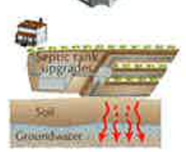
Local impacts of TMDL implementation

TMDL implementation poses several important benefits to watershed residents. Reduced pollution loads result in cleaner waters and healthier marine ecosystems, which in turn lead to:

- Improved public health,
- The conservation of natural resources,
- Increased aesthetics,
- Improved recreational activities,
- Greater economic opportunities (e.g., improved agricultural production and tourism), and
- Enhanced real estate values for homes, farms, and businesses located in the watershed.

These benefits are realized through the practical actions taken by state and local governments (Table 1).

Table 1: Examples of implementation actions that will be taken by local, state, and federal governments to meet allocation goals of the Chesapeake Bay TMDL.

TMDL implementation actions	Example	
Upgrade wastewater treatment plants (WWTPs)	Upgrading plants' technology to enhanced nutrient removal will remove more nutrients from WWTP discharges	
Install green infrastructure	Green roofs reduce heating and cooling costs and also stormwater runoff.	
Retrofit septic systems	New technologies allow bacteria to break down organic material and convert nitrogen to harmless gas.	
Additional controls on animal operations	Poultry and livestock waste structures prevent waste from running into local streams	
Additional controls on crop agricultural	Water control structures, wetland restoration, and increased nutrient management plan compliance decreases nutrient runoff	
New development rules	Larger riparian buffers with infiltration practices along waterfront developments will help to filter pollutants and reduce runoff.	

Implementation actions may impact your taxes, your current lifestyle, and the priorities and focus of city and county projects. For example, an implementation plan could require counties and/or municipalities to adopt certain laws or ordinances to establish a stormwater remediation, or local stormwater utility, fee. The fees could be placed in local watershed protection and restoration funds, which would then be used for implementing local stormwater management plans.

Implementation plans may place restrictions on the way you use your property—such as limiting the permissible amount of impervious surface or prohibiting the use of certain chemicals. However, financial incentives could be offered for reducing stormwater run-off from your property, conserving water, or building a low-impact home.

Strategies to meet TMDL allocations vary in cost and effectiveness. By participating in the TMDL public process and educating yourself about this important issue, you can ensure that your voice is heard.

Top: A sign urging dog owners to clean up after their pets. Bottom: Volunteers plant a buffer along Beaver Creek in Boonsboro, Maryland, in the Antietam Creek watershed.

Chesapeake EcoCheck
Assessing and forecasting ecosystem status
NOAA
University of Maryland Center for Environmental Science
www.eco-check.org

Chesapeake Bay Program
A Watershed Partnership

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http://www.epa.gov/chesapeakebaytmdl/
http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/decisions_index.cfm
http://water.epa.gov/polwaste/nps/ex-bmps.cfm
http://www.chesapeakebay.net/watershedimplementationplans.aspx?menuitem=52043
http://stat.chesapeakebay.net/?q=node/59&quicktabs_3=2&quicktabs_10=2

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Total Maximum Daily Loads
A citizen's guide to the Chesapeake Bay TMDL

Residents of the Chesapeake Bay watershed depend upon a healthy Bay for food, recreation, and commercial enterprises. But the ways in which we use the watershed's lands—from driving our cars to spreading fertilizers—impact the health of the Bay's waters. Wastewater treatment plants, agricultural operations, and urban runoff are major sources of the nitrogen, phosphorus, and sediment pollution that threaten the Bay's health. The Chesapeake Bay Total Maximum Daily Load (TMDL) is designed to restore the health of the Bay's waters by reducing the pollution from these and other sources.

TMDLs help restore clean and healthy waterways

A Total Maximum Daily Load (TMDL) calculates the maximum amount of a specific pollutant that a waterbody can receive and still meet water quality standards. It also establishes a pollutant budget or "diet," which allocates portions of the overall pollution load to the pollutant's various sources. Just as a person can only eat a certain amount of calories in one day without harming their health, a waterbody can only absorb so much of a pollutant without harming its health. Currently, there are more than 40,000 TMDLs in place across the country (Figure 1). The majority of these (more than 9,000) are for pathogens (disease-carrying organisms). Other significant causes of impaired waters include non-mercury metals (e.g., lead, copper, iron), nutrients (e.g., nitrogen, phosphorus), and sediment.

While regulations in the Clean Water Act refer to a TMDL strictly as a calculation or formula used to address a pollutant in a waterbody, the concept of a TMDL has evolved and expanded in both scale and content. For example, some states are establishing TMDLs that cover multiple watersheds, for multiple pollutants. States are not required to develop TMDL implementation plans, but many are doing so, because in the end, the goal of developing a TMDL is to restore impaired waterbodies to the point where they meet water quality standards (Figure 2).

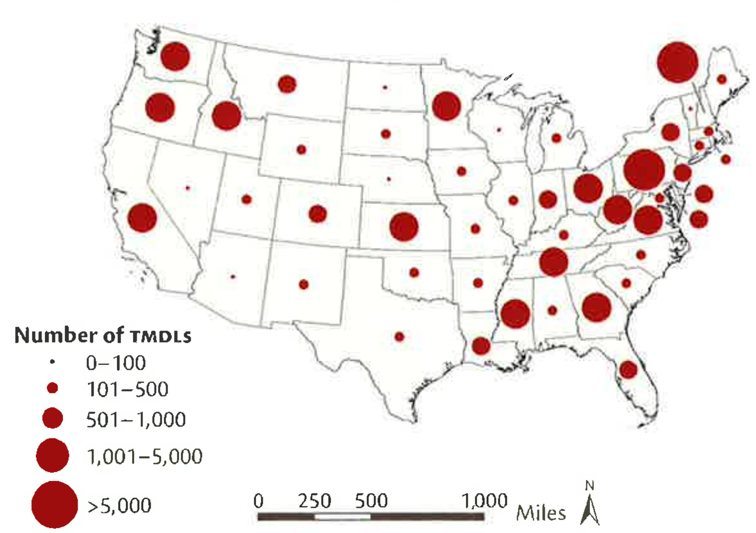


Figure 1. There are currently over 40,000 TMDLs in place in the United States, all designed to address specific causes of impairment. This map illustrates the number in each of the contiguous United States. Data: U.S. EPA http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/index.cfm.

The goal of the Clean Water Act (CWA), which governs water pollution, is to ensure that all of the Nation's waters are clean and healthy enough to support aquatic life and recreation. To achieve this goal, the CWA created programs designed to regulate and reduce the amount of pollution entering United States waters. One such program is Section 303(d) of the CWA, which requires states to assess their waterbodies to identify those not meeting water quality standards. If a waterbody is not meeting standards, it is listed as impaired and reported to the U.S. Environmental Protection Agency. The state then develops a plan to clean up the impaired waterbody. This plan includes the development of a Total Maximum Daily Load (TMDL) for the pollutant(s) that were found to be the cause of the water quality violations.

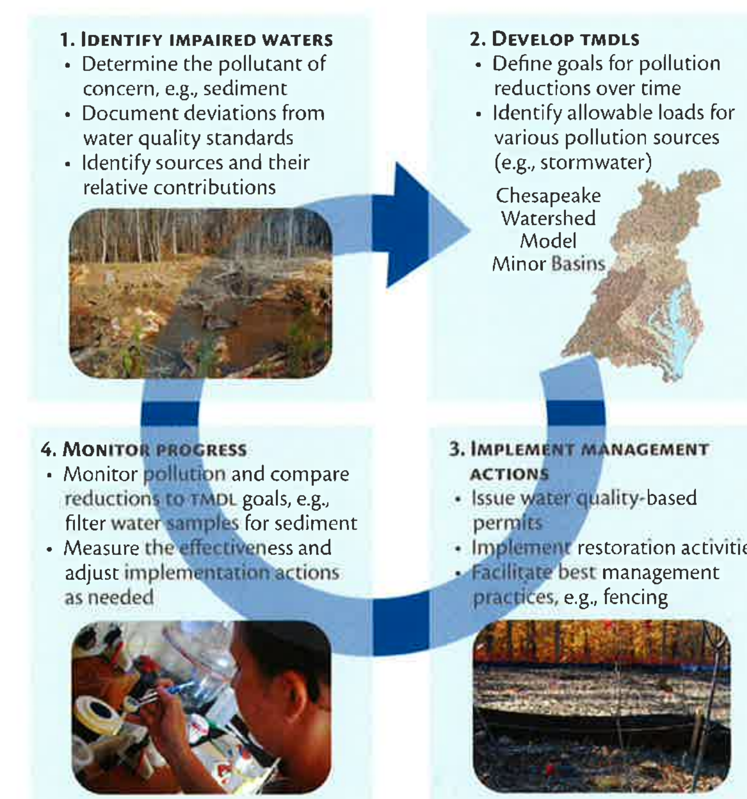


Figure 2. The TMDL process provides an assessment and management framework for identifying actions necessary to attain water quality standards. Figure adapted from U.S. EPA; photos from Chesapeake Bay Program.

A pollution diet for the Chesapeake Bay

The Chesapeake Bay TMDL provides guidelines for restoring the health of the Bay's waters by defining pollution reduction goals for nitrogen, phosphorus, and sediment. Under the TMDL, all practices needed to restore the Bay's health must be in place by 2025.

NITROGEN

Nitrogen is a major pollutant of the Chesapeake Bay. Excess nitrogen fuels the growth of algae, creating dense algae blooms that block sunlight and reduce dissolved oxygen available to fish, blue crabs, and other organisms. Sources of nitrogen include fertilizers, household septic systems, and municipal and industrial wastewater.

The map below illustrates the 2025 nitrogen pollution reduction goals in the eight major Chesapeake Bay regions. The Upper Western Shore and Susquehanna River watersheds have the farthest to go to reach their goals, while the Patuxent River is already close to meeting its goal.

PHOSPHORUS

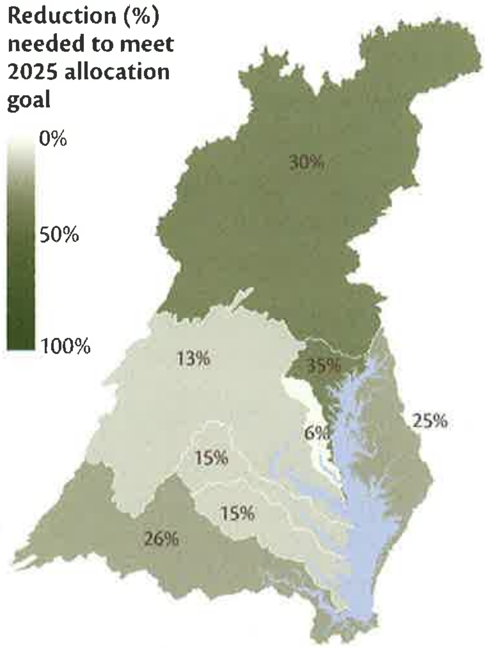
Phosphorus is also a major pollutant of the Chesapeake Bay. While phosphorus is needed for plant growth, human activities contribute more phosphorus than the Bay's waters can handle. Sources of phosphorus include fertilizer, municipal and industrial wastewater, and stormwater runoff.

The map below illustrates the 2025 phosphorus pollution reduction goals in the eight major Chesapeake Bay regions. The Upper Western Shore and Susquehanna River watersheds have the farthest to go to reach their goals, but every region will need to implement pollutant reduction actions to meet their goals. The York River watershed is closest to reaching its goals.

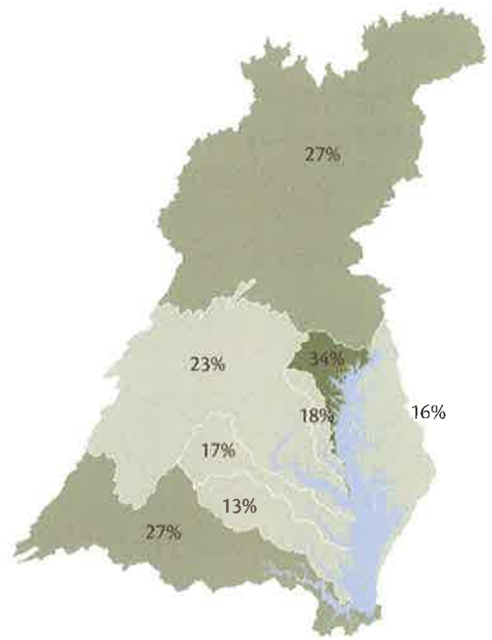
SEDIMENT

Excess sediment suspended in the water is one of the leading causes of the Chesapeake Bay's poor health. Too much sediment clouds the water, harming fish, oysters, and aquatic grasses. Much of the excess sediment comes from eroding land and stream banks. Impervious surfaces, such as roadways and parking lots, help transport sediments into the Bay, and lead to higher stormwater flows, which in turn exacerbate erosion.

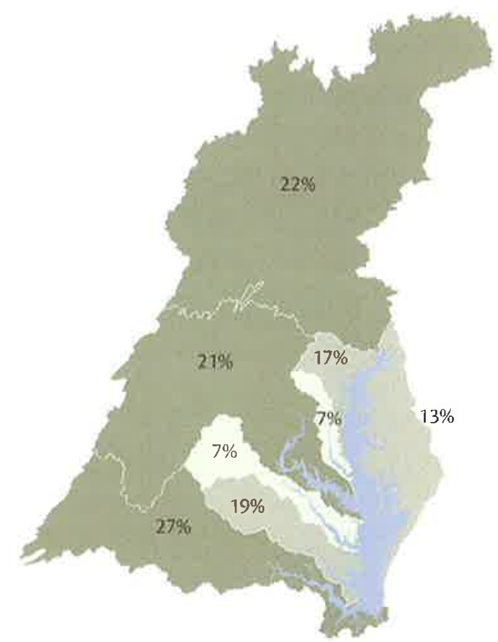
The map below illustrates the 2025 sediment pollution reduction goals in the eight major Chesapeake Bay regions. Unlike nutrients, sediment shows a different pattern. The James River watershed has the farthest to go to meet its goals, while the Patuxent and Rappahannock River watersheds are close to meeting their goals.



Total nitrogen



Total phosphorus



Total suspended solids

Left to right: Animal manure, heavily used as fertilizer in agriculture, is recognized as a major source of nitrogen and phosphorus. Algal blooms are exacerbated by high levels of nutrients, which often originate from fertilizers and municipal and industrial wastewater discharges, and are washed into waterways via runoff. Urban stormwater, which contributes sediments and other pollutants to waterways, is responsible for about 15% of the impaired river miles in the United States (U.S. EPA 2000).

WATERSHED IMPLEMENTATION PLANS

Watershed Implementation Plans (WIPs) are the next step in reducing the amount of pollutants entering the Chesapeake Bay. WIPs propose how allowable nitrogen, phosphorus, and sediment loads should be distributed among sources (e.g., agriculture, industry) and describe the management steps necessary to meet water quality standards.

In 2010, each of the seven Bay watershed jurisdictions (New York, Pennsylvania, Maryland, Virginia, West Virginia, Delaware, and Washington, D.C.) drafted WIPs, solicited public comment, and submitted them to the U.S. EPA for review. The draft WIPs provided a roadmap for how and when each jurisdiction intended to meet its pollutant allocations under the Bay TMDL. Many of the Bay jurisdictions' draft WIPs were sent back for substantial revisions. EPA and the jurisdictions worked closely together, and the jurisdictions submitted substantially stronger final Phase I WIPs in fall 2010. As a result and with only a few exceptions for agriculture in West Virginia, wastewater in New York, and urban runoff in Pennsylvania, EPA used the allocations proposed in the final WIPs as the basis for the TMDL allocations.

Each jurisdiction is now working with local governments to begin implementation. Many jurisdictions are identifying leaders at the county, municipal, and soil conservation district levels and providing training on the WIPs. For example, Caroline County, Maryland, volunteered to work with the state as a pilot county for the local WIP process. The county is working to establish a long-term water quality monitoring system to identify the level of impairments in all segmentsheds within the county. This new system will allow the county to prioritize the segmentsheds that need the most help in meeting water quality standards and to implement appropriate Best Management Practices (BMPs). This system will help to reduce the cost of BMPs by monitoring their effectiveness, which will ultimately lead to strategies that are the most effective.

Governor Martin O'Malley listens to citizens' concerns about Watershed Implementation Plans at a Maryland Forward forum in February 2011.

THE SCIENCE BEHIND THE CHESAPEAKE BAY TMDL

In order to determine allowable loads for nitrogen, phosphorus, and sediment pollution—and, ultimately, to remove the Chesapeake Bay from the impaired waters list—TMDL development followed a rigorous scientific process:

1. **Development of models**
   Information about land use, agricultural operations, wastewater plant discharges, septic systems, and other variables are incorporated into a computerized watershed model, which is used to estimate the total amount of sediment and nutrient pollution reaching the Bay. The model divides the Bay watershed into more than 2,000 segments, each containing segment-specific data on rainfall, evaporation rates, nonpoint pollution sources, streamflow, and other pertinent details that help TMDL developers understand the relationship among all elements.
2. **Test Best Management Practices**
   Each Watershed Implementation Plan defines a list of Best Management Practices (BMPs) to implement that will reduce pollutants.The Watershed Model simulates how much these BMPs reduce the amount of nitrogen, phosphorus, and sediment that are reaching the Bay.
3. **Assess water quality standards**
   The results of the watershed model tests—which contain information on how, and to what degree, BMPs affect the amount of pollution that reaches the Bay—are used in the water quality model to calculate whether water quality standards in the Bay are met. If the standards are not met, then jurisdictions would resubmit WIPs with a more stringent set of BMPs, and the models would be rerun to assess whether these BMPs would result in pollutant reductions necessary to meet water quality standards.

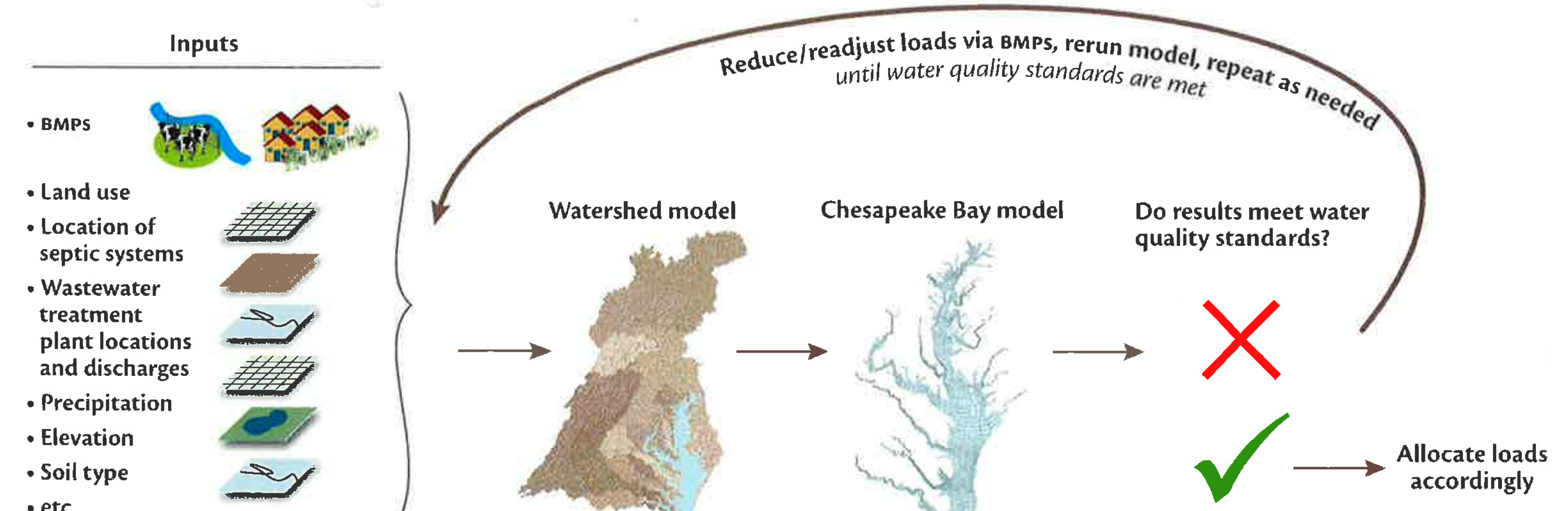


Figure 3. Simplified schematic of how pollution reduction goals were determined for the Chesapeake Bay TMDL using environmental models. The models used are complex mathematical representations of the real world, based on up-to-date peer-reviewed science, that produce estimates of how pollutant loads to the Bay change under different management scenarios (i.e., implementation of different kinds of BMPs).