Bay Restoration Spending Report

Chesapeake Bay Environmental Center
Grasonville, Maryland

A Report to the Maryland General Assembly pursuant to the 2022 Joint Chairmen's Report

December 1, 2022

Maryland Department of the Environment
Maryland Department of Natural Resources
Maryland Department of Agriculture
Maryland Department of Planning
Maryland Department of Budget and Management
Maryland Department of Transportation

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Executive Summary

A. Purpose

The Chesapeake Bay (Bay) lies at the core of Maryland's culture. While the costs and challenges of realizing a healthy and vibrant Bay are significant and complex, the environmental, social, and economic benefits of a healthy Bay are far greater. Maryland is committed to Bay restoration and we have strong programmatic and financing infrastructure to achieve our goals.

The following is a summary of Maryland's framework for realizing those goals in response to the Joint Chairmen's Report (JCR) of the 2022 General Assembly Session (pages 228–230) requesting that the Maryland Departments of Planning (Planning), Natural Resources (DNR), Agriculture (MDA), Environment (MDE), and Budget and Management (DBM) provide:

1. State Fiscal Year (SFY) 2022 spending on Bay restoration and associated Bay health responses,
2. Projected SFY22–25 spending on Bay restoration and expected Bay health responses,
3. A framework of needed regulations, revenues, laws, administrative actions and their resulting impacts on individuals, organizations, governments, and businesses SFY22–25 in order to realize a restored Bay,
4. An analysis of options for financing Bay restoration,
5. An analysis of the cost effectiveness of existing Bay Restoration fund sources, and
6. Updated information on Phase III Watershed Implementation Plan (WIP) implementation and how the impacts of Conowingo Dam infill, growth, and climate change will be addressed.

It is critical to recognize that these JCR responses are based on an extremely complex, unpredictable, and constantly improving suite of scientific understandings, fiscal realities, and policy initiatives. The agencies have responded to the requests based on the current landscape. Requests will undoubtedly vary and change as time progresses, and responses must change accordingly if the state is to realize its goals.

B. Regulatory Framework

The Bay Total Maximum Daily Load (TMDL) required under the federal Clean Water Act (CWA) sets the pollution limits necessary to restore the health of the Bay and its tidal tributaries. The TMDL–developed in close collaboration with Maryland and all Bay watershed jurisdictions–sets regulated limits on the amount of nitrogen, phosphorus, and sediment pollution that can enter the Bay and its tidal rivers, and still meet water quality standards. Maryland and the other six Bay watershed jurisdictions (Virginia, Pennsylvania, Delaware, West Virginia, New York, and Washington, D.C.) are required by the U.S. Environmental Protection Agency (EPA) to implement sufficient pollution reduction practices by 2025 to meet the TMDL.

To provide reasonable assurance that the TMDL will be met, the EPA has directed each jurisdiction to develop WIPs that detail the regulatory and non-regulatory actions the jurisdiction will take by 2025 to meet its TMDL. WIPs have been required since 2010. In August 2019, Maryland and the other Bay jurisdictions all submitted our Phase III WIPs, which detail the strategies for meeting the 2025 restoration targets. As part of the accountability framework for achieving the 2025 restoration targets, EPA and the Bay jurisdictions develop short-term goals, called milestones, to increase restoration work and ensure progress. In January of 2022, Maryland submitted a Phase III WIP addendum to address additional load reductions required due to climate change conditions that are needed to meet TMDL endpoints by 2025.

In addition to the suite of actions detailed in the WIP and 2-Year milestones, all seven watershed jurisdictions, the federal government, and the Chesapeake Bay Commission, a tri-state legislative commission, signed the Bay Watershed Agreement in 2014, which commits the signatories to a wide variety of related Bay restoration activities beyond the pollution reduction actions required by the TMDL (like stewardship, environmental literacy, sustainable fisheries, climate resiliency, and diversity).

C. Maryland's Progress and Plans

In SFY00–22, Maryland spent about $14 billion on Bay Restoration activities, $6.5 billion of which has been appropriated within the last seven years. This amount includes funding for activities that directly reduce nutrient and sediment inputs to the Bay (like cover crops and WWTP upgrades), activities that support the broader commitments of the 2014 Bay Watershed Agreement (like monitoring, education, outreach), and activities that prevent or minimize future degradation of the Bay (like land conservation). From 2010–2020, Maryland had successfully implemented actions to reduce the amount of nitrogen entering the Bay by about 11.2 million pounds. The state's monitoring of water quality and habitat conditions in Maryland's streams, rivers, and the Bay has shown increased resilience and improvements to our waters as a result of these actions. However, during SFY21, due to operational issues at two of the major WWTPs in Baltimore City, the total amount of nitrogen reduction to the Bay was approximately 8.5 million pounds, which was less than originally planned. Maryland expects to get these two plants back operating as expected in the near future.

Under Maryland's Phase III WIP, which included Chesapeake Assessment Scenario Tool (CAST) 2019 model changes, the state needs to reduce its pollution to the Bay by more than 9 million pounds of nitrogen, and 100,000 pounds of phosphorus from 2017 levels. These reductions will come primarily from the wastewater and agricultural sectors. By 2025, these sectors are expected to reduce their nitrogen loads from 2017 levels by 41%, and 20%, respectively. Loads from the stormwater and septic sectors are anticipated to remain constant or slightly increasing, with reductions from implementation being offset by loads from new growth. It will be important, however, for the stormwater and septic sectors to increase implementation beyond 2025 in order to offset the impacts of expected future growth to to remain under our TMDL.

The Bay model version used by Chesapeake Bay Program (CBP) to evaluate Maryland's Phase III WIP indicated that the state's plans achieved 1 million pounds more nitrogen reduction and 440,000 pounds more phosphorus reduction than needed to meet EPA's pollution reduction targets. These additional reductions provided Maryland with a margin of safety by creating a surplus that could be applied toward achieving climate change allocations. In 2019, updates to the Bay model reduced this surplus to about 394,000 pounds of nitrogen and 330,000 pounds of phosphorus. In 2022, Maryland submitted an addendum to its Phase III WIP and developed 2022/2023 milestones to address the impacts of climate change quantified by CBP. This climate addendum used all of Maryland's surplus pollution reductions while also requiring wastewater treatment plants (WWTPs) to perform much better through financial incentives. Maryland and the other Bay jurisdictions also finalized a collaborative Conowingo WIP (CWIP) to reduce the estimated 6 million pounds of nitrogen entering the Bay as a result of the Conowingo Dam infill in a phased approach that will extend beyond 2025.

D. Reaching Our 2025 Goals and Sustaining Restoration into the Future

Moving toward the 2025 restoration deadline, Maryland has a narrower path to achieving and sustaining our Bay Restoration goals than was anticipated in the Phase III WIP. Increased climate loads calculated after the Phase III WIP was developed cut into Maryland's planned pollution reduction surplus that had provided a margin of safety in achieving our 2025 goals. Recent proposed data updates to the CAST, a water quality and stormwater management (SWM) planning and modeling tool used to measure progress, now indicate less progress reducing nitrogen than anticipated. At the same time, operations and maintenance failures at our largest WWTPs have identified some systemic challenges, like the need for preventive maintenance and more certified plant operators, which are further slowing our progress. In addition to a need for trained WWTP operators, there are other workforce needs, such as agricultural technical assistance, private sector capacity to design and install pollution reduction best management practices (BMPs), maintain installed projects, and fully ramp up a restoration economy to meet our goals. The new Bipartisan Infrastructure Law (BIL) will provide additional support to our Bay restoration effort. Since most of the BIL funding is going into existing competitive grant programs, there is a critical need to build capacity to compete for this funding and implement projects. Maryland is anticipating these needs by dedicating additional BIL funding toward technical assistance.

Meeting Maryland's existing Phase III WIP, and 2014 Bay Watershed Agreement commitments, addressing the impacts of climate change, implementing a CWIP, and offsetting future growth will be challenging, but not impossible. Maryland's Phase III WIP identifies seven "guiding principles" to ensure success in this effort, which are balanced, feasible and locally-driven:

1. Balancing regulations and incentives.
2. Using WWTP capacity wisely while driving long term and sustained progress in the slower paced sectors.

3. Creating a restoration economy and driving innovation.
4. Locally-driven restoration and co-benefits.
5. Accounting for and leveraging conservation and protection programs.
6. Holistic ecosystem management.
7. Accountability and adaptive management framework.

Central to success will be an emphasis on maximizing and continually improving the cost effectiveness of Maryland's three primary Bay restoration funding programs: the Bay Restoration Fund (BRF), the Chesapeake and Atlantic Coastal Bays Trust Fund (Trust Fund), and the Maryland Agricultural Water Quality Cost Share (MACS) Program. Funds from these programs can, in turn, be leveraged with funds from more focused state programs (like Program Open Space (POS), Water Quality Revolving Loan Fund (WQRLF), federal programs (like Conservation Reserve Enhancement Program (CREP), local funds, and the private sector. Maryland has a strong tradition of remaining grounded in sound science while pushing the envelope on innovative policies (like the recently re-enacted Clean Water Commerce Act (CWCA) and initiatives (like water quality trading, Transportation-Infrastructure Restoration Partnership, Grants Gateway, Innovative Technology Fund, recognizing and reacting to the co-benefits of stormwater mitigation projects), which place it in a strong position for success.

As we look beyond 2025, Maryland will likely have the ongoing challenge of reducing loads due to climate change impacts determined by new science and modeling tools. Regarding Conowingo Dam's pollution impacts, the phased approach that goes beyond 2025 will allow more time for jurisdictions to reduce Conowingo pollution loads while Maryland ramps up pay-for-success financing with its historic $25 million investment. With the potential for future data and model updates to impact our progress, we will need to ensure that robust scientific vetting processes are in place through the CBP partnership. Lastly, technical and financial assistance is being expanded to support our farmers and a growing number of diverse, small farm operations, but additional work will still be required to achieve ambitious agricultural sector pollution reductions.

Introduction

A. Historical Perspective

In 2010, after decades of voluntary efforts to fully restore the Bay, the EPA established regulatory limits under the federal CWA to restrict three major pollutants in the Bay's waters: nitrogen, phosphorus, and sediment. These limits, known as TMDLs, are science-based estimates of the amount of each substance that the Bay and its tributaries can receive daily and still meet standards for clean, healthy water. The pollution limits require the seven Bay watershed jurisdictions (Maryland, Virginia, Pennsylvania, Delaware, West Virginia, New York, and D.C.) to have pollution reduction practices in place to achieve these limits by 2025. It is important to note, however, that fully restored water quality standards will not be realized until sometime after 2025 due to time lags between when the practices are implemented and when the ecosystem fully recovers.

To provide reasonable assurance that the TMDL would be achieved, the EPA directed jurisdictions to develop WIPs that detail the specific actions each jurisdiction will take to meet their 2025 limits. The EPA recognized that the level of detail it expects the jurisdictions to include in their WIPs would take time to develop, and that the scientific understanding and tools available to meet the goals were constantly improving and, therefore, divided the process into three distinct phases:

- Phase I (submitted 2010): WIPs identified initial strategies and practices that each jurisdiction would begin implementing in 2010 to achieve 60% of the necessary pollutant load reductions by 2017.
- Phase II (submitted 2012): WIPs were a more detailed and geographically directed suite of actions informed by 2 years of implementation lessons learned and discussions with local officials. Like Phase I, the Phase II WIPs were focused on achieving 60% of the necessary pollutant load reductions by 2017.
- Phase III (submitted 2019): In 2017, CBP conducted a "mid-point assessment" during which EPA evaluated each jurisdiction's progress at achieving its Phase I and Phase II WIP commitments, and applied new understandings of the science and updated models to identify necessary mid-course adjustments. Examples of some of the identified adjustments included an increased understanding about phosphorus saturated soils, the changing conditions (infill) behind the Conowingo Dam, increased loads due to growth, and water quality impacts due to climate change. Based on new scientific understandings and lessons learned during the Phase I and Phase II WIP implementation, jurisdictions then were to submit Phase III WIPs in August 2019 that detailed actions necessary to meet 100% of the necessary pollutant load reductions by 2025.
- Phase III WIP Climate Addendum (submitted 2022): The impacts to jurisdictions' Bay Restoration efforts due to climate change were not fully understood during the preparation of the Phase III WIPs. In January 2022, climate change impacts and related

strategies were incorporated into the jurisdictions' Phase III WIPs through an addendum and/or the jurisdictions' 2022-23 milestones. Maryland is leveraging existing Phase III WIP wastewater strategies that include enhanced nutrient removal (ENR), and continued operation and maintenance grants to optimize performance. The expectation is that these existing strategies will result in overall average WWTP concentrations of 2.85 mg/L nitrogen that will achieve increased climate loads. The addendum and milestones were submitted to EPA on January 15, 2022.

By successfully implementing the actions called for in its Phase I, Phase II and Phase III WIPs, Maryland has made significant progress toward its ultimate 2025 TMDL pollution reduction goals. The pollution reduction practices implemented to date are accounted for in the Bay models, which, when combined with the planned future pollution reduction strategies, help determine whether Maryland is on a trajectory to achieve its 2025 restoration goals. Figure 1 shows Maryland's modeled progress from 2010 to 2021, with projected reductions toward meeting its 2025 Phase III WIP nitrogen target, including climate change allocation. Figure 2 shows the 2010 and 2021 nitrogen contributions by source sector.

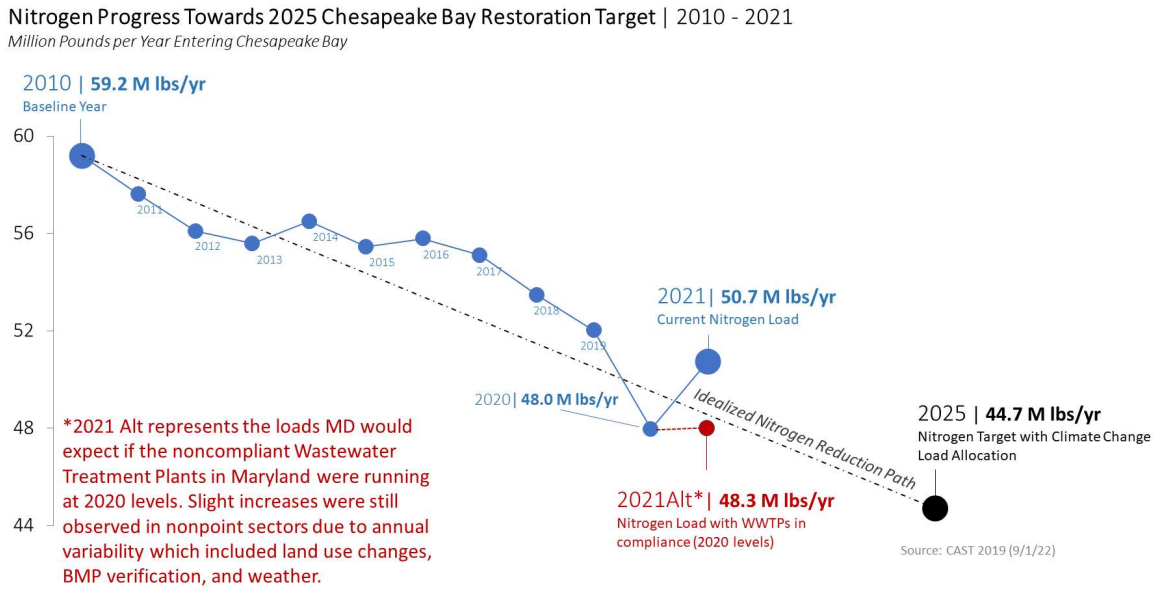

Figure 1. Modeled trends in Maryland's nitrogen loads to the Bay[1]

[1] SFY21 model trends results presented in this document were obtained from the current official version of the Bay Model "CAST19". The model is being updated to CAST21 but several data and methodology issues have arisen and are still under discussion by the partnership. Maryland supports the use of the best available data and science to inform the partnership management decisions, independently of any undesirable outcomes. However, Maryland will not use CAST21 results until it is officially approved by the CBP partnership.

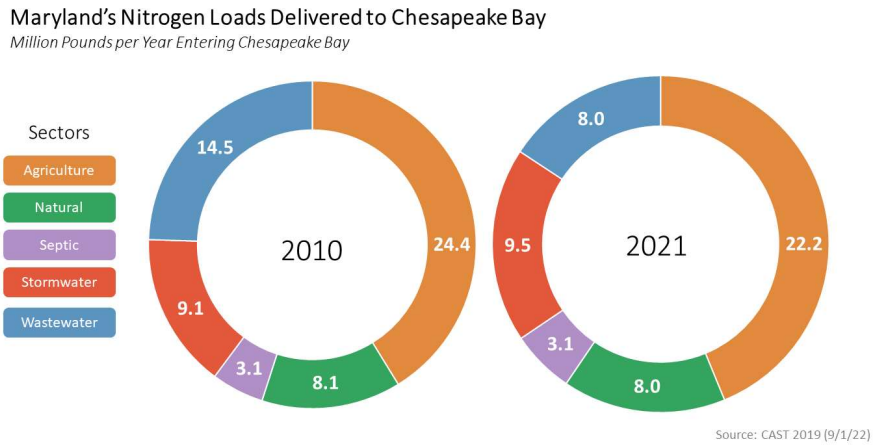

Figure 2. Maryland's modeled total nitrogen load delivered to the Bay by sector.

These past actions have addressed all pollutant sectors. Critical to realizing this progress has been Maryland's BRF and the Trust Fund and, in particular, the doubling of the BRF in 2012, and the full funding of the Trust Fund since 2017 by Governor Hogan.

B. Looking Forward

When Maryland developed its Phase III WIP in 2019, we were on a path to achieving our share of the Bay pollution reduction targets by 2025. Maryland's Phase III WIP accounted for projected growth in human and livestock populations, while still achieving a nitrogen load of 44.8 million pounds per year, and a phosphorus load of 3.28 million pounds per year by 2025, which exceeded our required targets by 1 million pounds of nitrogen, and 440,000 pounds of phosphorus. Subsequent 2019 updates to the Bay model decreased our Phase III WIP surplus to 394,000 pounds of nitrogen and 330,000 pounds of phosphorus. The model updates indicated that our Phase III WIP pollution reduction surpluses were not sufficient to offset additional climate change nutrient load reductions assigned to Maryland in 2020. In January 2022, MDE submitted a Phase III WIP addendum and 2022-23 milestones to EPA that describe strategies to meet the additional climate change pollution reductions, while continuing to provide a margin of safety. EPA's draft review of the Phase III WIP addendum concluded that the proposed strategies met expectations.

By 2020, Maryland was still on track to meet our 2025 WIP targets and climate allocation. The WWTP sector was very close to achieving its WIP sector targets, indicating that success was possible. However, in 2021, inspections conducted at Baltimore City's Patapsco River and Back River WWTPs found them to be in significant noncompliance. Numerous actions continue to be taken by MDE, the Maryland Environmental Service (MES), and the Office of the Attorney

General to bring the facilities back on track as they were in 2020. Recent analyses and inspection reports indicate that they have been meeting the nutrient limits in its permit. MDE is committed to ensuring that both facilities have a clear path to achieving compliance with their permit limitations, and ensuring that Maryland is on track to achieve its 2025 Bay goals.

Maryland has divided its total pollution reduction targets among five major pollutant source sectors identified in Figure 2. It is important to recognize that the pace of progress varies among sectors. This is due to the fact that the pollution reduction opportunities, planning constraints and costs vary widely between sectors. As a result, the stormwater and septic system sectors are expected to continue steady implementation past 2025. Wastewater sector performance is planned to offset the slower pace of reductions in the stormwater and septic sectors allowing the state to meet its 2025 goals.

Moving toward the 2025 restoration deadline, Maryland now has a more difficult path to achieving our Bay restoration goals than was anticipated in the Phase III WIP. The increased loads resulting from climate change, new data and related model updates have cut into Maryland's pollution reduction surplus. At nearly the same time, operations and maintenance failures at our largest WWTPs have identified some systemic challenges that can threaten the sector's progress. We also know that future data and model updates can impact our progress and that we need to put mechanisms in place to ensure these updates have full scientific vetting through the CBP partnership. Lastly, technical and financial assistance is being expanded to support our farmers and a growing number of diverse, small farming operations, but additional work will still be required to achieve ambitious agricultural sector pollution reductions.

The remainder of this document is organized into four parts:

- Part I documents our progress to date - state spending on Bay restoration from SFY00–22, and the resulting changes in Bay health *(addresses 2022 JCR Section 35 request (1)).*
- Part II discusses where we still need to go - a general framework for implementing Maryland's Phase III WIP and meeting our required TMDL by 2025 *(addresses 2022 JCR Section 35 requests (2), (3), and (6)).*
- Part III describes how we are making the most of the Bay restoration resources available to us - how we are maximizing the cost-effectiveness of existing state-funded programs *(addresses 2022 JCR Section 35 request (5)).*
- Part IV looks to the future and discusses several financing options under consideration that will help enable the state to better fund its water quality restoration obligations *(addresses 2022 JCR Section 35 request (4))*.

Part I - Where We Have Been: Bay Restoration Funding and Progress to Date (SFY00-SFY22)

A. Bay Restoration Funding

Since SFY07, the Governor's annual budget highlights have included a table of Bay Restoration Activities Funded in the Budget. A gross summary table of SFY00–22 Bay Restoration spending is provided below (Table 1), and a more detailed table is attached as Appendix 1. In SFY00-SFY22, the state spent about $14 billion on Bay Restoration activities, $6.5 billion of which has been appropriated in the last 7 years.

Table 1. SFY00-SFY22 Maryland Bay Restoration Funding Summary

Category	Total SFY00-SFY22 Funding Amount
Bay Cabinet Agencies Bay Restoration Funds	$ 6,901 M
Land Conservation	$ 919 M
Agricultural Land Preservation	$ 730 M
General Obligation (GO) Bonds	$ 1,699 M
Transportation	$ 3,782 M
Education	$ 226 M
Total	**$ 14,257 M**

Several important caveats and approximations must be recognized in interpreting Table 1 and Appendix 1.

1. Data is not consistent over time: Records are less accessible and, therefore, reported funding amounts are less reliable for the beginning of this time period than more recent years.
2. Not all funding goes directly to reducing pollutant loads to Bay: Bay Restoration involves a diversity of important functions beyond simply reducing the amount of nitrogen, phosphorus, and sediment entering the Bay. For example, water quality monitoring is essential to track progress and direct future actions to the most cost-effective practices; education and outreach are important to providing Maryland students and citizens with access to and appreciation for a restored Bay; planned development and growth, and land conservation and preservation programs minimize growth impacts and protect the Bay from future degradation. All of these examples (and others) are essential aspects to Bay Restoration, but do not directly result in reductions in loadings to the Bay. (*As a result, it is inappropriate to simply divide the total cost presented in this report by the number of pounds pollutant reduction to get a dollar amount per pound reduced.)*

3. Judgment calls are necessary in identifying a program as Bay Restoration. Many state agency programs and budget categories contribute to restoration, as well as other non-Bay related efforts. In an effort to remain as consistent as possible, only those programs that are estimated to have more than 50% of their activities related to Bay Restoration are included in this analysis.

Although the total funding by Maryland state agencies for Bay Restoration varies from year-to-year, the total restoration funds for the first 3 years of the evaluated time period (SFY00–02) was $882,327,165 while the total for the past 3 years of the period (SFY20–22) was $3,368,855,725, an increase of 282%. This increase was driven in part by Governor Hogan, and the creation and subsequent funding increases in the two primary Bay Restoration Special Funds: the BRF and the Trust Fund.

B. Modeled Bay Restoration Progress 2000–2021 as per Reported Implementation

Maryland and the other Bay jurisdictions annually report to the EPA the number, type, and locations of pollution reducing BMPs that they have implemented, maintained, and verified are working. The EPA then uses that information to estimate and track annual progress toward our nitrogen, phosphorus and sediment goals. This assessment looks at the modeled loads of nutrients and sediment originating from each jurisdiction that end up in the Bay. These estimates are produced with a watershed model that normalizes for weather fluctuations and accounts for approved pollution management practices on the ground. *This model was updated in 2019 to a version called CAST 2019, and will be held steady until the partnership decides on whether or not to adopt a newer version of the model for SFY22.*

Figure 3 shows the modeled contributions of phosphorus and sediment loads to the Bay from Maryland's five source sectors in 2021. The total modeled nitrogen, phosphorus and sediment loads to the Bay from the Maryland portion of the watershed from 2010 to 2021 are displayed in Figure 4**.** Based on the latest Bay model (CAST 19), Maryland's actions from 2010 through 2021 have reduced nitrogen loadings by 14%, phosphorus loadings by 8%, and sediment loadings have remained even/stable.

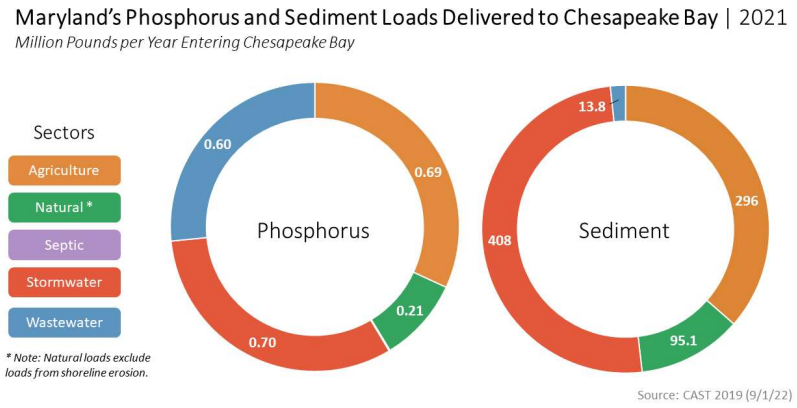

Figure 3. SFY21 source sector phosphorus and sediment contributions of Maryland's loads delivered to Bay.

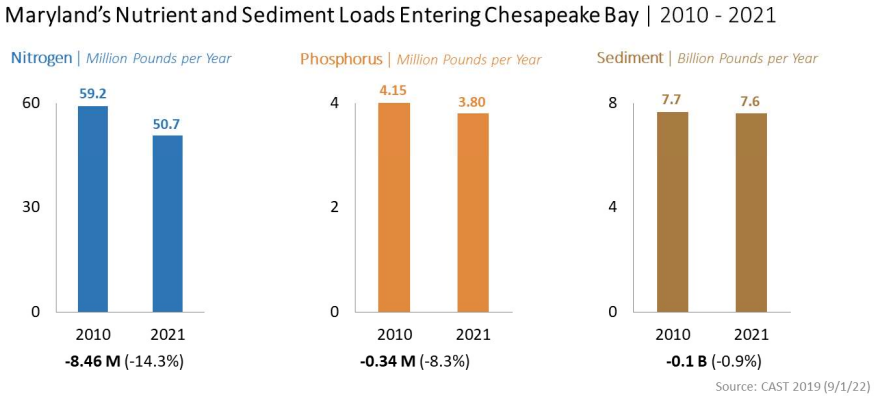

Figure 4. Maryland modeled loads of nitrogen, phosphorus, and sediment from SFY10–SFY21.

Changes in loads can result from changes in data inputs and model outputs, conservation practices, land use, wastewater treatment, air deposition, animal population estimates, septic systems, and precipitation. A description of the key programs in each sector are as follows:

- Agriculture: This sector makes up the largest contribution of nitrogen and sediment to the Bay, and is continually working to achieve additional nutrient reductions while balancing dynamic market influences and variable weather. MDA continues to adopt new incentives to increase adoption of key conservation practices that will achieve the

2025 reductions targets. For example, cost-share was increased up to 100% for high priority conservation practices (e.g., riparian forest buffers) and the cost-share ceiling was increased to $75,000 per project, up from $50,000. Additionally, MDA and its conservation partnership are expanding technical assistance in the state's 24 Soil Conservation Districts (SCDs) through the hiring of 37 additional staff as of June 30, 2022.

- Wastewater: This sector makes up Maryland's second largest contribution of nitrogen to the Bay, and it has achieved the largest sector reductions despite some challenges with compliance at several major municipal-managed treatment plants. Changes in the loads from WWTPs are a combination of the upgrades of municipal plants, treatment plant performance, performance incentives, population growth, and the impact of year-to-year rainfall variability.
- Urban Stormwater: This sector is Maryland's third-largest contributor of nitrogen to the Bay and is a substantial contributor of phosphorus. Atmospheric deposition is a major nitrogen source in the urban environment and implementation of air pollution reduction strategies in the region is a key driver of nitrogen reduction. Phosphorus reductions are due in part to fertilizer management. Since 2010, new development has to meet Environmental Site Design to the Maximum Extent Practicable, which helps to minimize nutrient and sediment pollution reaching the Bay from developed land. Currently, 33% of developed land is covered by SWM.
- Septic Systems: The septic sector has the least contribution of nitrogen to the Bay and contributes no phosphorus or sediment. In general, restoration practices, such as upgrades to Best Available Technology (BAT) and connecting failing septic systems to public wastewater treatment facilities have kept pace with the addition of loads from new systems. Future reductions are anticipated from the elimination of septic systems due to increase of connections to WWTPs. Additionally, at low elevations, there may be more failures of septic systems due to sea level rise and storm events; therefore, this may result in additional connections to WWTPs.

C. Chesapeake Bay Water Quality Monitoring Data

To understand the health of the Bay and track progress of restoration efforts, the state, through DNR, regularly monitors tidal and non-tidal waters at 125 sites. Monitoring data provides highly accurate information on the past and present concentration of pollutants in our waterways as well as our progress toward providing more oxygenated habitat for fish and crabs and clearer water for submerged aquatic vegetation (SAV). Monitoring data cannot, however, identify the sources of the pollutants nor predict future pollutant loads resulting from planned pollutant reduction efforts, the impacts of climate change, growth, etc.; for that information, we must depend on models.

Trends are determined using a flow-adjustment method. The flow-adjusted method uses daily flow data from U.S. Geological Survey (USGS) gaging stations to include the impact of changes in river flow on the nutrients and sediments levels; higher nutrients and sediments are associated with high river flows. Changes in the levels of nutrients and sediments are flow

adjusted by using flow as one of the factors that determines the differences between years. The flow-adjusted method is much more robust for determining the impact of changes in water quality over a long-time period, and for determining what changes over time have resulted from management actions, not due to changes in rainfall from 1 year to the next.

Statistical analysis of monitoring data collected at both tidal and non-tidal stations from 1999 through 2021 demonstrates that the current impact of historical **Bay** Restoration spending has resulted in significant reductions in nitrogen concentrations at 60% of stations (Figure 5), phosphorus concentrations at 47% of stations (Figure 6), and sediment concentrations at 28% of stations (Figure 7).

Monitoring results confirm that most nutrient and sediment reductions occur in streams and rivers closest to where the management actions have been implemented. Moving downstream into the tidal tributaries, water quality improvements, especially in nitrogen levels, are more likely to be observed on Maryland's western shore where those reductions are associated with WWTP upgrades. Conversely, water quality improvements on Maryland's Eastern Shore, which are dominated by diffuse nonpoint source impacts, have a more delayed response.

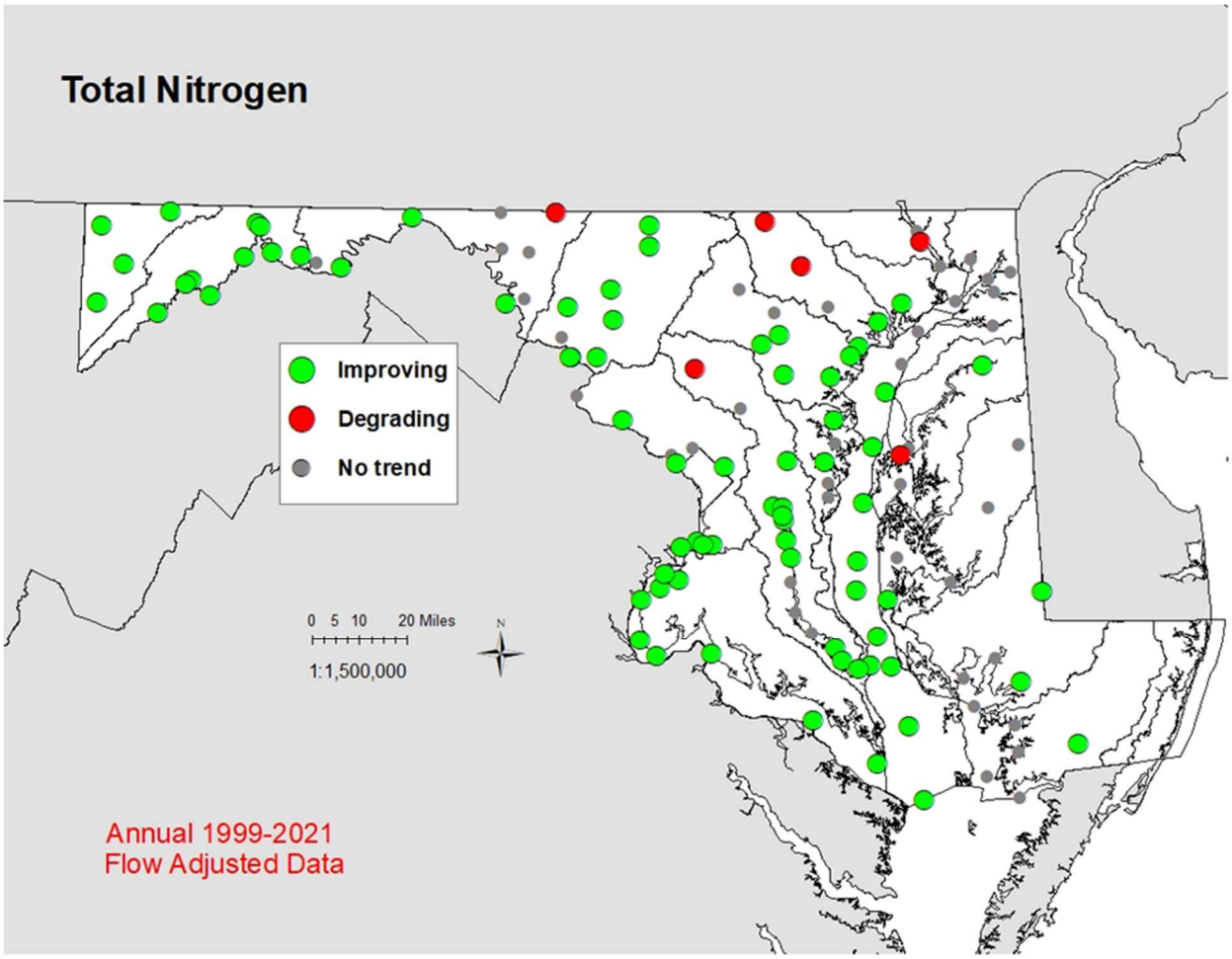

Figure 5. Trends in flow adjusted total nitrogen concentrations 1999–2021.

- 60% of stations (75 of 125) have improved nitrogen levels compared to 1999.
- 5% of stations (6 of 125) have degraded nitrogen levels compared to 1999.
- 35% of stations (44 of 125) do not have nitrogen levels that are significantly different from 1999.

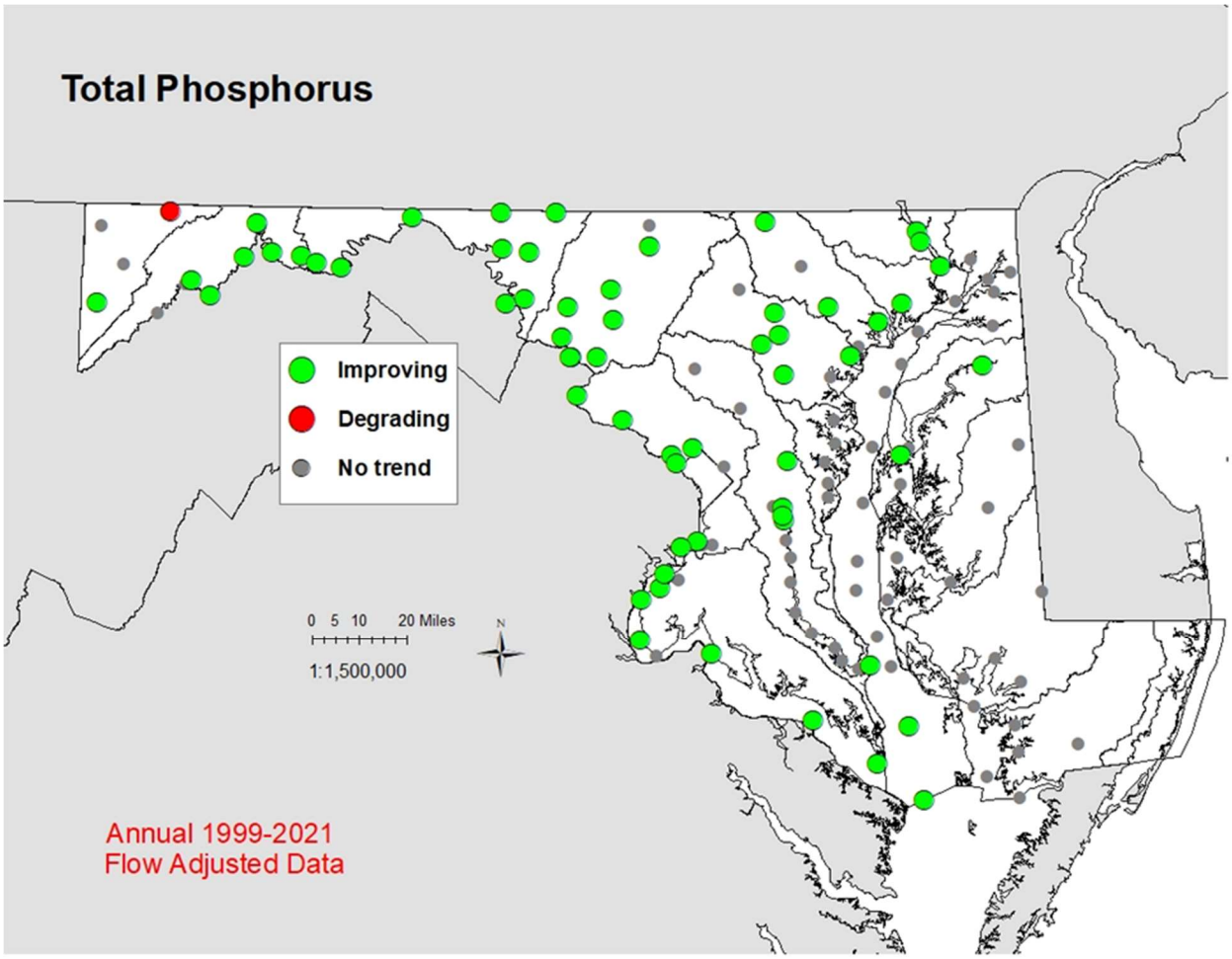

Figure 6. Trends in flow-adjusted total phosphorus concentrations 1999–2021.

- 47% of stations (59 of 125) have improved phosphorus levels compared to 1999.
- >1% of stations (1 of 125) has degraded phosphorus levels compared to 1999.
- 52% of stations (65 of 125) do not have phosphorus levels that are significantly different from 1999.

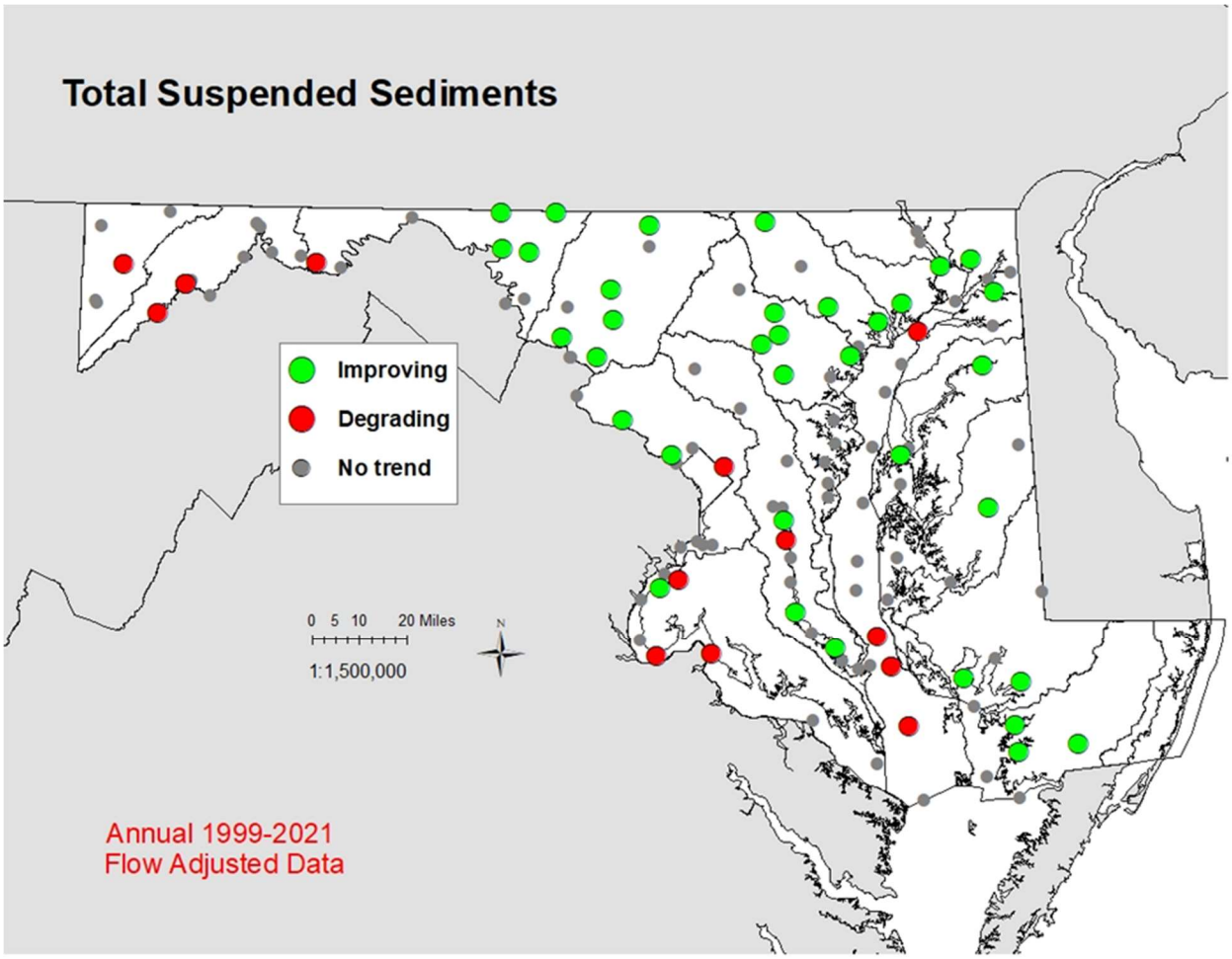

Figure 7. Trends in flow-adjusted total suspended sediment concentrations 1999–2021.

- 28% of stations (35 of 125) have improved sediment levels compared to 1999.
- 11% of stations (14 of 125) have degraded sediment levels compared to 1999.
- 61% of stations (76 of 125) do not have sediment levels that are significantly different from 1999.

Bottom dissolved oxygen (Figure 8) is a key indicator of overall Bay health and improved bottom dissolved oxygen is a primary goal of nutrient and sediment reduction activities. However, only 7% of stations have improved dissolved oxygen levels, so further actions to reduce nutrients and sediments will still be required to see continued widespread improvement in bottom dissolved oxygen.

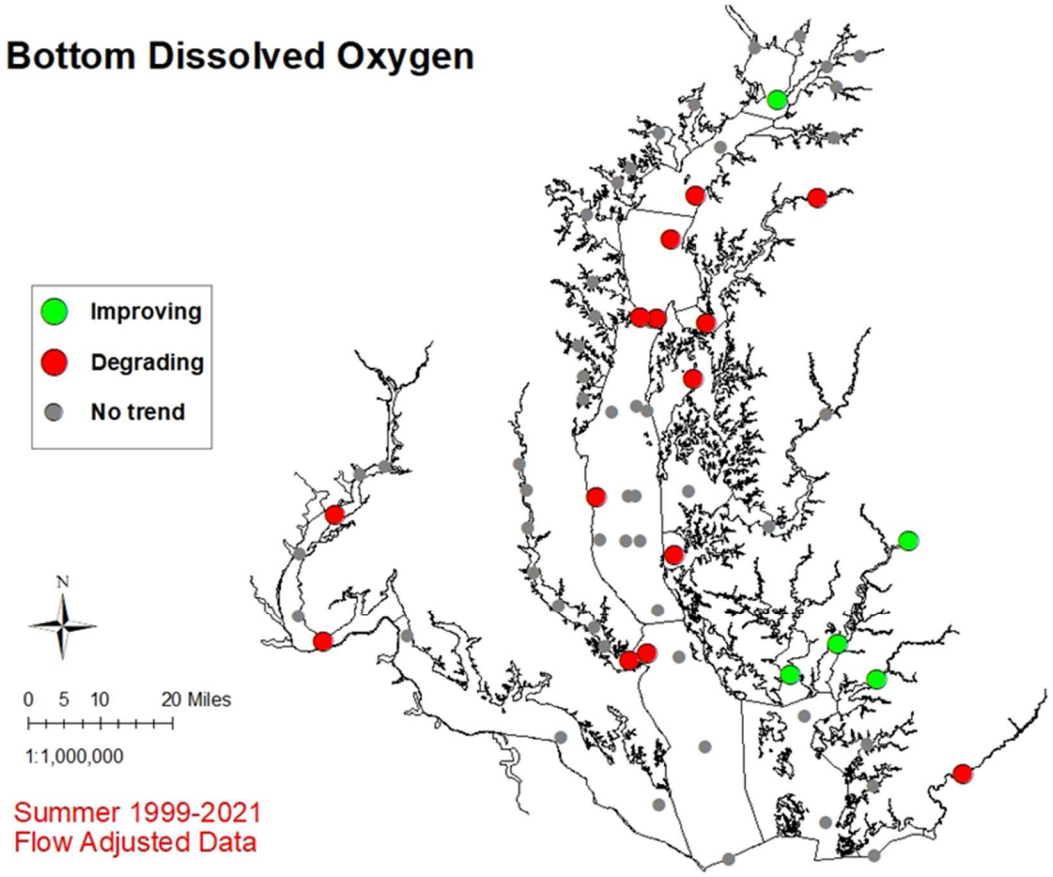

Figure 8. Trends in flow-adjusted bottom dissolved oxygen concentrations 1999–2021.

- 7% of stations (5 of 71) have improved dissolved oxygen levels compared to 1999.
- 20% of stations (14 of 71) have degraded dissolved oxygen levels compared to 1999.
- 73% of stations (52 of 71) do not have dissolved oxygen levels that are significantly different from 1999.

Submerged aquatic vegetation (SAV) is a key indicator of Bay health since it quickly responds to improvements in water quality. As such, sustaining and increasing the habitat benefits of SAV is a vital Bay Agreement outcome. Maryland's SAV exceeded the state's 2017 target of 57,000 acres in 2016 and 2017, following several years of increased abundance (Figure 9). However, record high rainfall and stream flows into the Bay in 2018 and 2019 led to higher levels of nutrient and sediment pollution, changes in salinity, and poorer water clarity in many of Maryland's waterways. As a result, SAVn declined (Figure 9). After 3 years of weather-related declines, 34,991 acres of SAV were mapped in Maryland waters during the 2021 annual survey. This represents 44% of the state's 2025 restoration target of 79,800 acres.

Despite these record high rainfall and stream flows in 2018 and 2019, long-term monitoring has identified major reductions in polluted runoff entering the Bay as a result of Maryland's Bay

restoration activities. Substantial SAV increases have occurred in areas with long-term reductions in nutrient loads entering the Bay. Continued nutrient and sediment reduction actions are expected to result in greater SAV resilience despite increased symptoms of climate change.

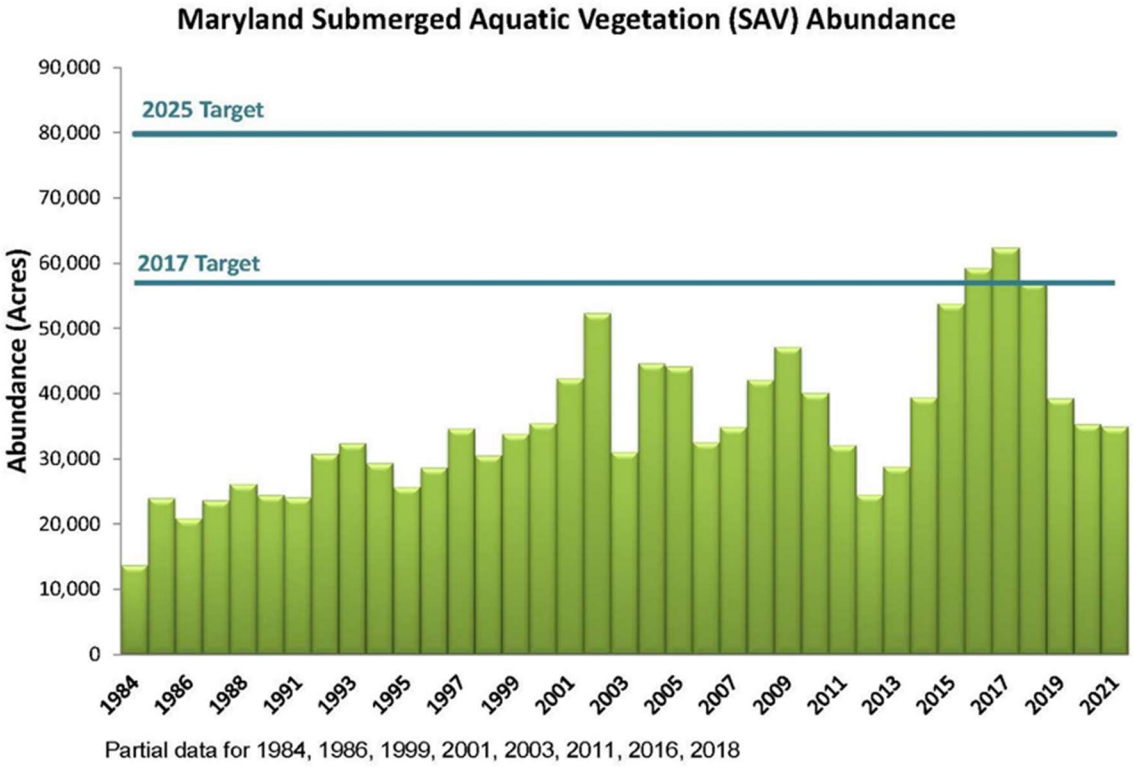

Figure 9. Total abundance of SAV in Maryland's portion of the Bay and tidal tributaries, 1984–2021. (2021 data is preliminary and subject to change.)

Water clarity, chlorophyll *a* and suspended solids are major factors for understanding the amount of light available for SAV. Tidal water clarity (Figure 10) has worsened at many stations, especially in the mainstem Bay. Chlorophyll *a*, an indicator of algal concentration (Figure 11), has improved in upper portions of the larger rivers and in some of the smaller rivers, but has worsened in the middle portions of the larger rivers.

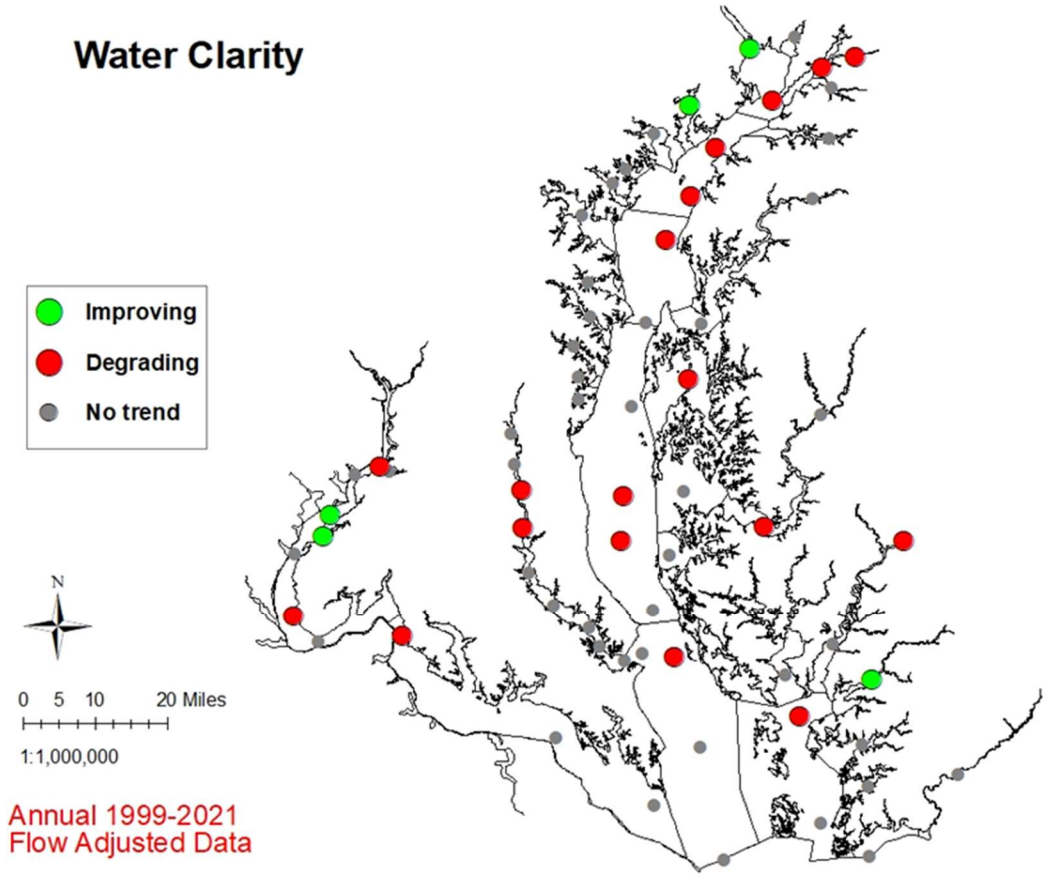

Figure 10. Trends in flow-adjusted water clarity concentrations 1999–2021.

- 8% of stations (5 of 66) have improved water clarity compared to 1999.
- 27% of stations (18 of 66) have degraded water clarity compared to 1999.
- 65% of stations (43 of 66) do not have water clarity that is significantly different from 1999.

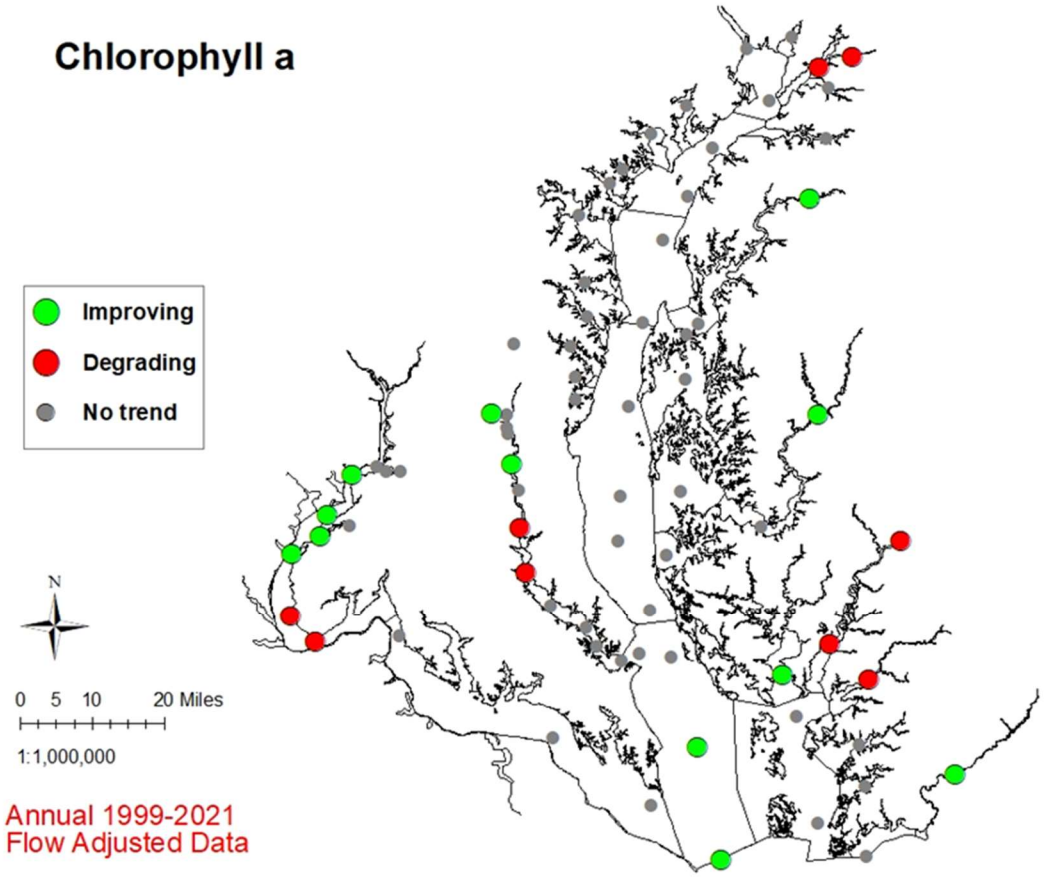

Figure 11. Trends in flow-adjusted chlorophyll *a* concentrations 1999–2021.

- 17% of stations (12 of 73) have improved chlorophyll *a* levels compared to 1999.
- 12% of stations (9 of 73) have degraded chlorophyll *a* levels compared to 1999.
- 71% of stations (52 of 73) do not have chlorophyll *a* levels that are significantly different from 1999.

Climate change has increased surface water temperatures throughout the non-tidal and tidal waters; 83% of stations have an increase in surface water temperature since 1999 (Figure 12). Water temperature is 1 degree F or more warmer at 67% of the non-tidal and tidal stations (Figure 13). Increased temperatures can cause negative changes in water and habitat quality. Water temperature determines what areas plants and animals can live in and which species will thrive or disappear from an area. In addition, warmer water holds less dissolved oxygen, further impacting habitat conditions and making the goal of providing more areas with suitable oxygen for fish, crabs and other Bay organisms more difficult. Implementing practices such as forest buffers and stormwater infiltration will help address rising temperatures while also reducing nutrients.

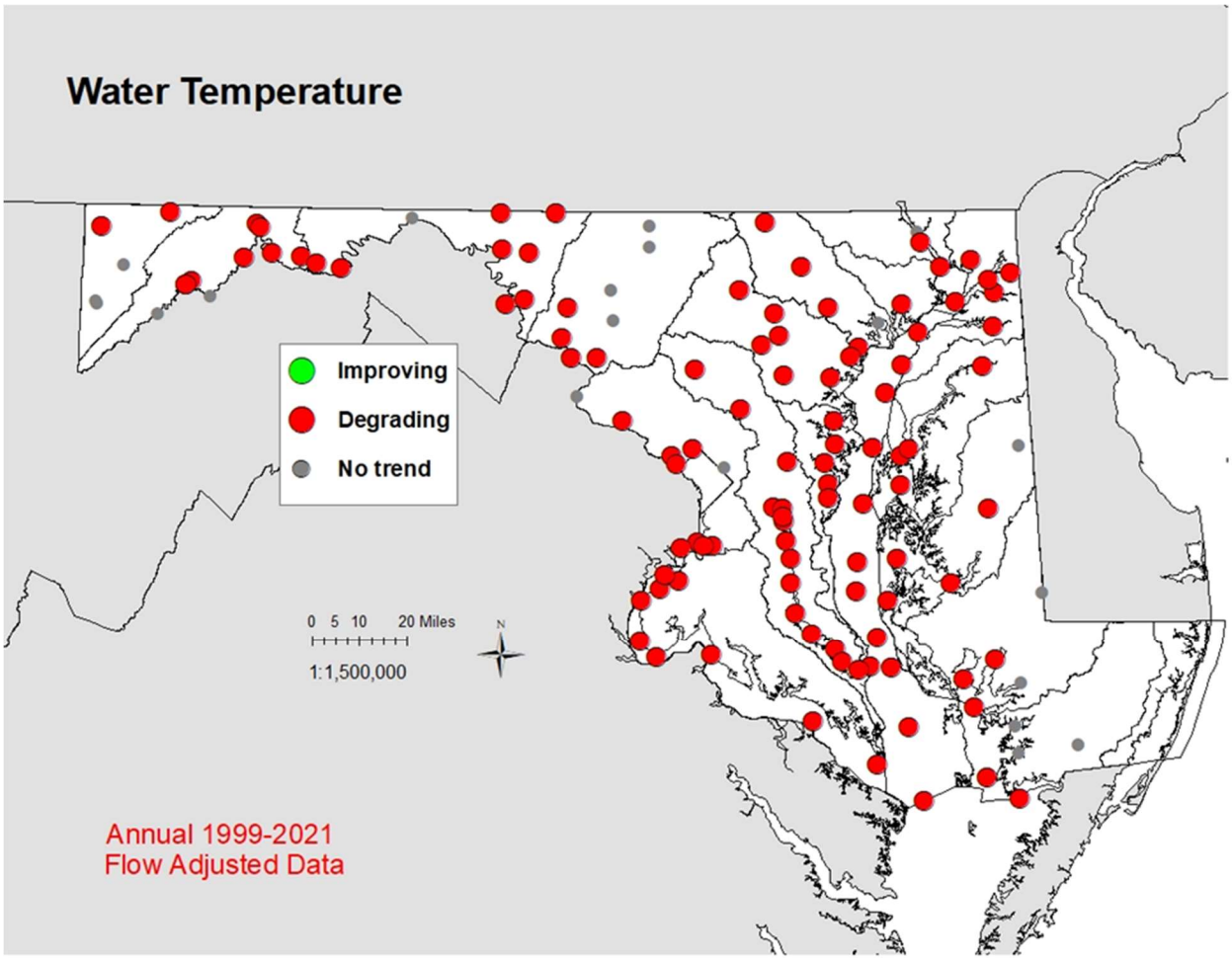

Figure 12. Trends in flow-adjusted surface water temperature 1999–2021.

- 0% of stations (0 of 125) have cooling surface water temperatures compared to 1999
- 83% of stations (104 of 125) have warming surface water temperatures compared to 1999
- 17% of stations (21 of 125) do not have surface water temperatures that are significantly different from 1999

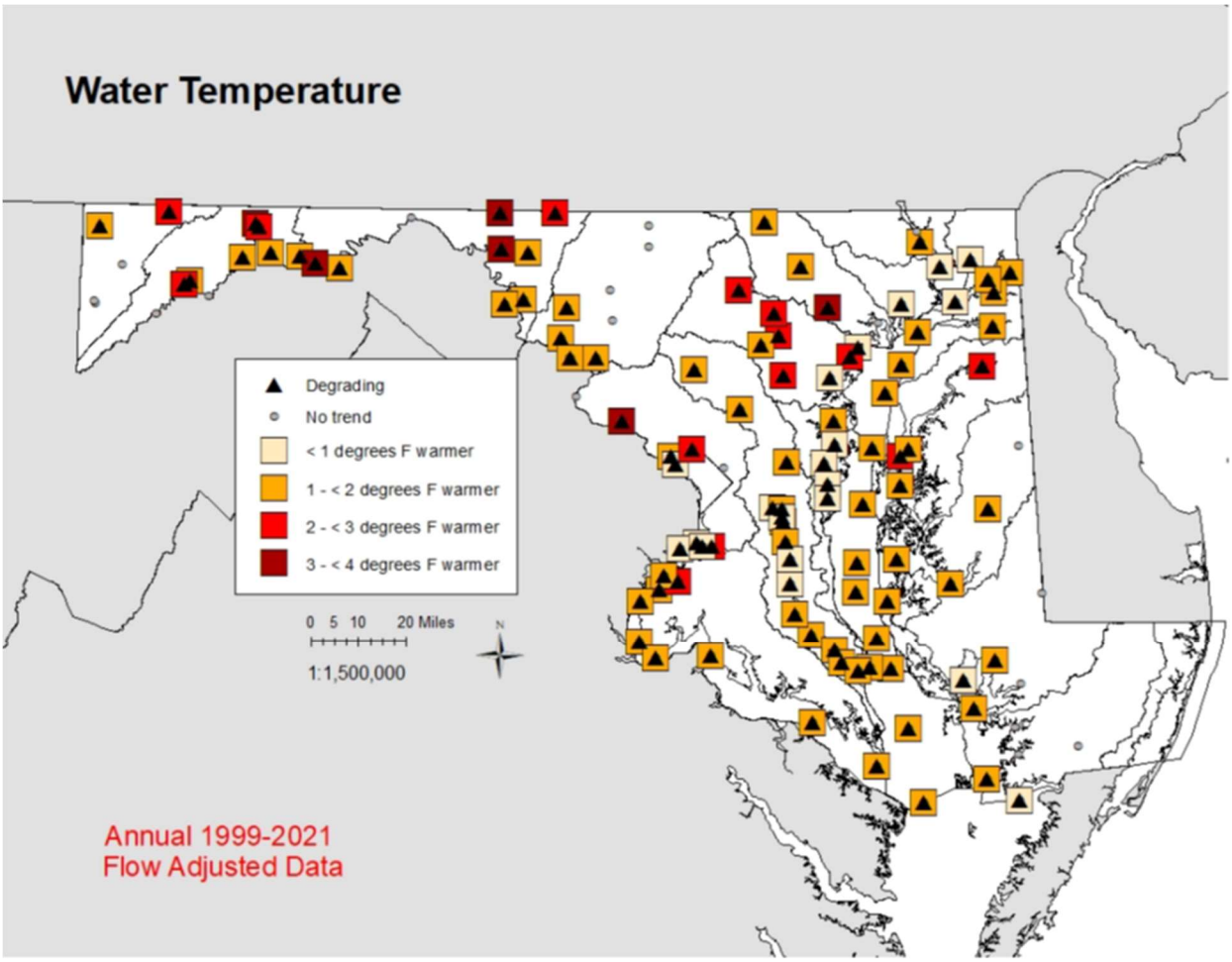

Figure 13. Magnitudes of change in surface water temperature 1999–2021.

- 16% of stations (20 of 125) are less than 1 degree F warmer
- 50% of stations (63 of 125) are between 1 and less than 2 degrees F warmer
- 12% of stations (15 of 125) are between 2 and less than 3 degrees F warmer
- 5% of stations (6 of 125) are between 3 and less than 4 degrees F warmer

Part II - Where We Still Need To Go: Maryland's Framework for Bay Restoration 2021 - 2025

The Phase I and Phase II WIPs effectively established the pollution targets, responsibilities, and initial strategies for achieving the required pollution reductions. The Phase III WIP (completed in 2019) uses lessons learned from Phase I and Phase II to refine those strategies, and identify the next steps to ensuring that the necessary policies, regulations, incentives, and financing structures are in place to achieve restoration success in the long term (2025 and beyond). This section of the report summarizes those strategies.

The following framework focuses on the necessary role of the state and the associated policies and financing resources needed for a successful restoration effort. Achieving pollution reduction targets will require the resources and engagement of multiple stakeholders and entities, public and private, working in concert over the coming years. Due to the Bay's importance to our culture, identity and economy, Maryland has a unique leadership role in its restoration. EPA leadership is also critical for holding all jurisdictions accountable and responsible for achieving and maintaining their final pollution targets. The following framework is intended to address Maryland's capacity to lead the restoration effort subject to several key technical parameters.

A. Background–Pollutant Source Sector Status

Under the Phase III WIP, which includes CAST 19 model changes, the state plans to reduce its pollution to the Bay by more than 9 million pounds of nitrogen and about 0.1 million pounds of phosphorus from 2017 levels. These reductions will come primarily from the wastewater and agricultural sectors. Loads from the urban stormwater and septic sectors are anticipated to remain the same, with reductions from implementation being offset by loads from new growth.

1) Wastewater

In SFY21, wastewater represented about 11% of the nitrogen load in Maryland, and reductions in this sector—from 14.5 million pounds per year in SFY10 to 8 million pounds per year in SFY21—represent a true water quality financing success. The combination of firm, enforceable regulations coupled with a dedicated and consistent revenue stream from the BRF, has resulted in pollution reductions in the wastewater sector, and has provided room for future growth.

As of 2018, BRF upgrades to Maryland's 67 major WWTPs to ENR have been fully obligated. As of September 2022, 65 upgrades of significant municipal plants were completed, with one under construction, and one in the planning phase. Minor WWTPs (less than 0.5 million gallons

per day) are also being upgraded using the BRF on a voluntary basis, and when the upgrade is cost-effective. As of September 2022, 10 upgraded minors were in operation, seven were in construction, and 18 were in design or planning stages.

With the substantial investments in advanced treatment systems at its municipal wastewater plants, the state is now considering ways to ensure that plants will fully utilize these technologies. The state has developed several performance incentive programs, such as the Wastewater Operations and Maintenance (O&M) Grant through the BRF, to ensure that the wastewater sector surpassesthe statewide annual average operational goal, established in the Phase III WIP, of 3.25 milligrams of nitrogen per liter in plant effluent. A statewide annual average concentration of 2.85 milligrams of nitrogen per liter is required to meet the recently assigned additional nutrient load reductions needed to address 2025 climate change conditions, as explained in the climate change addendum to Maryland's Phase III WIP.

The SFY20 aggregate average municipal wastewater nitrogen concentration was 2.9 milligrams per liter, down from 7.5 milligrams per liter in SFY10. In SFY21 the aggregate average nitrogen concentration was 4.17 milligrams per liter. The concentration increase compared to 2020 was due to poor performance at Maryland's two largest WWTPs. Inspections conducted at Baltimore City's Patapsco River and Back River WWTPs in 2021 found them to be in significant noncompliance. In January 2022, the Office of the Attorney General filed suit on behalf of MDE requesting that the Baltimore City circuit court require the city to stop discharges of pollutants from the plants that are not authorized by an MDE permit and to take all steps necessary to come into permanent and consistent compliance with the applicable environmental law. In March 2022, MDE directed MES to take charge of operations at Back River, to ensure that the city operates the plant in compliance with all terms of its discharge permit and ceases all illegal discharges. Recent analyses indicate that the Back River plant has been meeting the nutrient limits in its permit. MDE is committed to ensuring that both facilities have a clear path to achieving compliance with their permit limitations, and ensuring that Maryland is on track to achieve its 2025 wastewater sector goals. Websites maintained by MDE on the Back River and Patapsco WWTPs provide up-to-date information.

Maryland's Phase III WIP and its climate change addendum assume that WWTP performance will exceed permit requirements, and expect that plants will not be operating at full design capacity by 2025. This should result in plant loads that are well below the allocations established in the Bay TMDL and compensate for the slower pace of reductions in the septic and stormwater sectors through 2025. As WWTPs approach design capacity as a result of population growth, it will be critical for continued reductions to occur in the other sectors, and to increase the transfer of loads from other sectors to the Natural sector using nature-based practices. Continued optimization and use of the Wastewater BRF O&M Grant are priority strategies for achieving the aggregate average wastewater operational goal.

2) Agricultural Lands

In SFY22, nutrient loads from agricultural lands accounted for about 44% of the nitrogen loads in Maryland according to 2021 progress results. Implementing nutrient management plans, soil conservation and water quality plans, planting cover crops, and maintaining buffers continue to be significant nutrient and sediment reduction practices for load reduction. Programmatically, MDA is continually evaluating opportunities within the MACS Program to accelerate adoption of high priority conservation practices. In SFY22, the cost-share ceiling was increased from $50,000 per project to $75,000, and flat rates for materials to construct projects were increased up to 30% to offset rising costs associated with the COVID-19 pandemic. Enhanced technical and financial assistance opportunities are also being explored for equine, small farm, and urban agriculture operations to ensure equitable program access for all Maryland farmers. The Tree Solutions Now Act of 2021, established an additional $1,000 per acre signing bonus for riparian forest buffers, and riparian forest buffers through the CREP increased by 37.5 acres to 91.3 acres, a 70% increase from 2021.

After a successful pilot year in SFY21, MDA opened a second round of applications for the Conservation Buffer Initiative to accelerate the adoption of riparian buffers through more flexible terms for management and contract length. Through the program, MDA expects nearly 415 additional acres of buffers to be planted.

Additionally, the administration's Agricultural Phosphorus Initiative, which is providing solutions through implementation of the Phosphorus Management Tool (PMT), is now in full effect. Farmers with soil phosphorus levels of 150 or greater (Fertility Index Value) are now required to follow PMT guidelines. A second round of soil phosphorus reporting was initiated in SFY22, with 1,036,211 acres reported statewide to-date. The department continues to prioritize support for those farms affected by PMT with manure transport assistance and the Animal Waste Technology Fund.

With the combination of agriculture initiatives, the sector anticipates meeting its sediment and phosphorus goals by 2025, including continuing to address and develop strategies to minimize the impact of legacy phosphorus concentrations. Moreover, Maryland farmers are being asked to further reduce nitrogen by 4.1 million pounds by 2025. Accomplishing this goal by 2025 will depend on the combination of technical assistance, provided by Maryland's SCDs and other conservation partners, coupled with state and federal financial incentives. Farmers rely on the technical expertise provided by SCDs to ensure resource concerns are being addressed, and to assist them in navigating various state and federal programs. MDA will continually evaluate best options to meet the needs of Maryland farmers, growers and producers.

Providing technical assistance to farmers remains a high priority of Maryland and all Bay jurisdictions. MDA's Office of Resource Conservation received 53 new permanent positions funded through the Trust Fund to help meet the agricultural technical assistance needs. Recruiting and training of new staff has been a priority during SFY22, and MDA was successful

in hiring 37 new field-based staff. The remaining 16 positions were under recruitment as of June 30, 2022, and efforts will continue into SFY23.

3) Urban Stormwater

In SFY21, urban stormwater represented around 19% of Maryland's nitrogen loads to the Bay. Compared with the nutrient reductions from the state's farms and WWTPs, the pace of progress in reducing urban stormwater loads is more gradual since stormwater does not generally contain as many nutrients as other sectors. Controls to address stormwater pollution also cannot be rapidly deployed because they include longer planning and implementation horizons to scale up. Over the longer-term stormwater pollution is a critical piece of Maryland's plan for restoring the Bay and its non-tidal waters.

As opportunities for reductions on agricultural land become exhausted, and as wastewater plants reach capacity, urban stormwater will make up an increasing portion of the loads, and the potential nutrient reductions in the state. With population growth beyond 2025, and with additional reductions required to meet climate change reduction goals and Conowingo Dam infill, it may be impossible for the state to meet and maintain its targets. The result of these factors is that stormwater implementation will not account for a large portion of the 2025 nutrient reductions, but it will need to make continued, steady progress to and beyond 2025.

Implementing stormwater practices poses numerous challenges, including the decentralized nature of SWM, where practices must be constructed throughout the watershed instead of at a single, centralized location, and the significant amount of time that must be spent in planning, design, and permitting. One major hurdle faced throughout the Bay watershed is the cost of installing these practices. In the 2019 University of Maryland Center for Environmental Science (UMCES) study, "Cost Analysis of Stormwater and Agricultural Practices for Reducing Nitrogen and Phosphorus Runoff in Maryland," indicated the cost of reducing a pound of nitrogen through stormwater practices ranges from $384 per pound to over $10,000 per pound, with a mid-range practice costing around $1,500 per pound. In contrast, the median cost of reducing a pound of nitrogen through WWTPs upgrades is about $40 per pound, with further reductions using BRF O&M grant incentives estimated as low as $10 per pound.

Recognizing the necessity of SWM in maintaining Maryland's nutrient caps, while also understanding the price tag of implementation, the state is looking to optimize the cost-benefit relationship. This can be done not just by minimizing the cost of implementation, but also by maximizing the potential environmental impact — particularly by looking at effects beyond just nutrient reductions. Maryland's non-tidal streams, for example, are commonly impacted by sediment, flow-related stressors, temperature and channelization. In many cases these sorts of impairments cannot be addressed by any means other than managing urban runoff. Practices that address stormwater runoff may also be designed to address water quantity, such as by mitigating the impacts of flooding and other factors driven, in part, by climate change. These additional, non-nutrient impacts are referred to as co-benefits, and are a major focus of the Phase III WIP. By stacking multiple benefits and co-benefits, state and local governments can

ensure that each dollar spent has a far-reaching impact. As this co-benefit framework guides the implementation process, watershed managers should be planning in a way that focuses on multiple objectives, rewarding long term planning rather than just meeting a near term goal.

Over 80% of impervious surfaces in Maryland are covered under stormwater National Pollutant Discharge Elimination System (NPDES) permits. The state has reissued NPDES Municipal Separate Storm Sewer System (MS4) Permits for the regulated Phase I large jurisdictions and will be reissuing permits for the Phase I Medium jurisdictions and the Maryland Department of Transportation (MDOT) State Highway Administration (SHA). These permits require nutrient reductions associated with 20% impervious area restoration over the current 5-year permit cycle with an additional 10% restoration required for the next permit cycle. Phase I permittees that did not meet their restoration requirements have been required to pay penalties and operate under a legally enforceable consent order. The Phase II MS4 general permits for small municipalities, and for state and federal facilities took effect in October 2018, and require 20% of permittees' impervious areas to be restored by 2025.

MDE has been working with both the regulated community and stakeholders on the next generation of Phase I MS4 permits to ensure a robust restoration pace in the stormwater sector while addressing local priorities and implementation challenges. MDE issued final permits for Anne Arundel, Baltimore, and Montgomery counties, as well as Baltimore City, on November 5, 2022. At that time, MDE also issued its plan for advancing stormwater resiliency to adapt to climate change impacts. Prince George's County entered into a consent decree with MDE to finish the requirements of its previous permit and to continue work to meet the goals established in their new permit.

The department began issuing these permits in early 2020 and anticipates that, on average, the next generation Phase I permits will achieve 2% restoration each year for a total of 10% restoration over a 5-year permit cycle. Nutrient trading regulations have also been promulgated, which allow the purchase of lower-cost nutrient reduction credits by the stormwater sector to accelerate nutrient reductions to the Bay. In addition, recognizing the need for a consistent and efficient restoration project permit review process, the department worked with the U.S. Army Corps of Engineers to develop flexible permitting for restoration projects designed to provide ecosystem improvement.

Finally, MDE is also currently working with a stakeholder consultation group to help modernize Maryland's stormwater program by incorporating precipitation projections into design standards. Warming temperatures increase evaporation, evapotranspiration and also the amount of rainfall that can be held in the atmosphere. This warming effect increases both precipitation amounts and the frequency of extreme precipitation events. Maryland will likely be proposing new standards to increase stormwater capture and reduce pollution runoff to the Bay while providing other important public safety and ecosystem co-benefits. MDE staff are also looking at watershed-wide flooding data that can identify other factors, like undersized stormwater conveyance, that contribute to local flooding. More information on Advancing Stormwater Resiliency in Maryland (A-StoRM) can be found here.

4) On-Site Septic Systems

The septic sector contributes about 3% of Maryland's nitrogen load to the Bay. Similar to the urban stormwater sector, reductions from the septic sector are slower than those from wastewater and agriculture. Implementation in this sector faces many of the same challenges as the urban stormwater sector, with dispersed sources and significant costs for implementation. The 2019 UMCES cost study referenced above found that nitrogen reductions from septic practices cost between $130 and $330 per pound—lower than stormwater, but higher than agriculture or wastewater.

As with the urban stormwater sector, the state is looking for ways to increase the impact of this implementation by seeking practices that offer multiple co-benefits. In the case of septic systems, two of the most significant direct benefits, apart from nitrogen reductions, are public health and groundwater protection. Toward this end, the state agencies are pursuing "high-benefit" reductions in places with impacts to public health and drinking water quality. Additional strategies include accelerating the pace of septic connections to sewers in high-benefit areas to take advantage of the significant investments Maryland has made in ENR treatment at Maryland's WWTPs. By maximizing the potential impact to public health and groundwater protection, these projects are also more likely to address needs of Maryland's disadvantaged communities where those concerns are more prevalent.

The state will continue to fund the upgrade of septic systems to BAT, targeted to failing and other systems in the Critical Area, and address about 1,000 systems per year. In 2018, the legislature passed a bill establishing a new incentive for the proper operation and maintenance of septic systems. The bill authorizes financial assistance through the BRF to eligible homeowners in jurisdictions with a septic stewardship plan, to pump out septic tanks at least once every 5 years. As with the urban stormwater sector, it is anticipated that implementation of septic practices will need to continue well beyond 2025 in order to meet TMDL goals.

5) Clean Air Act Role

Atmospheric deposition is a major nitrogen source in the urban environment, and air pollution reduction strategies brought about by the federal Clean Air Act (CAA) are a key driver of nitrogen reduction. Actions implemented from 2010 to 2020 through the CAA are expected to have resulted in 6.5 million pounds of nitrogen reduction in the Bay. Credit for federal programs is applied across the watershed, rather than being given to any specific state, however through its Phase III WIP, Maryland has been investigating the potential for nitrogen reductions from state programs that it is implementing toward non-federal goals, such as climate change.

In addition, the state is pushing for tighter controls on nitrogen oxide emissions from upwind states (Pennsylvania), such as in its 2016 CAA Section 126 petition to EPA, and its 2019 petition to the Ozone Transportation Commission. While these would not result in WIP credit for

Maryland, they could drive a significant air and water quality improvement for the Bay. Maryland is working closely with the CBP to ensure modeling tools account for these important reductions.

6) Conowingo Dam

When the TMDL was first published in 2010, it was estimated that Conowingo Dam would be trapping sediment and associated nutrients through 2025. New science has determined that this is not the case, and that the reservoir behind Conowingo Dam has reached capacity. As a result, more nitrogen, phosphorus and sediment are now entering the Bay than were estimated when the TMDL was written. This additional pollutant load (estimated at 6 million pounds total nitrogen and 260,000 pounds total phosphorus) must be addressed if we are to meet the Bay's water quality standards. In July 2022, the CBP partnership approved a phased approach to CWIP implementation that goes beyond 2025. This allows Conowingo jurisdictions (Maryland, Pennsylvania and New York) the flexibility to participate in the collaborative CWIP to achieve their share of the Conowingo nutrient reductions, or otherwise reduce their assigned loads in their jurisdictional WIPs.

Maryland has a three-pronged strategy to address pollution loads and ecosystem impacts form Conowingo Dam, including:

- Collaborating with Pennsylvania and New York on CWIP Implementation to reduce the increased nutrient loads to the Bay from Conowingo infill;
- The settlement agreement with Exelon to reduce pollution loads, increase resiliency, and help restore ecosystems and aquatic life in the Susquehanna River Basin watershed; and,
- Exploring Conowingo Reservoir Environmental Dredging and Reuse through an Innovative and Beneficial Reuse Pilot.

For CWIP implementation, Governor Hogan put $25 million in the SFY23 State Budget for CWIP Implementation. These monies are being planned to go through the Susquehanna River Basin Commission (SRBC) for pay-for-performance projects that help reduce nutrient loads to Bay from Conowingo Pond filling with sediment. Maryland will oversee and provide policy direction to the SRBC in selecting Conowingo projects with the main goal of achieving the most cost-effective nutrient reductions.

The Conowingo settlement agreement requires Constellation Energy to invest more than $200 million in environmental projects and operational enhancements to improve water quality in the Lower Susquehanna River and the Bay. The restoration actions include:

- Improvements to downstream flow to help fish migrate up the river and past the dam;
- Restoring lost ecosystem services such as the filtering of pollution by freshwater mussels and oysters as well as funds to implement other projects upstream to reduce nutrient loads from the Susquehanna River;

- Improving upstream fish passage to advance efforts to restore lost fisheries for American shad and river herring, species which were blocked for many decades from moving upstream to spawn.
- Improving the resiliency of the river to climate change, including SAV restoration and living shoreline construction.

To further explore environmental dredging as a Conowingo Dam solution, Maryland funded a $3.3 million Conowingo Sediment Characterization and Innovative Reuse and Beneficial Use pilot to provide Maryland with better information on the quality of sediments behind the dam, dredging costs, dredged material reuse options, scalability, and feasibility for addressing Conowingo's pollution impacts. In SFY23, Governor Hogan also budgeted $6 million to do the preliminary engineering, design, public outreach and agency coordination needed in advance of a larger Conowingo dredging and reuse project. At the same time, Maryland is working through the CBP partnership to evaluate the science behind how much Bay pollution a strategic dredging program could reduce.

The innovative financing and BMPs envisioned in these Conowingo solutions present some of the greatest opportunities to modernize and accelerate Bay restoration. By leveraging pay-for-success financing, targeting BMPs in the most effective areas of the watershed, pushing development of new BMPs and science, and collaborating across jurisdictions to address pollution, Conowingo is helping to create new restoration approaches across the watershed. To ensure success, Maryland must continue to lead Conowingo efforts within the CBP partnership, and provide continuity across administrations in funding and prioritization.

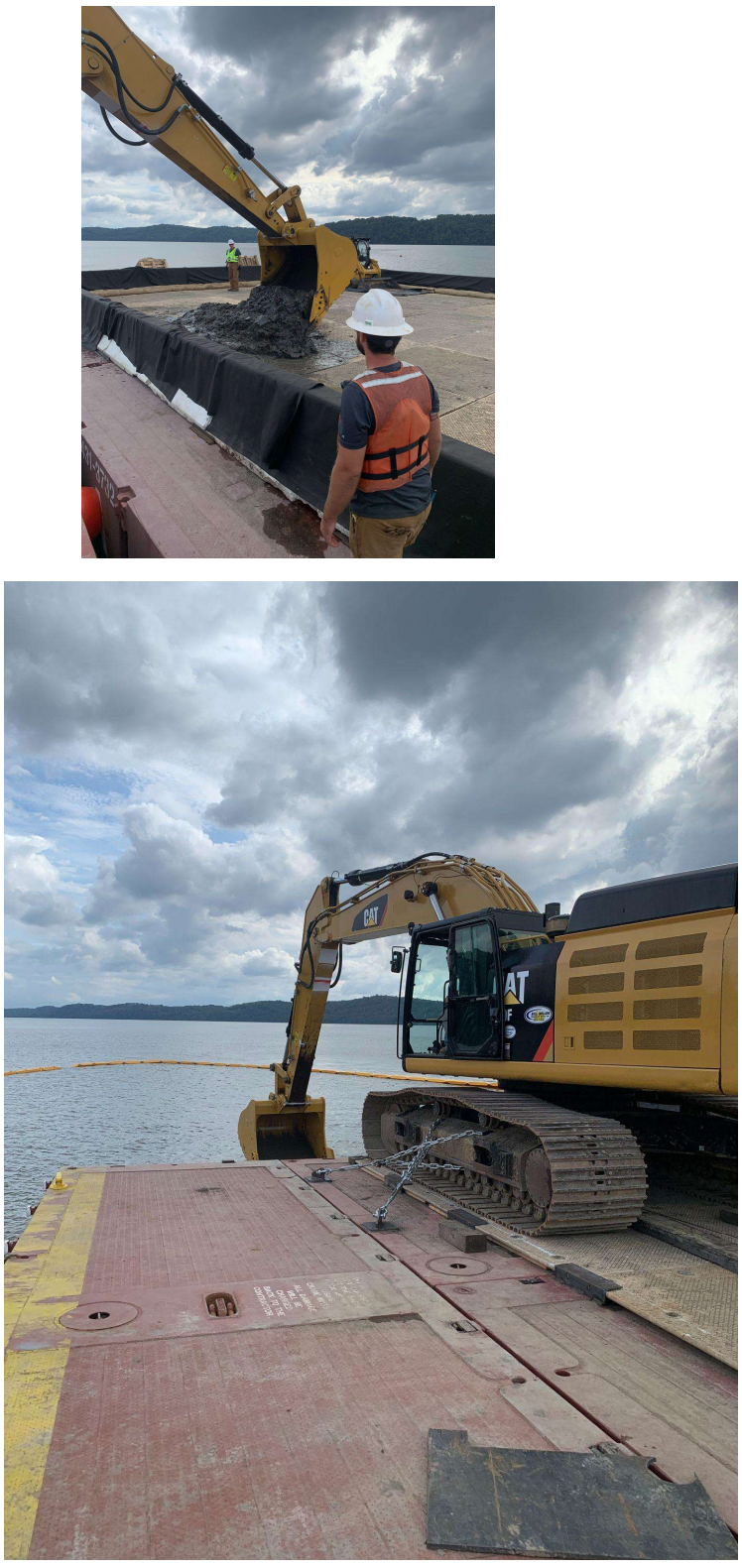

Figure 12: Dredging component of Maryland Innovative Reuse and Beneficial Reuse Pilot.

7) Climate Change

The Bay region is projected to experience changes in temperature, sea level, and precipitation as a result of climate change (Najjar, et al. 2010; Johnson et al., 2016). These changes are expected to affect nutrient and sediment loads to the Bay, and in turn, affect the Bay's health (Sinha et al., 2017, Wang et al., 2017; Irby, et al. 2018; Herman, et al. 2018; Linker, et al., 2018).

The Bay TMDL and the Phase I, Phase II, and Phase III WIP planning targets were established based on 1995 climate conditions. In March 2018, the CBP Principal Staff Committee (PSC), who represent the Bay-state governors and the mayor of D.C., agreed that the Bay jurisdictions' Phase III WIPs would include a narrative strategy to address changes in climate between 1995 and 2025. As part of the same decision, the PSC agreed to refine the climate modeling and assessment framework based on improved understanding of the science of the impacts of climate change.

CBP further committed to adopting revised numerical climate change targets by 2021 using updated versions of the CBP's modeling tools. Changes were made to model inputs of rainfall, air temperature, wetland area, sea level rise, and ocean temperature and salinity. Watershed delivery of nitrogen, phosphorus, and sediment were modeled using improved processes to capture the effects of climate changes on watershed loads. At its December 2020 meeting, the PSC approved the recommendation that jurisdictions will be expected to address additional nutrient loads due to 2025 climate change conditions in a Phase III WIP addendum and/or 2-year milestones beginning in 2022. EPA expected each jurisdiction to also submit a Bay model scenario that numerically demonstrates that the additional nutrient load reductions will address 2025 climate change conditions. According to the CBP, sediment targets for 2025 climate change conditions will be developed after the overall modeling scenario addressing 2025 climate change is finalized.

Preliminary estimates for the climate impact through 2035 indicate a doubling of the 2025 load effect. The effect of climate change on our ability to meet the Bay's water quality standards is a significant and increasing concern. The CBP partnership has committed to continue improving understanding of climate effects and reassess its impact to Bay water quality in 2025. Maryland also is investing in tangible climate mitigation efforts through new legislation and funding, including the implementation of the 5 Million Trees goal from the Tree Solutions Now Act of 2021, and addressing emissions through the Climate Solutions Now Act of 2022. The Tree Solutions Now Act of 2021 brought an equity focus to the tree planting effort by requiring at least 10% in urban underserved areas and focusing $10 million of the $15 million in funding there. These bills will help accelerate progress toward riparian forest buffers, urban tree canopy, and other upland tree planting, and contribute to further declines in airborne nutrient contributions.

Maryland had already committed to additional nutrient load reductions beyond its Phase III WIP targets, equal to an additional 1.142 million pounds of nitrogen per year and 0.111 million pounds of phosphorus per year. **The 2017 model used by CBP to evaluate Maryland's**

Phase III WIP indicated that the nitrogen load reduction achieved by implementing the WIP would provide a surplus of 1 million pounds of nitrogen and 0.44 million pounds of phosphorus beyond the EPA target. These additional reductions not only provided Maryland with a margin of safety, but more importantly, provided a surplus that could be applied toward achieving climate change allocations. Moreover, 2019 science updates to the Bay model indicated that Maryland's required Phase III WIP targets are only exceeded by about 0.394 million pounds of nitrogen and to 0.33 million pounds of phosphorus. Therefore, the Phase III WIP pollution reduction surpluses that were planned for were not sufficient to offset the additional climate change nutrient load reductions assigned to Maryland in 2020. Maryland was facing a nitrogen load reduction deficit of about 750,000 pounds per year, but still had a surplus reduction of about 218,000 pounds of phosphorus. Maryland submitted an addendum to its Phase III WIP detailing its climate allocation strategy, which focuses on a viable solution to address the nitrogen reduction gap caused by the combination of Bay model updates and Maryland's additional nitrogen reductions required to offset impacts from 2025 climate conditions. Maryland's primary strategy relies on further improvements in the performance of the state's WWTP operations.

8) Accounting for Growth in Loads

Maryland is expected to grow by approximately 14,100 households per year through 2045, resulting in increased nutrient pollution (Planning, Projections and State Data Center, October 2021). Overall, Maryland projects that expected load reductions under the Phase III WIP will overcompensate for new loads from development and increased agricultural animal populations beyond 2045. The latest analysis indicates that development has been occurring inside the locally designated priority funding areas , areas where sewer and water infrastructure exists. The rate has increased 12.4% from the period 1999-2012 (71.3%) to a new high of 83.7% between 2013 and 2021.

In developing the Phase III WIP to meet 2025 pollution reduction targets, the PSC agreed in December 2017 to use 2025 projected conditions to account for growth impacts on land use and populations. Consequently, Maryland's Phase III WIP strategies have already accounted for projected 2025 growth in calculating each sector's load reduction.

CBP allowed Bay jurisdictions to modify the future land use scenarios for projecting 2025 growth conditions to reflect existing and proposed conservation and protection efforts, such as agricultural and forest conservation, and growth management (e.g., local zoning). Due to the fact that Maryland and local governments have many existing land use conservation, preservation and protection programs in place, the state included these programs in a Conservation Plus scenario and incorporated it into the Bay model. This process allowed Maryland to take credit for the nutrient load reductions from these programs. Moving forward, Maryland will work with CBP to develop periodic comparisons of projected increases in sector loads to actual increases in sector loads. When actual increases exceed projected increases, Maryland will assess whether and when additional BMP implementation is needed to compensate.

B. Maryland's Guiding Principles for Bay Restoration

The phased watershed planning and implementation approach for Bay Restoration is designed to be adaptive and allow jurisdictional flexibility based upon lessons learned throughout the implementation process. During development of the Phase III WIP, Maryland evaluated each pollution sector's progress in coordination with local governments and stakeholders responsible for on-the-ground implementation. We also reassessed Maryland's guiding principles for restoration to determine their continued applicability, effectiveness, as well as alignment with larger administration priorities and approaches for achieving and maintaining our 2025 restoration goals.

Prior to development of the Phase III WIP, Maryland's Bay Restoration framework was informed by the University of Maryland Environmental Finance Center (EFC) assessment of, a) Bay Restoration progress to date, b) necessary future progress to meet the 2025 goals, and c) available resources. The EFC's findings indicated "that the resources are in place to achieve interim and final restoration targets. In other words, no new state-based fees or taxes are required moving forward." The EFC's conclusion that Maryland had sufficient financial resources to achieve its interim and final pollution reduction targets were predicated on three caveats:

1. The state applies its expected excess WWTP allocation (i.e., urban growth capacity) today to offset expected shortfalls in the stormwater and septic sectors, and then builds the capacity for growth back into the system;
2. Assume that the current level of regulation will be maintained within each of the four pollution sectors, and that enforcement will be consistent and effective; and,
3. Current state Bay grant programs are fully funded and applied in the most cost-effective manner possible.

While the conclusions, caveats, and recommended next steps of the EFC assessment were valuable and remain largely applicable today, they were based on an earlier version of the watershed model, different (Phase II) pollutant reduction targets, and an older suite of BMPs and associated efficiencies. Furthermore, the assessment did not take into account the impacts of climate change and Conowingo Dam, as they were not identified at that time. As a result, and building upon the solid foundation of the EFC report, Maryland developed an expanded set of Bay Restoration guiding principles that will both get us to 2025, and maintain those pollution reductions into the future.

There will be no single action that will bring us success. Instead, we will need to rely on a diversity of practices, constant vigilance to and grounding in sound science, and the willingness and ability to constantly evaluate, innovate, and adapt approaches as our understanding of the environmental, financial, and social landscapes constantly change. In recognition of these realities, Maryland's Phase III WIP identifies seven guiding principles to meet our 2025 goals, and sustain a restored Bay into the future that is balanced, achievable, and locally-driven:

1. Balancing regulations and incentives: Maryland has many regulatory tools under the federal CWA and state law that set numeric pollutant discharge limits, restoration conditions, or other requirements on the regulated community. Maryland also has significant pollution sources within the non-regulated community that play an essential role in achieving and maintaining our Bay Restoration targets. Consistent with the EFC findings, Maryland will continue to use a balanced approach of both effective regulations and financial incentives to drive restoration progress across sectors by prioritizing areas that achieve the most pollution reductions for each dollar invested. This will continue to be backed by robust and effective compliance and enforcement.
2. Using WWTP capacity wisely while driving long term and sustained progress in slower paced sectors: Accelerated pollution reductions from WWTPs and farms are the primary drivers of success in meeting our Bay Restoration targets. Consistent with the EFC report, Maryland continues to use its wastewater capacity to help attain our 2025 restoration goals. However, as Maryland's population grows, wastewater plant loads will increase from the growing use of public wastewater and must be offset by steady progress in reducing nutrient discharges from the stormwater and septic sectors.
3. Creating a restoration economy and driving innovation: In addition to traditional funding approaches, the Hogan administration is pursuing market-based strategies that are designed to stimulate a restoration economy and reduce costs. Examples of new approaches in place or currently under development include nutrient credit trading, the CWCA, the Conservation Finance Act (CFA), the CWIP and Innovative and Beneficial Reuse Pilot, public-private partnerships, improved alignment of greenhouse gas reduction goals with Bay Restoration goals, and new water reuse technologies.
4. Locally-driven restoration and co-benefits: Bay Restoration will not be successful without sufficient capacity and close collaboration with local partners. Additionally, the state is working with those partners to develop a strategic implementation plan for addressing local restoration challenges.
5. Accounting for and leveraging conservation and protection programs: Protecting Maryland's ecologically significant lands, aquatic resources, and wildlife is among the most effective ways to sustain Bay Restoration. Maryland is ensuring its Bay Restoration effort fully accounts for land conservation programs, while funding land conservation programs for future acquisitions.
6. Holistic ecosystem management: While Maryland's Phase III WIP is designed to be consistent with EPA's expectations and achieve the TMDL nitrogen, phosphorus, and sediment targets, Maryland is also committed to the broader goals outlined in the 2014 Bay Watershed Agreement, which include sustainable fisheries, vital habitats, reducing toxic contaminants, healthy watersheds, land conservation, stewardship, public access, environmental literacy, and climate resiliency. Maryland's commitment to this broader ecosystem management framework helps the state achieve its TMDL restoration targets while maintaining the productivity of the Bay's living resources and supporting local economies.
7. Accountability and adaptive management framework: Consistent with CBP's Accountability and Adaptive Management Framework, Maryland develops short term milestones that identify practices, programs, policies, and resources to be implemented

over 2-year periods. EPA and Maryland evaluate our progress toward achieving these milestone commitments, and then take appropriate actions to improve progress during the next 2-year period.

Another important component of Maryland's overall Bay Restoration strategy is to ensure other jurisdictions are doing their fair share and that EPA is holding all jurisdictions accountable to reducing their pollution loads. While Maryland and Virginia have reduced their annual nitrogen loads by a combined 59 million pounds since 1985, Pennsylvania has only reduced 12 million pounds, with 4 million of those coming since the establishment of the Bay TMDL in 2010. Under the Phase III WIP, Maryland and Virginia have 9 million pounds remaining to reduce, while Pennsylvania still has 37 million pounds to go. **Furthermore,** Pennsylvania's Phase III WIP, its plan for 2025, left it 10 million pounds short of its CBP 2025 pollution reduction goal. **In** light of Pennsylvania and New York falling short of their commitments, and EPA's failure to ensure that jurisdictions achieve and maintain their goals, Maryland, Virginia, D.C., Delaware, and others filed complaints in September 2020 to sue EPA. While Maryland's focus on the Bay is rightly directed toward the development, management and funding of its own environmental programs, the importance of a serious, sustained effort on the part of our CBP partners cannot be overestimated. Maryland and its partners' legal actions to hold EPA and all jurisdictions accountable are critical steps on this path. **New York submitted an amended WIP in May 2021. Pennsylvania subm**itted amended WIPs in December 2021, and July 2022. MDE continues to work with the other parties to ensure EPA uses all of their regulatory tools and backstop measures to address shortfalls in the Pennsylvania and New York WIPs as well as progress toward their respective TMDL goals.

The pandemic's impacts on the guiding principles for Bay Restoration are still playing out. COVID-19 was a confounding factor in the operation and maintenance failures at Patapsco and Back River WWTPs, and ongoing supply chain shortages continue to impact recovery. At the same time pandemic relief funding and the new BIL have injected unprecedented funding into water infrastructure and environmental restoration programs. The BIL increased Bay Program funding by almost $44 million/year over the next 5 years. The challenge with this increased funding is that much of it is directed to competitive grant programs. In order to effectively compete for this funding, local governments and implementers need to have the capacity to develop robust grant proposals and have the necessary resources (staffing, contractors, equipment and supplies) to do the work. Providing local implementers the technical support to compete for grant funding and creating workforce development programs that build the next generation of clean water professionals will be key to our continued success.

Part III - Maximizing Existing Resources: Cost-Effectiveness of State Funded Programs

The following section briefly describes how the respective lead state agencies are implementing each of the three primary Bay Restoration funding sources (BRF, WQRLF, and the Trust Fund) as well as a variety of other efforts underway to maximize the cost-effectiveness of our Bay Restoration efforts.

A couple of important principles relative to this section:

- Multiple Water Quality Objectives: Multiple objectives, or co-benefits, are being considered in Maryland's WIP. Beyond low-cost nutrient and sediment reductions to the Bay, other water quality impairments are also a key consideration in funding projects. For example, streams are commonly impaired by flow-related stressors, such as temperature and sediment. These flow-related stressors are effectively managed through stormwater control measures and practices that bridge rural and urban sectors, such as riparian forest buffers and soil health. Bacteria impairments found in Maryland's streams and tidal tributaries may be addressed through implementation in the septic sector. In looking at the cost effectiveness of a practice, Maryland is working on improving measures to quantify the significant non-nutrient impacts of practices. Furthermore, to promote more holistic projects and more strategically identify all the co-benefits of practices and their locations, the Trust Fund will incorporate the following co-benefits into project selection: restoration of aquatic resources, climate resilience, carbon sequestration, creation of wildlife habitat, local employment opportunities, recreational opportunities, and/or environmental justice benefits.
- Other Bay Agreement Outcomes: Beyond nutrient and sediment reductions, states are being asked to address other objectives of the 2014 Bay Watershed Agreement in their WIPs. A notable example is the need to install more resilient infrastructure and restoration practices in expectation of extreme weather to facilitate climate change adaptation. This can be more costly than the standard nutrient reduction alternatives that do not consider additional resilience. Similar issues of additional costs may be associated with striving to meet other Bay Agreement goals, rather than solely nutrient and sediment targets.

  One particular Bay Agreement Outcome that has received significant, renewed attention and focus is the Diversity Outcome, which seeks to increase engagement and participation by communities currently underrepresented in the Bay Restoration effort. In 2021, DNR established a partnership with the Chesapeake Bay Trust (CBT) with funding provided by EPA to launch the Capacity Building Organization-Capacity Building Initiative. This program will identify historically under-engaged community-based organizations that have not previously participated in two grant programs - the Watershed Assistance Grant Program and the Resiliency Through Restoration Initiative. Interested organizations will receive the technical assistance needed to develop robust

proposals to these grant programs. This initiative will enhance the state's capacity to achieve Bay Restoration goals and regulatory requirements by making the collective body of organizations pursuing restoration projects more inclusive. In April 2020, CBP formally accepted a "Diversity, Equity, Inclusion, and Justice" strategy to further progress toward that Outcome and, under Governor Hogan's leadership, the Executive Council signed a statement at their August 18, 2020 meeting reaffirming their commitment to increasing participation by underrepresented communities and charging the leadership with moving forward on implementation of the strategy. A draft implementation plan was released in fall 2021, providing a roadmap for achieving the recommendations outlined in the strategy. Maryland's Bay Cabinet agencies are currently exploring new opportunities to better engage these important stakeholders. One example is MDE's recent partnership with Moonshot Missions to build a Maryland Utility Peer-to-Peer network, which will provide supplemental technical assistance to water utilities in underserved communities with the goal to increase water sustainability, equity and affordability.

When considering the cost-effectiveness of Bay Restoration, it is also important to consider the return on investment (ROI) that a clean Bay provides, be it for boating, fishing, recreation, tourism, and increased opportunities for currently underserved communities within our watershed.

A 1989 report by the Maryland Department of Economic and Employment Development (now Labor) estimated the value of the Bay in excess of $33 billion annually and at a total value of $678 billion. The 2004 Bay Blue Ribbon Finance Panel estimated that in today's dollars, that value would now be in excess of $1 trillion. This 2004 report also cited estimates of $2 billion annually just for recreational boating activity in Maryland. As far as the costs of Bay Restoration, a Congressional Research Service Report estimated total costs of restoration from $7 billion for each state to $28 billion for the entire watershed. These estimates did not include ongoing maintenance costs for sustaining restoration.

A. Chesapeake Bay Restoration Fund

The BRF provides grants for projects that reduce nutrient and sediment loads to the Bay. The BRF is composed of two separate funds, the Septic Fund, and the Wastewater Fund. The Septic Fund pays for septic upgrades to BAT, and prioritizes these based on proximity to the Bay, which results in the most cost-effective reductions per pound of nitrogen. A 2019 Cost Effectiveness study by UMCES estimated the cost efficiency of BAT upgrades to be around $300 per pound. The septic ranking scheme also prioritizes failing systems, which provides the important co-benefit of protecting public health. The Septic Fund also pays for cover crops, another cost-effective practice, through MDA's Cover Crop Program.

Up to 10% of the Wastewater Fund may be used to pay WWTPs that optimize their ENR operation after the upgrade and demonstrate high performance levels (those discharging

nitrogen concentrations below 3 mg/L, and phosphorus concentrations below 0.3 mg/L). This program is highly cost-effective, generating reductions at an estimated $10 per pound of nitrogen. In 2021, the BRF regulations were amended and the BRF O&M grant can now be distributed in a way that pays for nutrient load reductions below the current grant threshold of 3 mg/l of nitrogen and 0.3 mg/l of phosphorus, in other words, providing additional grants to facilities achieving better than ENR.

Up to $20 million annually is allocated from the Wastewater Fund to the CWCA, which allows MDE to purchase cost effective nitrogen reduction from both public and private entities. Reductions must be achieved above and beyond the permit requirements. The program encourages innovation and is intended to reach entities and projects that are not eligible to participate in the MDE traditional capital projects program.

The Wastewater Fund also pays for upgrades to minor WWTPs, sewer improvements to reduce overflows and improve climate resiliency of the sewer system, septic connections, and stormwater projects. Projects are prioritized using the EPA-approved Integrated Project Priority System (IPPS), which evaluates which projects provide the most cost-effective nutrient reductions in dollars per pound. MDE has also worked with other state agencies to expand the IPPS to also factor in non-nutrient co-benefits such as public health benefit, sustainability and climate resiliency.

Maryland's Phase III WIP recognizes that as opportunities for low-cost nutrient reductions are used up, per pound costs will increase. As costs rise it will become increasingly important to ensure that the cost-benefit ratio is optimized—not just through lower costs, but by maximizing the benefits. This can be thought of as stacking co-benefits. Maryland's Bay Cabinet agencies will continue their work with our CBP partners to define and quantify non-nutrient co-benefits, and this work will be used to inform state project prioritization metrics, including subsequent iterations of the IPPS.

B. Water Quality Revolving Loan Fund

The WQRLF provides below market interest rate loans, and loan principal forgiveness (where applicable) to local governments and other eligible entities to finance water quality improvement projects. Since its inception in 1987 through June 2022, the WQRLF has provided approximately $3.291 billion in financing for water quality projects. In addition to protecting public health, one of the primary goals of the program is to achieve these improvements by reducing the amount of nutrients being discharged into the Bay. Projects eligible for funding include WWTP improvements and upgrades, eliminating failing septic systems, reducing combined sewer overflows and sanitary sewer overflows, nonpoint source projects such as urban stormwater control, and sewer system rehabilitation.

Projects submitted for consideration are rated and ranked using the IPPS, which prioritizes cost effective projects, along with co-benefits such as public health benefit, sustainability, and climate resiliency.

The WQRLF is receiving significant additional federal funding through the BIL. Between Federal Fiscal Years 2022 and 2026 the WQRLF will receive approximately $270 million in additional funding from EPA for all eligible uses of the WQRLF. These funds will be prioritized using MDE's EPA approved scoring system, providing more funding to local governments and other eligible funding recipients for projects that reduce nutrients being discharged into the Bay.

C. Chesapeake and Atlantic Coastal Bays Trust Fund

The Trust Fund allows Maryland to accelerate Bay Restoration by focusing financial resources on the most efficient, cost-effective nonpoint source pollution control projects in targeted areas of the state. The ability to award the maximum amount of Trust Fund resources to local partners through competitive measures is mandated in the Trust Fund's enabling statute and is critical to the fund's success at delivering quantifiable benefit to water quality. State agencies work with our local partners to administer the money in ways that leverage the funds to the greatest extent possible, target the funds geographically, engage the community at large, and hold everyone accountable.

Step 1: Incorporating science into decision making. The Trust Fund's explicit goal is to ensure the greatest environmental ROI. To that end, the Trust Fund is advised by a Scientific Advisory Panel, which reviews and advises on priorities and geographic targeting based on the latest scientific advancements. TheTrust Fund utilizes a targeting map to geographically guide investments. For SFY23, the Trust Fund is piloting a new map that incorporates co-benefits. The traditional targeting map that was developed using the USGS SPARROW v4 model remains available for this fiscal year, but will sunset in SFY24. The panel guidance and updates to the targeting map allow the Trust Fund to prioritize investments in specific watersheds and watershed areas, using projects and practices that provide the most cost-effective water quality benefits to the Chesapeake and Coastal Bays via reductions in nonpoint source nutrient and sediment loadings. Additionally, the state has created an online tool, FieldDoc.org, in collaboration with the National Fish and Wildlife Foundation and Chesapeake Commons, to ensure accurate and efficient returns on investment. During project proposals, applicants use FieldDoc to estimate nitrogen, phosphorus and sediment reductions. The land use loading rates and BMP effectiveness estimates within FieldDoc are consistent with CBP protocols and are required to calculate reductions for all proposal submissions.

Step 2: Prioritizing cost-effective projects through the project solicitation process. The Trust Fund has quickly become one of the most innovative and important water quality financing programs in the region. Its singular focus on reducing nonpoint sources of nutrient and sediment pollution makes it one of the only programs of its kind. The first

step toward incentivizing cost efficiency was to prioritize efficiency through the competitive solicitation process. Competitive award processes allow state agencies to target funds for performance-based outcomes that have true, quantifiable benefit to the Chesapeake and Coastal Bays. Given that the restoration goal is to reduce pollutant loadings, the efficiency is measured in Trust Fund dollars per pound of pollutant reduced. This cost per pound metric guides decision making and has been made more reliable using FieldDoc. To aid in the annual competitive process, the state created the Chesapeake and Coastal Grants Gateway, which provides a one-stop location for partners seeking technical and financial support for projects that foster healthy ecosystems, communities, and economies that are resilient in the face of change. The Trust Fund dollars are awarded through the gateway along with other state and federal funding to allow for comprehensive project support and leveraging across financial programs leading to more cost-efficiency and project efficacy. The CFA further extends the Trust Fund's ability to work with aggregators to fund large-scale pay for success projects. The CFA is a broad legislation allowing the Trust Fund to contract directly with for-profit restoration firms to target cost-efficient nutrient and sediment reduction while also considering other benefits, including climate resilience, DEIJ considerations, habitat and carbon sequestration.

Step 3: Incorporating monitoring data into future decision making. The most logical outcome of adaptive decision-making is a system where data is used to inform future funding decisions by Trust Fund managers. The entire system requires data reporting requirements that are clearly established as part of the project monitoring protocols; in addition, a clear system for incorporating those data into future decision making must be established. To do this, the Trust Fund managers leverage the expertise of DNR to establish clear project monitoring protocols to ensure consistency among projects. Additionally, in SFY15, the Trust Fund partnered with CBT to create a pooled monitoring initiative and issue the Restoration Research Grant. The goal of this research program is to answer several key restoration questions that are a barrier to watershed restoration project implementation. Answering these questions will ultimately lead to increased confidence in proposed restoration project outcomes, clarification of the optimal site conditions in which to apply particular restoration techniques, information useful to regulatory agencies in project permitting, and information that will help guide monitoring programs.

Step 4: Incentivizing cost-effectiveness at the project level. The Trust Fund has been working to predicate financing on performance rather than implementation rates. Perhaps the greatest benefit associated with the adaptive decision-making system of the Trust Fund is that it enables the state to shift its financing away from practice-based metrics of success to actual performance-based metrics. With a more accurate understanding of how well projects and practices mitigate nutrient emissions, it becomes more efficient to focus financing on that performance. This contrasts with how typical restoration investments are made where increasing units of practices installed is the primary financing goal. It is the hope that by increasing performance at any given

price point, a project implementer has an opportunity to increase their return on investment. This incentive is much less impactful in the practice-based system because the reductions in cost could be at the expense of pounds removed from the system.

The Governor is authorized by the Trust Fund enabling legislation to dedicate approximately $50 million annually to the Trust Fund from Maryland's motor fuel and rental car tax revenues. In its early years, only a portion of this $50 million maximum was provided to the Trust Fund, but Governor Hogan's administration made restoring Bay Restoration funding a priority, fully funding the Trust Fund in every year of his administration. In addition, Governor Hogan ensured that the increase in funds were not only targeted for on-the-ground projects, but were made available to local partners through a competitive solicitation. Dedicating funds through the competitive processes in the Trust Fund meets legislative mandates while ensuring cost-effective solutions and measurable impact.

D. Increasing the Co-Benefits of Agricultural Implementation

In addition to reducing nutrient and sediment flows into the Bay and its tributaries, many of the agronomic and conservation practices used by Maryland's farmers, growers and producers have the potential to make a significant contribution to the state's climate change goals by sequestering carbon and reducing other greenhouse gas emissions.

The 2017 Healthy Soils Act charged MDA with the development of a healthy soils program to improve the health, yield, and profitability of Maryland's soils and promote the further adoption of conservation practices that foster soil health while increasing sequestration capacity. In January 2022, the MDA's Soil Health Advisory Committee completed its initial recommendations to MDA to advance the Maryland Healthy Soils Program. The program's objective is to encourage the widespread implementation of healthy soils practices. Advancing the Healthy Soils Program is key to the state's climate change goals. MDA, in partnership with MDE, is evaluating tools to quantify the soil carbon sequestration and greenhouse gas reduction potential of key conservation practices and seeking to capitalize on co-benefits for both water quality and carbon sequestration. An initial menu of Maryland-specific practices were included in the 2030 Greenhouse Gas Reduction Act Plan update from MDE, and it is anticipated the menu and goals for soil health practices will be refined with the next version.

E. Increasing the Co-Benefits of Stormwater Implementation

Maryland's Phase III WIP Stormwater Sector Report states that "care should be taken to select specific restoration practices that provide both a nutrient reduction benefit for the Bay as well as address other important local stressors." These "important local stressors" can impact both aquatic life as well as human health and safety and include, but are not limited to, fecal bacteria, temperature, metals and other toxic pollutants, trash, increases in total stream flow and peak flow, and both riparian and interior watershed flooding. Further, Maryland's WIP states "A different way to maximize the impact of money spent on SWM is to expand the

benefit across multiple water quality objectives." While current stormwater permit credits are based on nutrient and sediment load reductions for variable practices, Maryland is working with researchers from UMCES to develop crediting systems and protocols for these other water quality objectives that are systemic to urban watersheds. These systems and protocols that are in development could be applied in future stormwater permits. The first phase of this work utilizes the Capacity, Opportunity, Payoff, and Equity (COPE) strategy to assess the benefits of any particular water quality objective. COPE assesses the combined effectiveness of any given project at reducing the pollutant of concern, the number of people the project will benefit, the opportunity for providing a benefit based on project location, and the social vulnerability of the population the project will benefit. Phase I of this work was recently completed in August 2022, and Phase II of this work is expected to begin in fall 2022.

F. Leveraging Private and Public Investments through the Innovative Technology Fund

Providing efficiency and cost effectiveness within the restoration effort requires innovative partnerships and financing structures. Through the Innovative Technology Fund (funded through the Trust Fund), the state is taking a lead role in financing the advancement of knowledge in the areas that most impact restoration programs, practices and policies. The goal of the Innovative Technology Fund is to support Maryland businesses that are developing new, cost-effective approaches to reducing nonpoint source pollution to the Bay. To achieve this goal, the Innovative Technology Fund works with both the Maryland Industrial Partnership to provide grants that develop and validate emerging restoration technologies, and with the Maryland Technology Enterprise to invest seed funding for direct commercialization efforts. Both programs co-invest with other funds to leverage additional resources for the startup and increase the cost-effectiveness of the state's investment. Co-investments with other professional investors include the University System of Maryland Momentum Fund, Intelis Capital, the Exelon Climate Change Investment Initiative, the KCRise Fund, and GreenGen Ventures. To date the Innovative Technology Fund has invested $9.2 million with $11.2 million in private matches, supporting 56 new technologies and 46 Maryland businesses.

G. Trading Oyster Aquaculture Credits

An adult oyster feeds by filtering the Bay's water. In doing so, it helps to improve water quality by assimilating nutrients into its tissue and shell, removing sediment particles from the water column, increasing the availability of bioavailable nitrogen to bacteria and depositing particles that may become buried on the bottom.

Now recognized as a water quality improvement practice, MDE and DNR are implementing an oyster harvest verification process to allow participation in the Water Quality Trading (WQT) Program and the CWCA. This approach incentivizes the oyster aquaculture industry while providing a water quality improvement co-benefit. Many oyster aquaculture growers have

participated in Maryland's WQT program, with several selling credits to buyers in the state. MDE is investigating new ways to promote the sale of these credits through the CWCA that will encourage participation from a number of growers.

Additionally, Maryland continues to work with CBP to potentially include aspects of the public oyster fishery (i.e., the commercial harvest of wild oysters) and oyster reef restoration as verified water quality improvement practices. While no such practices have been approved to date, we are optimistic that the commercial harvest of wild oyster populations that have been enhanced with hatchery-produced spat and certain aspects of oyster reef restoration will move forward for potential approval in 2023.

H. Water Quality and Climate Change

Many of the implementation strategies that result in water quality improvements also provide climate change adaptation and mitigation co-benefits. This also applies to Maryland's Ocean Acidification Action Plan, adopted in 2021. These co-benefits include mitigating greenhouse gasses through the use of renewable energy or energy efficiency, and adapting to climate change by improving soil health, and utilizing natural filter BMPs such as wetland creation and tree planting. To capitalize on these water quality and climate co-benefits, state agencies have prioritized these implementation strategies leveraging the benefits with one project budget. This has been done with Maryland's Resiliency through Restoration Initiative; Water Quality and Climate Change Portfolio; and by synchronizing the beneficial use of dredged material in restoration projects that reduce flooding, stabilize shorelines and mitigate storm impacts. Maryland's new CFA updated funding priorities for the Trust Fund to include climate resilience in the project investment criteria. The CFA opens the Trust Fund investment metrics to focus not only on water quality but also climate, carbon sequestration, habitat and other project benefits as well.

A-StoRM seeks to improve the resiliency of our state's stormwater infrastructure network by reviewing new rainfall patterns, identifying areas of flooding concern due to inadequate stormwater treatment, and to update the stormwater design manual to incorporate additional volume control. This effort is being conducted to enhance community safety by building BMPs that are able to withstand larger and more intense amounts of precipitation.

I. MDOT-DNR MOU

Since 2021, DNR and MDOT have moved forward with three project task agreements under their executed Memorandum of Understanding (MOU). Two of the tasks involved the MDOT Urban Tree Program, which was established in 2021 to promote sustainable practices that would improve local air quality, enhance bicycle and pedestrian connections to transit, alleviate urban heat island effects and prioritize the initial replacement of trees, on public or private property, in communities affected by environmental justice issues or heat island effect. These tasks provide co-benefits beyond air quality, including nutrient uptake, carbon sequestration,

and the creation of wildlife habitat. The third task focuses on the development of training curriculum for MDOT staff and leadership to build capacity and awareness of the impacts of climate change on transportation, existing assets (including stormwater BMPs), and how to improve resiliency within our transportation system.

J. EPA Infrastructure Investment and Jobs Act Most Effective Basins Grant

IIJA: The EPA has awarded the State of Maryland $3,212,158 through the IIJA targeted at the Most Effective Basins (MEB). The funding is divided into two pots: $2,637,999 for implementation, $574,159 for MEB technical assistance. DNR and MDE worked to identify projects in the targeting MEB areas that had been competitively submitted through existing channels. The additional federal funding allowed the state programs to extend their capacity to fund effective projects.

Priority IIJA MEB Projects:

- MDE - City of Brunswick Stream Restoration and Technical Assistance sub-projects
- Blue Water Baltimore - Eden Korean Green Retrofit
- Anne Arundel County - Ruth Parker Eason School Stream Restoration
- Druid Heights Community Development Corporation - Druid Heights green space
- Washington County SCD - Ecological restoration for water quality in the Little Antietam South and Bay watershed
- Town of Emmitsburg - Silo Hill Pond Retrofit

Additional funds, $722,603, are being provided through U.S. Department of Agriculture Forest Service to Maryland Forest Service to address forest health and wildfire reduction, including full participation in the new Community Wildfire Defense Grant program, which helps manage fire risk in forests and wildland-urban interface communities.

Part IV - Planning for the Future: Implementing a Sustainable Chesapeake Bay Restoration Financing Strategy

Over the past 30 years, significant resources have been committed to studying threats to the Bay and its watersheds, identifying restoration opportunities, assigning and implementing restoration responsibilities. From SFY00-SFY22, about $14 billion (Table 1) has been invested in Bay Restoration.

Overcoming these barriers will require local, state, and federal leaders to look beyond traditional funding programs and tools to develop effective, sustainable, market-based financing strategies. Over the last several years, Maryland has also been engaging private sector conservation, restoration, and financing experts to review Maryland's Bay financing framework, develop and implement recommendations and approaches for creating efficiencies and scale, while harnessing market forces and private capital to sustain and grow Maryland's restoration economy into the future. Maryland's CFA, passed by the General Assembly and signed by Governor Hogan in 2022, addressed many of these approaches by:

- Modifying Maryland's procurement codes to include environmental outcomes as a commodity, which state-funded programs (such as the BRF and the Trust Fund) can purchase.
- Modifying the state's Water Quality and Drinking Water revolving funds to better include green infrastructure projects.
- Expanding the Trust Fund criteria to include consideration of other environmental and social co-benefits beyond strictly nutrient and sediment reductions.
- Adjusting current state policies to ensure that conditions of water quality agreements and easements with private landowners do not preclude those landowners from also participating in carbon sequestration markets.
- Better leveraging public dollars invested in Bay Restoration by bringing more private capital into the restoration effort by allowing "pay-for-performance" approaches where private entities assume some of the upfront risk in implementing restoration practices with public funds reimbursement over a longer term based upon pounds of pollution reduced.

The Bay Cabinet recognizes that the state must continually keep the door open to and explore new, innovative approaches to Bay Restoration if we are to be successful. Innovation and flexibility within existing programs can also be mechanisms to promote cost-effective water quality restoration solutions. The following are some innovative ideas under consideration within or in addition to existing programs. The following sections discuss strategies, challenges and opportunities within key Bay Restoration fund sources:

A. Bay Restoration Fund

This fund continues to be a pollution reduction driver. Between SFY05 and SFY22, the fund awarded $1.655 billion in grants for enhanced nutrient reduction at the state's major and minor WWTPs, sewer overflow abatement projects, SWM control measures, and septic connections to Biological Nutrient Removal or ENR WWTPs. With the major wastewater treatment plants fully funded, the fund will continue its emphasis on cost efficient nitrogen reductions to achieve Bay Restoration goals. Some recent highlights of this fund include:

Increased Emphasis on Cost Efficiency through the Revised Project Ranking and Selection System

The system consists of four rating categories, which include Water Quality or Public Health Benefits, Compliance, Cost Efficiency, and Sustainability. Total scoring points were increased in cost efficiency to ensure that grant funded projects are providing the highest environmental benefits for the least dollars spent. The most points are still awarded to either the project's nitrogen reduction benefit or public health benefit. The revised scoring system is resulting in higher scores for projects that have a high nitrogen reduction or significant public health benefits and are also cost-effective at reducing nitrogen. The revised project rating system was used to select projects for the SFY24 budget cycle. The revised IPPS has led to more holistic scoring for each project application, as well as a stronger list and more diverse mix of projects selected.

Paying Directly for Nutrient Reductions through the CWCA

During the 2017 session, the CWCA was signed into law by Governor Hogan, which allows up to $30 million ($4, $6, $10, and $10 million in SFY18-SFY21, respectively) of Bay Restoration Funds to purchase cost-effective nitrogen, phosphorus, and sediment load reductions. This is expected to leverage market forces and provide the state with another mechanism to more cost effectively meet Bay Restoration goals. The CWCA was reauthorized during the 2021 legislative session. The new iteration of the program has more robust funding ($20 million a year through SFY30) and an enhanced scope, including additional project eligibilities such as agricultural BMPs, and focus on additional benefits, including equity for overburdened communities, climate mitigation and resiliency, and improving local water quality in addition to Bay water quality. The first project solicitation under the reauthorized program was open during summer 2022, and closed on September 9, 2022. The Department is in the process of evaluating the project proposals received to award funding. There has been significant interest in the new iteration of the program.

Paying-for-Performance at WWTPs

Up to 10% of the Wastewater Fund may be used toward O&M grants, which pay WWTPs that optimize their ENR operation after an upgrade, and demonstrate high performance levels (discharging nitrogen concentrations below 3 mg/L and phosphorus concentrations below 0.3 mg/L). In 2021, the BRF regulations were amended and the BRF O&M grant can now be distributed in a way that pays for nutrient load reductions below the current grant threshold of

3 mg/l of nitrogen and 0.3 mg/l of phosphorus, in other words, providing additional grants to facilities achieving better than ENR. This provides an additional incentive for ENR WWTPs to further optimize their performance. MDE anticipates utilizing the full 10% of BRF wastewater funding (up to $11 million) for this program going forward.

B. Chesapeake and Atlantic Coastal Bays Trust Fund

The Trust Fund was fully funded again in SFY23, with an allocation of $46.66 million. Between 2009 and 2022, the fund has invested more than $600 million in efforts to improve the health of the Bay by advancing the implementation of local and state WIPs. In SFY22, the fund targeted $46.66 million, and leveraged an additional $20 million awarded through a competitive process to accelerate state and local efforts to improve the health of the Bay.

As a transformative step forward, the Trust Fund's annual solicitation for projects began directly linking investments to water quality performance rather than implementation rates. By establishing pounds reduced per dollar spent as the primary criterion for selecting projects, the Trust Fund built an inherent incentive into the financing system to improve efficiency. The Trust Fund is the most impactful when it uses this cost-effective, performance-based framework through competitive processes to the greatest extent practicable to engage in implementation of nutrient and sediment reduction projects as dictated in the guiding legislation.

To continue to build on the Trust Fund's innovative structure to expand its reach and influence, it is essential that the Trust Fund be catalytic in nature, facilitating the flow of public and private capital and improving the effectiveness of other restoration policies and programs across the state, while ensuring the most water quality benefit for every dollar invested. In this effort, DNR introduced the Grants Gateway, a single point of entry for organizations seeking technical and financial assistance to restore local waterways, increase their resilience to climate impacts, strengthen local economies and develop the next generation of environmental stewards. Created to streamline the grant application process for government and non-governmental organizations as well as academic institutions, grants are made possible with funding through the Trust Fund, the Coastal Resiliency Program, the Waterway Improvement Fund, the National Oceanic and Atmospheric Administration and CBP. This streamlined application process allows Trust Fund managers to work closely with other state and federal sources to leverage funds and support comprehensive projects that achieve a myriad of co-benefits.

The Trust Fund managers are working to establish technical and financial support to assist with the ongoing maintenance and adaptive management needs of funded watershed projects. Many projects require periodic maintenance that some community partners are not well-equipped to perform or finance. Additionally, nature-based BMPs can require a period of adaptive management to best ensure how these dynamic systems respond to restoration and increased storm events. In order to address these needs, the Trust Fund has begun to explore opportunities to provide technical and financial assistance aligned with post-construction sustainability.

There are several market-based financing pilots initiated through the Trust Fund in recent years that continue to advance, and are assessed for future consideration and fund growth. These include building cost-efficiency through project aggregation and pursuing pay-for-success models with private investment. Additionally, through financing for startups with Bay improving technologies, the Trust Fund has helped support the development of 56 new technologies that improve water quality in the Bay, and is now also investing in climate technologies that mitigate nutrients loads attributed to climate change. Recent co-investments with other professional investors has leveraged additional resources for the startup and increase the cost-effectiveness of the state's investment

C. Water Quality Trading

Following the adoption of trading regulations in 2018, Maryland implemented its WQT program, which creates a public market for nitrogen, phosphorus and sediment reduction credits to enhance the restoration and protection of the Bay and local waters by reducing the cost and accelerating the pace of nutrient and sediment reduction efforts. Credits can be purchased to meet pollution control requirements for permits at facilities where pollution control measures are infeasible or too expensive. Credit trading provides a means to ensure pollution controls are implemented in the most cost-effective manner possible.

The first credits were certified under the program in February 2019, and the first trade was approved in March 2019. The first trade for credits from oyster aquaculture occurred in May 2020. In 2020, MDOT Maryland Port Administration became the first state agency to generate and trade credits under this program. Trades have been used to meet industrial stormwater and municipal stormwater restoration requirements.

As of October 2022, 240,009 pounds of nitrogen reduction credit, 47,968 pounds of phosphorus reduction credit, and 6,795,552 pounds of sediment reduction credit had been certified through the program for CY21. Maryland is continuing to work to promote additional supply and demand in the market through voluntary credit acquisition efforts.

D. Phase I MS4 Financial Assurance Plan requirements/review and implementation plans

In May 2015, revisions to Maryland's SWM law, signed by Governor Hogan, repealed the statewide mandate for stormwater fees, but preserved the authority of counties and towns to mandate such fees if they chose to do so. These revisions resulted in new fiscal reporting requirements for Maryland's Phase I MS4 jurisdictions, which include Baltimore City and Anne Arundel, Baltimore, Carroll, Charles, Frederick, Harford, Howard, Montgomery, and Prince George's counties. One of the new reporting requirements, financial assurance plans, are required to demonstrate how impervious surface restoration plans (ISRP) are going to be paid

for during the permit term. Each jurisdiction submitted comprehensive information on local SWM projects, costs, and budgets for meeting ISRP requirements, including:

- Annual Programs: street sweeping, inlet cleaning, storm drain vacuuming
- Structural Practices: wet ponds, swales, infiltration, dry wells, rain gardens, green roofs, permeable pavement, rainwater harvesting, submerged gravel wetlands
- Alternative Practices: tree planting, outfall stabilization, stream restoration

The 10 Phase I MS4 jurisdictions certified that they have sufficient revenue to fund 100% of the projected SFY21 and SFY22 costs to comply with ISRP requirements, meeting the stormwater law's criteria. The 10 Phase I MS4 jurisdictions have projected spending $644.9 million over the next 2 fiscal years. The next FAP submittals, due with SFY22 MS4 annual reports, must show how each jurisdiction can fund 100% of its ISRP requirement for SFY23 and SFY24.

E. The Maryland Agricultural Water Quality Cost Share Program

Since 1985, the MACS program has been the state's premier program to assist tenant farmers and farm owners with the implementation costs of BMPs to control water quality problems on their property. Helping farmers comply with regulatory requirements and meet Maryland's Bay Restoration goals remains at the heart of the program. Costs for installing BMPs vary depending on the area being protected, the scope of the problem, and local construction costs. MDA has taken steps to increase cost-share rates and per project maximums to address needs from the agricultural sector.

Between 1988 and 2022, MACS has provided cost-share on over 26,000 conservation practices to address water quality concerns on agricultural land in Maryland. During SFY22, this included 335 installed practices for a state investment of $3.6 million, not including cover crops. MDA continues to seek opportunities and partnerships to leverage state cost share for the further adoption of conservation practices and to maximize co-benefits. Also in 2022, the MDA's Field Assessment Team continued to field inspect and verify the presence of conservation practices that continue to provide water quality benefits. To date, over 52% of WIP eligible conservation practices, many installed with MACS funding, are present and continue to meet standards.

F. Federal Highway Administration Promoting Resilient Operations for Transformative, Efficient, and CostSaving Transportation (PROTECT) Program

The BIL added the Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Formula Program into Federal-Aid Highway Program Apportionments for Maryland. MDOT SHA received approximately $20.6 million in PROTECT formula funds in Federal Fiscal Year 2022. This new federal funding is for resilience improvements that protect:

- Surface transportation assets by making them more resilient to current and future weather events and natural disasters, such as severe storms, flooding, drought, levee and dam failures, wildfire, rockslides, mudslides, sea level rise, extreme weather, including extreme temperature, and earthquakes;
- Communities through resilience improvements and strategies that allow for the continued operation or rapid recovery of surface transportation systems that serve critical local, regional, and national needs, including evacuation routes, and that provide access or service to hospitals and other medical or emergency service facilities, major employers, critical manufacturing centers, ports and intermodal facilities, utilities, and Federal facilities;
- Coastal infrastructure, such as a tide gate to protect highways, that is at long-term risk to sea level rise;
- Natural infrastructure that protects and enhances surface transportation assets while improving ecosystem conditions, including culverts that ensure adequate flows in rivers and estuarine systems. (See 23 U.S.C. 176(b)(2); 176(c)(1)).

PROTECT Formula Program funds may be combined with other eligible U.S. Department of Transportation or other federal funding for projects that support the goals of the PROTECT Formula Program if the eligibility requirements and applicable federal share are met for each program. When combined with certain other federal programs, it is possible that the required non-federal match could be lowered from the typical 20%. This would help extend state dollars for other priority needs. Eligible resilience improvement activities must improve the ability of an existing surface transportation asset to withstand one or more elements of a weather event or natural disaster, or to increase the resilience of surface transportation infrastructure from the impacts of changing conditions, such as sea level rise, flooding, wildfires, extreme weather events, and other natural disasters. These activities include (but are not limited to):

- The upgrade of an existing surface transportation facility to meet or exceed a design standard adopted by the Federal Highway Administration.
- Installation of mitigation measures that prevent the intrusion of floodwaters into surface transportation systems.
- Strengthening systems that remove rainwater from surface transportation facilities.
- Upgrades to and installation of structural stormwater controls
- Other protective features, including natural infrastructure, as determined by the Secretary. (23 U.S.C. 176©(1) and 176(d)(4)(A)(ii)(II)(aa)-(qq)).

MDOT is currently evaluating PROTECT program requirements and eligibility for innovative solutions that can support additional stormwater BMPs toward targeted reductions.

G. Conowingo WIP Financing

The CWIP is sometimes referred to as an eighth WIP, separate from jurisdictional WIPs and where all the CBP partners are working collaboratively to fund and implement restoration practices in the most cost-effective way. Governor Hogan put $25 million in the SFY23 State Budget for CWIP implementation. These monies are planned to go through the SRBC for pay-

for-performance projects that help reduce nutrient loads to Bay from Conowingo Pond filling with sediment. In addition, the Conowingo Settlement Agreement requires Constellation Energy (new name for Exelon) to invest more than $200 million in environmental projects and operational enhancements to improve water quality in the Lower Susquehanna River and the Bay.

The recent CFA, passed during Maryland's 2022 legislative session, allows the CWIP to capitalize on the opportunity to energize the conservation finance directive and use conservation finance tools to combine robust public funding for public projects with private sector partnership. Maryland will oversee and provide policy direction to the SRBC in selecting Conowingo projects with the main goal of achieving the most cost-effective nutrient reduction while building a market-based strategy to ensure investments in green and blue infrastructure across the watershed.

H. Paying for Performance and enlarging pool of bidders

The CFA was a bold step to incentivize more private dollars in the Bay cleanup effort. The broad bill addresses Environment, Agriculture, Natural Resource and Procurement law to encourage for profit aggregators to bring pay for success (pay for performance) model restoration to Maryland in a meaningful way. The bill encourages leveraging of the State Revolving Loan Fund and the Trust Fund to advance large-scale projects that address not only water quality but also DEIJ, climate resilience, local jobs, habitat creation and carbon sequestration. State agencies are working together and with procurement to develop the appropriate programmatic conditions for successful implementation.

Long-term costs are minimized by funding practices that are known to be the most efficient and by enabling innovation that reduces costs over the long term. Increasing the flexibility to propose alternative practices through competitive bidding is a tested approach to enhancing cost-effectiveness. In addition, paying for performance (rather than practices) can attract problem solvers who can reduce nutrient runoff control costs over the long term. Due to the fact that complexity of program design can limit participation, more complex competitive bidding and pay-for-performance programs are best used as complements to simpler pay-for-practice programs that enable widespread implementation of practices with demonstrated performance.

To enable a program that used competitive bidding to fund a wide variety of actions, multiple legal, regulatory and policy impediments would need to be addressed. Examples of such impediments include: 1) Sewer hookup policies (category change process is cumbersome); 2) variability in local health department rules can hinder use of successful low impact development and water reuse techniques; 3) concerns about nutrient credit accounting create confusion as to who owns credits. Solutions include: a) Streamlining approval processes for innovative techniques, including working with the CBP to rapidly establish reduction efficiencies of new practices; b) evaluating approaches to manage risk of underperformance (e.g., state

self-insuring, portfolio rules to limit proportion of high risk practices, or establishing assurance bonds); c) Developing standardized agreements to use to reduce risk to innovators, such as safe harbor agreements for landholders.

To address public concerns that the most cost-effective nutrient reduction practices may not provide equivalent social benefits, cost-effectiveness can be measured using outcome measures that integrate multiple concerns and co-benefits. Alternatively, separate programs can be used to achieve goals that are not complementary. For example, the most cost-effective stormwater reduction practices may not be the most cost-effective nutrient reduction practices. Therefore, creating separate funds to achieve distinct goals can enhance overall cost-effectiveness of spending.

I. Enabling innovation in stormwater practice design by reducing financial risk

An impediment to innovation in the stormwater sector is a concern of industry that anything out of the ordinary will take a long time to get permitted or may be denied a permit, since novel practices may not have state-recognized performance criteria on nutrient and water volume reductions. Some innovative practices have performance data from elsewhere or may be sufficiently similar to existing practices to provide confidence in performance. Yet, these promising practices may never be proposed because they create risk or uncertainty. The state has several processes in place to enable innovation in the urban sector.

To enable innovation for addressing restoration requirements found in local MS4 permits, the state considers approving new practices when proper documentation and monitoring information are provided to verify performance claims. The policies and procedures for approving innovative stormwater practices are found in MDE's "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits, November 2021." MDE works closely with the CBP workgroups and MS4 jurisdictions to enable the use of innovative technologies in a manner that is equitable and consistent with other activities in the Bay region. This calendar year, MDE has begun to offer credit for new stormwater retention and infiltration technologies where study plans and corresponding results are provided in coordination with reviewers.

Stronger incentives to promote innovation that meet multiple Bay Restoration goals would be to offer expedited permit options for innovative approaches that both meet a minimum threshold of performance information and offer substantial ancillary public benefits. Benefits include those derived from energy savings, aesthetics, air quality or habitat. Such approaches are in place in a few jurisdictions around the country and these case studies could be examined for lessons learned. As detailed above, Maryland is currently working to develop crediting systems for these other benefits.

J. Comprehensive Water Quality and Climate Resiliency Portfolio

DNR is assembling a portfolio of projects focused on enhancing resilience to climate change stressors that will also leverage habitat, water quality and greenhouse gas reduction benefits. The portfolio will comprise a suite of restoration and conservation projects identified in close coordination with affected communities and public/private/nonprofit sectors. These projects will work together to optimize resiliency benefits and leverage important habitat, water quality, and greenhouse gas mitigation gains. This approach lends itself to longer budgeting timeframes, beyond a 1-year cycle, for fiscal certainty, generates new financing opportunities with other partners and provides opportunities to better integrate green and grey infrastructure approaches. DNR has identified two targeted resiliency areas with restoration and conservation potential that provide high value resiliency benefits for communities, economies, public lands, and important ecosystems. One is located in Worcester County and the other in Washington County. In close coordination with climate affected communities and public, private, and nonprofit partners, a portfolio of projects within these zones will be assembled over the next year. Procurement for subcontractor services is currently underway and kickoff meetings are anticipated in early fall 2022. This complements existing project portfolios, drawn from prior Grants Gateway solicitations that are currently being used to take advantage of new federal and other emerging funding opportunities.

Appendix 1

Bay Restoration Activities Funded in the Budget

Total Funds

	SFY22 Actual
DNR	91,955,652
POS	48,231,796
Rural Legacy	20,037,061
Planning	5,711,299
MDA	54,288,882
Maryland Agricultural Land Preservation Foundation	56,126,643
MDE	313,082,880
Maryland State Department of Education	33,238
Maryland Higher Education	27,465,208
MDOT	516,975,627
Total	**1,133,908,286**

Fund Type Summary

	SFY22 Actual
General Fund	42,985,295
Special Fund	445,397,555
Federal Fund	57,803,039
Reimbursable Funds	29,195,984
Current Unrestricted	24,692,495
Current Restricted	2,772,713
GO Bonds	14,085,578
MDOT	516,975,627
Total	**1,133,908,286**

Spending Category

	SFY22 Actual
Land Preservation	125,371,868
Septic Systems	22,168,299
Wastewater Treatment	279,114,112
Urban Stormwater	43,901,818
Agricultural BMPs	75,748,040
Oyster Restoration	6,467,375
Transit & Sustainable Transportation Alternatives	481,814,325
Living Resources	53,417,560
Education and Research	27,782,600
Other	18,122,289
Total	**1,133,908,286**

Note: This presentation only includes state agency programs that have more than 50% of their activities directly related to Bay Restoration. Funding related to salaries and fringes does not reflect health insurance or increment adjustments.