Losses of Aquatic Resources, 40 CFR Part 230, *Federal Register* Vol. 73, No. 70, April 10, 2008) establishes standards and procedures for ensuring that actions are taken to offset unavoidable adverse impacts to wetlands authorized under Section 404 of the Clean Water Act, after all appropriate steps have been taken to avoid and minimize impacts. Compensatory mitigation is a critical tool in helping meet the national goal of "no net loss" of wetland acreage and function.

Monitoring and assessment: EPA administers comprehensive monitoring and assessment programs through Wetland Program Development Grants. EPA encourages states and tribes to develop a monitoring and assessment strategy consistent with the *Elements of a State Water Monitoring and Assessment Program for Wetlands* guidance, implement a sustainable monitoring program consistent with the wetlands monitoring strategy, and incorporate monitoring data into agency decision-making.

NOAA C-CAP: C-CAP produces a nationally standardized database of land cover and land change information for the coastal regions of the United States. C-CAP products provide inventories of coastal intertidal areas, wetlands, and adjacent uplands with the goal of monitoring these habitats by updating the land cover maps every five years. C-CAP products are developed using multiple dates of Landsat (30-meter resolution) imagery and consist of raster-based land cover maps for each date of analysis, as well as a file that highlights what changes have occurred between these dates and where the changes were located.

C-CAP land cover is produced through documented, repeatable procedures using standard data sources and includes extensive field sampling, validation, and standard quality control review procedures and provides the "coastal expression" of the National Land Cover Database, a contribution to the Earth Cover layer of the National Spatial Data Infrastructure.

C-CAP data sets are not jurisdictional or intended for use in litigation. While efforts have been made to ensure that these data are accurate and reliable within the limits of current technology, the NOAA cannot assume liability for any damages or misrepresentations caused by inaccuracies in the data, or as a result of the data to be used on a particular system. NOAA makes no warranty, expressed or implied, nor does the fact of distribution constitute such a warranty.

The intended use is in identifying regional landscape patterns and major functional niches (habitat), and for environmental impact assessment, urban planning, and zoning applications. C-CAP data will not identify individual species. This is a national and regional data set that should be used only as a screening tool for very local or site specific management decisions. Small features and changes should be verified with a higher-resolution data source.

Rapanos case: In response to the Supreme Court's decision in the consolidated cases *Rapanos v. United States* and *Carabell v. United States*, EPA and the U.S. Army Corps of Engineers have issued joint guidance to the regions and districts addressing jurisdiction over waters of the United States under the Clean Water Act. The Supreme Court addressed where the federal government can apply the Clean Water Act, specifically by determining whether a wetland or tributary is a "water of the United States." The guidance clarifies that wetlands and other aquatic resources that are traditional navigable waters, relatively permanent waters, or have significant nexus are protected under the Clean Water Act.

(http://www.epa.gov/wetlands/guidance/CWAwaters.html)

Swampbuster: Like the Section 404 program, the Swampbuster program generally allows the continuation of most farming practices so long as wetlands are not converted or wetland drainage increased. However, the program does address activities such as clearing, draining, or otherwise converting a wetland. It discourages farmers from altering wetlands by withholding federal farm program benefits from any person who plants an agricultural commodity on a wetland that was converted by drainage, dredging, leveling, or any other means (after December 23, 1985) or converts a wetland for agricultural commodity production, or to make such production possible (after November 28, 1990).

(http://www.epa.gov/owow/wetlands/facts/fact19.html)