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Reflecting on actions to restore the Chesapeake Bay and its tributaries has reached a new level as states and the EPA prepare to release strategies to meet cleanup goals. Photo / Dave Harp

As talk of TMDLs turns into action, here's what you need to know

If the third time is the charm, then the cleanup plan to be completed this year may restore the Chesapeake Bay to its former glory.

Goals set in 1987 and 2000 were missed by wide margins, leading to widespread criticism of the state and federal cleanup efforts. Instead of achieving the Chesapeake 2000 goal for cleaning up the Bay this year, state and federal agencies have vowed to create a tough, new cleanup strategy.

Past plans relied largely on voluntary efforts, and had no penalty for failure—except public criticism. EPA officials say that will change this year when they finalize a new plan, called a total maximum daily load, which is intended to give cleanup efforts more regulatory teeth and accountability.

The new goal is to take all actions needed to achieve the elusive clean Bay goal by 2025—something that will require states to double their annual nutrient and sediment control actions. Here's a primer.

What is a TMDL?

TMDL stands for total maximum daily load. And it is exactly that: a calculation of the maximum amount of pollution that a body of water can receive and still meet its water quality standards: acceptable levels of dissolved oxygen, water clarity or other criteria that are set to ensure waterways are safe, swimmable and fishable.

Once established, the "load" is then "allocated" to sources contributing to the problem, essentially setting a pollution limit for each source. When that source has a permit, the TMDL allocation is typically required to be part of the permit.

The federal Clean Water Act requires that a TMDL be written for all segments of a waterway that fails to meet a state's water quality standards. Every two years, each state reports a list of impaired segments to the EPA. The agency may also add segments to the list if it has evidence that they are impaired. States are required to write a TMDL for each impaired segment. If they don't, the EPA is supposed to write one for them.

Why does the Bay need one?

Most of the Bay, its tidal tributaries and embayments do not meet the water quality standards set for the Chesapeake by its surrounding jurisdictions, Maryland, Virginia, Delaware and the District of Columbia. In many places, the water has too little oxygen to support aquatic life, has too much algae, or is too murky to allow underwater grass beds to grow.

Why is one needed now?

The date stems from a 1999 consent decree resolving a suit by the American Canoe Association against the EPA. The consent decree required the EPA to develop TMDLs for Virginia's impaired waters by May 1, 2011, if the state failed to complete them a year earlier. While Virginia took

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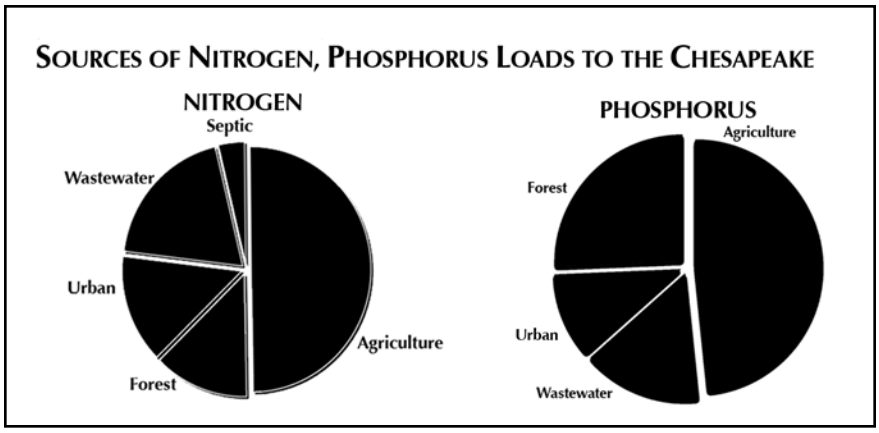
Nutrient Reductions & Clean Water

What causes the Bay's water quality problems?

Too many nutrients and too much sediment wash into the Chesapeake. The nutrients, phosphorus and nitrogen spur algae blooms. When there are more algae than can be consumed by predators, the excess die and sink to the bottom and decay in a process that draws oxygen out of the water, often leaving too little oxygen to support fish, shellfish and other creatures. Algae blooms also cloud the water, blocking the sunlight necessary to support underwater grass beds that are important habitats for juvenile fish and crabs, as well as waterfowl. Murky water can also prevent predators from finding their prey. Sediment also contributes to the cloudy water. In addition, it smothers bottom habitats important for oysters, mussels and a variety of other bottom-dwelling creatures.



Computer model estimates show that agriculture is the largest source of nutrients to the Bay, although urban is the only sector from which nutrient loads are increasing. Unlike nitrogen, air pollution is not a source of phosphorus. And, phosphorus from septic systems binds to the soil and does not reach streams.

Where do nutrients & sediment come from?

Agriculture is the largest source of nitrogen and phosphorus, which are key parts of fertilizer and animal waste. Farms are also the largest source of sediment. Wastewater treatment plants are major sources of nitrogen and phosphorus, although their contributions have declined sharply in recent years as large plants are upgrading to new technologies. Air pollution (nitrogen oxides from fossil fuel combustion and ammonia from agriculture) contributes between a quarter and a third of the nitrogen reaching the Bay; phosphorus is not an air pollutant. Urban and suburban areas contribute smaller amounts of nitrogen and phosphorus, but those amounts are growing as more areas are developed.

Besides farms, sediment comes from construction sites and the erosion of stream banks and shorelines.

Old & New Nutrient Goals

Estimates (millions of pounds)

New	Nitrogen	Phosphorus
1985	397	28.4
2008	284	16.3
Goal	197	15
Old	**Nitrogen**	**Phosphorus**
1985	338	27.2
2008	258	17.8
Goal	175	12.8

How are nutrient & sediment goals determined?

The nutrient reduction goals are based on estimates from a series of sophisticated computer models. Those models estimate the amount of atmospheric deposition that lands on the Bay and its watershed, the amount of nutrients and sediment that reaches the Bay from different portions of the watershed, and their impact on Chesapeake water quality.

Why have some of these numbers changed?

The models are periodically updated as new science and technology becomes available. The most recent update showed that the amount of nutrients entering the Bay has been underestimated over time. That's largely because the amount of nutrient runoff is affected by the amount of rain. New data showed that the models underestimated rainfall, and therefore, nutrient runoff in the past.

Similarly, the models also estimate that more nitrogen and phosphorus can enter the Bay than previously thought while still meeting water quality standards—maximum nitrogen loads have gone from 175 million pounds a year to 200 million pounds annually, while the maximum phosphorus loads have risen to 15 million pounds from 12.8 million pounds. That's largely because of several changes in the way the attainment of water quality standards are determined.

What are water quality standards?

Water quality standards establish measurable criteria by which the health of the water body can be determined. In the Bay, those standards require that specific amounts of dissolved oxygen be available in different areas to support the species expected to be found in those areas. The standards also set requirements for how clear water must be to support underwater grass beds, and set limits for chlorophyll *a* (a measure of algae) in the Bay.

What determines success — achieving nutrient reduction goals or meeting water quality standards?

Water quality standards trump nutrient reductions. The Bay could be considered "clean" if those standards are met before all nutrient reductions are made. Conversely, it's possible that additional nutrient and sediment reductions may be needed—at least in some places—to meet the standards. Nutrient goals are only the best available *estimates* of what it will take to meet those Bay water quality standards.

For information about preliminary nutrient reduction goals for rivers, visit www.bayjournal.com, click on reprints, and download "Target Nutrient Load Figures Released for Bay's Rivers, States."

For information about the Bay TMDL, visit www.epa.gov/chesapeakebaytmdl

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responsibility for other TMDLs, the EPA took responsibility for development of TMDLs for the Bay and its tidal tributaries because they required pollution control efforts throughout the six-state watershed. Separately, an agreement between Maryland and the EPA committed to a TMDL for Maryland's portion of the Bay consistent with the Virginia deadline. More recently, the EPA and states have agreed to finish the TMDL by the end of 2010.

Why has it taken a decade since the consent decree to develop a TMDL?

Work did not begin immediately because the states and the EPA instead signed the Chesapeake 2000 agreement, which pledged to reduce enough nutrient and sediment pollution by 2010 to remove the Bay and its tidal tributaries from the impaired waters list. If its water quality standards were met before May 2011, a Bay TMDL would not have been required

Recognizing that goal would be missed, work on the Bay TMDL started several years ago. The Chesapeake Bay TMDL will be the largest, most complex one ever written. It affects a 64,000-square-mile watershed that includes portions of six states and the District of Columbia, as well as nearly 17 million people, 88,000 farms, almost 500 large wastewater treatment plants and thousands of counties, cities, towns and townships. In fact, the "Bay" TMDL will actually be 92 TMDLs—the Bay and the tidal portions of its tributaries and embayments are divided into 92 segments.

What is the maximum load?

The draft basinwide maximum loads for nitrogen, phosphorus and sediment will be announced late next summer for public comment. Initial computer model estimates put the maximum loads at about 200 million pounds a year for nitrogen, and 15 million pounds a year for phosphorus.

Those nutrient levels would allow the deep portions of the mid-Bay—the location of the so-called "dead zone"—to meet the states' dissolved oxygen standards for the Chesapeake Bay.

Why will the load numbers change?

The EPA has used the 200 million-pound nitrogen and 15-million pound phosphorus numbers to make initial nutrient allocations—or maximum allowable loads—to each jurisdiction and major river basin. But that's just the starting point for state planning.

In some areas, such as small creeks and coves with poor circulation, or areas with severe, water clarity problems, those nutrient levels may not be enough to meet Bay water quality standards, and more efforts will be needed. States are using the preliminary numbers to estimate whether additional actions are needed in those areas.

In addition, states have the option to tweak how and where they achieve reductions. If they can find more cost-effective ways to meet water quality standards by concentrating nutrient control efforts in certain areas, or even make trade-offs between nitrogen and phosphorus reductions, they may do so.

Numbers will probably also be changed to a degree because of ongoing computer model refinements. The model adjustments are to be completed this winter with a revised set of draft maximum loads ready in the spring.

Those figures are for nitrogen and phosphorus. What about sediment?

Some of the work necessary to complete sediment allocations, including upgraded modeling, is not yet complete. Draft sediment maximum loads and allocations are expected in April. Detailed sediment allocations are expected to be part of the final TMDL.

If Chesapeake 2000 didn't result in a clean Bay, why should a TMDL?

Under a traditional TMDL, it might not, as they often provide little detail about how pollution reductions will be made, especially for nonpoint, or runoff, sources.

As part of the Bay TMDL, the EPA is requiring detailed watershed implementation plans that describe how jurisdictions will achieve their nutrient and sediment allocations. As part of those plans, states must identify the amount of reductions that will come from wastewater treatment plants, farms, animal feedlots, stormwater, septic systems, air deposition, eroding stream banks and tidal shorelines, and other sources.

In the plans, states must demonstrate they have the necessary regulations, permits or other enforceable agreements to reach the goals. (An enforceable agreement may include voluntary, incentive-based programs with contracts specifying needed actions and how they will be funded).

If state programs do not have the necessary funding, laws or regulations, the implementation plans must commit to dates by which those program "gaps" will be closed.

To ensure that programs stay on track, states must also set two-year milestones detailing the amount of nutrient and sediment reductions that will be achieved during that time, as well as program changes (such as more funding or regulations) needed to achieve those goals.

The watershed plans and two-year milestones must be approved by the EPA. Preliminary watershed plans are due in June, with draft plans ready for public review in August. Final plans must be approved by the EPA by November.

What if the states fall short?

Potential consequences from the EPA would depend on why a goal was missed. If it was missed because a program was less effective than anticipated, a state would likely be asked to fix that program, or find alternative ways to achieve the needed reductions.

If implementation plans or milestones are not submitted, if milestones are not achieved, or if severe problems are not corrected, the EPA has identified a number of actions it could take:

- It could force greater nutrient reductions from regulated sources, such as wastewater treatment plants.
- It could establish tougher regulations for stormwater or for large feedlots, known as concentrated animal feeding operations.
- It could deny permits for new or expanding sources of nutrient and sediment discharges unless a state shows how those loads would be offset by nutrient and sediment reductions beyond those necessary to meet the TMDL. This could affect wastewater or industrial discharges, some construction permits, animal feedlots and other permitted sources.
- It could withhold some Clean Water Act grants and distribute them to other states that use money more efficiently, or target grants to a specific area, action or facility within a state.

Those actions largely target regulated sources. What if goals are missed because of nonpoint sources?

Under the Clean Water Act, the EPA has little authority over nonpoint sources, such as runoff from farm fields, lawns or septic systems. As a result, its back-up actions target the sources it has authority to regulate. Forcing further reductions from wastewater treatment

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plants could be hugely expensive, and the threat of denying permits could affect new development. The EPA believes states will develop tougher nonpoint source control programs as part of their implementation plans to avoid such consequences.

Why is Congress considering legislation that requires the same state actions as the EPA?

Sen. Ben Cardin and Rep. Elijah Cummings, both Maryland Democrats, have introduced Chesapeake Bay Program reauthorization legislation that embodies much of the EPA's proposed actions under the Bay TMDL. But the EPA's proposals are based on agency interpretations of its authority under the Clean Water Act. By making the agency's plans part of the law, the legislation provides a stronger legal foundation if its actions are challenged in court.

Aren't states up in arms?

Not really. There are differing views on some issues, and all have concerns about adequate funding to achieve their goals. But most states recognize that failure to show significant improvements in Bay water quality after more than two decades of action has increased public skepticism about their commitment.

Also, states (and legislatures) have many competing priorities, and officials from several states have said that they are unlikely to get support for needed Bay actions without the threat of a stronger federal "hammer." Much of the Bay TMDL development process has been done in consultation with the states, and the concept of two-year milestones was proposed by the states.

Will local governments be affected?

Almost all of the actions needed in the implementation plans will have to be carried out at the local level, whether they are stormwater programs, wastewater treatment plant upgrades, septic system upgrades, stream restoration, shoreline stabilization, or the implementation of runoff control practices on farms by county conservation districts.

After the initial Phase I watershed implementation plans are completed this year, the EPA expects the states to produce updated plans by Nov. 1, 2011, which further subdivide the allocations to more local levels such as counties, conservation districts and/or subwatersheds. The extra year provided for these Phase II watershed plans is to allow states to work with local governments, watershed organizations and other local stakeholders on their development.

What if local areas don't achieve their objectives?

The EPA will look at whether states as a whole meet their goals. Any EPA consequences would target states, not local entities. If state officials feel local efforts are falling short, they could address it if they wish. But if goals are being missed, local-level information may provide clues about issues that limit or prevent progress.

Will these actions help local waters?

In many cases, yes. Actions that reduce runoff—whether improved stormwater controls or forest buffers along streams to reduce farm runoff—will also help local water quality. But the level of benefit depends on the specific action and location. Upgrades for the sole purpose of controlling nitrogen discharges from wastewater treatment plants into large freshwater rivers will have little impact on local waterways. But watershed implementation plans and two-year milestones can be developed specifically to emphasize programs that benefit local streams and rivers as well as the Bay.

Do states have to consider growth in their plans?

Yes. Implementation plans must estimate population growth, land use changes and other factors that could contribute to nutrient increases between now and 2025. The plans have to show how states will offset any increase in nutrient and sediment loads stemming from population growth and new development.

How much will it cost to clean up the Bay?

No one knows. Cost estimates generally start at $15 billion and go up. The actual cost depends on what actions are taken, and where they take place. Nutrient and sediment control actions differ in costs and effectiveness. Actions taken in some places —especially areas near the Bay and major rivers—are more effective than others. Also, new technologies or actions could also provide more cost-effective solutions.

Because of those variables, the watershed implementation plans emphasize developing programs that will successfully achieve nutrient and sediment reduction goals—not the specific number of cover crops of forest buffers needed to achieve them. Instead, specific nutrient reduction efforts will be spelled out in each two-year milestone. This will allow states the flexibility to adapt lessons learned into their plans, and adopt new technologies.

Will the federal government pay for cleaning up the Bay?

Ultimately, like all water quality standards, meeting Chesapeake Bay water quality standards is the responsibility of the states.

Nonetheless, Congress has in recent years steered increasingly large amounts of funding either directly toward Bay restoration, or to programs that will help. The 2008 Farm Bill provided an unprecedented $188 million to reduce nutrient and sediment pollution from farms in the Bay watershed. State Revolving Loan Funds, which help finance wastewater treatment plant upgrades and other water improvements, got large increases in the economic stimulus legislation approved by Congress last spring, as well as in the EPA's 2010 budget. Congress also boosted funding for the EPA's Bay Program Office by more than $20 million in 2010, with most of the increase steered toward states to help implement their programs. The legislation introduced by Cardin and Cummings would provide $1.5 billion in stormwater grants to communities.

What's to keep nutrient control actions from being put off until it's nearly 2025?

The EPA is requiring that 60 percent of needed nutrient control actions be in place by 2017. At that time, Phase III watershed implementation plans that cover 2018 through 2025 will be produced using the latest information. Accounting for the impacts of growth is expected to get greater emphasis in these plans.

How will the TMDL deal with air pollution?

A quarter to a third of all nitrogen reaching the Bay originated from air pollution. A bit more than half of that comes from nitrogen oxides, and most of the rest comes from ammonia. Nitrogen oxides are a byproduct of fossil fuel combustion by power plants, vehicles, ships and even lawn mowers. Ammonia largely originates from farms, primarily animal feedlots.

The EPA plans to estimate the impact

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of current air pollution programs, as well as those considered likely in the future, through 2025. With that information, the EPA will adjust nitrogen loads from river basins. The EPA expects air pollution controls to reduce the amount of nitrogen reaching the Bay from its watershed by at least 7 million pounds.

The air pollution reductions that benefit the Bay are mainly the result of programs aimed at reducing ground level ozone (smog) or particulate pollution. There are no air reduction actions currently being taken to specifically benefit the Chesapeake Bay.

Can changes in the management of filter feeders such as oysters and menhaden be used to meet river basin goals?

Yes and no. To the extent that more nutrients and sediment are filtered from the water, it will help meet water quality goals, which can reduce the nutrient and sediment reduction burden from the watershed. However, watershed implementation plans cannot count oyster restoration or similar actions toward nutrient and sediment goals at this time because it is too difficult to estimate their actual benefit.

Will the Bay be removed from the impaired waters list in 2025 if state cleanup strategies are fully implemented?

Probably not, at least not all of it. Removal from the impaired water list requires meeting water quality standards for the Bay— in other words, the Bay itself is the judge of whether it's removed from the list.

While some of 92 segments that comprise the Bay and its tidal tributaries may meet water quality standards, that's unlikely to be the case for many areas in 2025. Even if all of the needed practices are in place, it will take years for cover crops, streamside buffers and other actions to affect local streams or the Bay. In addition, it may take the Bay itself years to respond—scientists believe water quality may respond slowly until a "tipping point" or threshold is reached, at which point improvements may take place rapidly.

As a result, actually meeting the standards could take years beyond 2025, at least in some segments. During that time, all nutrient control practices would have to be maintained, and the impacts of new growth offset to ensure there is no backsliding.

When water quality standards are met, will fish, shellfish, waterfowl and other resources come back?

Restoring water quality helps to create conditions for species to rebound, but other actions are also needed to return aquatic resources to their former abundance. Diseases, exotic species, overharvests, barriers to fish migration and the destruction or degradation of habitat are all problems that must be addressed before most species will rebound.