DRAFT
DO NOT CITE OR QUOTE
9.6.13

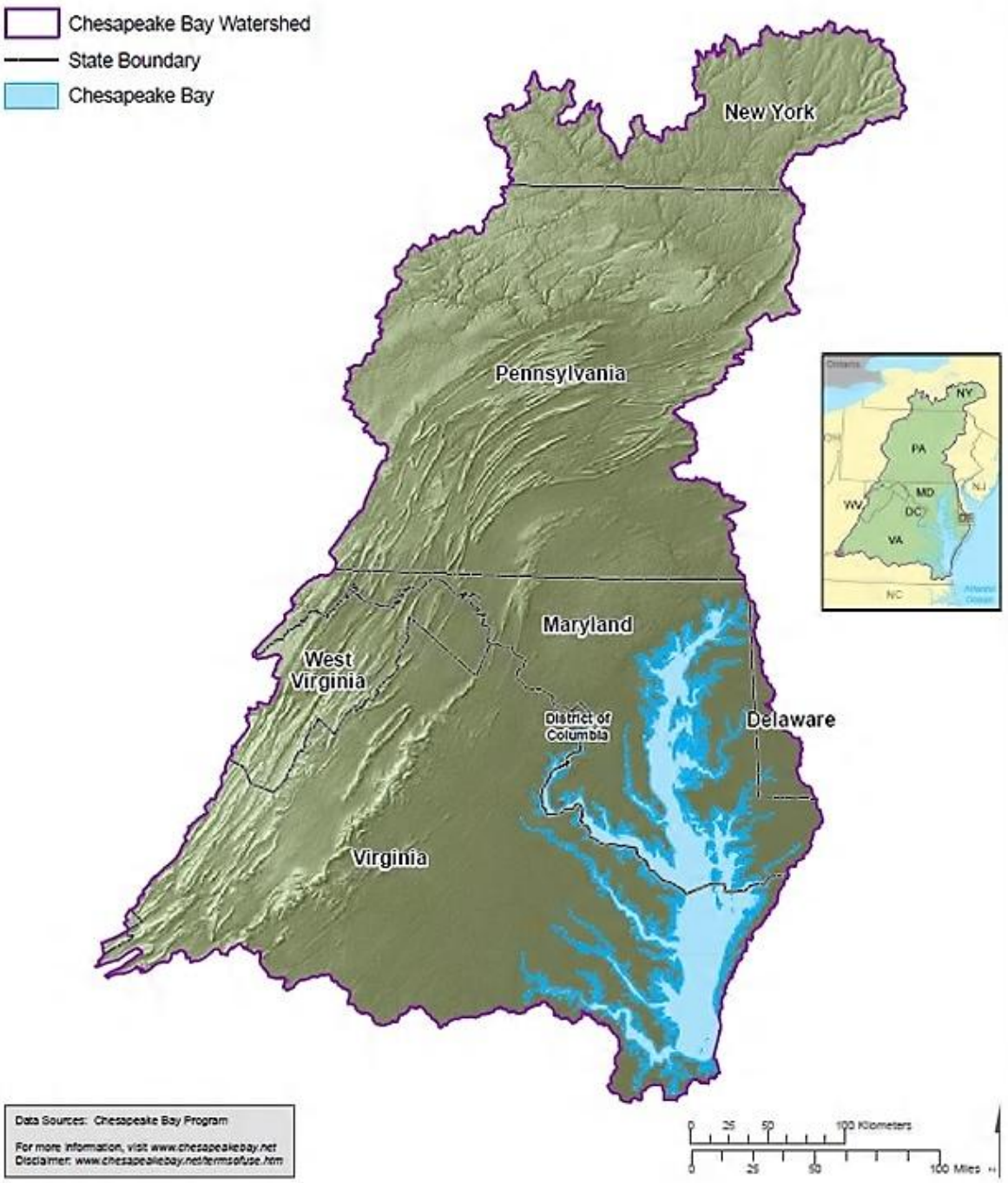
The Chesapeake Bay Program 2013
In accordance with Clean Water Act §117

Submitted
By

U.S. Environmental Protection Agency
On Behalf
Of
Chesapeake Bay Program
Annapolis, Maryland

Chesapeake Bay Watershed

Chesapeake Bay Program
A Watershed Partnership



Data Sources: Chesapeake Bay Program

For more information, visit www.chesapeakebay.net
Disclaimer: www.chesapeakebay.net/termsofuse.htm

Created by EA, 1/24/08

UTM Zone 18N, NAD 83

Dear Members of Congress,

This report of the Chesapeake Bay Program 2008 is submitted in accordance with the requirements of Section 117(h) of the Clean Water Act. The Chesapeake Bay Program has worked collaboratively for 30 years to guide efforts toward a restored Bay ecosystem in which civic responsibility and environmental stewardship are considered essential components of maintaining the high quality of life we enjoy in the watershed . Using state of the art science and ecological restoration techniques, the Partnership has built upon its successes while learning from the challenges associated with restoring a varied and complex ecosystem covering a 64,000-square mile watershed and spanning seven political jurisdictions.

This 30-year mark serves as an opportunity for the existing Bay scientists, policy-makers and citizens to set the stage for generations to follow. While we examine the successes of the past three decades, as well as the challenges not yet solved, the time has come for the Chesapeake Bay Program to lay the foundation for transition. It is time for a new Bay Watershed agreement that builds on this incredible body of scientific knowledge, takes into account both existing conditions and emerging circumstances; and forging an agreement that brings all Bay partners together. To move forward, we need Delaware, the District of Columbia, Maryland, New York, Pennsylvania, Virginia, West Virginia, the Environmental Protection Agency and the Chesapeake Bay Commission, sharing responsibility and working toward the same goals. This is why the partners are crafting a new *Chesapeake Bay Watershed Agreement*.

The original Chesapeake Bay agreement signed in December 1983 was a simple 1-page document committing the signatories to work cooperatively to address pollution entering the Bay. Over the years, a number of subsequent agreements of greater complexity and detail have been executed, the most recent being *Chesapeake 2000*, with more than one hundred individual goals, commitments and outcomes. While many of these goals and commitments were met, the health of the Chesapeake Bay ecosystem has not sufficiently improved.

The *Chesapeake Bay Watershed Agreement* will provide clearer goals and outcomes. It will provide an unprecedented level of transparency and accountability. It will be flexible, incorporating adaptive management decision making to address changing conditions and circumstances. Finally, it will provide for full participation of headwater states – Delaware, New York and West Virginia – that will have the opportunity to join the Partnership as full members.

While the 30th anniversary is cause to celebrate and reflect on our unique partnership and its accomplishments, it marks a transition to the next generation who will carry on the restoration efforts while adapting to a rapidly changing environment. While we honor our past achievements, the *Chesapeake Bay Watershed Agreement* is our preparation for the future – a future where the Chesapeake Bay watershed remains an economic engine for the region, rebuilds a thriving and diverse ecosystem, and reclaims its status as a celebrated treasure for the citizens who live in the watershed and throughout the nation.

Respectfully submitted,

Nicholas A. DiPasquale
Director, Chesapeake Bay Program

Study of Chesapeake Bay Program 2013

Table of Contents

The Chesapeake Bay Program 2013

Executive Summary

A report on the Chesapeake Bay Program (CBP) is required every five years as a mandate of the Clean Water Act, Section 117(h). This report includes: a summary of the effectiveness of the CBP partnership; a summary of the state of the Bay ecosystem; the effectiveness of CBP in implementing management strategies; and, where assessments revealed the need, key actions taken to enhance or accelerate implementation of the strategic goals.

Placeholder – will be updated when report is finalized

Introduction

About this Report

This report is completed in accordance with the Clean Water Act (CWA) PL 109-169, Section 117(h). Section 117 (h) of the CWA requires the EPA Administrator, in coordination with the Chesapeake Bay Executive Council, to complete a report to Congress every five years.[1]

Section 117 of the Clean Water Act, as amended:

(h)Study of Chesapeake Bay Program

1 In general. Not later than April 22, 2003, and every 5 years thereafter, the Administrator, in coordination with the Chesapeake Executive Council, shall complete a study and submit to Congress a comprehensive report on the results of the study.

2 Requirements. The study and report shall :

A. Assess the state of the Chesapeake Bay ecosystem;

B. Compare the current state of the Chesapeake Bay ecosystem with its state in 1975, 1985, and 1995;

C. assess the effectiveness of management strategies being implemented on the date of enactment of this section and the extent to which the priority needs are being met;

D. make recommendations for the improved management of the Chesapeake Bay Program either by strengthening strategies being implemented on the date of enactment of this section or by adopting new strategies; and

E. be presented in such a format as to be readily transferable to and usable by other watershed restoration programs.

The Chesapeake Bay Program

The Chesapeake Bay Program (CBP) is a comprehensive cooperative effort by federal, state, and local governments, non-governmental organizations, academics, and other entities that share the mission of restoring and protecting the Chesapeake Bay and its watershed.

From 1984, the first year of funding for the Chesapeake Bay Program through 2013, Congress enacted $734.2 million in funding through EPA to restore the Chesapeake Bay.

Created in 1983 and authorized by Section 117 of the Clean Water Act (CWA), the Chesapeake Bay Program is directed by the Chesapeake Executive Council (EC). The CBP office is maintained by the U.S. Environmental Protection Agency (EPA), supported and staffed by its many partners; plus it provides support to the EC and various CBP committees.

The original state signatories to Chesapeake Bay agreements (1983, 1987 and 2000) were Maryland, Pennsylvania, Virginia and the District of Columbia. In 2000, the CBP determined the headwater states of Delaware, New York and West Virginia were needed to meet the nutrient and sediment reductions necessary to remove the Bay from the impaired waters list. Subsequently, in 2002 the headwater states signed a Memorandum of Understanding (MOU) committing them to fully

[1] The first EPA report: "Report to Congress: Section 117(h) of the Clean Water Act Study of the Chesapeake Bay Program," 2003.

participate in CBP's water quality issues. The CBP is guided by the policy direction established by CWA §117 (Chesapeake Bay Restoration Act).

In 2011, the Chesapeake Executive Council and the Federal Leadership Committee for the Chesapeake Bay acknowledged the need to integrate the goals, outcomes and actions of the Bay Program with those of federal *Strategy for Protecting and Restoring the Chesapeake Bay Watershed*. The partnership is now in the process of developing a new *Chesapeake Bay Watershed Agreement* expected to be signed by the Chesapeake Executive Council in December 2013. This new plan will clarify our vision, mission and values and establish shared goals and outcomes. It is intended to have more flexibility, increased accountability, and greater participation by all partners. Current goals being considered by the partnership include:

Sustainable Fisheries Goal: Protect, restore, and enhance finfish, shellfish and other living resources, their habitats and ecological relationships to sustain all fisheries and provide for a balanced ecosystem in the watershed and Bay.

Vital Habitats Goal: Restore, enhance, and protect a network of land and water habitats to support high-priority species and to afford other public benefits, including water quality, recreational uses and scenic value across the watershed.

Water Quality Goal: Reduce pollutants to achieve the water quality necessary to support the aquatic living resources of the Bay and its tributaries and protect human health.

Healthy Watersheds Goal: Sustain state-identified healthy waters and watersheds, recognized for their exceptional quality and/or high ecological value.

Land Conservation Goal: Conserve landscapes treasured by citizens in order to maintain water quality and habitat; sustain working forests, farms and maritime communities; and conserve lands of cultural, indigenous and community value.

Public Access Goal: Expand public access to the Bay and its tributaries through existing and new local, state and federal parks, refuges, reserves, trails and partner sites.

Environmental Literacy Goal: Enable every student in the region to graduate with the ability to use scientific evidence and citizenship skills to act responsibly to protect and restore their local watershed.

Local Government Leadership Goal: Engage, empower and facilitate local governments as partners in the protection and restoration of the Chesapeake Bay watershed.

Chapter 1: Status and Trends of the Chesapeake Bay Ecosystem

Signs of Continuing Recovery

As we approach 30 years of the CBP partnership, we have witnessed clear signs—from local streams and small watersheds to the deep waters of the Bay itself—of continuing recovery across the Chesapeake Bay ecosystem and throughout the surrounding six-state watershed.

The U.S. Geological Survey (USGS), in partnership with the Chesapeake Bay Program watershed water-quality monitoring partnership, routinely reports trends as well as monthly and annual loads for water-quality monitoring stations across the Chesapeake Bay Watershed.

The data from the network are used to help scientists and managers assess water-quality conditions and long-term trends as management practices are implemented to reduce the amount of nutrients (primarily nitrogen and phosphorus) and sediment reaching the streams in the watershed and the Bay. The data will also be used to help states and localities measure progress towards meeting their pollutant reduction responsibilities under the Chesapeake Bay Total Maximum Daily Load (TMDL).

Trends through 2011 show over the past 25 years there have been decreasing nutrient and sediment concentrations indicating improving conditions in local streams and rivers. Nitrogen and phosphorus concentrations have decreased at almost 70 percent of the 31 long-term monitoring sites within the Bay watershed. Sediment has decreased at about 30 percent of the sites. However, several of the 31 sites had increasing sediment concentration trends over the last 25 years, which indicates degrading conditions. Three sites had increasing trends for nitrogen, four for phosphorus, and eight for sediment.

While jurisdictions are implementing management actions throughout the watershed, there is a lag time between implementation and detection of water-quality improvement. Additional factors affecting water-quality changes include population increases, the influence of watershed characteristics, as well as changes in nutrient sources and land use.

Restoration Spotlight: Blue Plains Wastewater Treatment Plant

In the Potomac River estuary, wastewater treatment plant upgrades in the metropolitan Washington, D.C. area resulted in reductions in phosphorus and nitrogen concentrations, as well as toxic bacteria (Buchanan et al. 1999).

Sewage removal and detergent bans in the 70s and 80s led to decreased summer algal blooms caused by phosphorus (Kemp et al. 2005), however nitrogen was still negatively affecting water quality. Upgrades to remove biological nitrogen in 1996 and 2000 led to significant decreases in nitrogen concentrations (Buchanan 2003).

Upgrades are also associated with the resurgence of SAV. Research found decreases in nitrogen inputs, nutrient concentrations, and total suspended sediment were highly correlated with increases in total SAV abundance (Ruhl and Rybicki 2010).

Mixed results of upgrades in the Potomac emphasize the complexity of estuarine systems and the need for multiple nutrient reduction practices.

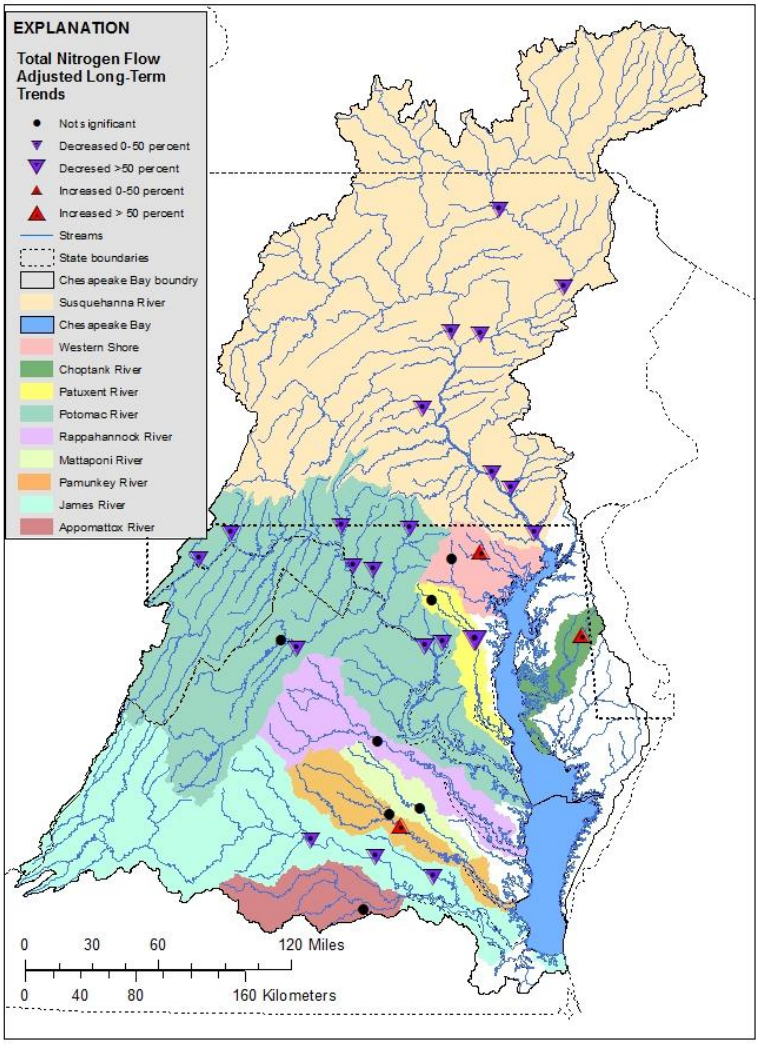
These long-term, multi-decade trends suggest pollution-reduction efforts, such as improved controls at wastewater treatment plants and practices to reduce nutrients and sediment from farms and

suburban lands, are improving water-quality conditions in many areas of the watershed. However, nutrients, sediment, and contaminant pollutant loads still need to be further reduced to clean local streams and bring back a healthier Bay.

Flow adjusted concentration trends throughout watershed 1985-2011

Nitrogen

Changes in nitrogen concentrations were assessed from 1985-2011 at 31 stream sites in the Chesapeake Bay watershed. The majority of the flow-adjusted concentration trends were improving, with 21 sites improving, 3 sites degrading, and 7 sites where the trends were not statistically significant.



Flow-adjusted trends for total nitrogen for 31 sites in the Chesapeake Bay Watershed, 1985-2011.

What if it rains a lot… or not?

Nitrogen, phosphorus and sediment concentrations are highly variable, depending on the amount of water flowing in streams and rivers throughout the Bay watershed.

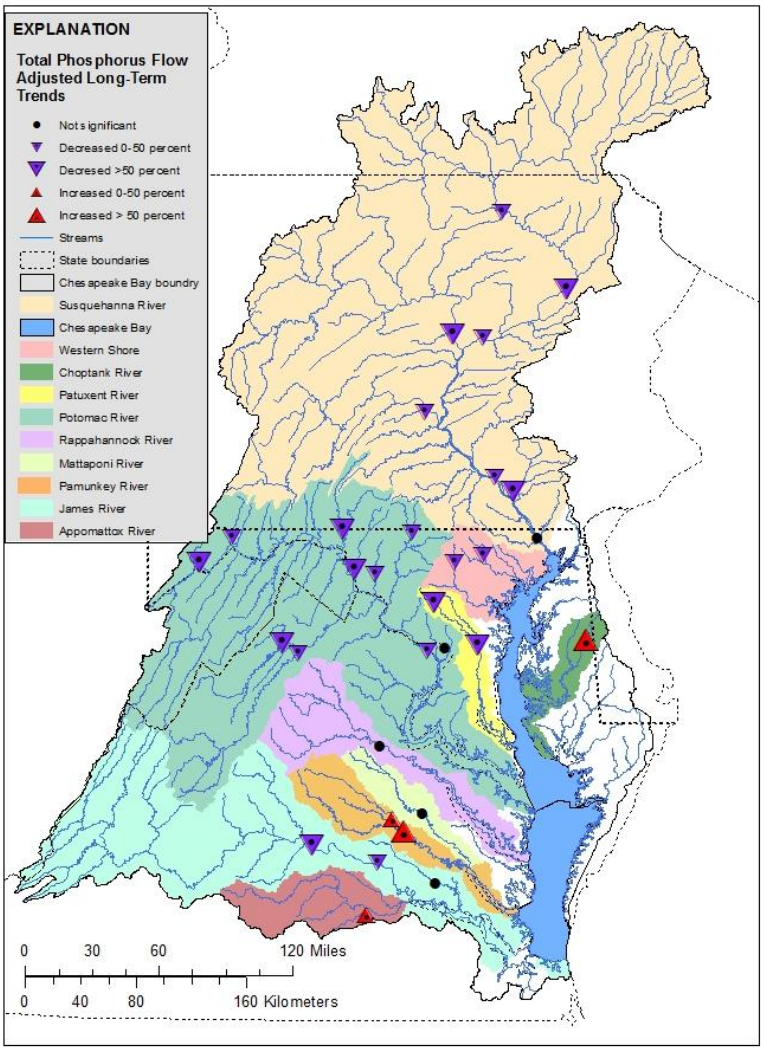
To account for these variations, scientists calculate flow-adjusted trends to determine whether concentrations have changed over time.

By removing the effects of natural variations in streamflow, resource managers can evaluate the changes in stream health that may result from nutrient-reduction actions or other changes within the watershed.

Phosphorus

Changes in phosphorus concentrations were also assessed from 1985-2011 at the 31 watershed stream sites. Again, the majority of the flow-adjusted concentration trends were improving, with 22 sites

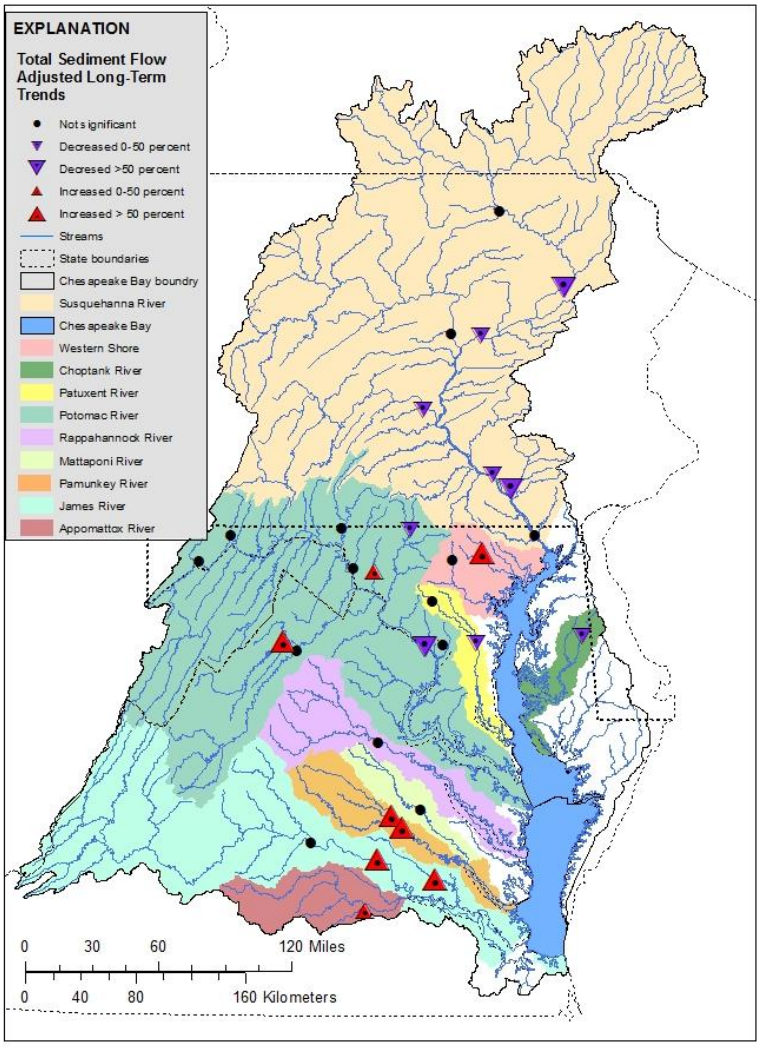
showing decreasing trends, 4 sites increasing, and 5 sites showing trends that were not statistically significant.



Flow-adjusted trends for total phosphorus for 31 sites in the Chesapeake Bay Watershed, 1985-2011.

Sediment

Changes in suspended sediment concentrations were assessed at the same 31 stream sites from 1985-2011. Nearly half the sites (14) show concentration trends that were not statistically significant, with 9 sites improving, and 8 sites degrading.



Flow-adjusted trends for total sediment for 31 sites in the Chesapeake Bay Watershed, 1985-2011.

Restoration Spotlight: Livestock Grazing Management

Cattle exclusion resulted in vegetation growth on land along rivers and streams, reduced suspended sediment loads, improved in stream habitat, reduced nutrients and improved aquatic life in multiple locations through the Chesapeake Bay watershed.

Limiting livestock access to streams as well as improving vegetation and the land along the banks will reduce the direct cow manure input into the system, alleviate stream bank erosion and improve aquatic habitat (Teels et al. 2006).

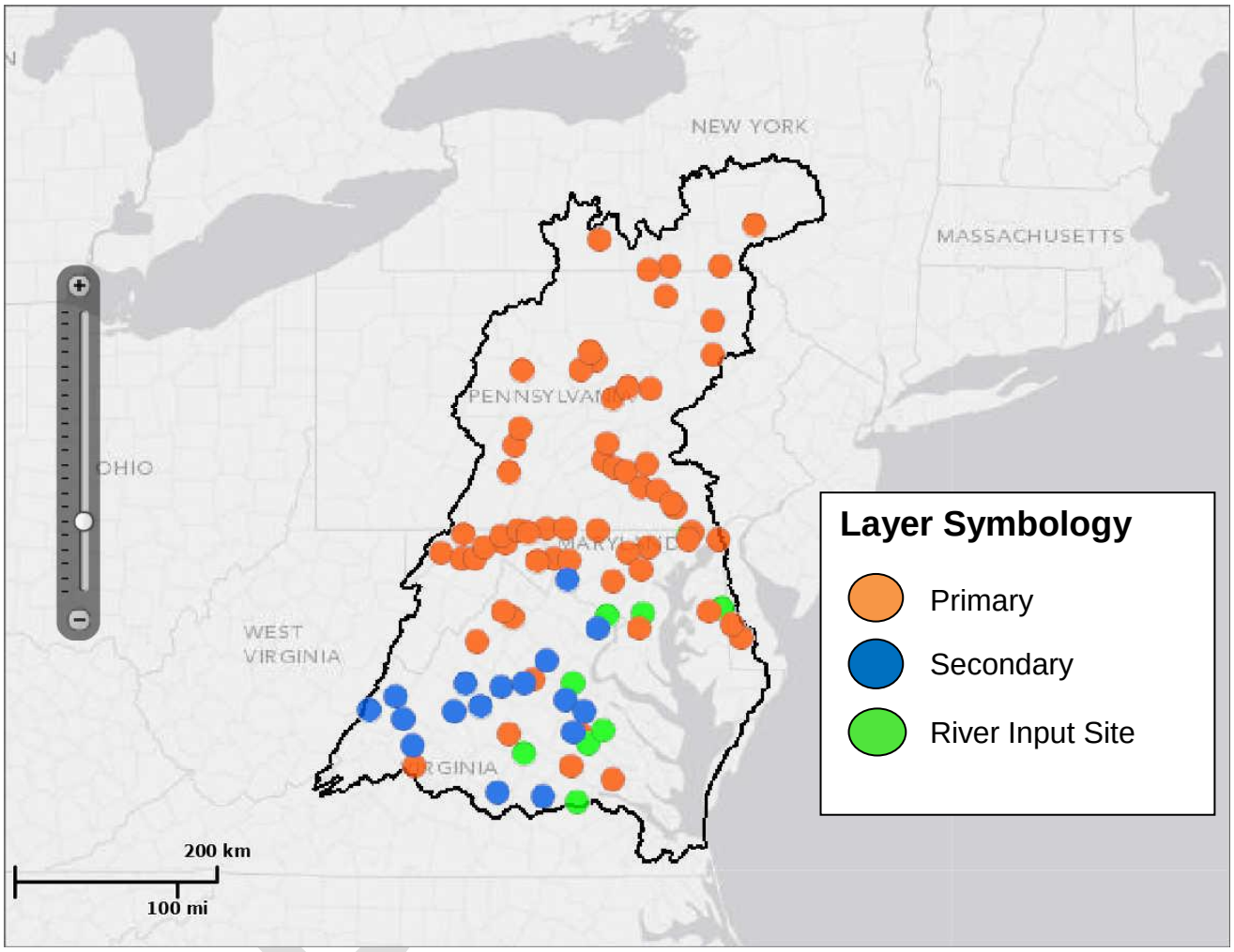
Photo courtesy of U.S. Department of Agriculture

In the Chesapeake Bay region, several studies in Pennsylvania, Maryland and Virginia showed that after cattle were excluded from the land along the banks and streams and the land was replanted, the response time in vegetation growth was rapid, usually on the order of one year. Other benefits observed in Big Spring Run, Mill Creek Basin, Spring Creek, Lower Monocacy River and Lake Linganore—including a decrease in suspended sediment load and improved in stream habitat, bank stability and vegetation—were observed within the first five years after practices were implemented (Galeone et al. 2006; Carline and Walsh 2007; U.S. EPA 2010b).

In Big Spring Run, Mill Creek Basin, Lower Monocacy River and Lake Linganore, the concentrations of key nutrients also decreased (Galeone et al. 2006; USEPA 2010b). Furthermore, aquatic life metrics that included fish and benthic macro invertebrates increased in a short period of time in Big Spring Run, Mill Creek Basin, Occoquan River, Goose Creek and Spring Creek (Galeone et al. 2006; Teels et al. 2006; Carline and Walsh 2007).

Monitoring network

The Chesapeake Bay Program partners have collected data on stream flow and water quality at 31 locations throughout the non-tidal portions of the watershed since the 1980s. These watershed monitoring sites collectively represent 78 percent of the area of the Bay basin and range in size from the 100-square-mile Choptank River watershed to the Susquehanna River's 27,000 square mile watershed. Over the past three years, the partners worked toward to expand the watershed water-quality monitoring network up to over 120 stations across the six-state watershed.



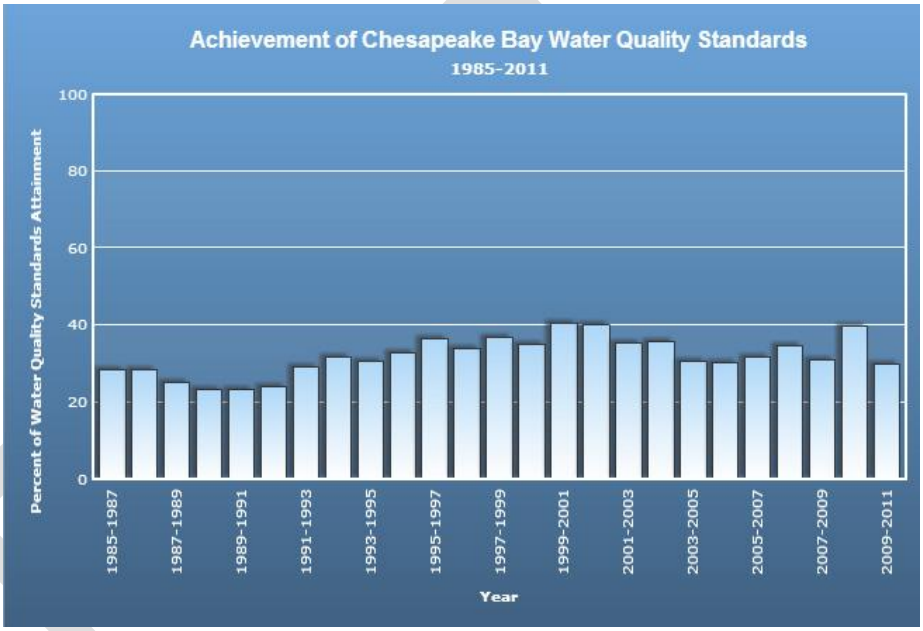
Non-Tidal Monitoring Network

The Chesapeake Bay watershed monitoring network measures streamflow, nitrogen, phosphorus, and suspended sediment concentrations from 88 freshwater river and stream sites throughout the watershed. The seven jurisdictions, the Susquehanna River Basin Commission, and USGS all use the same set of standardized CBP protocols based on USGS sampling methods and EPA approved analytical methods.

Achievement of Chesapeake Bay water quality standards

The Chesapeake Bay Executive Order water quality outcome calls for 60 percent of segments achieving Bay water-quality standards by 2025 via the implementation of pollution reduction actions for nitrogen, phosphorus and sediment. With the implementation of the Chesapeake Bay TMDL, the 2009 baseline condition showed 89 of 92 segments of the Bay and its tidal tributaries and embayments were impaired.

At the recommendation of the partnership's Water Quality Goal Implementation Team, CBP adopted a new indicator in September, 2013 to track achievement of Chesapeake Bay water quality standards, fully consistent with how Delaware, the District of Columbia, Maryland, and Virginia currently list their portion of the Bay's tidal waters, and provides a means for illustrating improvements through time.



The new indicator illustrates how the 92 segments in the Chesapeake Bay's tidal waters can have up to 5 designated uses and in some cases also numeric chlorophyll-*a* criteria. The methodology takes into consideration all designated uses (migratory spawning and nursery, open-water, deep-water, deep-channel, and shallow water bay grasses) for all segments to meet water quality standards for dissolved oxygen, water clarity/underwater grasses, and chlorophyll-*a* in the tidal Chesapeake Bay. Rather than simply 92 segments measured as either pass or fail, this methodology reports on 291 designated-use segments, of which only 82 currently meet water quality standards.

Results for 2009-2011 indicated that 30 percent of the Bay was attaining water quality standards. These results are similar to those of the previous assessment period (2008-2010) in which 40 percent of the Bay was attaining water quality standards.

Restoration Spotlight: Stormwater Infiltration

In Montgomery County, Maryland it was shown that multiple redundant stormwater best practices and combinations of different practices were more effective than a single practice.

Clarksburg, Piney Branch, Upper Paint Branch, and Upper Rock Creek are designated as Special Protection Areas in Montgomery County. SPAs are geographic areas characterized by high quality or highly sensitive water resources that are also under threat of degradation by proposed land uses. Developers in these sites worked with county agencies in planning impervious surfaces, creating environmental buffers, conserving forests, controlling sediment and erosion, and managing stormwater.

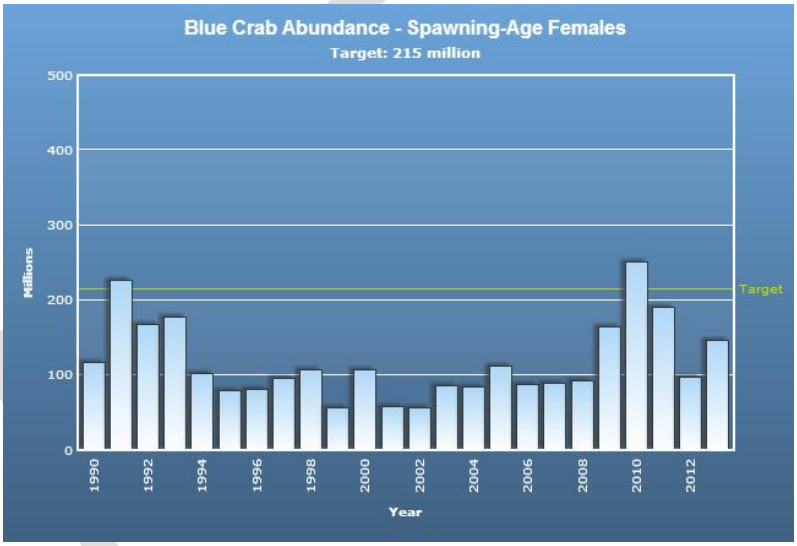
During construction, sediment and erosion control measures included basins with forebays, filter fence baffles, floating skimmers, series of dual basins, and greater storage volumes. These practices were also used in combination as "treatment trains." After construction, stormwater management practices were created, including natural and constructed filtering systems, storage for excess water during storm events, and adequate recharge volume. particularly when implemented in redundant trains, practices reduced runoff and decreased pollution loads.

The success in Montgomery County emphasizes the need for careful planning prior to development. However, the health of the biological aquatic communities within the SPAs did not always rebound with improvements in water quality and may require more time to respond to decreased pollution loads (MCDEP 2009). This delay in response highlights the urgent nature of effective practices as development rapidly expands.

Blue Crabs

Another sign of recovery is the stabilization of blue crab populations. Perhaps no species is more closely associated with the Chesapeake Bay than the blue crab. Because they reproduce by the millions, eating virtually anything, crabs are one of the Bay's hardiest species.

However, water quality and adequate habitat are important for the crab's continued health.

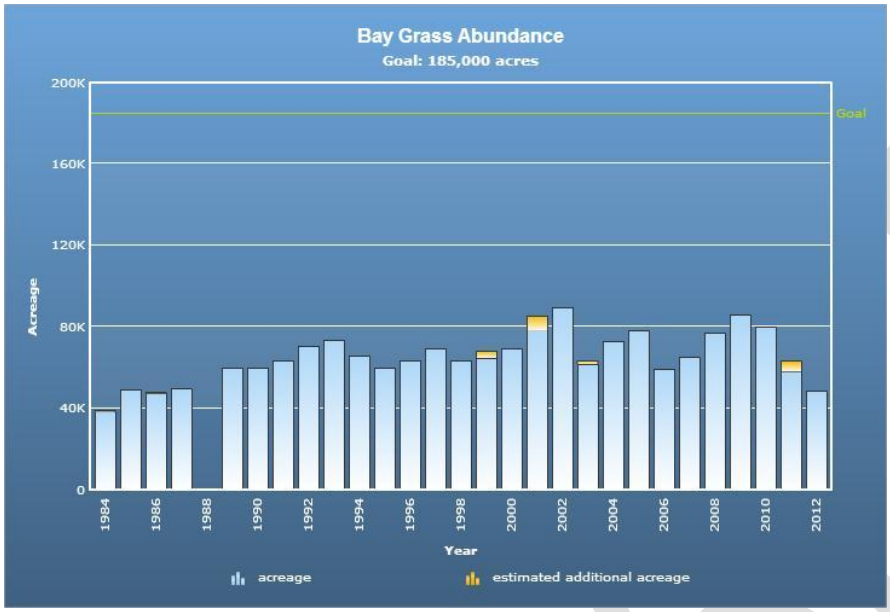


Led by the Chesapeake Bay Stock Assessment Committee and the National Oceanic and Atmospheric Administration's Chesapeake Bay Office, a 2011 benchmark assessment recommended establishing a threshold number of 70 million female spawning-age crabs and replacing the interim target of 200 million male and female spawning-age crabs with a target of 215 million female spawning-age crabs.

Approximately 147 million female crabs over age 1 were estimated in the Bay at the start of the 2013 crabbing season. This number is below the recommended target but still above the new threshold and within the range of values observed for the 13 year period prior to implementation of the female-specific safeguards put in place in 2008.

Underwater Grasses

In 2003, the Bay Program adopted the *Strategy to Accelerate the Protection and Restoration of Submerged Aquatic Vegetation in the Chesapeake Bay*. The strategy included a new Bay-wide restoration goal of 185,000 acre, representing the approximate historic abundance from the 1930s. Scientists believe having more grasses in the Bay and rivers will dramatically improve the entire ecosystem. The expectation is as nutrient and sediment pollution decrease and water clarity improves, underwater grass acreages should expand.



Underwater grasses provide significant benefits to aquatic life and serve many critical ecological functions in the Bay and its tributaries. Bay grasses provide shelter for young striped bass, blue crabs and other species; improve water clarity by helping suspended sediment particles settle to the bottom; add oxygen to the water; and reduce shoreline erosion.

From 1984-2012, the abundance of underwater grasses has increased from 38,958 to 48,191 acres. Acreage has averaged 65,666 and ranged from 38,958 acres to 89,659 acres.

"Dead Zones"

Further evidence of the benefits of nutrient and sediment reductions was presented in a study published in the November 2011 issue of Estuaries and Coasts, by researchers from Johns Hopkins University and the University of Maryland Center for Environmental Science, examining 60 years of Chesapeake Bay water-quality data.

The research team found the size of mid- to late-summer low to no oxygen areas, called "dead zones," leveled off in the Bay's deep channels during the 1980s and has been declining ever since. This is the same time the Chesapeake Bay Program formed and federal and state agencies set the Bay's first numeric pollution reduction goals. The study also found the duration of the dead zone – how long it persists each summer – is closely linked to the amount of nutrient pollution entering the Bay each year.

The study also eased fears surrounding an early summer jump in dead zones, determining they were influenced by stratification, not by the runoff of pollutants. Fresh water from rivers entering the Bay forms a layer on top of more dense salt water from the ocean. The two layers don't easily mix, so when air near the surface adds oxygen to the top layer, it doesn't reach the deeper salt water. Without oxygen at these lower depths, marine animals cannot live, and a dead zone is formed.

We are also seeing more and more stories of the recovery and restoration of free flowing creeks and rivers, tidal embayments, and small watersheds – waterbodies of importance to local communities as sources of swimming, boating, fishing, wildlife watching or other forms of recreation, aesthetic beauty, economic growth, ecosystem services, drinking water, or other benefits.

The recovery of these waterbodies located in communities and small watersheds people call home are the direct result of local actions by neighbors, homeowner, farmer, municipalities, and many others working at the local scale.

Each of these local stories give us new insights into how to better restore the next creek, river or watershed, how long until we should expect to see a positive water quality response downstream, what trajectory the restoration of other rivers and embayments will take and what signs should we be watching out for.

Restoration Spotlight: Manure and Fertilizer Management

Reducing the application of phosphorus in commercial and manure fertilizer resulted in significant water quality improvements in a small watershed in the Lower Susquehanna River Basin (Brush Run Creek).

The 0.63 square mile watershed in south-central Pennsylvania is dominated by agriculture. Reducing commercial and manure fertilizer decreased phosphorus and nitrogen loads by 57% and 14%, respectively. Total phosphorus and suspended sediment concentrations decreased at three water quality monitoring sites. Total nitrogen concentrations decreased slightly, but not significantly.

Photo of Pennsylvania Rt. 213 bridge over Brush Run Creek from bridgemapper.com

At two of the sampling sites, the volatilization of ammonia from livestock manure likely added additional nutrient loads through atmospheric deposition. The reductions in phosphorus point to the effectiveness of nutrient management, but the insignificant decreases in nitrogen point to the need for long-term monitoring. The monitoring period likely needs to be extended beyond three years post-nutrient load decreases to observe changes in nitrogen concentrations (Langland and Fisher 1996).

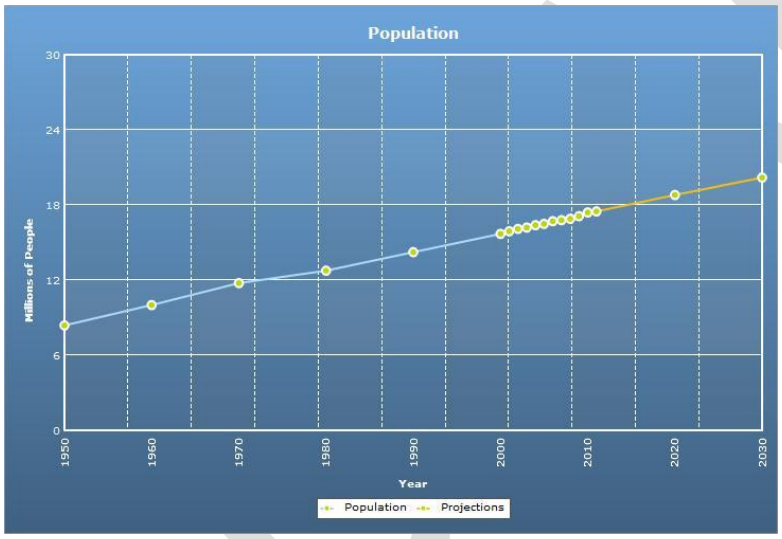
In 2010 and 2011, New York, Maryland and Virginia took the additional step of banning the use or sale of residential phosphorus fertilizers.

Resilience

We have also observed a growing resilience in the Bay ecosystem to withstand and bounce back from severe stresses and impacts – numerous major storms, sustained droughts and record summer time temperatures, all while population growth and development in the watershed has more than doubled since the 1950s.

Population Growth

In the face of significant increases in population across the Chesapeake Bay watershed, accompanied by continued development of the land, the partnership has been able to not only prevent hold the line on pollutants loads – it's been able to improve water quality conditions. Given more than 5 million additional people now call the Bay watershed home since the partnership was established in 1983, the fact the Bay ecosystem is showing real signs of recovery is significant.



As of 2011, 17.5 million people were estimated to live in the Bay watershed, up from 17.5 million in 2010. Experts predict the watershed's population will increase to more than 20 million by 2030.

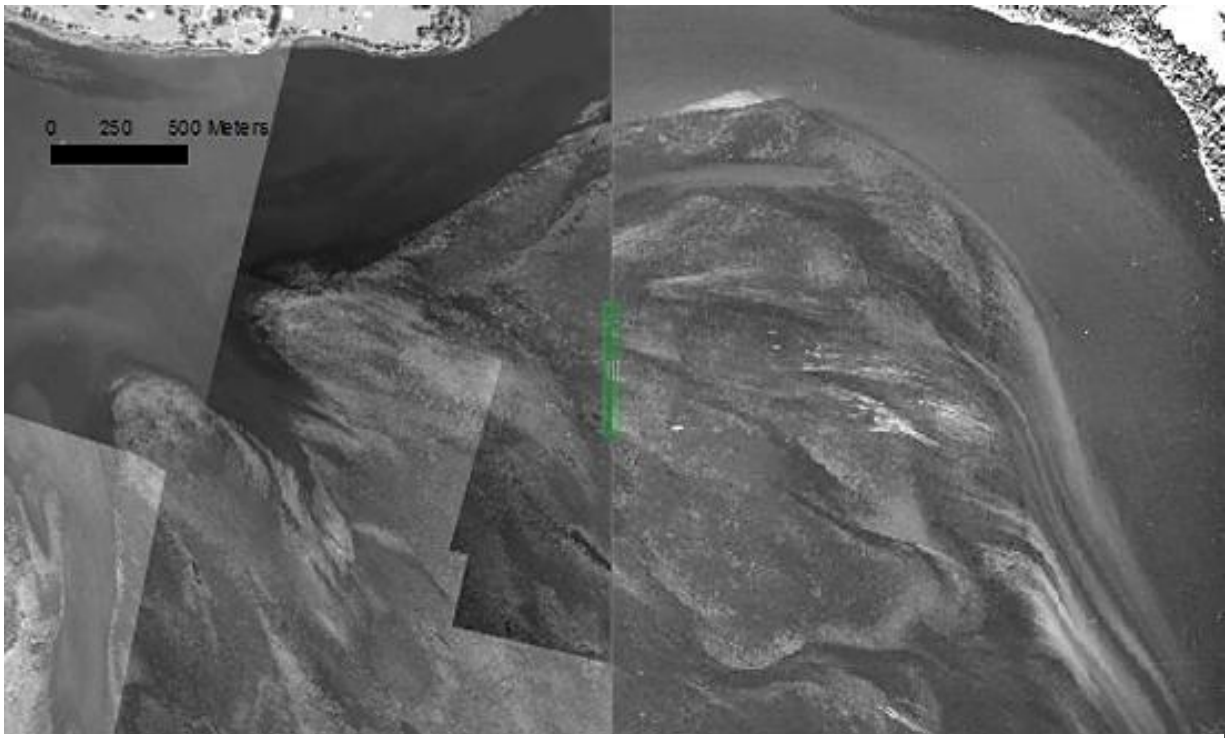
Water's getting warmer…

The Potomac River, one of the Bay's largest tributaries, was one of 20 major U.S. rivers and streams showing statistically significant long-term warming. In Maryland's Patuxent River, University of Maryland Center for Environmental Science (UMCES) researchers have noted a 3°F increase since 1939.

"We are seeing the largest increases in the most highly urbanized areas which lead us to believe that the one-two punch of development and global warming could have a tremendous impact on stream and river ecosystem health," said Dr. Sujay Kaushal of UMCES.

Major Storm Events

In August and September of 2011, Hurricane Irene and Tropical Storm Lee dumped a large amount of water in the Susquehanna watershed, creating a muddy plume that extended down the Chesapeake Bay to the mid-bay islands and persisted for several months. Scientists with the Chesapeake Bay Program acquired aerial imagery in early November. The photos showed while some underwater grasses in the Susquehanna Flats were lost, the bed mostly survived.



The Virginia Institute of Marine Science's SAV blog has an interactive version of the above image comparing the Susquehanna Flats underwater grass bed from 2010 to post-storms 2011.

A 2012 study by UMCES showed some positive effects of tropical storms, as well as negative impacts. The report points out oysters benefit from salinity reductions, reducing incidence of two major diseases. Low salinity also reduces the rate of infection as well as occurrence of parasites.

"Mixing" of Chesapeake Bay waters following high winds, like those of Hurricane Irene, was another positive effect found by the study. Coming on the heels of a large dead zone that summer, the high winds from the storm mixed the water, improving oxygen levels.

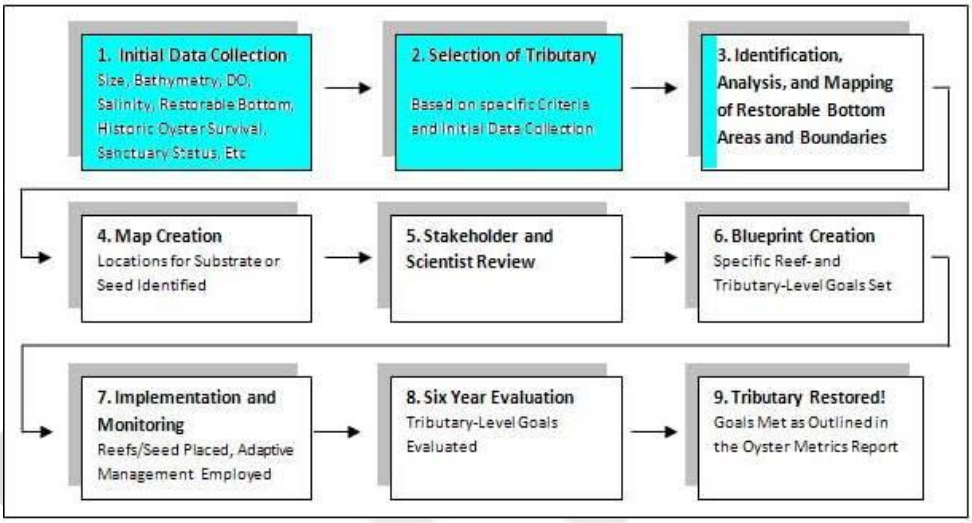
The effect on other species, such as blue crabs, was minimal as they are highly mobile and migrate to avoid areas with decreasing water temperatures or reduced salinity as a result of the storms.

These major storm events did not overwhelm the restoration progress made to date – impacts from these and other tropical storms and hurricanes in years past were barely observed in the spring which followed. Compared with the devastating impacts of Tropical Storm Agnes in June 1972 from which it was more than a decade later that the Bay recovered, Bay and watershed restoration efforts have successfully re-built a level of resilience to withstand these natural events.

Lynnhaven River Oyster Restoration

In the past 100 years, the population of the native Virginia oyster (*c. Virginica*) has fallen dramatically, due to over-harvesting, disease and poor water quality. Lynnhaven River has been the center of many community-based restoration and oyster shell recycling efforts over the past few decades. Agencies such as the National Oceanic and Atmospheric Administration, state efforts like the Virginia Oyster Heritage Program, and nonprofit organizations including Lynnhaven River NOW, the Chesapeake Bay Foundation, and Oyster Reef Keepers of Virginia have performed smaller-scale restoration involving students and citizen groups. Most of these projects involved creation of artificial reefs and adding spat-on-shell to these reefs. These projects have seen some measureable progress and have increased the oyster population in the Lynnhaven dramatically.

How Close Are Oysters in the Lynnhaven River to Being "Restored"?



The Lynnhaven was chosen by NOAA for restoration partly because of these previous efforts, its sufficient water quality, and evidence that Lynnhaven oysters have developed some resistance to disease. In addition, it is one of only three tributaries in Virginia currently closed to oyster harvesting (except aquaculture), which will allow existing and implemented populations to grow and reproduce. The Chesapeake Bay Program's Sustainable Fisheries Goal Implementation Team is in the process of determining whether the Lynnhaven River already meets the restoration standards set forth in the oyster metrics, and will determine next steps after the data has been analyzed.

Contractors working for the U.S. Army Corps of Engineers, Norfolk District, use high-pressure water cannons to spread fossilized oyster shell in the Lynnhaven River in Virginia Beach, Va., in an effort to build medium relief oyster reefs for an ongoing oyster restoration project. (Photo courtesy USACE Norfolk)

Not Seeing Expected Response to Management Actions

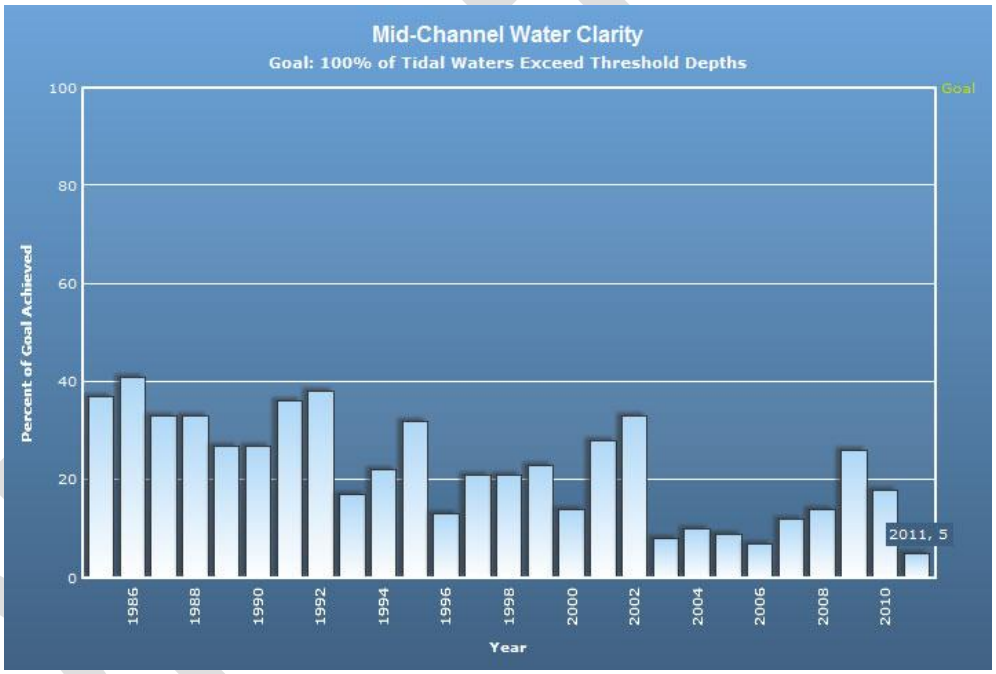
We have also found ourselves in situations where our restoration efforts have not progressed the way we would have hoped in some areas.

Water Clarity

Water clarity measures the depth to which light can penetrate into the water. It is routinely hindered by fine sediment, plankton and other debris suspended in the water. Greater water clarity generally leads to a healthier Bay.

The goal is for 100 percent of the Chesapeake Bay to meet water clarity standards. Visibility depths greater than 0.65–2 meters (depending on waterbody salinity) during the underwater bay grass growing season is acceptable.

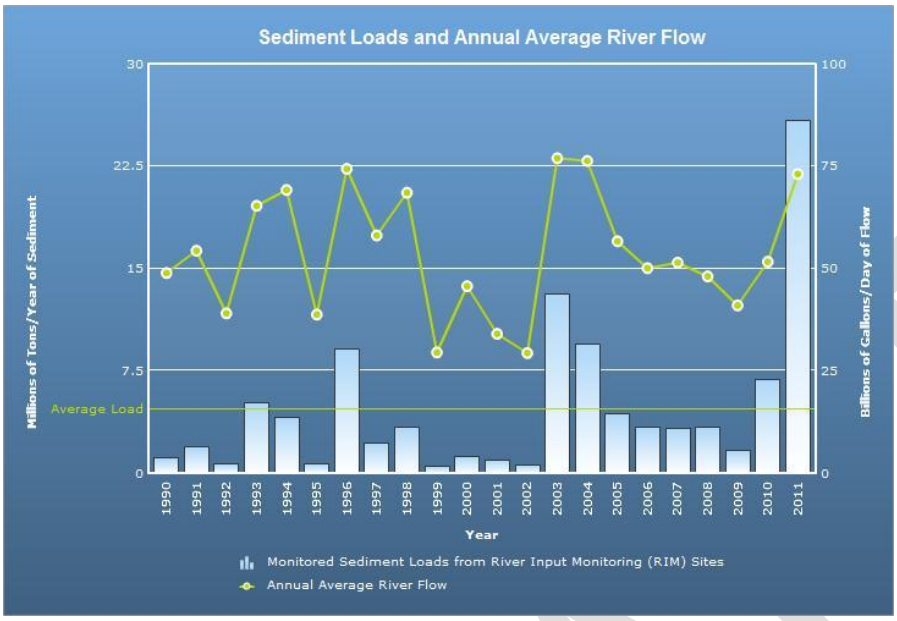
Annual clarity levels can vary greatly, but the long-term trend indicates Bay water has become more turbid (less clear). Since 1985, goal achievement has averaged 22 percent and has ranged from 5 percent to 41 percent. In the most recent measurements for 2010-2011, the water clarity score decreased from 18 percent to 5 percent of goal achieved.



Unfortunately, systematic monitoring of water clarity in shallow water areas has been underway for only the past few years and there are not yet sufficient data to provide a Bay-wide assessment. Thus, water clarity data from deeper, mid-channel areas are used to indicate general conditions and trends.

Sediment Loads and River Flow

We are witnessing water quality trends in the wrong direction in the case of reduced water clarity in the tidal waters and sediment loads at the river input monitoring stations.



Following heavy rains from Hurricane Irene and Tropical Storm Lee, preliminary estimates show 25.8 million tons of sediment from nontidal rivers reached the Bay during the 2011 water year (October 2010-September 2011). This is an 18.9 million ton increase from 2010 and significantly higher than the 4.7 million ton average load from 1990-2011 and was the highest delivered yield of sediment to the Bay since 1990.

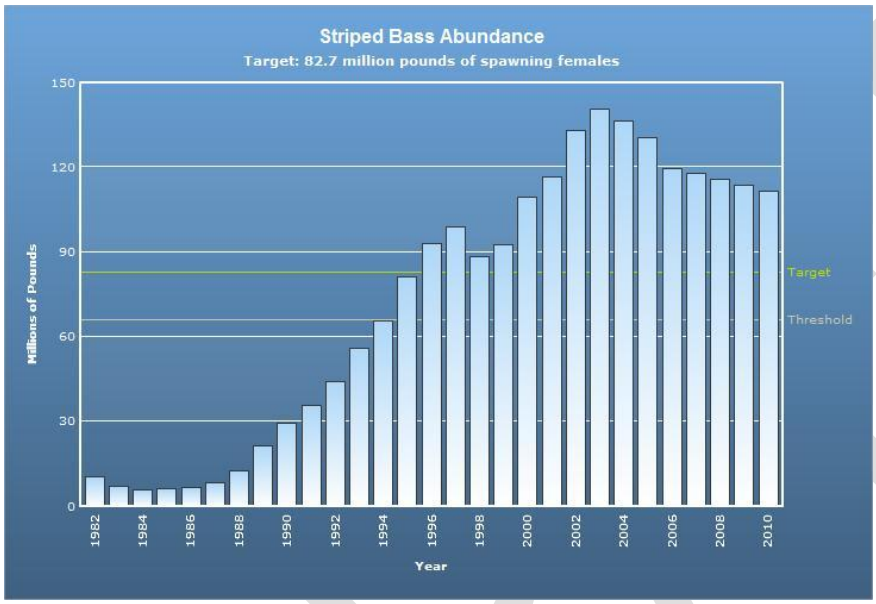
Smallmouth Bass

Starting with severe losses in smallmouth bass populations in the Shenandoah River, reports of fish kills and similar population declines in this prized freshwater sport fish were reported in the South Branch of the Potomac River in West Virginia, the Cowpasture River in Virginia, the Monocacy River in Maryland, and the Susquehanna River in Pennsylvania. Specific causes of the observed lesions, abnormal sexual development, and resultant severe population declines remain unclear. There are indications a combination of elevated nutrient conditions, high water temperatures, and chemical contaminants may have weakened the natural immune systems of the fish, leaving them more susceptible to bacteria, viruses, and parasites living naturally in these river systems.

A smallmouth bass collected from the Susquehanna River near Selinsgrove displays the black spots that have anglers concerned. Photo by Pennsylvania Fish & Boat Commission.

For striped bass the message seems to be "proceed with caution." The Chesapeake Bay is the primary spawning and nursery habitat for striped bass on the East Coast. Striped bass support one of the most important commercial and recreational fisheries on the Atlantic seaboard. The striped bass population rebounded from historic lows in the mid-1980s to highs exceeding the population target. Multi-state fishing moratoria in the late 1980s, as well as commercial quotas and recreational harvest limits set in the 1990s, were successful at rebuilding the stock.

Female striped bass spawning stock biomass measured 111.44 million pounds in 2010 and has exceeded the target since 1995. The stock is not overfished and overfishing is not occurring.



However, scientists are now concerned about the high prevalence of disease (mycobacteriosis) and whether there are enough prey available to adequately support this predatory fish.

Mycobacteria are widespread in aquatic environments. A small fraction of mycobacterial species causes disease in animals and humans.

Mycobacterial infections in humans are commonly known as "fish-handler's disease." Although the risk of contracting the disease is generally low (Panek and Bobo 2006), there is the potential for human infection from handling infected striped bass. There is no reported evidence that humans can contract mycobacteriosis by consuming cooked fish.

Anglers aboard the charter boat "My Desire" show off their haul of striped bass. Also known as "rockfish" or "stripers" around the Chesapeake Bay, striped bass is the Maryland state fish and one of the most popular commercial and recreational catches.

Climate Change

The Chesapeake region is experiencing the effects of a changing climate. Historical records show increasing temperatures and sea level rise in the Chesapeake region over the past century. Long-term observations corroborate model projections that upward trends in temperature and sea level will continue, and even accelerate, in the Chesapeake. Bay scientists are working to understand the possible effects of these changes on the Chesapeake and its watershed, including how they affect Bay restoration efforts already in progress.

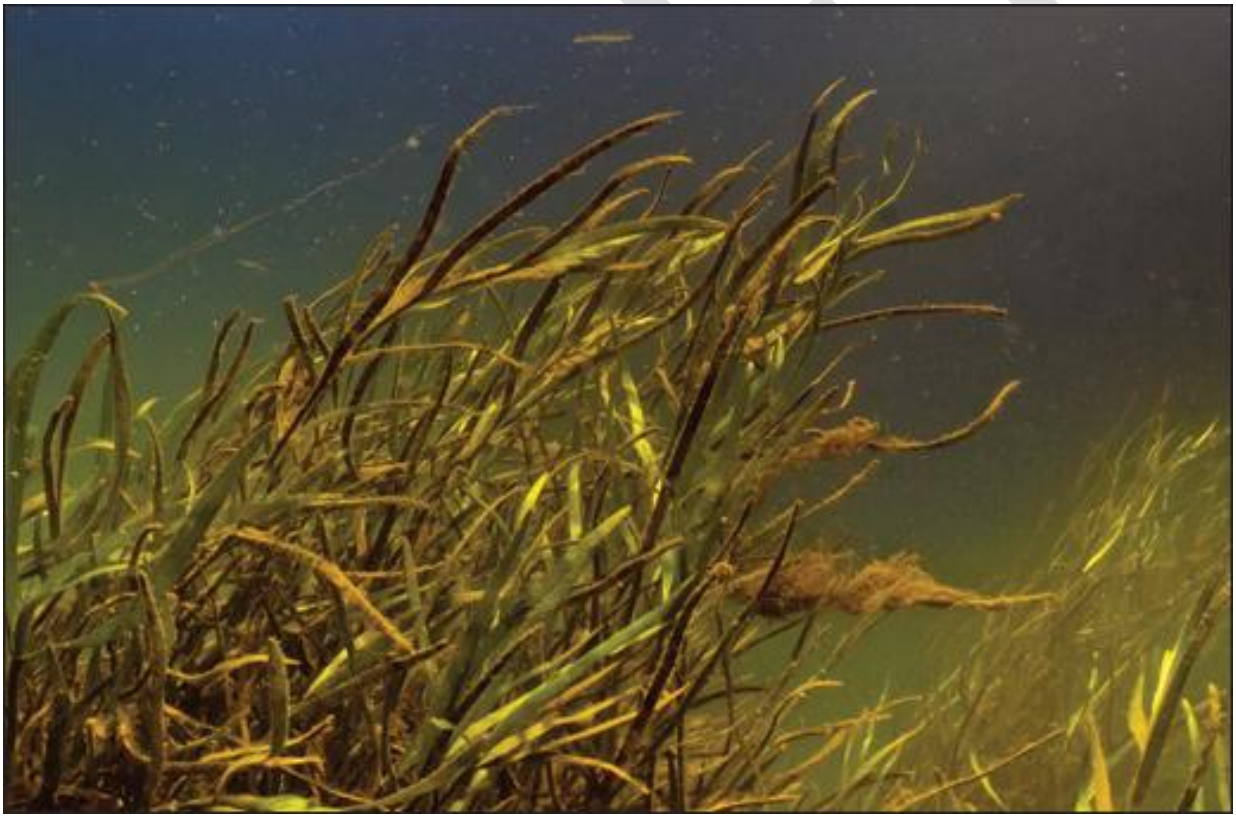
The influence of climate change and sea level rise is widespread, and adapting to changing conditions will require the involvement of all Bay Program partners in their particular areas of expertise. For example, the Interstate Commission on the Potomac River Basin is examining the viability of Washington D.C.'s water supply in the face of increased water demand from increased temperatures and population, as well as the potential for less annual available river flow under climate change conditions in 2050. Elsewhere, the Department of the Navy is examining new pier designs for installations like Naval Station Norfolk to ensure force readiness despite continuing sea level rise. These and other activities at the federal, state, and local levels are ongoing in the watershed to allow adaptation to the changing conditions.

The Chesapeake Bay Program is now engaged in estimating the influence climate change and sea level rise will have on the Chesapeake Bay TMDL. Partners will examine the estimated influence of temperature increases, sea level rise, the loss of tidal wetlands, changes in air quality, and other climate change influences on the TMDL. In 2017, the Chesapeake Bay Program partners will decide how to factor into the Bay TMDL the effects of increased temperatures and sea level rise.

Summary of Status and Trends

The past 30 years of scientific discovery, collaborative decision making, taking local actions, and monitoring the responses of the Bay ecosystem and its surrounding watershed have told us clearly:

- We are not only holding our own in the face of continued population growth and development in the watershed, we are making progress;
- Our actions, taken locally and in enough places, can lead to recovery and restoration of local waters and waterbodies;
- Our pollutant reduction goals set more than a decade ago, now in the form of more specific allocations, are still the right ones to restore local and Bay water quality conditions;
- We know we must do more and do it now to further build back the resilience of local ecosystems to withstand increasing extreme variations in weather and climate.



Underwater grasses of the Susquehanna Flats. Photograph from *Chesapeake Quarterly*, Vol. 11, No. 4, December 2012.

Chapter 2: Management Strategies Effectiveness

The Chesapeake Bay Program has a history of building on what has worked and adding more complexity to achieve the overall goal of restoring and protecting the Chesapeake Bay. As a result of the 1975 EPA study of the Chesapeake Bay called for by Senator Charles "Mac" Mathias, which identified the key problems the Chesapeake faced, the partnership has led the Chesapeake Bay restoration effort through a series of agreements, each building on the accomplishments of the last.

Signed in 1983 by the Governors of Maryland, Virginia, Pennsylvania, the Mayor of the District of Columbia, the chair of the Chesapeake Bay Commission (a tri-state legislative assembly representing Maryland, Virginia and Pennsylvania), and EPA on behalf of the Federal Government, the first Chesapeake Bay Agreement was renewed twice, and amended once, each building off the last. The 1983 Agreement focused on building of an **engaged and effective partnership**.

In 1987, a new Agreement was signed, this one building on the effective partnership but adding **aggressive commitments** the partners could work on to restore the Chesapeake Bay, most notably a call for a 40 percent nutrient reduction by 2000, the first time a measurable and time-bound goal was set for the Program. This Agreement was amended in 1992, when the partnership recognized they had to focus attention not only to the Bay itself, but the tributaries, calling for the states and D.C. (jurisdictions) to develop **individual tributary strategies**, a standard used today for the jurisdictional Watershed Implementation Plans developed to achieve the goals of the Bay-wide Total Maximum Daily Load restoration blueprint described below.

At the start of the new millennium, the partners signed *Chesapeake 2000*, building on earlier agreements, but focusing on additional time-bound and measurable goals focused on **accelerating implementation and influencing change**.

Building An Effective Partnership

The 1983 Agreement was a simple agreement focused on the notion the collective group could be more effective working together than apart. It established a Chesapeake Executive Council (EC) that would oversee the Program, assess progress on coordinated plans to "improve and protect the water quality and living resources of the Chesapeake Bay estuarine system." At the time, the EC was to be comprised of cabinet members of the Mayor and Governors' administrations, as well as the Regional Administrator of the EPA, and it was to meet at least twice a year. The EC still exists to this day, but has been elevated to the level of the original Agreement signatories (Governors, Mayor, Administrator, Chair of CBC) and meets annually to oversee, set new or more specific direction, and adopt policies and strategies.

The original agreement also called for the establishment of an implementation committee, comprised of agency representatives of all signatories who would coordinate the development and evaluation of the management plans. Advisory committees were established for citizens and scientists whose membership was comprised of nominations by the governors. An advisory committee for local governments was later established when the partners recognized local governments were essential in the implementation of actions needed to restore the Bay. At the same time, EPA developed Memorandums of Understanding with key Federal Agencies to articulate the ways in which EPA could represent them in the partnership. To develop individual management strategies, the Implementation Committee convened subcommittees for each key focus area of the Program.

The structure set up early in the Partnership still exists, fundamentally unchanged, today. The organization has been reorganized twice, in 1996 and in 2009, to face the future challenges of the restoration effort and accelerate implementation. CBP partners recognized the need to embrace an "adaptive management" approach to respond better to changing conditions and better information.

Key elements have remained consistent since the 1983-1987 timeframe. There is still an Executive Council and its Principals' Staff Committee, the Implementation Committee became what is now the Management Board, there are three advisory committees, Citizens, Science, and Local Governments, and the Subcommittees are now called Goal Implementation Teams.

Two major expansions in the partnership have occurred since the 1983-1987 timeframe. After the 1992 Amendments to the Agreement, the partnership recognized the need for involvement and engagement by the states in the headwaters of the watershed. In 2002-2003, New York, Delaware, and West Virginia signed on to the water quality commitments through a Memorandum of Understanding. In addition, the EC representatives of the states and D.C. felt a strengthened leadership from the federal government was needed. In 2009, they wrote a letter to newly elected President Obama seeking that leadership. The upshot of that request became President Obama's first environmental executive order – the Chesapeake Bay Protection and Restoration Executive Order (EO 13508).

Management Strategies

Water Quality requirements necessary to restore living resources

The Chesapeake Bay Program's priority attention for meeting water quality requirements to restore living resources has been on two key areas: (1) correcting the nutrient- and sediment-related problems in the Chesapeake Bay and its tidal tributaries sufficiently to remove the Bay and the tidal portions of its tributaries from the list of impaired waters under the Clean Water Act; and (2) fulfilling the 1994 goal of a Chesapeake Bay free of toxics by reducing or eliminating the input of chemical contaminants from all controllable sources to levels that result in no toxic or bioaccumulative impact on the living resources that inhabit the Bay or on human health.

Achieving and Maintaining Nutrient goals of the Chesapeake Bay Agreement

The strategy set forth in the Chesapeake 2000 Agreement included defining water quality conditions necessary to protect aquatic living resources, aligning and, as necessary, adopting new or revised water quality standards, and monitoring progress toward meeting the standards (see Appendix __ for tidal and non-tidal monitoring programs). The strategy also included using Chesapeake Bay models (see appendix __) to set nutrient load allocations for each major tributary to meet those standards. Finally, the strategy called for Bay jurisdictions to develop tributary strategies that define and commit to the actions necessary to reduce nutrient pollution enough to meet those allocations. The progress in implementing the tributary strategies was tracked annually through collecting implementation information from the jurisdictions and processing that information through the Chesapeake Bay Watershed model.

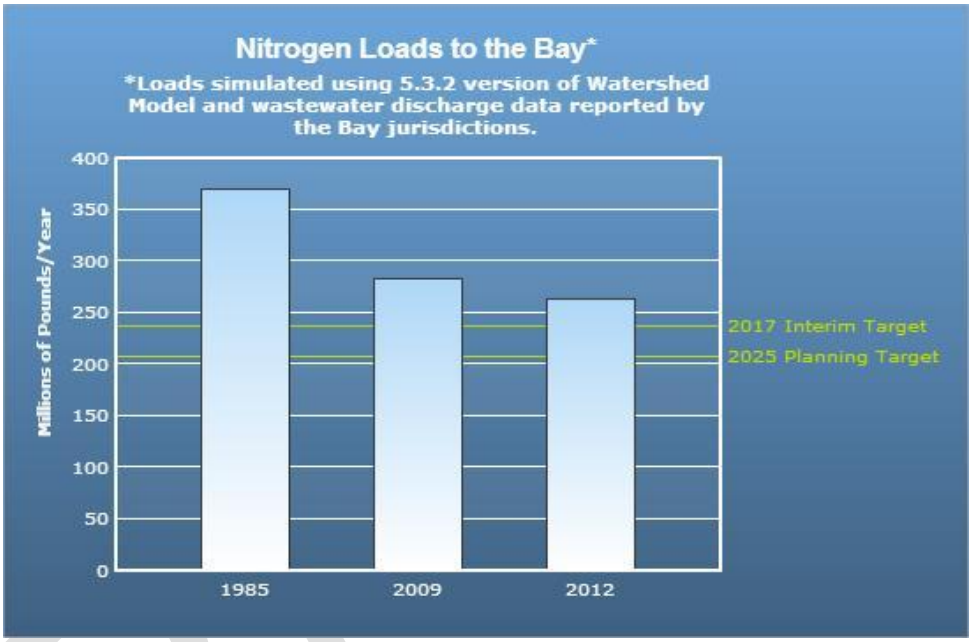
In 2008, the Executive Council directed the partnership to take an innovative approach toward improved accountability. In pursuit of the long-term goal set in 2009 for having all water quality restoration practices in place by 2025, the partners would begin to track their progress through short, two-year targets, starting with the years 2009 through 2011. These short-term checks on water quality restoration progress were a significant departure from prior CBP tracking periods of ten or more years.

When it appeared the partnership would not be able to meet the ambitious goal of removing the tidal waters of the Bay from the impaired waters list by 2010, the Chesapeake Executive Council called for the Program to develop shorter term, 2-year milestones to hold them to a more accountable incremental timeframe. By 2009 it was apparent, even though there were significant reductions in nitrogen and phosphorus, not enough progress would be made. A Bay-wide TMDL was developed to increase the rate of implementation necessary to have all practices and controls in place by 2025 that would achieve water quality standards. This TMDL (see section on page 52 for more) is like no other TMDL in the country, largely because it is based on the success of the Partnership in developing the monitoring and modeling tools necessary to track progress, in developing and implementing tributary strategies that were the precursor to the jurisdictional Watershed Implementation Plans, and in the commitment to develop shorter term 2-year milestone commitments.

The original intent of the 2009-11 water-quality milestones was to allow for flexibility so the partners could alter their management decisions based on what worked best. Success was to be measured against the end goal of reducing the pounds of pollutants entering the region's waters, rather than acres or miles of specific practices put in place. This "common currency" of expected pounds of

pollution reduced allowed jurisdictions to establish an initial set of practices to implement and to adapt if the original practices were less effective than anticipated.

Between 2000 and 2010, this general strategy has been implemented, updated, and revised. New water quality standards were developed for dissolved oxygen, chlorophyll-*a*, and clarity and SAV. Pollutant load allocations have been set and revised for each major tributary, tributary strategies were developed by the Bay jurisdictions and progress is measured annually. In addition, the headwater states of Delaware, West Virginia, and New York joined the signatories to the Chesapeake Bay Agreement through a Memorandum of Understanding in agreeing to meet this water quality goal in 2003. Data collection and modeling were continually improving.



At the end of the 2012 annual progress run, the jurisdictions have made 23 percent of the overall watershed-wide reductions necessary to meet their combined 2025 TMDL tracking goal for nitrogen, relative to the 2009 TMDL baseline. The jurisdictions are 26 percent towards their goal for phosphorous and 32 percent for sediment.

Chesapeake Bay Basinwide Toxins Reduction and prevention strategy goal

In December 2000, the CBP Executive Council adopted the *"Toxics 2000 Strategy: A Chesapeake Bay Watershed Strategy for Chemical Contaminant Reduction, Prevention, and Assessment"* (USEPA 2000a). The agreement made substantial commitments to prevent and reduce chemical contaminants and eliminate toxic impacts on living resources inhabiting the Bay and rivers. The EC also committed to eliminating all chemical contaminant-related fish consumption bans and advisories, to clean up contaminants in the sediment in the three most urbanized areas referred to as "Regions of Concern" (Baltimore Harbor, Anacostia River, Elizabeth River), and to sustain progress in the face of increasing population and expanded development within the watershed.

Since adopting the *Toxics 2000 Strategy*, while CBP activities have focused primarily on reducing nutrient and sediment loads, some progress has been made by federal and state agencies as well as non-government organizations (NGOs) completing ongoing work to control chemical contaminants. EPA, for example, has continued numerous contaminated site cleanups, improving conditions in the Chesapeake Bay watershed. Jurisdictions have enforced permit conditions including industrial

wastewater permits, and have also continued to monitor fish tissue for determining consumption advisories and impairment listings. Federal agencies such as USGS, NOAA, Fish and Wildlife Service and EPA continue to monitor for chemical contaminants and assess possible ecological effects.

Progress has been made in at least two of the three previously designated Regions of Concern, the Elizabeth River and Anacostia River, due in part to the leadership provided by the Elizabeth River Project and Anacostia Watershed Restoration Partnership. For example, in the Elizabeth River watershed contaminated soil at a former naval shipyard was removed and the site replanted to create a wetland. Multiple industrial sites are being cleaned up to reduce bottom sediment contaminated with PAHs and other pollutants.

In the Anacostia watershed, stormwater retrofit projects have been completed to allow for improved treatment of stormwater originating from hundreds of acres. The Anacostia is benefiting from a trash TMDL, which reduces contaminants from household products and other industrial sources of waste. The multijurisdictional Anacostia Watershed Restoration Plan includes projects reducing toxic contaminants into the river. During 2012, EPA Chesapeake Bay Program Office focused one million dollars of grant funds toward the Anacostia watershed. Both the Anacostia watershed and Baltimore Harbor were chosen for EPA's Urban Waters Initiative, which is working to align federal programs and investments and build local capacity for improving ecological conditions in these watersheds.

In 2006, the CBP completed analysis of information that led to prioritization of organic pollutants targeted for reduction. Strategies for reducing those high priority pollutants were in development when the decision was made in 2007, to disband the former CBP Toxics Subcommittee to allow for greater focus on development of the Chesapeake Bay TMDL. Prior to 2007, the efforts of the Toxics Subcommittee focused on further characterizing the condition of the Bay with regard to ecological impacts from toxic contaminants.

Since the *Toxics 2000 Strategy* was written, the conditions that existed remain. According to the environmental indicator maintained by CBP, which measures the number of tidal segments with a partial or full jurisdiction-listed impairment due to toxic contaminants in 2010, a similar extent of impairment exists in the Bay compared with the previous version of 2008 jurisdiction listings. Research has augmented our understanding of sublethal effects of contaminant mixtures and new issues, such as intersex characteristics in fish in the Bay watershed, have arisen. The focus of a new report released in December 2012 was to summarize the current conditions of extent and severity of effects from toxic contaminants. The report findings will be used to assist the partnership in considering goals and strategies to reduce risk to the Bay's biological resources.

Habitat Restoration, protection, creation, and enhancement goals

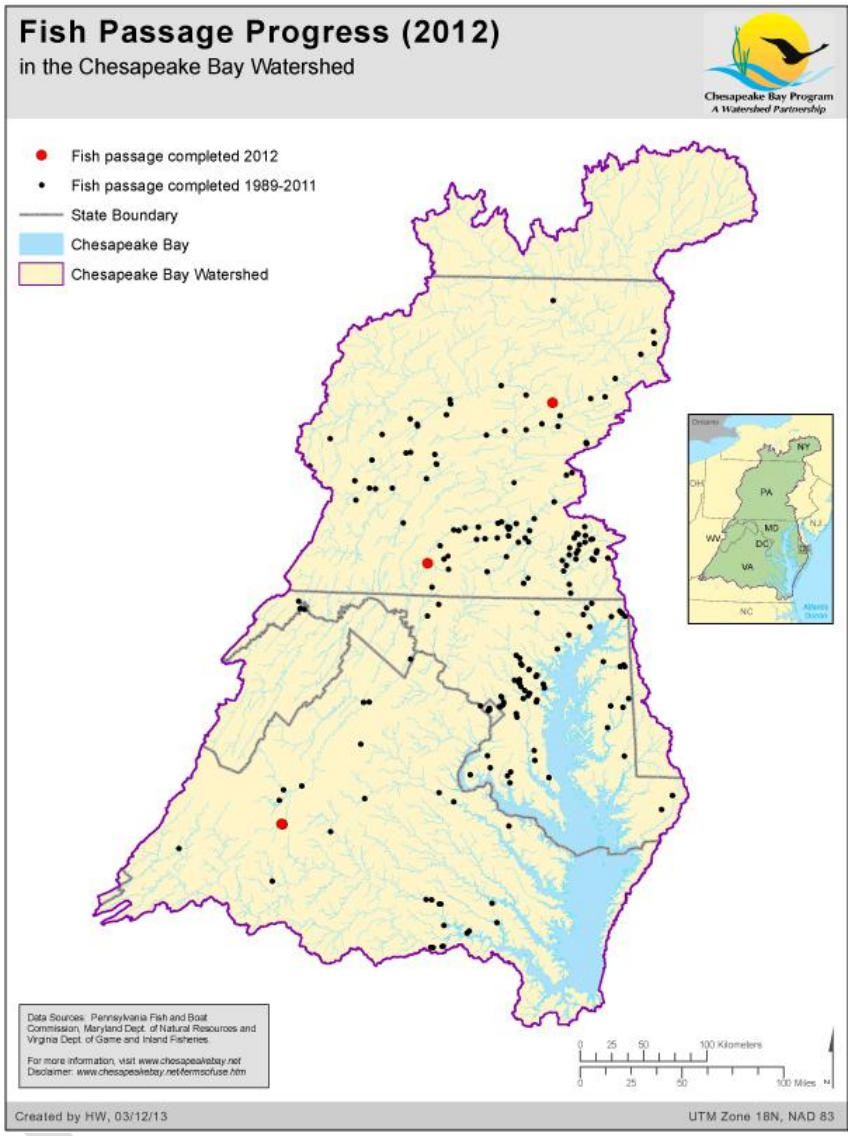
The restoration of critical wildlife habitats is an important component to a healthy Bay ecosystem. Habitats within the Chesapeake Bay watershed— including underwater grasses, streams, wetlands, and forests—have been degraded and in some cases no longer support an abundance of wildlife.

Submerged Aquatic Vegetation

- Recommit to the existing goal of protecting and restoring 114,000 acres of submerged aquatic vegetation (SAV).
- By 2002, revise SAV restoration goals and strategies to reflect historic abundance, measured as acreage and density from the 1930s to the present. The revised goals will include specific levels of water clarity which are to be met in 2010. Strategies to achieve these goals will address water clarity, water quality and bottom disturbance.
- By 2002, implement a strategy to accelerate protection and restoration of SAV beds in areas of critical importance to the Bay's living resources.
    - In 2011, The SAV Workgroup requested a review of the CBP's SAV restoration program. In its request, the SAV workgroup acknowledged that the "Bay Program has fallen far short of its proximate SAV goal of direct restoration of 1,000 acres of SAV. Further, it is unclear whether or not direct restoration has or could advance the overall goal of achieving 185,000 acres of SAV bay wide." Specifically, the workgroup requested STAC conduct a review of the effectiveness of direct SAV restoration efforts, evaluate the efficacy of the direct restoration strategy for accelerating broader SAV recovery, and, if appropriate, provide guidance on how the CBP might improve restoration efforts. To conduct this review, STAC members and external SAV experts from outside the Chesapeake Bay Watershed reviewed a number of published and unpublished scientific studies provided by the SAV workgroup.
    - STAC provided the following recommendations to the SAV Workgroup:
        - Discontinue efforts aimed at widespread restoration of SAV until environmental conditions improve
        - Continue targeted restoration efforts, both to establish viable beds and to further understand site selection criteria
        - Develop SAV restoration strategies that are responsive to climate change.
        - Incorporate full adaptive management into restoration decision making
        - Build on the successful research into restoration techniques
    - The SAV Workgroup responded to the STAC review by revising the SAV outcome and strategy document based on the recommendations provided by STAC.
    - The SAV workgroup has shifted its focus from direct planting efforts to research.
    - Technical Synthesis III research project was recently funded to continue SAV research to better understand how to achieve successful restoration efforts.
    - The SAV workgroup is working with the Water Quality GIT to align outcomes.

Fish Passage

Fish passage is a key component to the restoration of anadromous fish (shad and river herring) in the Chesapeake Bay watershed. These fish are blocked from much of their historic spawning areas, which included waters over 200 miles from the Bay. Maryland, Virginia, Pennsylvania and the of Columbia have set goals to provide fish passage to make much of those historic spawning areas District once again accessible to migratory fish. Other species that benefit from the unblocking of streams include eels, native species such as brook trout and other resident species.



American shad once supported the most valuable finfish fishery in the Chesapeake Bay. Commercial shad harvest has been banned for decades throughout the Chesapeake Bay and its rivers. Shad form an important link in the Chesapeake Bay food web. They feed on plankton, and in turn are eaten by larger predators.
Shad populations are depleted due to pollution, historic overfishing, and dams that block access to the fish's freshwater spawning grounds. Although Bay Program partners are working to remove dams, install fish passageways and stock rivers with hatchery-reared fish, shad populations remain very low due to a variety of factors.

Chesapeake 2000 committed, by June 2002, to identify the final initiatives necessary to achieve our existing goal of restoring fish passage for migratory fish to more than 1,357 miles of currently blocked river habitat by 2003 and establish a monitoring program to assess outcomes. In 2002 it further calls for the Partnership to develop a new goal for fish passage. The new goal for an additional 1,000 miles was set by the Executive Council in 20__?

- As of 2012, more than 2,500 miles of streams have been re-opened through fish passage projects and about 1,500 of those miles have been since 2000. The current goal is to open an additional 1,000 miles during 2011-2025 with restoration success

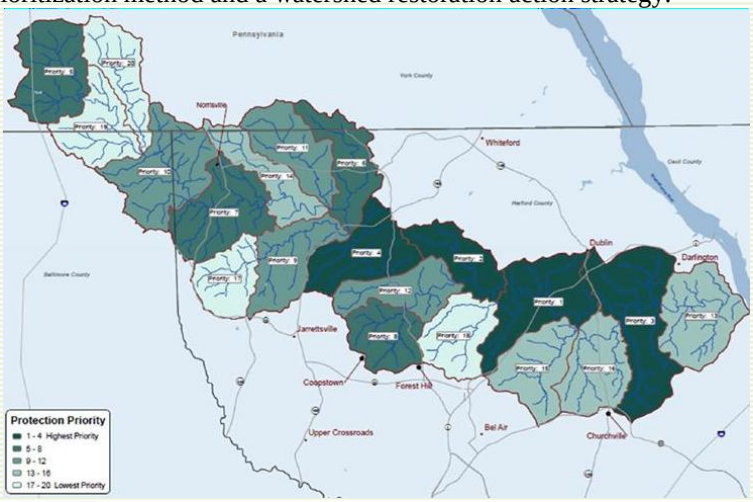
indicated by the presence of Blueback herring, Alewife, American shad, Hickory shad, Brook Trout or American eel.

- Throughout the Northeast, hundreds of dams have been removed over the last two decades to provide additional habitat for recreational and commercial fish species.
- Given the likelihood of future constraints on availability of funds and staff, it is critical to be more strategic about investments in fish passage restoration projects. One approach to strategic investment is to assess the likely ecological "return on investment" associated with a fish passage project. Through the Chesapeake Bay Program's Fish Passage Work Group, Federal, state and local partners have been working together to prioritize fish passage projects in the Chesapeake Bay. In FY12, The Nature Conservancy, in concert with members of the Fish Passage Work Group, developed a geographic information system, known as the Fish Passage Prioritization Tool, to assist the Work Group in strategically identifying key barriers to fish passage. Removing or bypassing key barriers will reconnect fragmented aquatic habitats, thereby, enhancing populations of fish including: diadromous fish species, coldwater species, and other species of concern. The project focused on collecting and processing spatial data and, using a consensus-based approach, developing a priority ranking for dam removals and fish passage projects.
- The overarching goal of the project was focused on the difficult task of determining what metrics should be used to assess barrier removal throughout the Chesapeake Bay, given data limitations and the limits of GIS technology. In the end, a total of 39 metrics from five metric categories -- Connectivity Status, Connectivity Improvement, Watershed and Local Condition, Ecological, and Size/System Type -- were used in the analysis. These metrics were calculated in the GIS based tool and each dam is ranked according to its potential to benefit to anadromous fish if removed or bypassed. The Fish Passage Work Group has begun using this ranking to identify dam removal projects that would produce the greatest ecological gain for target species in the Chesapeake Bay.
- The Chesapeake Bay Fish Passage Tool can be found at the following link https://maps.tnc.org/EROF_ChesapeakeFPP/

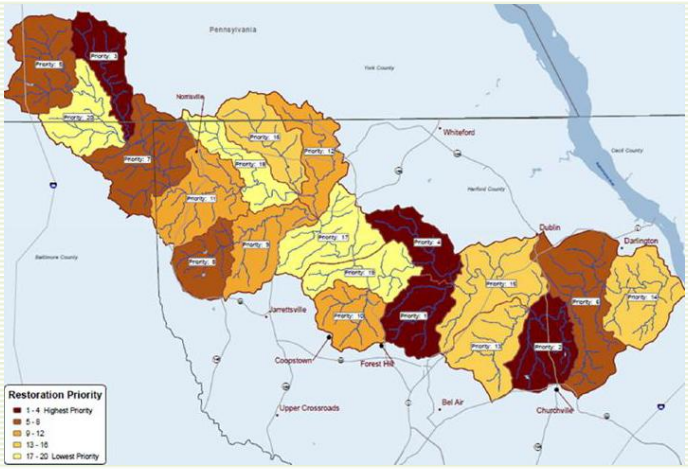
Wetlands ???

Deer Creek Healthy Watersheds Protection Plan

Deer Creek is a tributary to the Susquehanna in Harford County, Maryland. The county assessed the conditions of the watershed and created a protection prioritization method and a watershed restoration action strategy.



The majority of the watershed is characterized as "good" and "fair" for biological conditions and ranks third in the state for biodiversity. According to state antidegradation designations, there are several Tier II segments located along Deer Creek. A high percentage of the watershed is also listed as ecologically significant for sensitive species. The county considered projected land use changes including future impervious thresholds and used a weighted scale to prioritize both protection and restoration priorities at the subwatershed scale. See Map 1 for priority protection areas. The county is accomplishing preservation goals by increasing easements, expanding the Rural Legacy Area, and designating the watershed as a Priority Preservation Area.



In addition to a protection strategy, the assessment calls for a restoration plan. See Map 2 for priority restoration areas. The restoration strategy includes agricultural BMPs, created wetlands, stream restoration, and riparian and equine conservation plans. It also includes outreach activities such as workshops and site visits with property owners. By combining these two assessments and creating management strategies for both protection and restoration, the county was able to take a holistic look at the health of the watershed and plan for future growth with a balanced strategy.

Forest Buffers

Bay Program partners achieved their original buffer restoration goal of 2,010 miles in 2002, 8 years ahead of schedule. In 2003, they set a new, long-term goal to conserve and restore forests along at least 70 percent of all streams and shoreline in the watershed, with a near-term goal of at least 10,000 miles in the watershed portions of Maryland, Pennsylvania, Virginia and the District of Columbia by 2010. This very ambitious goal was based on the early success – with a high point in 2002, when over 1,000 miles of riparian forest buffer were put in the ground.

Many partners came together to prioritize riparian forest buffer restoration at that time because of their multiple ecosystem benefits. Effective management strategies included additional funding and outreach, elevated ranking for federal cost-share dollars, and outreach by multiple specialists (fisheries, forests, agriculture, habitat, etc).

In the past 6 years, the average miles restored dropped well below the 2002-2006 annual average of 829 miles. It also became evident the buffers planted in the earlier years were not receiving the necessary site preparation and maintenance. Many of them needed to be replanted for successful establishment. Landowners and technical assistants became discouraged and this was reflected in the lower number of new projects. Subsequently, better strategies were implemented since 2007 and the success rate for plantings has increased by a factor of six, while the tree growth rate has doubled.

Restoration, protection, enhancement goals for living resources

Crabs

The Bay Program has made significant advances in baywide blue crab management, since the Chesapeake Bay blue crab stock was considered a federal disaster in 2008. These advances have resulted in more effective coordination between jurisdictions (Maryland, Virginia, and the Potomac River Fisheries Commission), and an improved management framework, and overall improvements in the sustainability of the blue crab stock.

The improved management framework is being facilitated by the Bay Program's Sustainable Fisheries Goal Implementation Team (SFGIT) which serves as a forum for interjurisdictional blue crab management. Through the SFGIT jurisdictions have established a management framework based on scientifically derived abundance targets and exploitation fractions (harvest targets and thresholds). The current management framework complements the original Chesapeake 2000 strategy to "establish harvest targets for the blue crab fishery and begin complementary state fisheries management strategies Baywide".

A short-term interim target of 200 million adult (age 1+) blue crabs Baywide was in effect from 2008-2011. The 2011 benchmark stock assessment of the blue crab population provided updated data and knowledge of the blue crab population. This became the scientific foundation of a new blue crab management scheme in the Bay based on female-specific reference points.

Based on the 2011 stock assessment, the Chesapeake Bay Stock Assessment Committee (CBSAC), a science advisory workgroup under the SFGIT, recommended a new blue crab abundance target of

215 million adult females (age 1+) and an overfished threshold of 70 million adult females. This is a more conservative target compared to the previous target of 200 million adult crabs total (males and females). The SFGIT as well as Maryland, Virginia, and the Potomac River Fisheries Commission endorsed the new female-specific management framework, and the new targets were implemented baywide in 2012.

The 2013 CBSAC Blue Crab Advisory Report and Figures states the current population status of blue crabs in the Bay as not overfished and that overfishing is not occurring. The estimated abundance of female adult (age 1+) crabs is 147 million, which is below the target of 215 million, but above the overfished threshold of 70 million. Following the female-specific targets, CBSAC and the jurisdictions are now planning to implement new male-specific conservation triggers in 2013.

Baywide adaptive management of blue crabs will continue as CBSAC produces their annual report with management recommendations based on blue crab population data from the annual Winter Dredge Survey in Maryland and Virginia waters. Access to reliable, high-quality data on the blue crab population, scientific analysis and advice and coordinated management by the jurisdictions is essential for successful adaptive management of the blue crab fishery.

Oysters

Since the Chesapeake 2000 Agreement, oyster restoration efforts have shifted to a tributary-based strategy instead of a Baywide oyster abundance approach. This tributary strategy is a more targeted approach focused on integrating restored oyster reefs into tributary ecosystems and recovering the ecological benefits that healthy oyster reefs provide, including habitat for fish species and water quality benefits.

The 2010 Chesapeake Bay Executive Order Strategy called for this tributary approach with a goal of 20 restored tributaries by 2025. The Bay Program recognized that planning tributary restoration needed to be informed by sound science. In order to define the term "restored" in scientific, measurable terms, the Oyster Metrics Workgroup was created under the SFGIT in 2010 to reach a Baywide consensus on the definition of "restored reef" and "restored tributary". The resulting Oyster Restoration Success Metrics are the scientific basis for planning tributary restoration and determining restoration success.

After these metrics were developed, the SFGIT tasked the newly assembled MD and VA Oyster Interagency Teams to identify priority tributaries for oyster restoration. As of 2013, five tributaries have been identified in Virginia and three identified in Maryland. Restoration work is currently in progress on Harris Creek in Maryland.

After tributaries are selected, Bay Program partners provide restorable bottom mapping and analysis to determine best restoration site locations within each tributary. This data allows for the most effective use of restoration resources and ensures the best chance of oyster survival and growth from restoration efforts. This data is compiled into a 'Tributary Blueprint' describing which areas will be targeted for restoration work, the seed and reef-building materials required to restore the tributary, monitoring plans, and associated costs.

After considering progress on tributary oyster restoration to date and required financial and physical resources, the SFGIT has recommended an amended target of 10 restored tributaries by 2025. This new target is based on actual costs and implementation realized after implementation began.

Ecosystem-based fisheries management

Ecosystem-based fisheries management continues to be an important component of Bay Program living resource initiatives. While not fully achieved, the CBP through collaboration with the Goal Implementation Teams (primarily the Sustainable Fisheries, Habitat, and Healthy Watersheds GITs) is making progress toward incorporation of "ecological, social, and economic considerations, multi-species fisheries management and ecosystem approaches" in living resource management as stated in Chesapeake 2000.

This evolution in approach is needed because traditional management has not been effective in addressing the multiple factors influencing fish stocks. EBFM takes into account environmental stressors, like degraded water quality, fish diseases, species interactions, habitat loss and other environmental factors that have damaged the Bay's major commercial and recreational fisheries.

To clarify how ecosystem approaches for fisheries will work in the Chesapeake Bay, scientists at the NOAA Chesapeake Bay Office participated on the Chesapeake Fisheries Ecosystem Plan Technical Advisory Panel, which included fisheries scientists from institutions around the Bay as well as federal and state agencies. The Panel developed *Fisheries Ecosystem Planning for Chesapeake Bay*.

Fisheries Ecosystem Planning for Chesapeake Bay describes the structure and function of the Chesapeake Bay ecosystem, including key habitats and species interactions. Further, it serves as a guide to ecosystem approaches to individual fishery management plans, and includes recommendations for implementing these plans. It also recommends specific research that will help scientists in the future use their knowledge to support the entire ecosystem.

At the ground level, multiple GITs and other partners have begun discussions on the connection between the aquatic habitat of key fish and shellfish species to land use decisions. Further collaboration on land use and linking fisheries, habitat and water quality is set to continue through the development and implementation of the New Bay Agreement.

In addition to linking living resources to habitat and environmental factors, ecosystem-based management also considers the ecological relationships among species. The Bay Program and the SFGIT have begun exploring these relationships between invasive blue and flathead catfish and native Bay fish and shellfish species.

In January 2012, the SFGIT Executive Committee signed the Invasive Catfish Policy Adoption Statement as a call to action to examine mitigating the spread and impacts of invasive blue and flathead catfish, especially on native fish species. Efforts are currently aimed at improving scientific understanding of catfish biology, population dynamics, and impacts on the native fish community in order to develop mitigation strategies.

Stewardship

Education

Despite significant accomplishments, challenges to maintaining and restoring a healthy Bay ecosystem persist due to the impacts of individual decisions of the watershed's population. As environmental decisions become more complex and widespread—forcing individuals, businesses, and communities to make hard decisions—an environmental protection and restoration strategy built solely on the ability of trained environmental management experts cannot succeed. Like any other successful long-term strategy, natural resource management must be built on the collective wisdom of all citizens, gained through targeted education.

This position is supported by the National Science Foundation's Advisory Committee for Environmental Research and Education, which stated in a 2003 report that "in the coming decades, the public will more frequently be called upon to understand complex environmental issues, assess risk, evaluate proposed environmental plans and understand how individual decisions affect land air and water at local and global scales. Creating a scientifically informed citizenry requires a concerted, systematic approach to environmental education."

The Chesapeake Bay Program has formally supported environmental literacy since 1998 (Education Directive 98-1), with coordination for these efforts occurring through the Education Workgroup, currently under the Fostering Chesapeake Stewardship Goal Implementation Team 5.

In 2000, the Meaningful Watershed Educational Experience or MWEE (a pedagogical student experience that includes classroom preparation, outdoor learning, and reflection on the outdoor learning experience as part of a comprehensive unit of study) was identified as a keystone commitment of the Chesapeake 2000 Agreement and was signed onto by the states of Maryland, Pennsylvania, and Virginia and the District of Columbia. By adopting the MWEE keystone commitment, states agreed to provide one experience per student prior to their high school graduation. Several states have since expanded that goal to providing three MWEEs (elementary, middle, and high school) as suggested in the Stewardship and Meaningful Watershed Educational Experience Policy Memorandum (2001).

As a result of the Executive Council's Chesapeake Watershed Education Agreement: Fostering Chesapeake Stewardship (2005), the Education Workgroup developed a K-12 grade education tracking mechanisms to articulate progress toward Chesapeake 2000 MWEE commitment. This metric was tracked from 2007-2009. At last count, approximately 81% of elementary, 81% of middle, and 80% of high school students were reported as receiving MWEEs. Tracking was discontinued in 2009 in recognition of the non-uniform methods and rigor being used by states. Revised metrics are currently being developed by the Education Workgroup and will replace the previous reporting requirements for the Chesapeake Bay Program.

To evaluate the effectiveness of the MWEE model, the NOAA B-WET Program, with support from the Chesapeake Bay Trust and the Keith Campbell Foundation for the Environment, completed an intensive multi-year evaluation in 2007 that showed that students are more knowledgeable about the watershed and more likely to take action to protect the Bay after participating in B-WET supported

programs. The study also showed that B-WET trained teachers are more confident about and more likely to use field experiences to teach about the watershed.

Students and teachers served by NOAA B-WET in the Chesapeake Bay Watershed: 2002-2012											
Fiscal Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012***
Total Funding	$1.2M	$2.5M	$2.5M	$2.5M	$3.5M	$2.1M	$3.5M	$3.5M	$3.5M	$1.7M	$2.1M
# of Awards	19	33	34	33	40	30	32	33	33	19	23
Students	9,000	34,000	23,000	30,000	58,000	40,000	65,000	50,000	55,000	59,000	23,000
Teachers	1,000	700	1300	1150	1700	2100	2750	1300	2,000	1850	1600

*2012 figures for students and teachers are estimates based on proposals, actual numbers are yet to be reported.

The NOAA B-WET grants have been cited by all jurisdictions as being instrumental in assisting the states to meet the C2K commitment

In 2010, the Strategy for Protecting and Restoring the Chesapeake Bay Watershed, issued in response to President Obama's Executive Order 13508, directed NOAA to pursuing engagement from additional federal and state partners to initiate a robust elementary and secondary environmental literacy initiative that expands upon the meaningful watershed educational experience objective.

Accordingly, in 2012 NOAA and the Chesapeake Bay Program's Education Workgroup developed the Mid-Atlantic Elementary and Secondary Environmental Literacy Strategy. This strategy draws on the full strength of the federal government to support state efforts to transform their schools to provide the next generation of citizen stewards the knowledge and skills they need to make informed environmental decisions. It builds upon the long history cooperation of the Chesapeake Bay Program and calls upon federal, state, and nongovernmental partners to advance shared priorities in four key areas—students, educators, schools, and the environmental education community. The strategy also broadens the priorities for providing resources in association the existing MWEE commitment — expanding the focus of the scope (from watershed education to environmental education affecting the Chesapeake Bay watershed) and scale (from Maryland, Pennsylvania, and Virginia and the District of Columbia to all states that fall within the Chesapeake Bay Watershed).

In addition to the Mid-Atlantic Elementary and Secondary Environmental Literacy Strategy, many of the states in the region have had a focus on environmental education for many years. However, over the past several years there has been an effort to renew and strengthen these programs. Successful management strategies will take into consideration these existing state and federal efforts and work to advance and scale up model programs. Recent state actions towards developing student environmental literacy plans are outlined below:

- In 2010, the Council of the District of Columbia signed into law the *Healthy Schools Act of 2010.* This act required District Department of the Environment to draft an environmental literacy plan as part of a broad effort to "substantially improve the health, wellness, and nutrition of the public and charter school students in the District of Columbia." Mayor Vincent C. Gray submitted the environmental literacy plan to the Council in July 2012. The Council plans to have draft Healthy Schools Act Amendments available in the spring of 2013.

- Delaware passed a resolution in 2011 supporting the Delaware No Child left Inside/Children in Nature Initiative. A taskforce with representatives from the Delaware Department of Natural Resources and Environmental Control, Department of Education, and other public and nongovernmental organizations formed "to develop a statewide plan to increase opportunities for children to engage in nature, both in school, at home, and on public lands." The final *State of Delaware Child left Inside/Children in Nature Initiative Taskforce Report* was released in October 2012.
- In 2011, Maryland passed the nation's first environmental literacy graduation requirement mandating schools to implement a multidisciplinary environmental education program, with a specific focus on the state's natural resources. This solidified work began in 2008 by a gubernatorial Executive Order that established the Maryland Partnership for Children in Nature, which is co-chaired by the Maryland State Department of Education and the Department of Natural Resources. That Executive Order also called for a comprehensive environmental literacy plan, which was completed in 2010.
- Pennsylvania has long had rigorous, stand-alone environment and ecology standards, which include content about the Chesapeake, watersheds, and the environment. This content is included in standardized tests in the state. The Pennsylvania Advisory Council on Environmental Education completed a draft environmental literacy plan in July 2012.
- The Virginia Science Standards of Learning adopted in 2003 and revised in 2010 integrate environmental literacy concepts throughout K-12 education. The Virginia Resource-Use Education Council, an interagency team of state and federal partners along with non-governmental organizations and universities, works to implement the standards through Virginia Naturally, the Commonwealth's environmental education program. Measurable goals for specific Virginia Naturally projects—Meaningful Watershed Experiences, Classroom Grants, Professional Development and School Recognition—are outlined in the state's Business Plan for Environmental Education. The group is currently updating their Business Plan.
- West Virginia recently established a green school certification program and is in the early stages of development for an environmental literacy plan. The state has also been taking part in the U.S. Department of Education's Green Ribbon Schools awards recognition program since its inception in 2012.
- In addition to the state plans, the state affiliates of the North American Association for Environmental Education have completed a plan that outlines how they will support the Mid-Atlantic Elementary and Secondary Environmental Literacy Strategy.

Public access

Open, green spaces and waterways with ample public access bolster public health and quality of life. People rely on these special places to exercise, relax, and recharge their spirits. Outdoor time strengthens family bonds and nurtures fit, creative children. At the same time, it builds personal connections with the very places that have shaped life in the region for centuries—especially its streams, rivers, and bays. This has a distinct economic value too, as tourism, much of it associated with the area's waters, is a potent force in the region.

The sense of place that evolves from outdoor experiences along Chesapeake waters often leads to a feeling of shared responsibility for the resources. People who enjoy the outdoors are more likely to become active citizen stewards, engaged in the many conservation and stewardship efforts taking place throughout the region. Despite this, physical access to the Bay and its tributaries—the very resources that form the basis for the Chesapeake's unique identity—is limited. This has real consequences for quality of life, for the economy, and for long-term conservation.

Increasing public access opportunities has been a formally recognized priority of the Chesapeake Bay Program since the 1987 Chesapeake Bay Agreement established a goal, and associated objective and commitments, to "promote increased opportunities for public appreciation and enjoyment of the Bay and its tributaries."

Signatories of the Chesapeake 2000 Agreement identified several commitments associated with expanding the network of bay-related access opportunities available to the public:

- Bay Gateways Designated: By 2003, develop partnerships with at least 30 sites to enhance place-based interpretation of Bay-related resources and themes and stimulate volunteer involvement in resource restoration and conservation. (Status: *This goal was accomplished and surpassed in 2001. By 2010, a total of 173 Gateways sites had been added to the Network.)*
- Water Trails in the Bay Watershed: By 2005, increase the number of designated water trails in the Chesapeake Bay region by 500 miles. (Status: *This goal was accomplished and surpassed in 2002. By 2010, a total of 2,184 miles of water trails had been designated.)*
- Public Access Sites in the Bay Basin: By 2010, expand by 30 percent the system of public access points to the Bay, its tributaries and related resource sites in an environmentally sensitive manner by working with state and federal agencies, local governments and stakeholder organizations. (Status: *by 2010, 95% of this goal had been accomplished. Between 2000 and 2010, a total of 148 public access sites are known to have been opened to the public.)*

Several actions by Congress have helped spur development of public access since 1998 and engaged the National Park Service in as a principal partner in the effort. These include passage of the Chesapeake Bay Initiative Act (stimulating development of the Chesapeake Bay Gateways and Watertrails Network) (1998), establishment of the Captain John Smith Chesapeake National Historic Trail (2006) and establishment of the Star-Spangled Banner National Historic Trail (2008). These three partnership entities span thousands of miles of the Chesapeake Bay and its tributaries and are helping advance water trail development in the region and the addition of new public access sites. Along with other activities, the National Park Service provides planning and technical and financial

assistance for improving water trails and expanding access and convenes partners along the trails and throughout the watershed in collaborative efforts toward those ends.

The Strategy for Protecting and Restoring the Chesapeake Bay Watershed, issued in 2010 under Executive Order 13508, established a watershed-wide public access goal to "increase public access to the Bay and its tributaries by adding 300 new public access sites by 2025" and called for the National Park Service, in conjunction with the states, the U.S. Fish and Wildlife Service, and other federal agencies to development of a plan to expand public access.

The resulting Chesapeake Bay Watershed Public Access Plan , finalized in June 2013, was developed by the Public Access Planning Action Team, a team of staff involved in public access planning and implementation at each of the Chesapeake watershed states, the District of Columbia, and the National Park Service. As was called for in the Executive Order Strategy, the Chesapeake Bay Watershed Public Access Plan was designed to assess the demand for public access; describe (inventory) the existing public access facilities; assess barriers to public access; determine gaps in the public access system; identify opportunities for new access sites; and help direct federal, state, and local funding toward public access opportunities.

As a result of the in-depth inventory conducted for the *Chesapeake Bay Watershed Public Access Plan* and the switch to watershed-wide tracking, a revised 2010 baseline of 1,138 public access sites was established. Table 1a shows this baseline, as well as the progress in adding new public access sites in 2011 and 2012. At the end of 2012, a cumulative total of 1,171 public access sites were identified as having been opened to the public.

Table 1a: Existing Public Access Sites in the Chesapeake Bay Watershed

Year	MD	PA	VA	DC	DE	NY	WV	Cumulative Total
Baseline	572	180	286	22	6	28	44	1138
2011	578	183	291	23	6	28	44	1153
2012	582	187	297	23	6	32	44	1171

Though existing access opportunities are not insignificant, the number of access sites is very low in comparison to the amount of shoreline in the Chesapeake watershed. There are just 770 existing access sites along the shorelines of the Bay and tidal portions of its tributaries, a combined length of 11,684 miles— equivalent to the distance along the United States' west coast from Mexico to Canada. On average, sites are about 15 miles apart, creating significant stretches of shoreline with no access. In some cases, the gap between sites is dozens of miles. Long, inaccessible stretches make it difficult to plan trips along water trails and reduce the benefits of ecotourism. A lack of public access also leads to trespassing, as users have no other option for getting on or off the water.

In support of resolving these issues, 320 potential new public access sites were identified during the development of *Chesapeake Bay Watershed Public Access Plan*. The plan also recognizes and documents a series of planning and policy considerations that will influence a strategic and collaborative approach to expanding public access. Additionally, the plan sets out a series of actions for moving access development forward. Implementing these actions, continued collaboration

through the Public Access Planning Action Team, and responding to the specific opportunities for adding access sites will expand the number of places for people to get to the water by more than 20 percent by 2025.

Land Use

Land preservation – goal met

The population in the Chesapeake Bay watershed continues to grow. By 2030, it is expected that nearly 20 million people will live in the region. The supporting development and land conversion this growth implies rank among the top stressors to the Bay's ecosystem and are a major threat to its restoration and protection. One strategy to combat loss of high value lands is to permanently protect them from development.

States, local governments, federal agencies and non-governmental organizations have identified millions of acres of lands with important conservation values—lands key to working farms and forests, to maintaining water quality, to sustaining fish and wildlife, to preserving our history, and to providing for outdoor recreation. These lands are what form the ecological and cultural heritage of the Chesapeake watershed.

For decades, Chesapeake Bay Program partners have pursued land conservation efforts through permanently protecting important conservation lands by buying key properties, accepting donations, arranging for easements and purchasing development rights. Accordingly, land conservation goals have been included in Chesapeake Bay Program Agreements for many years.

The Chesapeake 2000 Agreement contained several commitments for land conservation. Specifically, the agreement called for the Chesapeake Bay Program and its partners to, "strengthen programs for land acquisition and preservation within each state that are supported by funding and target the most valued lands for protection. Permanently preserve from development 20 percent of the land area in the watershed by 2010." This goal was achieved and surpassed in 2007.

The Chesapeake Executive Council Directive 06-1: Protecting the Forests of the Chesapeake Bay Watershed and its 2007 response expanded on Chesapeake 2000 by establishing a goal to "permanently protect an additional *695,000 acres* of forest from conversion, targeting forests in areas of highest water quality value" by 2020.

The Strategy for Protecting and Restoring the Chesapeake Bay Watershed issued in 2010 under Executive Order 13508,carried over the forest protection goal when it established a watershed-wide land conservation outcome to "protect an additional two million acres of lands throughout the watershed currently identified as high conservation priorities at the federal, state or local level by 2025, including 695,000 acres of forest land of highest value for maintaining water quality."

A broad group of partners engaged in land conservation in the Chesapeake Bay watershed has been assembling annually since 2009 to foster collaboration and partnership strategies in support of conservation goals. Now called "Chesapeake Large Landscape Conservation Partners," the group

includes more than sixty representatives of local land trusts, conservation organizations, state and federal agencies, and regional landscape conservation initiatives within the watershed. Over the past four years, these partners have developed specific recommendations for advancing land conservation and public access, advised on the land conservation and public access goals and outcomes, engaged in establishing action teams for implementing initiatives, and set out next steps for enhancing collaboration. This group functions to support strategic collaboration on a large landscape scale, recognizing that it can provide avenues to fulfill goals in ways individual organizations' efforts might not.

The Chesapeake Large Landscape Conservation Partners have identified both an extensive set of specific initiatives to support progress and overall approaches for moving their collaboration forward. These are outlined in more detail in several summary reports produced as a result of partners' sessions.[2] Complementary reports that contribute to management strategies have also been developed by organizations and agencies also participating in the partners group.[3]
One specific initiative intended to facilitate strategic land conservation and collaboration is development of LandScope Chesapeake. In late 2010, Chesapeake watershed land conservation partners began collaborating on development of a watershed-wide land conservation priority system. The intent was to create a means for fostering further joint conservation efforts, supporting strategic conservation and tracking progress.

By 2012, this system was launched as LandScope Chesapeake (through a broad partnership among NatureServe, watershed states, the National Park Service, US Geological Survey and many others). This effort has improved information on the status of land protection and sharing of conservation priorities. LandScope Chesapeake now contains over 150 GIS data layers addressing a broad range of information and conservation priorities. This includes priorities associated with conservation of wildlife habitat, scenic resources, cultural and historic resources, sensitive species, working lands, and ecological value (including value for supporting water quality). There is no other comparable source of data across the Chesapeake Bay watershed. Yet, LandScope partners are continuously working to expand and update this data.

The expansion to watershed-wide tracking called for in the Executive Order Strategy, advances in geospatial data, and a broad regional commitment among many partners to land conservation data sharing through LandScope Chesapeake created a need for transitioning to tracking protected lands in a GIS environment. Unlike pure tabular data, land protection information associated with a GIS database better serves the needs of multiple users and objectives. It allows visualizing protected lands on the landscape and assessing progress relative to various conservation goals, such as protecting targeted ecological areas, wildlife corridors, and forested shorelines.

In response to this need, USGS undertook a data collection effort between December of 2011 and July 2012 to complete an updated watershed-wide protected lands GIS layer. Cumulatively, the resulting GIS data indicates that 8,013,132 acres of land have been permanently protected in the

[2] *Landscape Conservation & Public Access in the Chesapeake Bay Region* (2009); *Landscape Conservation in the Chesapeake Watershed: Building the Foundation for Success* (2012)
[3] For example: *Conserving Chesapeake Landscapes: Protecting Our Investments, Securing Future Progress* (2010), Chesapeake Bay Commission and Chesapeake Conservancy.

Chesapeake Bay watershed through 2011. These results form a new "working baseline" of geospatial protected lands data from which to measure future watershed-wide land conservation progress.

State agencies are the largest entity contributing to land protection; they own approximately 49% of the protected acres in the Chesapeake Bay watershed. Watershed-wide, the federal government owns approximately 28% of the protected acres. Private organizations, non-governmental organizations, local governments, and other entities have also been very active in land conservation, and will remain critical partners in protection efforts that will be counted towards the two million acre goal. The attached Map "Protected Lands 2011: Chesapeake Bay Watershed" shows protected lands in the Chesapeake Bay watershed as defined by the Chesapeake Bay Program.

Sprawl – tools developed for states to use. Wholesale collective strategies not successful as partnership enterprise. Individual jurisdictions – MD sprawl/critical areas, VA Ches Bay Protection Act

Chesapeake Bay Model

Because the Chesapeake Bay and its watershed are so large and complex, scientists and restoration managers rely on computer models for critical information about the ecosystem's characteristics and the impact of various environmental actions to reduce pollution. Models are vital tools that help guide decision-making for reducing pollution and meeting water quality standards.

Chesapeake Bay model simulations, which are called scenarios, project pollution loads and flow. Scenarios simulate how various changes or pollution-reduction actions could affect the Bay ecosystem, especially water quality, wildlife and aquatic life.

Although model simulations are an important part of the Chesapeake Bay restoration effort, they are not considered to be perfect forecasts. Rather, model simulations are best estimates based on state-of-the-art, extensively peer-reviewed science. Modeling is part of a broader toolkit that includes research and monitoring to gain the highest possible level of accuracy.

Bay Program partners and other stakeholders use a suite of computer models that are among the most sophisticated, studied and respected in the world. The models provide a comprehensive view of the Chesapeake ecosystem from the depths of the Bay to the upper reaches of the watershed, and from the land to the air.

Watershed Model

The Watershed Model incorporates information about land use, fertilizer applications, wastewater plant discharges, septic systems, air deposition, farm animal populations, weather and other variables to estimate the amount of nutrients and sediment reaching the Chesapeake Bay and where these pollutants originate.

The Watershed Model divides the 64,000-square-mile Chesapeake Bay watershed into more than 2,000 segments delineating political and physical boundaries. Each segment contains information generated by several sub-models:

- The hydrologic sub-model uses rainfall, evaporation and meteorological data to calculate runoff and sub-surface flow for all land uses, including forest, agricultural and urban lands.
- The surface and sub-surface flows ultimately drive the non-point source sub-model, which simulates soil erosion and pollutant loads from the land to rivers.
- The river sub-model routes flow and associated pollutant loads from the land through lakes, rivers and reservoirs to the Chesapeake Bay.

Estuary Model

The Estuary Model examines the effects that pollution loads generated by the Watershed Model have on water quality. In the Estuary Model, the Chesapeake Bay is represented by more than 57,000 computational cells and is built on two sub-models:

- The hydrodynamic sub-model simulates the mixing of waters in the Bay and its tidal tributaries.
- The water quality sub-model calculates the Bay's biological, chemical and physical dynamics.

Scenario Builder

Scenario Builder can generate simulations of the past, present or future state of the Chesapeake Bay watershed to explore potential impacts of management actions and evaluate alternatives.

Scenario Builder produces inputs for the Watershed Model based on factors from a wide range of land uses and management actions. For example, information such as acres of different crops, numbers of animals and extent of conservation practices is used to generate Watershed Model inputs for use types on working farms and ranches.

Airshed Model

The Airshed Model uses information about nitrogen emissions from power plants, vehicles and other sources to estimate the amount of and location where these pollutants are deposited on the Chesapeake Bay and its watershed. That information is fed into the Watershed Model.

Land Change Model

The Land Change Model analyzes and forecasts the effects of urban land use and population on sewer and septic systems in the Chesapeake Bay watershed.

The forecasts are based on:

- Reported changes from the U.S. Census Bureau in housing, population and migration
- Land cover trends derived from satellite imagery
- Sewer service areas
- County-level population projections
- Conversion of forests and farmland development is based on a thorough examination of urban development and land conversion trends derived from satellite imagery dating back more than 25 years.

How do models determine land uses and pollution loads?

To accurately simulate the Chesapeake ecosystem, models are built on current and specific uses of land in the watershed, such as forests, farms and development. Land uses are determined using authoritative sources such as satellite imagery and the USDA Census of Agriculture. Models are further refined by inputting land management features such as cover crops on farm fields and stormwater controls in urban areas.

The types and amounts of pollution that run off a particular land use are based on comprehensive reviews of the latest scientific literature. For example, the pollution loads incorporated into the Watershed Model are based on research from more than 100 academic papers. This comprehensive literature review provides the average pollution loads that various land uses contribute.

Pollution loads are also cross-checked with previous versions of the model and other regional and national models. Pollution loads are further adjusted based on in-stream monitoring data, which increases accuracy for land use and location. Conservation practices, management actions and pollution controls that are implemented in specific places are then entered into the model to simulate reductions from these factors.

How are the Chesapeake Bay models being improved?

The suite of Chesapeake Bay models has been developed during nearly 30 years of collaboration by federal, state, academic and private partners. Developers include the U.S. Environmental Protection Agency, U.S. Geological Survey, USDA Natural Resources Conservation Service, U.S. Army Corps of Engineers, University of Maryland, Virginia Tech, Penn State University and Chesapeake Research Consortium. Advisers include Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia and the District of Columbia.

The Bay Program continues to improve the quality of the data in the models by involving a wide range of partners, stakeholders and experts. Revised versions of the models are regularly shared with partners throughout the Chesapeake Bay community to allow for review, testing and suggestions. Anyone can participate in improving the Bay models, including working with the Bay Program to have credible data and restoration practices incorporated. The models also undergo extensive independent scientific peer review by federal, state and academic scientists, as well as modeling experts.

The Transition Years

Chesapeake Action Plan

In July 2008, EPA released a Report to Congress titled "Strengthening the Management, Coordination, and Accountability of the Chesapeake Bay Program" [CBP/TRS-292-08]. This document constituted the Chesapeake Bay Program's response to Congress for a report on the implementation of actions recommended by the 2005 U.S. Government Accountability Office report titled "Chesapeake Bay Program: Improved Strategies Are Needed to Better Assess, Report, and Manage Restoration Progress" [GAO-06-96]. The report also describes the program's development and refinement of an action plan for the Chesapeake Bay.

The document included:

- A strategic framework unifying the program's planning documents
- An activity integration plan identifying activities of CBP partners and the funding committed to those activities
- A series of "dashboards" to track and measure progress on the partners' actions
- An adaptive management process specifying how program partners would track and improve progress in restoring the Chesapeake Bay

Chesapeake Bay Program Partnership Reorganization

For the most recent reorganization, two major reviews of the CBP structure were undertaken. First, a series of over fifty stakeholder interviews and approximately sixty surveys were completed from August through October 2006 to prepare for initial planning. Key stakeholders interviewed and surveyed included state agencies, academics, non-profits, federal partners, subcommittee and advisory committees, contractors, and others.

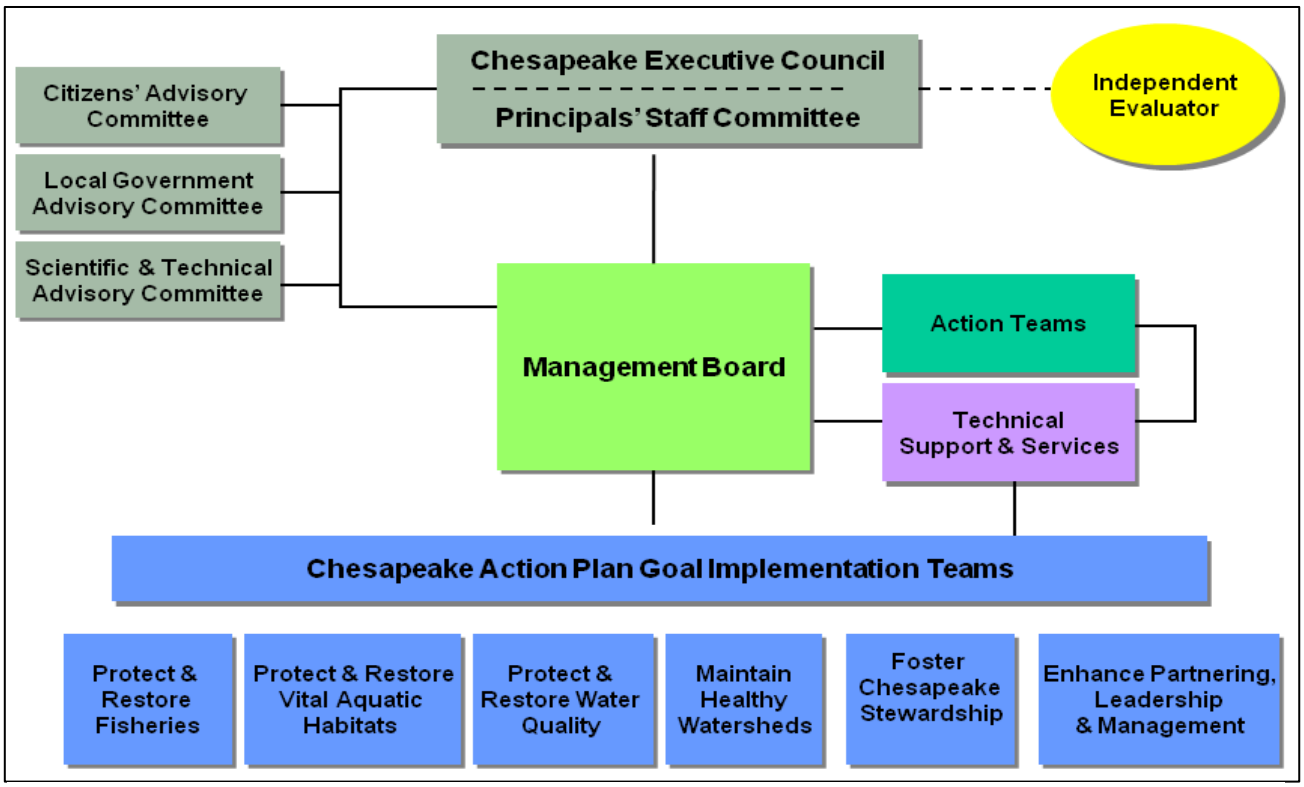
A parallel effort was led by the Keith Campbell Foundation. The Foundation convened a series of meetings from September 2006 to January 2007. The meeting participants shared a wealth of Bay-related experience and knowledge in policy, science, communications, advocacy, philanthropy, and all levels of government. The result was a report outlining operating principles and offering concepts for a framework aimed at accelerating implementation of Bay restoration.

At the Principals' Staff Committee (PSC) meeting in May 2007, the Chair, Secretary Griffin, directed formation of an ad hoc Reorganization Workgroup to develop new organizational options for CBP. A group comprised of federal and state partners, advisory committee chairs, and other stakeholders, reviewed the previous efforts and discussed reorganization options and procedures.

The Reorganization Workgroup put forth a proposed structure to the PSC in June 2008. The PSC asked the workgroup to provide more detail on how the new structure would operate and to delineate roles and membership of each individual structure. The workgroup created a document describing functions, roles, and membership of each box in the organization and shared it with Subcommittee Chairs in August and early September 2008. The reorganization structure was refined based on feedback from the groups. The CBP organization chart and an outline of roles, functions and

membership were presented to the PSC at their September 2008 meeting, and the committee approved the basic structure of the reorganization, shown in the figure below.

Following approval of the organization structure, a Transition Team was commissioned to more fully describe the governance and implementation of the new organization.



CBP Organization Chart Approved by the PSC on September 22, 2008

Executive Order 13508

On May 12, 2009 President Obama issued Executive Order 13508 on Chesapeake Bay Protection and Restoration. It is the first-ever presidential directive on the Chesapeake Bay and was the first Executive Order of the Obama administration related to the environment. In the Executive Order, President Obama declared the Chesapeake Bay a "national treasure" and ushered in a new era of federal leadership, action and accountability.

The purpose of the Executive Order is "to protect and restore the health, heritage, natural resources, and social and economic value of the nation's largest estuarine ecosystem and the natural sustainability of its watershed." The Executive Order recognized that the efforts of the past 25 years were not making sufficient progress in restoring the Chesapeake Bay and its watershed, and that success will require responsible government agencies to make dramatic policy changes and initiate bold new actions.

To bring the full weight of the federal government to address the Chesapeake's challenges, the Executive Order established the Federal Leadership Committee for the Chesapeake Bay (FLC),

which is chaired by the Administrator of the U.S. Environmental Protection Agency and includes senior representatives from the departments of Agriculture, Commerce, Defense, Homeland Security, Interior and Transportation.

The federal agencies were charged with developing recommendations to address seven key challenges: water quality, targeting of resources, stormwater management on federal land, climate change, land conservation and public access, scientific tools and monitoring, and protection of habitat, fish and wildlife. Draft reports containing the initial recommendations were completed in September 2009 and refined in updates published in November 2009.

The initiatives in the seven reports were blended into a draft strategy that was released in November 2009 and now form the core of this *Strategy for Protecting and Restoring the Chesapeake Bay Watershed.* The strategy also identifies goals for environmental improvement, outlines federal coordination with state activities, creates a process for reporting on progress and explains how efforts will be adapted based on science and resources.

A Collective Effort

The Executive Order acknowledges that although the federal government should assume a strong leadership role in the restoration of the Bay, success depends on a collaborative effort involving state and local governments, businesses, non-government organizations and the region's residents. Pursuant to the Executive Order, representatives of the FLC agencies have consulted with the six Bay watershed states (Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia), the District of Columbia, and the Chesapeake Bay Commission. The federal government has also reached out to key stakeholders in the private sector, held public meetings and created a web site to promote government transparency and public engagement. Citizens provided comments on the draft strategy and on proposed environmental measures and goals. A summary of public comments is available at http://executiveorder.chesapeakebay.net. The final strategy for Chesapeake Bay restoration and protection was forged through this collaborative process and published by May 12, 2010 as required by the Executive Order.

Structure of the Strategy

The Executive Order directed federal agencies to "define environmental goals for the Chesapeake Bay and describe milestones for making progress toward attainment of these goals." For the strategy, federal agencies identified the four most essential goals for a healthy ecosystem and developed 12 key environmental outcomes that reflect progress toward these goals:

- **Goal: Restore Clean Water**
  Outcomes: restoration of Bay water quality, stream restoration, agriculture conservation
- **Goal: Recover Habitat**
  Outcomes: wetlands restoration, expanded forest buffers, improved fish passage
- **Goal: Sustain Fish and Wildlife**
  Outcomes: sustainable populations of oysters, blue crab, brook trout, black ducks
- **Goal: Conserve Land and Increase Public Access**
  Outcomes: expanded land conservation and public access to the Bay and its tributaries

These four goals and associated actions are presented in the strategy. Each chapter describes the overall goal, such as restoring water quality, and explains why it is vital to the Chesapeake Bay ecosystem. The specific measures of progress supporting the goal are also presented, including numerical targets for future progress compared to current conditions. The heart of the strategy is a description of the actions that will be taken to accomplish the goals. Enclosed is a summary of each of the four goals and associated environmental outcomes.

The strategy also includes four supporting strategies, which contain actions that provide invaluable cross-cutting support to achieving overall goals or are critical complementary efforts in the restoration and protection of the Chesapeake Bay and watershed. The supporting strategies are:

- **Expand Citizen Stewardship**
- **Develop Environmental Markets**
- **Respond to Climate Change**
- **Strengthen Science**

The strategy also focuses on implementation and accountability. It outlines the role and responsibilities of the FLC in implementing the strategy, as well as the federal government's commitment to meet milestones every two years. Also outlined are a series of accountability tools and processes to promote transparency in the planning, tracking, reporting, evaluating and adapting of restoration activities. These tools include:

- **Federal Two-Year Milestones**
- **Annual Action Plan**
- **Annual Progress Report**
- **Independent Evaluation**
- **Adaptive Management**

Chesapeake Bay Total Maximum Daily Load (TMDL)

EPA has established the Chesapeake Bay TMDL, a historic and comprehensive "pollution diet" with rigorous accountability measures to initiate sweeping actions to restore clean water in the Chesapeake Bay and the watershed's streams, creeks and rivers.

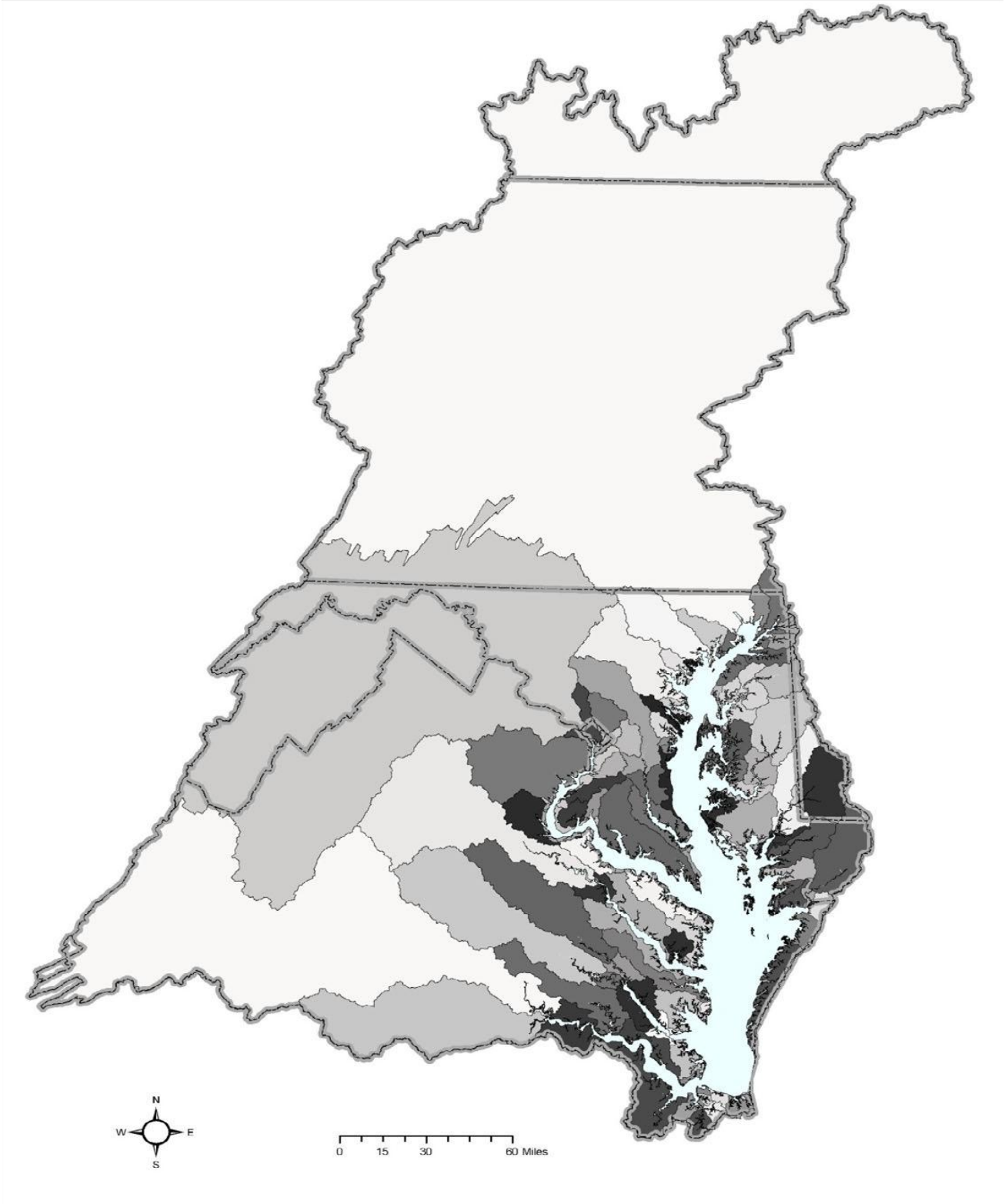
Most of the Chesapeake Bay and its tidal waters are listed as impaired because of excess nitrogen, phosphorus and sediment. These pollutants cause algae blooms that consume oxygen and create "dead zones" where fish and shellfish cannot survive, block sunlight that is needed for underwater Bay grasses, and smother aquatic life on the bottom. The high levels of nitrogen, phosphorus and sediment enter the water from agricultural operations, urban and suburban stormwater runoff, wastewater facilities, air pollution and other sources, including onsite septic systems.

Despite extensive restoration efforts during the past 30 years, the TMDL was prompted by insufficient progress and continued poor water quality in the Chesapeake Bay and its tidal tributaries. The TMDL is required under the federal Clean Water Act and responds to consent decrees in Virginia and the District of Columbia from the late 1990s. It is also a keystone commitment of a federal strategy to meet President Barack Obama's Executive Order to restore and protect the Bay.

The TMDL – the largest and most complex of 45,000 TMDLs developed by or approved by EPA – identifies the necessary pollution reductions of nitrogen, phosphorus and sediment across Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia and the District of Columbia and sets pollution limits necessary to meet applicable water quality standards in the Bay and its tidal rivers and embayments. Specifically, the TMDL sets Bay watershed limits of 185.9 million pounds of nitrogen, 12.5 million pounds of phosphorus and 6.45 billion pounds of sediment per year – a 25 percent reduction in nitrogen, 24 percent reduction in phosphorus and 20 percent reduction in sediment. In addition, EPA has committed to reducing air deposition of nitrogen to the tidal waters of the Chesapeake Bay from 17.9 to 15.7 million pounds per year. The reductions have begun through implementation of ongoing federal air regulations.

These pollution limits are further divided by jurisdiction and major river basin based on state-of-the-art modeling tools, extensive monitoring data, peer-reviewed science and close interaction with jurisdiction partners. The TMDL is actually a combination of 92 smaller TMDLs for individual Chesapeake Bay tidal segments and includes pollution limits sufficient to meet state water quality standards for dissolved oxygen, water clarity, underwater Bay grasses and chlorophyll-*a*, an indicator of algae levels (Figure ES-1). It is important to note the pollution controls employed to meet the TMDL will also have significant benefits for water quality in tens of thousands of streams, creeks, lakes and rivers throughout the region.

The TMDL is designed to ensure all pollution control measures needed to fully restore the Bay and its tidal rivers are in place by 2025, with practices in place expected to achieve at least 60 percent of the load reductions by 2017. The TMDL is supported by rigorous accountability measures to ensure cleanup commitments are met, including short-and long-term benchmarks, a tracking and accountability system for jurisdiction activities, and federal contingency actions that can be employed if necessary to spur progress.



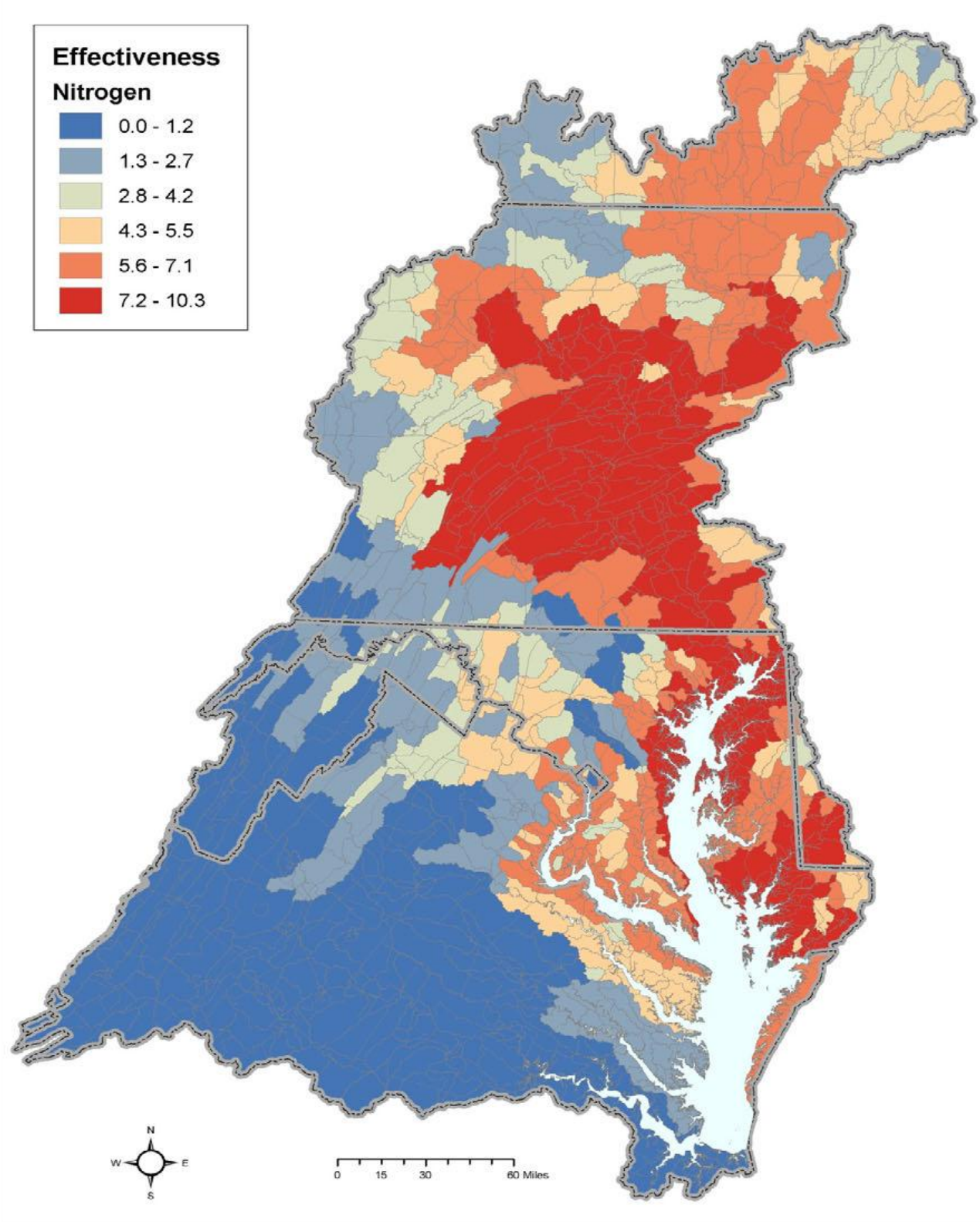
A nitrogen, phosphorus and sediment TMDL has been developed for each of the 92 Chesapeake Bay segment watersheds.

Developing the Chesapeake Bay TMDL

Development of the Chesapeake Bay TMDL required extensive knowledge of stream flow characteristics of the watershed, sources of pollution, distribution and acreage of various land uses, appropriate best management practices, the transport and fate of pollutants, precipitation data and many other factors. The TMDL is informed by a series of models, calibrated to decades of water quality and other data, and refined based on input from dozens of Chesapeake Bay scientists. Modeling is an approach that uses observed and simulated data to replicate what is occurring in the land, air and water to make future predictions, and was a critical and valuable tool in developing the Chesapeake Bay TMDL.

Since nitrogen and phosphorus loadings from all parts of the Bay watershed have an impact on the impaired tidal segments of the Bay and its rivers, it was necessary for EPA to allocate nitrogen and phosphorus loadings in an equitable manner to the states and basins. EPA used three basic principles to divide these loads.

- Allocated loads should protect living resources of the Bay and its tidal tributaries and should result in all segments of the Bay mainstem, tidal tributaries and embayments meeting water quality standards for dissolved oxygen, chlorophyll-*a*, water clarity and underwater Bay grasses.
- Tributary basins that contribute the most to the Bay water quality problems must do the most to resolve those problems (on a pound-per-pound basis) (Figure ES-2).
- All tracked and reported reductions in nitrogen, phosphorus and sediment loads are credited toward achieving final assigned loads.



Sub-basins across the Chesapeake Bay watershed with the highest (red) to lowest (blue) pound for pound nitrogen pollutant loading effect on Chesapeake Bay water quality.

Accountability and Goals

The Chesapeake Bay TMDL is unique because of the extensive measures EPA and the jurisdictions have adopted to ensure accountability for reducing pollution and meeting deadlines for progress. The TMDL will be implemented using an accountability framework that includes WIPs, two-year milestones, EPA's tracking and assessment of restoration progress and, as necessary, specific federal contingency actions if the jurisdictions do not meet their commitments. This accountability framework is established in part to provide demonstration of the reasonable assurance provisions of the Chesapeake Bay TMDL pursuant to both the Clean Water Act (CWA) and the Chesapeake Bay Executive Order, but is not part of the TMDL itself.

Beginning in 2012, jurisdictions (including the federal government) began to follow two-year milestones to track progress toward reaching the TMDL's goals. In addition, the milestones will demonstrate the effectiveness of the jurisdictions' WIPs by identifying specific near-term pollutant reduction controls and a schedule for implementation. EPA reviews these two-year milestones and evaluates whether they are sufficient to achieve necessary pollution reductions and, through the use of a Bay TMDL Tracking and Accountability System, determines if milestones are met.

Implementing the Chesapeake Bay TMDL

Watershed Implementation Plans (WIPs), which detail how and when the six Bay states and the District of Columbia will meet pollution allocations, played a central role in shaping the TMDL. Each of the Bay jurisdictions submitted Phase II WIPs in 2012 that provide planning targets for implementation on a more local scale. Phase III WIPs in 2018 are expected to be designed to provide additional detail of restoration actions beyond 2017 and ensure the 2025 goals are met.
Now the focus shifts to the jurisdictions' implementation of the WIP policies and programs that will reduce pollution on-the-ground and in-the-water. EPA will continue oversight of WIP implementation and jurisdictions' progress toward meeting two-year milestones.

If progress is insufficient, EPA is committed to taking appropriate contingency actions including targeted compliance and enforcement activities, expansion of requirements to obtain NPDES permit coverage for currently unregulated sources, increasing oversight of state-issued NPDES permits, revision of the TMDL allocations and additional controls on federally permitted sources of pollution, such as wastewater treatment plants, large animal agriculture operations and municipal stormwater systems, prohibiting new or expanded pollution discharges, redirecting EPA grants, and revising water quality standards to better protect local and downstream waters.

National Research Council of the National Academies report: Achieving Nutrient & Sediment Reduction Goals in the Chesapeake Bay

Background

In 2008, the Government Accountability Office concluded the Bay Program's actions had fallen short of the GAO 2005 recommendation to establish an independent and objective reporting process. Consequently, the Executive Council requested the Bay Program be evaluated by a nationally recognized independent science organization to accelerate implementation and increase the level of accountability.

Installed as an organizational function in the new Bay Program structure, the Independent Evaluator reported directly to the Executive Council and the Principals' Staff Committee.

First pilot study

The first independent evaluation was a pilot which began in December 2009. It was conducted through an EPA contract with the National Academies of Science. The purpose of the study was to evaluate the CBP implementation efforts to toward needed nutrient reduction goals for water quality. Specifically, the National Academies of Science study panel (via the National Research Council) looked at ***Tracking and Accountability*** and ***Milestones***.

With regards to ***Tracking and Accountability***, the panel addressed whether tracking for implementation of nutrient and sediment point and non-point source pollution best management practices appears reliable, accurate and consistent. Within each jurisdiction, the panel considered which efforts and systems appeared to be working, or not working, including implementation of federal programs and funding – and how to strategically improve the system to address gaps. Finally, the panel examined how gaps and inconsistencies appeared to impact reported program results.

The strategy of two-year ***Milestones*** was examined to determine if the level of implementation was likely to achieve the CBP nutrient and sediment reduction goals for that milestone period. The panel considered whether CBP agencies had developed adaptive management approaches to help meet program goals for nutrient and sediment reduction. They further analyzed potential improvements to the development, implementation, and accounting of the strategies to ensure achieving the goals.

National Research Council Report

In May 2011, the National Research Council delivered the committee report: Achieving Nutrient and Sediment Reduction Goals in the Chesapeake Bay: An Evaluation of Program Strategies and Implementation. The following are highlights of the Committee's findings:

The committee declared that tracking is of paramount importance because CBP relies upon data to estimate current and future loads, however the current data on practice implementation was, at best, an estimate. Current accounting of practices was found to be inconsistent across jurisdictions. The jurisdictions and CBP were credited for making strides toward improving reporting, however the scope of the task with limited resources has proved difficult. The committee recommended third-party auditing to ensure reliability of state and local data.

The two-year milestone strategy was noted for committing states to tangible, near-term implementation goals and improving accountability, but cautioned the strategy does not guarantee goals will be met and the consequences for nonattainment are unclear. The committee advised timely updates and synthesis of progress are required for states to receive the data necessary to make appropriate mid-point adjustments.

As for implementation of the milestones, the committee found the first milestones represented a sizeable increment of implementation and presumed the first milestones would likely be the easiest to achieve. Progress toward implementation was mixed across jurisdictions based on July 2009 reporting.

The committee did not feel EPA or the jurisdictions exhibited a clear understanding of adaptive management and how to apply it. As such, they deemed the current two-year milestone strategy largely a "trial and error" process.

Chesapeake Bay Program Partnership Response

The Principals' Staff Committee made recommendations for implementation and response to the NAS/NRC report in November 2011, as well as outlining key challenges. The partnership has addressed the report's findings through in-depth consideration and implementation of specific activities and program policy changes, including:

- BMP effectiveness monitoring, tracking and accountability
- Adaptive management of the Chesapeake Bay Program
- A Chesapeake Bay modeling laboratory
- The ongoing function of the independent evaluator

Chapter 3: Recommendations for Improved Management

New Chesapeake Bay Watershed Agreement

In 2011, both the Chesapeake Executive Council and the Federal Leadership Committee for the Chesapeake Bay acknowledged the need to look at potentially integrating the goals, outcomes and actions of the Chesapeake Bay Program (Chesapeake 2000) with those set forth in the 2010 *Chesapeake Bay Executive Order Strategy*. Most of the outcomes and commitments in the Chesapeake 2000 agreement have expired and there is now a need to update and refresh them in order to accelerate progress in achieving the water quality, living resource and goals of the program.

This new plan for collaboration across the Bay's political and geographical boundaries will clarify our vision, mission and values and establish shared goals and outcomes for the protection, restoration and stewardship of the Bay, its tributaries and the lands that surround them. The current draft agreement includes goals and outcomes for sustainable fisheries, habitat restoration, water quality, healthy watersheds, land conservation, public access, environmental literacy and local leadership. The agreement, now being drafted, is intended to encourage a forward-looking approach to conservation and restoration, focusing on immediate results and recognizing our long-term effort must be sustained by and for future generations. It is intended that the new Chesapeake Bay Watershed Agreement will have more flexibility, increased accountability and greater participation by all partners, including the Headwaters states of Delaware, New York and West Virginia.

If consensus can be reached by all of the signatories, the current schedule calls for the new Watershed Agreement to be signed by the Chesapeake Executive Council in December 2013.

Strengthening and Adopting New Strategies

Overview

The CBP partnership continues to address new complex issues, including those previously recognized by the partnership, which can affect actions necessary to restore the Chesapeake Bay watershed. Examples include: accounting for the potential consequences of population growth and continuing climate change; accounting for innovative, new technologies; factoring in new understanding of the Susquehanna River dams' influence on nutrient and sediment pollutant loads; invasive species; understanding and recognizing year-to-year variability of rainfall-driven nutrient and sediment loads and their impact on Bay water quality; and taking full advantage of living resources as natural filters. This is part and parcel of the adaptive management commitment of the partnership to consider new knowledge and updates in information which can best inform our watershed restoration strategies and management.

In recent years, CBP has begun using a decision framework to fully integrate an adaptive management process into Chesapeake Bay restoration. For example, the partnership will provide input on and review changes in decision-support tools, such as the models and methods used to assess progress, and weigh the effects of these proposed changes against the impacts to meeting the ultimate goal of having all practices on the ground by 2025 to meet water quality standards. To enable this

level of adaptive management throughout the program, CBP needs to ensure there is adequate funding to maintain the integrity of the monitoring program for both tidal and non-tidal networks.

Further, the partnership will consider the need for updates to the current TMDL and WIPs to address any needed modifications informed by the changes to the decision-support tools, as well as jurisdictions' implementation experience to date. EPA's expectations for the scope and content of the Phase III WIPs may vary by jurisdiction depending on their implementation progress through 2017. The CBP partnership will carefully consider scientific, technical, financial, social, political and other implementation factors during this review, called the Chesapeake Bay TMDL Midpoint Assessment. Using this assessment, jurisdictions will make necessary adjustments to their WIPs during Phase III to achieve the 2025 goal.

Guiding Principles for the 2017 Chesapeake Bay TMDL Midpoint Assessment

The December 2010 Chesapeake Bay TMDL called for an assessment in 2017 to review our progress toward meeting the identified nutrient and sediment pollutant load reductions for the TMDL, Phase I and Phase II WIPs and milestones. Recognizing change is inevitable over a 15-year period in a dynamic environment like the Bay. The Bay TMDL 2017 midpoint assessment has three primary objectives: 1) gather input from the partnership on issues and priorities to be addressed in order to help meet the goal of all practices in place by 2025 to meet water quality standards; 2) based on these priorities, review the latest science, data, tools and best management practices (BMPs), incorporate as appropriate into the decision-support tools that guide implementation, and consider lessons learned; and 3) help jurisdictions prepare Phase III WIPs, which will guide milestones and implementation from 2018 to 2025. In parallel, EPA will continue its oversight role on the implementation of the Bay TMDL and determine if the 2017 interim goal is on track.

The purpose of the guiding principles is to help direct the Partnership through the midpoint assessment and Phase III WIP development process. The following are the five principles guiding the Midpoint Assessment:

PRINCIPLE 1: Continue implementation, tracking progress and reporting results, with stable tools through at least 2017

PRINCIPLE 2: Enhance decision support and assessment tools to enable successful engagement of local partners

PRINCIPLE 3: Incorporate new or refined BMPs and verification of practices into existing accountability tools and reporting protocols

PRINCIPLE 4: Address emerging issues that may impact current strategies and future plans

PRINCIPLE 5: Prioritize midpoint assessment actions and use adaptive management to ensure water quality goals are met

Chesapeake Bay Program Partnership's BMP Verification Principles
Another important priority of the Chesapeake Bay Program partnership is implementation of the Chesapeake Bay TMDL, the jurisdictions' Watershed Implementation Plans, and 2-year milestones. The Partnership has committed to development of a basinwide BMP verification framework for use by the seven watershed jurisdictions to assure data quality for BMP reporting for annual Model Progress runs. The CBP partnership will establish a BMP Verification Review Panel which will examine the degree to which a jurisdiction's program meets the parameters established by the partnership's BMP verification framework. This review will include an examination of existing BMP measurements, accounting, and inspection systems and any proposed improvements to those systems submitted for CBP partnership review. The partnership recognizes some jurisdictional programs may already achieve some of these principles and may not require significant modification or enhancements.

The CBP partnership has defined verification as the process through which agency partners ensure practices, treatments, and technologies resulting in reductions of nitrogen, phosphorus, and/or sediment pollutant loads are implemented and operating correctly. The process for verifying tradable nutrient credits or offsets is a separate, distinct process not addressed either by these principles or through the partnership's BMP verification framework.

Working to verify that practices are properly designed, installed, and maintained over time is a critical and integral component of transparent, cost efficient, and pollutant reduction effective program implementation. Verification helps ensure the public of achievement of the expected nitrogen, phosphorus, and sediment pollutant load reductions over time. The CBP partnership will build from existing practice tracking and reporting systems and work towards achieving or maintaining the following principles.

PRINCIPLE 1: Practice Reporting
PRINCIPLE 2: Scientific Rigor
PRINCIPLE 3: Public Confidence
PRINCIPLE 4: Adaptive Management
PRINCIPLE 5: **S**ector Equity

Offset and Trading Programs – Focusing on Keeping Healthy Watersheds HealthyEPA believes nutrient credit trading can be an important part of reducing nutrient pollution and achieving water quality goals in a cost-effective way. EPA supports nutrient trading and offsets as a tool to protect water quality standards and meet water quality based effluent limitations. In 2003, EPA issued a policy on nutrient trading, followed up by a toolkit in 2007. The Chesapeake Bay Program issued its own trading guidelines in 2004.

The Bay jurisdictions have placed great reliance on trading to meet the reduction targets and to offset new growth. Understanding technical challenges and policy issues need to be addressed in order to establish consistent and reliable water quality trading programs, EPA is working with state, private and other interested partners to ensure programs are developed where trades are verified, trading partners are accountable, and the process is open to all interested parties. EPA's work plan includes

five major components: (1) addressing assessment findings; (2) oversight program; (3) program development and guidance; (4) outreach, education and integration; and (5) data and tracking.

EPA's primary focus of activity at this time is developing a series of technical memoranda that elaborate on the elements of Appendix S and Section 10 of the Chesapeake Bay TMDL with which the Chesapeake Bay jurisdictions' trading and offset programs are expected to be consistent. These memoranda will address topics such as: baseline demonstration, sector demonstration, representative sampling, , credit calculation methodology, credit permanence, trading ratio based on uncertainty, MS4 and construction permits, and verification measures for nutrient trading

To focus and support trading and offset efforts in Bay jurisdictions, the Chesapeake Bay Program established in 2011 a Trading and Offsets Workgroup that has three functions: 1) provide a forum for discussion and information exchange among trading and offsets stakeholders; 2) evaluate and facilitate strategies to exchange loads among affected source sectors; and 3) build consensus on common approaches to some program design elements.

Improving Governance of the Program

Overview

Executive Order 13508 established the FLC, chaired by the Administrator of the Environmental Protection Agency and including senior representatives of the departments of Agriculture, Commerce, Defense, Homeland Security, Interior, and Transportation. The Executive Order directs the FLC to carry out a series of responsibilities. In addition to producing this strategy, ongoing implementation responsibilities including:

- Oversee development, coordination and implementation of new federal programs and activities for Chesapeake Bay restoration.
- Collaborate with state partners to ensure that federal actions are closely coordinated with actions by state and local agencies and resources are used efficiently.
- Consult with stakeholder groups and the general public.
- Define milestones for meeting goals. Track and report restoration activities and spending.

Aligning FLC and CBP Functions

The Executive Order recognized the federal government cannot achieve the goals and outcomes needed to restore and protect the Chesapeake Bay and its watershed without significant collaboration with state and local government, non-governmental organizations and citizens. The FLC also recognizes the longstanding roles and functions of the Chesapeake Bay Program, which includes the states in the watershed, the District of Columbia, the Chesapeake Bay Commission and EPA (representing the federal government). A number of CBP's roles and functions dovetail or overlap with those of the FLC. Given this, and the long-standing participation of federal agencies in the partnership, the FLC plans to take steps toward increased collaboration with Chesapeake Bay Program partners to further align the responsibilities of both parties and implement this strategy.

The process for aligning federal, state and local actions has begun through the consultation called for in the Executive Order. The FLC and the EC acknowledge the need to more clearly define the role of the Chesapeake Bay Program in implementation of this strategy. In 2011, the FLC and EC convened a group to recommend steps for coordinating and, where appropriate, integrating the goals, outcomes and actions of the Chesapeake Bay Program with the goals, outcomes and actions described in this strategy. The group's recommendations will aim to produce the most efficient coordination mechanisms feasible that encompass the following principles:

- Mechanisms for reporting information on actions should not require multiple entries of the same data in different systems.
- There should be a coordinated, consistent mechanism for reporting progress to the public.
- There should be a consistent, coordinated adaptive management process for making changes to goals or outcomes that includes all partners.
- The systems should be mutually beneficial to partner agencies.

Since 2011, the Bay jurisdictions and Federal agencies have been working together through the CBP Goal Implementation Teams, Management Board and Principles Staff Committee and have undertaken the following steps:

1. Review vision, goals and outcomes identified in the Strategy for Protecting and Restoring the Chesapeake Bay Watershed with the goals and commitments of the Chesapeake Bay Program.

2. Identify issues and make specific recommendations for aligning Executive Order goals and outcomes with existing CBP commitments.

3. Review indicators of health, restoration and protection currently used in the Bay Barometer and recommend appropriate changes for purposes of tracking progress and assessing success. Review existing monitoring information and other data sources currently utilized in the CBP and assess their alignment with the goals and objectives resulting from the above.

4. Review the means to coordinate and integrate federal, state and local actions Evaluate the use of the annual federal action plan to incorporate state and local annual actions.

5. Recommend options to clarify the operational relationship between the FLC and the EC. Identify issues with and propose solutions to the current CBP structure related to implementing, monitoring, and supporting the integrated approach identified above; identify potential changes to the current CBP governance document.

It is anticipated that the new Chesapeake Bay Wateershed Agreement, planned for issuance by the end of 2013, will reflect the results of completeing Steps 1-3 above. The CBP Governance Document (issued in 2009) will be updated in 2014 to address Steps 5 and 6 as well as cclaifying EPA's regulatory role related to the Bay TMDL and CBP Partnership.

Chapter 4 Conclusion

Summary of progress since C2K; why a new agreement will help reach goals

To be written after body of document is complete

Appendix

A. Links to "Bay Barometers"

1. Bay Barometer: Spotlight on Health and Restoration in the Chesapeake Bay and its Watershed 2011-2012
2. Bay Barometer: A Health and Restoration Assessment of the Chesapeake Bay and Watershed in 2010
3. Bay Barometer: A Health and Restoration Assessment of the Chesapeake Bay and Watershed in 2009
4. Bay Barometer: A Health and Restoration Assessment of the Chesapeake Bay and Watershed in 2008 - Executive Summary and Bay Barometer: A Health and Restoration Assessment of the Chesapeake Bay and Watershed in 2008
5. Chesapeake Bay 2007 Health and Restoration Assessment
6. Chesapeake Bay 2006 Health and Restoration Assessment
7. Chesapeake Bay 2005 Health and Restoration Assessment Part One: Ecosystem Health and Chesapeake Bay 2005 Health and Restoration Assessment Part Two: Restoration Efforts
8. The State of the Chesapeake Bay and Its Watershed: A Report to the Citizens of the Bay Region (2004)
9. 2002-The State of the Chesapeake Bay: A Report to the Citizens of the Bay Region
10. 1999 State of the Chesapeake Bay
11. The State of the Chesapeake Bay 1995
12. The Chesapeake Bay...A Progress Report 1990-1991
13. State of the Chesapeake Bay: Third Biennial Monitoring Report - 1989
14. State of the Chesapeake Bay: Second Annual Monitoring Report 1984-1985

B. Links to all CBP indicators are available on the program website. Indicators are organized as follows:

Bay Health: Scientists evaluate the Chesapeake Bay's health by monitoring important habitats, fish and shellfish and water quality measures. These indicators are useful tools to gauge the overall health of the Bay and the animals that live in it.

Habitats and Lower Food Web

- Bay Grasses
  - Underwater Bay Grass Abundance (Upper, Middle and Lower Bay Zones)
  - Underwater Bay Grass Density
- Phytoplankton
- Bottom Habitat
- Tidal Wetlands

Fish and Shellfish

- Blue Crabs
- Oysters
- Striped Bass
- American Shad
- Atlantic Menhaden

Water Quality

- Achievement of Chesapeake Bay Water Quality Standards
- Chemical Contaminants

Watershed and River Health: CBP uses the most current monitoring data to assess forest and stream health.

Forests

- Forest Cover

Health of Freshwater Streams

- Health of Freshwater Streams in the Chesapeake Bay Watershed

Flow-adjusted Pollution Trends

- Nitrogen in Rivers Entering Chesapeake Bay: Long-term Flow-adjusted Concentration Trends
  - Nitrogen Short-Term Flow Adjusted Concentration Trends Measured in Watershed Streams and Rivers
  - Nitrogen Yields Measured in Watershed Streams and Rivers
- Phosphorus in Rivers Entering Chesapeake Bay: Long-term Flow-adjusted Concentration Trends
  - Phosphorus Short-Term Flow Adjusted Concentration Trends Measured in Watershed Streams and Rivers
  - Phosphorus Yields Measured in Watershed Streams and Rivers
- Sediment in Rivers Entering Chesapeake Bay: Long-term Flow-adjusted Concentration Trends
  - Sediment Short-Term Flow Adjusted Concentration Trends Measured in Watershed Streams and Rivers
  - Sediment Yields Measured in Watershed Streams and Rivers

Factors Impacting Bay and Watershed Health: CBP uses the most current monitoring data to track major factors influencing the health of the Bay and its watershed.

Pollutants

- Nitrogen
- Phosphorus
- Sediment

Land Use

- Population Growth
- Forest Cover

Natural Factors

- River Flow

Restoration and Protection Efforts: The most current monitoring and tracking data gathered by CBP partners and computer simulations are used to assess partners' efforts to restore the health of the Bay and its watershed.

Reducing Pollution

- Reducing Nitrogen Pollution
  - Wastewater
- Reducing Phosphorus Pollution
  - Wastewater
- Reducing Sediment Pollution
  - Wastewater

Restoring Habitats

- Planting Bay Grasses
- Restoring Wetlands
- Reopening Fish Passage
- Restoring Oyster Reefs

Managing Fisheries

- Blue Crab Fishery Management

Protecting Watersheds

- Planting Forest Buffers
- Developing Watershed Management Plans
- Protected Land

Fostering Stewardship

- Public Access
- Education and Interpretation (Meaningful Watershed Educational Experiences)

C. Additional Pertinent Links

NEEDS TO INCLUDE THE WEB LINKS TO THE NAS/NRC WORK. THESE WERE PROVIDED TO TOM VIA THE FIRST EMAIL FROM JULIE

MODEL FACT SHEETS