



2015

Maryland's Chesapeake Bay Restoration Financing Strategy Final Report



Prepared by the Environmental Finance Center (EFC) for the *Maryland Department of Natural Resources (DNR)* and the *Maryland Department of the Environment (MDE)*

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The following report was produced by the **Environmental Finance Center (EFC)** at the University of Maryland in College Park. For twenty years EFC has served communities in the Mid-Atlantic region by addressing the how-to-pay issues associated with natural resource restoration and protection. One of the EFC's core strengths is its ability to bring together a diverse array of individuals, agencies, and organizations to develop coordinated, comprehensive solutions for a wide variety of resource protection problems. The EFC has provided assistance on issues related to energy efficiency, stormwater management, source water protection, land preservation, green infrastructure planning, low impact development, septic system management, waste management, community outreach and training. For more information on EFC and this project, please visit our website at: www.efc.umd.edu.

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Integrated Public-Private Financing Initiative. This report is part of a series of three publications produced by EFC through its *Integrated Public-Private Financing Initiative*. Through the support of the Maryland Department of Natural Resources, this series of reports has focused on how state-based financing and revenue resources can be most efficiently and effectively invested in environmental restoration and conservation activities. The first report, *Analysis of the Chesapeake and Atlantic Coastal Bays Trust Fund*, assessed the impact and potential effectiveness of what has become one of the most important water quality financing resources in the region. This report, which is the second in the series, focuses specifically on the scale and cost of implementing restoration obligations codified in the state's Watershed Implementation Plan. The third report will be produced as part of the *Chesapeake Trust Fund Financing Task Force* project, which is a new collaboration between the Environmental Finance Center and the Center for Social Value Creation, located at the Robert H. Smith School of

¹ Please note that any errors, inaccuracies, or expressed opinions are entirely the responsibility of the Environmental Finance Center.

Business. The two centers have convened a student led Task Force, which has been charged with developing a detailed business plan for establishing a new public-private financing institution in support of the Chesapeake Bay restoration and protection effort. Building on the analysis and recommendations produced in this study, the Task Force's work will provide the framework for developing and implementing one of the most innovative and potentially effective public-private financing partnerships in support of environmental protection. The Task Force's final report will be released in July 2015.

For more information on the *Integrated Public-Private Financing Initiative*, please visit the EFC web site at: <http://efc.umd.edu/integratedfinancing.html>.

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Introduction

The following report was produced by the Environmental Finance Center (EFC) in partnership with the Maryland Department of Natural Resources (DNR) and the Maryland Department of the Environment (MDE). The analysis and recommendations provided in the report address the key policy and financing issues associated with the Chesapeake Bay restoration effort. The report was produced in response to the Maryland legislature's request for an assessment of the resources necessary for achieving Bay restoration success. To that end, our goal was to provide state leaders with a financing plan of action for achieving final pollution reduction targets, and maintaining those reductions over time.

The report contains the following sections:

Section 1 provides a brief summary of the Watershed Implementation Planning process and the progress towards meeting pollution targets. Rather than reproduce the detailed analysis provided by the state agencies as part of this project, our goal was to lay the foundation for assessing the financing trends and issues that will impact the restoration effort moving forward.

Sections 2 through 5 provide an analysis of each of the four primary pollution sectors: agricultural production, urban stormwater management, onsite wastewater management, and point source wastewater management. Our analysis for each sector includes an assessment of the regulatory and financing structures that guide the implementation and financing process, as well as an analysis of the revenue and regulatory gaps that will need to be addressed moving forward. Finally, we provide brief recommendations for achieving pollution reduction targets for each sector. Section 6 provides summary results of our analysis of each sector.

The sector-based analyses set the foundation for a more comprehensive restoration financing process. In Section 7 we provide detailed recommendations for how the State of Maryland can improve implementation efficiency, accelerate implementation, and incentivize efficiency and effectiveness, specifically through leveraging the private sector and the marketplace.

In the final section of the report we offer key observations and recommendations for the state to improve the efficiency and effectiveness of its water quality investments. We begin, however, with a summary of our key findings.

Summary Findings

Our primary goal with this project was to provide state leaders with recommendations for how best to accelerate and scale the financing effort supporting the Bay restoration process while at the same time ensuring the greatest environmental and financial return on investment. Based on our findings, we believe that there are several key issues or "take away" findings that should be highlighted:

- **Restoration success is achievable.** Though the costs for achieving pollution reduction targets are significant, the state is on track to meet required pollution reduction goals. Very simply, this means that restoration success is indeed possible and likely assuming some strategic shifts in how resources are invested moving forward.
- **The resources are in place to achieve restoration success.** Our analysis indicates 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.

- ***There must be a renewed focus on cost efficiency and effectiveness.*** Finally, the state has a unique opportunity to implement a financing system that incentivizes cost efficiency, innovation, and project effectiveness. By changing the foundation of how public resources are invested, the state is in a position to not only achieve pollution reduction targets, but to do so in the most cost effective way possible.

With these three primary “take away” themes in mind, we offer the following observations and summary recommendations for advancing the Chesapeake Bay restoration financing effort.

The state is on track to achieve interim and final aggregated nutrient reduction targets.

Perhaps our most important finding is that projected total nitrogen and phosphorus reductions in Maryland are on track to achieve both the 2017 interim and the 2025 final targets. In aggregate, i.e. when accounting for loads from the four key pollution sectors collectively (agriculture, point source wastewater, urban stormwater, and onsite wastewater or septic) the state will reduce more than 10 million pounds of nitrogen and .49 million pounds of phosphorus.² Maryland’s successful effort to achieve interim and final nutrient reduction targets will be the result of very aggressive implementation efforts within the agricultural and point source wastewater management sectors.

The state must mitigate the impact of population and economic growth. Because of the lack of substantive implementation at the local level to reduce the impact of both existing and new sources of urban stormwater runoff and emissions from septic systems, achieving the 2025 final pollution reduction targets will come at the expense of the growth allocations that were built into the wastewater treatment plant upgrades. As a result, the pollution impacts of any future population and economic growth must be mitigated completely to successfully maintain pollution load allocations. Therefore, the state’s focus over the next ten years should be to accelerate implementation across all sectors to efficiently and effectively build growth capacity back into the system. This must include an aggressive push towards establishing policies, processes, and regulations that will fully offset the impacts of new economic and population growth within the state.

The state must maintain focus on pollution reduction targets. Regardless of the policies, processes, and regulations that the state advances moving forward, achieving and maintaining final pollution targets must remain the primary goal, and those targets must be enforced and maintained as required caps. In other words, restoration success cannot be based on a process of assuming away responsibility or manipulating modeling results. We say this not to point fingers or cast judgment on the restoration effort to date, but rather to call attention to the adverse impact that shifting responsibilities and goals has on the restoration financing system and process. As we stated in the introduction to this report, we believe that restoration success is possible and that a more efficient, market-based approach to financing will reduce costs and accelerate implementation, and ultimately result in a restored Chesapeake Bay in the long-term. However, an efficient restoration financing system will not materialize if environmental goals shift or are assumed to be unnecessary. In short, achieving restoration success efficiently and cost-effectively requires a commitment to implementation and investment, and it is an investment that we believe will pay significant dividends to the citizens of Maryland and the rest of the watershed.

² Maryland’s Phase II Watershed Implementation Plan for the Chesapeake Bay TMDL. October 26, 2012. Page 9.

Achieving restoration success will come with costs. Given that restoration success will require achieving stipulated pollution reductions, accomplishing those reduction goals will come with costs. Based on analysis of each of the four primary pollution sectors, we estimate that the **additional** cost for reducing existing sources of pollution to the 2025 targets will be approximately **\$4.4 billion**, with an average cost of \$66 per treated pound of nitrogen.³ The majority of these costs – approximately 68% – are associated with implementing urban stormwater management permit obligations and are therefore the financing responsibility of local jurisdictions.

In addition to the costs of reducing existing sources of pollution, there will be costs to mitigate the impacts of growth. The costs of mitigating the impacts of growth will depend entirely on how that mitigation occurs and in which particular sector. MDE estimates that population growth will result in an additional annual nitrogen load of 2 million pounds, which represents about a 17% increase in the amount of nitrogen that would need to be treated.⁴ Therefore, it is reasonable to assume that mitigation of new growth could increase restoration costs by up to 10 to 20%. It is important to keep in mind that these estimates are exactly that—estimates. They are based on likely levels of implementation per unit (i.e. treatment costs per pound) that were generated by the state. Though the estimates will almost certainly be proven wrong over time, they provide a useful snapshot of the scale of the financing effort facing local, state, and federal leaders over time.

Restoration responsibility starts and ends with the Bay States. There is considerable friction within the restoration community in regards to the merits of a regulatory vs. incentive-based approach to restoration implementation. Regardless of which approach becomes the basis of the state’s financing strategy moving forward, ultimately someone or some entity must assume responsibility for the costs associated with implementation. Currently responsibility is distributed or assigned across the public and private sectors to varying degrees depending on pollution source. Ultimately, however, it is the Bay States that are being held accountable for achieving restoration goals.

The state has two options available to advance the implementation process (or perhaps more accurately, a combination of both). First, the state can assign restoration responsibility by regulating pollution emissions and/or reductions. It then becomes the responsibility of the regulated entity (i.e., entity assigned responsibility to reduce pollution emissions) to find ways of financing the necessary pollution reduction activities. If it is not possible or desirable to assign pollution reduction responsibilities through regulation, then the second option for the state is to assume responsibility for financing required pollution reductions. This would then of course require the state to lead the effort to finance those reductions. In short, the state can either regulate the reductions or pay for the reductions.

The revenue exists to solve the problem. There is no question that the state is facing a significant financing challenge and that very real funding and financing gaps will need to be addressed in the near future. That said, it is our opinion that Maryland has sufficient revenues and resources available to effectively finance the restoration effort, achieve the final pollution

³ The average cost per pound of course varies widely depending on the pollution source, ranging from \$26 per pound in agriculture to more than \$500 per pound for urban stormwater and septic.

⁴ http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Pages/Accounting_For_Growth.aspx. Last accessed: December 30, 2014.

targets, and maintain those pollution targets over time. Specifically, the Bay Restoration Fund (BRF) and the Chesapeake and Atlantic Coastal Bays Trust Fund will generate almost an additional **\$1 billion** by 2025, which can be used to advance implementation programs. As a result of these two revenue programs, there is no need for the state to raise additional revenue in the future. There are, of course, some caveats to this statement. First, we are assuming that the current level of regulation will be maintained within each of the four pollution sectors and that enforcement will be consistent and effective. Again, there are only two options available to the state for addressing pollution load reductions: assigning responsibility through regulation or directly financing reductions. If state regulators choose to back off existing regulations, then it will be the state's responsibility to finance those associated pollution reductions, which would in turn require additional revenue sources.

The second caveat is related to the availability of existing restoration funds. Achieving pollution reduction targets will require state leaders to ensure that all existing state-based revenues and funds targeting Bay restoration and conservation be restored to the programs for which they were intended. Though we recognize the need to address broad-scale budgeting and financing issues at the state level, Bay restoration will not occur if revenues are shifted to the state's general fund, as has happened many times in the past. Specifically, the BRF, the Chesapeake and Atlantic Coastal Bays Trust Fund, and Program Open Space revenues must be restored and maintained over time.

The final caveat is related to how the state invests its resources. Existing state-based revenues and resources will be sufficient if the state takes a much more performance and efficiency-based approach to its financing efforts. A focus on efficiency will have a profound impact on how the state leads the effort to achieve the final pollution targets, as well as the process for maintaining those reductions. Maryland is on track to achieve the 2025 pollution reductions. However, given current levels of implementation, success will be in large part due to the growth capacity that was built into wastewater system upgrades. In other words, investments in urban stormwater management and septic conversions specifically have not kept pace with investments in wastewater and agriculture. If the state were to maintain the focus on equity, it would require a massive investment between now and 2025, at a scale that is quite frankly impractical and likely unachievable. However, if the state were to focus on efficiency in its investments moving forward, then there is the opportunity to build the capacity for growth back into the system in a much more cost effective way.

The efficiency approach is in fact a form of water quality trading, though strictly in an administrative sense. The state would essentially be trading in time, using wastewater system growth allocations today rather than in the future. We feel this process is both efficient and inevitable, given the existing financing system. It requires, however, a firm commitment on the part of the state to invest in getting that capacity back into the system. Though the path to the final target may change, the target itself remains the same: restoring and protecting the Bay by achieving and maintaining necessary pollution reductions.

Success doesn't end in 2025. Finally, it is important to stress that the ultimate financing and restoration goal is not to achieve the 2025 pollution reduction requirements, but to also maintain those reductions over time. This will require state and local governments to effectively balance the need for aggressive pollution reduction activities with equally aggressive long-term protection strategies. This in turn will require the state to focus on two long-term

strategies. First, every new pound of pollution that is generated from population and economic growth in the future must be entirely mitigated. We believe that there are opportunities for market systems to dramatically reduce the costs of future mitigation efforts, but regardless of the system that is employed, it is essential to mitigate the impacts of growth into the future.

The second long-term strategy must involve a more aggressive effort to finance conservation activities, including forest, agricultural, and open space protection. By definition, an aggressive restoration effort can often discount or minimize the importance of conservation or land protection investments in favor of pollution reduction activities. Though financing pollution reductions must remain the state's primary implementation focus, it is also essential for long-term success to invest in land protection efforts that focus on maintaining pollution load reductions over time.

Section 1: Background

Section 1.1: The TMDL and WIP Process

The Chesapeake Bay restoration effort entered a more aggressive stage with the implementation of the Chesapeake Bay Total Maximum Daily Load (TMDL). After more than 20 years of unsuccessful attempts to restore the Bay and its tributaries, the U.S. Environmental Protection Agency (EPA) established the TMDL, which prescribes a comprehensive “pollution diet” with rigorous accountability measures to initiate sweeping actions to restore clean water in the Chesapeake Bay and the region’s streams, creeks and rivers.⁵ The TMDL is designed to ensure that all pollution control measures needed to fully restore the Bay and its tidal rivers are in place by 2025.⁶

In order to meet the TMDL limits, each of the Bay States must reduce their current pollution loads. EPA called upon each Bay State to develop Watershed Implementation Plans (WIPs) as part of the TMDL process.⁷ Development of the WIP involved three phases. The first phase of the WIP development process resulted in the allocation of pollutant loads among various source sectors including wastewater treatment plants, agricultural sources, urban and suburban stormwater, and septic systems.⁸ Phase II of the WIP process, which was completed in 2011, refined the details of the Phase I Plan by providing more geographically targeted pollution load reductions. It also included greater detail about pollution controls that the state and its partners will implement by the end of 2017.⁹ The third phase of the WIP process will be established in 2017. It will address necessary actions for achieving pollution reductions between 2018 and 2025. This report in effect sets the stage for the Phase III WIP, by addressing the opportunities and barriers associated with the State of Maryland achieving its 2025 deadline.

With uncertainties inherent to long-term planning, the WIP process set out interim and final load reduction targets. Specifically, EPA requires the Bay States to achieve 60% of expected reductions by 2017, which in Maryland equates to 6.47 million pounds of total nitrogen. The expected reduction is calculated as the difference between Maryland’s 2009 progress (51.95 million pounds of total nitrogen) and the 2025 allocation (41.17 million pounds of total nitrogen), which equates to 10.78 million pounds of nitrogen.¹⁰ Assuming a linear path to meet the 2025 goal, Maryland needs to reduce about 0.67 million pounds of nitrogen per year.¹¹

⁵ There will actually be 294 TMDLs, one for each of the three pollutants (nitrogen, phosphorus and sediment) for 98 impaired Bay segments (Maryland drains to 58 of the segments and will be subject to 174 TMDLs). Source: Maryland Phase II Watershed Implementation Plan for the Chesapeake Bay TMDL. October 2012. Page 1.

⁶ Chesapeake Bay Total Maximum Daily Load for Nitrogen, Phosphorus and Sediment. December 29, 2010. U.S. Environmental Protection Agency, Region 3. Page ES-1.

⁷ Phase II WIP. Page 1.

⁸ Ibid.

⁹ Maryland Phase I Watershed Implementation Plan – Executive Summary Submitted Final 12/03/10. Page ES-1.

¹⁰ Source: MDE

¹¹ Note: Analyses of Maryland’s Phase II WIP determine that the BMP actions proposed to meet the nitrogen goal are sufficient to also achieve the phosphorus goal.

Progress to date.¹² According to a briefing provided by the Maryland Department of the Environment to the Maryland Chesapeake Bay Cabinet on July 10, 2014, Maryland achieved its 2013 milestone targets for nitrogen, phosphorus and sediment. Specifically, the state finished the 2012-2013 milestone period more than 3.5 million pounds ahead of schedule for nitrogen reductions, nearly 147,000 pounds ahead of schedule for phosphorus reductions, and nearly 90 million pounds ahead of schedule for sediment.¹³

Maryland’s 2013 progress data indicates that Maryland is nearly 41% toward its 2025 nitrogen target and 62% toward its 2025 phosphorus target. Table 1.1 provides a summary of the 2013 progress results as compared to the 2025 targets established in the Phase II WIP.

Table 1.1: 2013 Progress Toward 2025 Targets

| Sector: | Nitrogen | Phosphorus |
|------------------|----------|------------|
| Agriculture | 58% | 32% |
| Urban Runoff | 0% | 34% |
| Wastewater + CSO | 57% | 156% |
| Septic | 2% | |
| All Sectors | 41% | 62% |

Source: MDE¹⁴

The EPA review of 2013 progress toward meeting 2012-2013 milestones shows that Maryland has made enough progress in the agriculture and wastewater sectors to ensure implementation is occurring, even though not all of the milestone goals were achieved.¹⁵ Using the 2013 progress data as a baseline, the state then estimated or projected expected pollution reduction levels in 2025, which is when final pollution targets must be met. Figure 1.1 provides a summary of those projections. As the graph indicates, while the progress towards interim and final targets varies by sector, the state appears to be on track to meet its final **aggregate** target of 41.17 million pounds of total nitrogen.

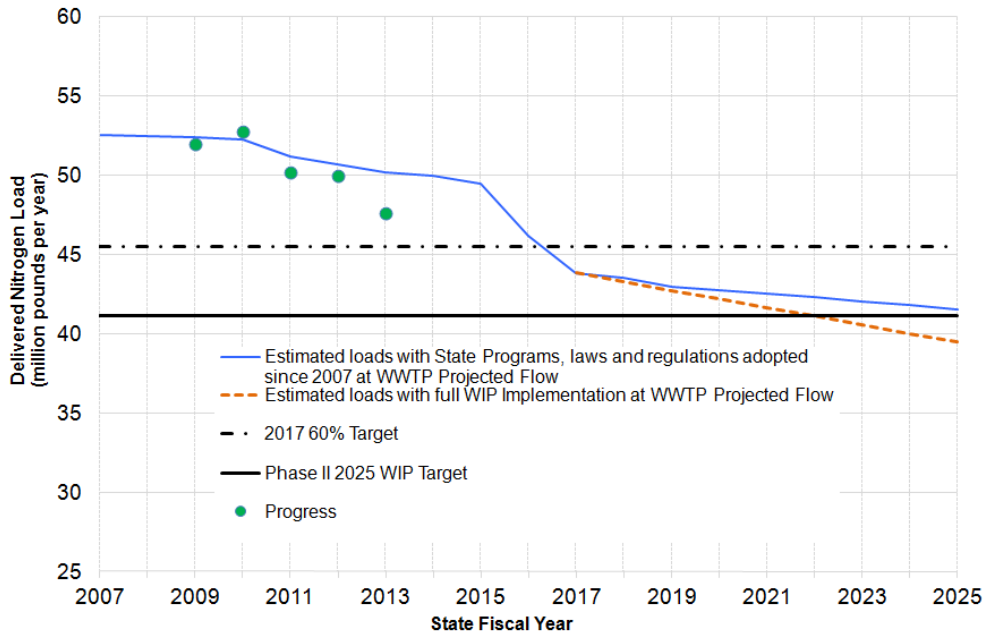
¹² A note in regards to EFC’s role in assessing implementation progress to date. This report was generated as a part of a joint project between EFC and state agencies. Specifically, EFC worked in direct partnership with MDE and DNR, and our findings were incorporated into a broader assessment of the impact of the state’s implementation process to date. Therefore, the analysis contained in this section of the report is meant to be summary in nature and relies on information provided by MDE and the other Bay Cabinet agencies. Documents developed and distributed by the state agencies provide detailed assessments of implementation progress to date as well as projections for achieving interim and final pollution targets.

¹³ Maryland Department of the Environment; Bay Cabinet Briefing on 2-Year Milestones and Progress. July 10, 2014. Page 6.

¹⁴ Based on 2013 modeling progress results.

¹⁵ Ibid.

Figure 1.1: Future Annual Nitrogen Load Projections



Source: Maryland Department of the Environment

In the following sections of this report, we provide a more detailed discussion of the accomplishments and trends of nutrient reductions for each sector. However, several key issues are important to point out up front. First, the state’s 2025 projections do not include the impacts of anticipated population and economic growth. As a result, total nutrient and sediment loads in all likelihood will miss pollution targets if new growth is not offset in its entirety. What this means, of course, is that achieving the 2025 target will occur at the expense of growth capacity that was built into the wastewater treatment sector, which we discuss in more detail in Section 5. As a result, a primary focus of the state’s implementation process over the coming years must be to build that capacity back into the system. Finally, achieving the final 2025 pollution reduction targets will occur in spite of the lack of progress in the urban stormwater and onsite wastewater (septic) sectors. Again, this will have direct impacts on the state’s restoration financing efforts into the future.

Section 2: Agricultural Management

Agriculture accounts for nearly 43% of the 2010 base nitrogen load, and the State WIP requires 23.7% reduction in nitrogen pollution emissions to 15.22 million pounds per year.¹⁶ According to the state agencies, agricultural loads are expected to decrease over time and are on track to meet interim and final targets.¹⁷ The decrease in loads from agricultural production is the net result of three factors. First, the share of land devoted to agriculture has fallen due to development. This land conversion results in an accounting shift of nutrient loads from agriculture to urban stormwater management. Second, animal production is projected to increase. Lastly, the rate of adoption and nature of best management practice has changed.¹⁸

Section 2.1: Regulatory Structure

The regulations and associated financing structures related to pollution emissions from agricultural production are relatively complex and varied whether addressing new or existing sources of emissions. In addition, pollution sources from the agriculture sector can be regulated (or not regulated) as point or non-point depending upon the nature and scale of operation. For example, point source pollution emissions from large animal feeding operations are regulated through the National Pollutant Discharge Elimination System (NPDES) permitting system. Conversely, nonpoint sources of agricultural pollution emissions are relatively unregulated, which has a direct impact on the agricultural financing structure. In short, the state's regulatory program is based on two structures: nutrient management planning and mitigating the impacts of animal production.

Nutrient Management Planning and the Water Quality Improvement Act. The foundation for regulating and managing nutrient emissions from agricultural production was established in 1998 when the Maryland legislature enacted the Water Quality Improvement Act (WQIA). The law mandated changes for Maryland's agricultural community and land managers, including:

- Nitrogen and phosphorus-based nutrient management plans;
- Reduction of the phosphorus in manure via feeding regimes;
- Provisions for transporting animal manure from fields showing excessive phosphorus to fields needing additional nutrients;
- Increased scrutiny of record keeping; and,
- Additional evaluations of the phosphorus nutrient.¹⁹

The WQIA put into regulation the state's Nutrient Management Planning program. The nutrient management planning requirement of the WQIA in effect set the baseline for measuring farm-level efforts to address impacts of operations on water quality and aquatic resources. Maryland law requires all farmers grossing \$2,500 a year or more or livestock producers with 8,000 pounds or more of live animal weight to follow nutrient management plans (NMPs) when fertilizing crops and managing animal manure. NMPs specify how much fertilizer, manure or other nutrient sources may be safely applied to crops to achieve yields and

¹⁶ Phase II WIP. Page 9.

¹⁷ Report to Bay Cabinet. Page 8.

¹⁸ Ibid.

¹⁹ <http://extension.umd.edu/anmp/about/history-nutrient-management-planning-maryland>. Last accessed: December 29, 2014.

prevent excess nutrients from impacting waterways. Because of their complexity, NMPs must be prepared by a certified University of Maryland specialist, certified private consultant for hire, or farmer who is trained and certified by MDA to prepare his/her own plan.²⁰

MDA's revised nutrient management regulations modify how a farm nutrient management plan is developed and implemented and changes the way organic nutrient sources and other materials are managed. The requirements are being phased in over the next several years.²¹ It is important to stress that the reductions associated with the Tier 1 Nutrient Management Planning rules are included in the baseline for the state's agricultural WIP efforts. In other words, Tier 1 nutrient management plans are assumed to be in place as of the 2010 baseline year or starting point for the WIP. Therefore, any associated reductions from those plans have already been incorporated into reduction estimates and allocations, meaning the state's entire pollution reduction strategy must be in addition to the baseline established by nutrient management planning.

Phosphorus Management Tool.²² One specific component of the nutrient management process is controlling phosphorus emissions. Since 2001, Maryland and many other states have been using a tool called the Phosphorus Site index (PSI) to calculate the risk of phosphorus pollution reaching waterways. About ten years ago, researchers at the University of Maryland began a new effort to revise the tool to better identify critical areas where there is a high phosphorus loss potential due to both a high transport potential and a large source of phosphorus, and to encourage the use of management practices in those critical source areas that protect water quality.²³ The resulting tool is referred to as the University of Maryland Phosphorus Management Tool, or PMT for short.

The PMT analyzes areas where excess phosphorus is present in the soil and identifies where a high potential for phosphorus loss exists. The PMT also allows farmers to evaluate the management options available to reduce the risk of phosphorus losses from agricultural fields to nearby waterways; revising and updating the tool is an element of Maryland's WIP. Though the state's intended goal is to include the PMT in the Nutrient Management Manual, the tool has yet to work its way through the regulatory process; it is not yet being implemented at scale, and its ultimate fate is uncertain. Therefore, given the uncertainty associated with the final application of the PMT, we consider the phosphorus emissions that it would address to be currently unregulated.

Large Animal Feeding Operations. Animal Feeding Operations (AFOs) are agricultural operations where animals are kept and raised in confined situations. AFOs congregate animals, feed, manure, dead animals, and production operations; AFOs that meet the regulatory definition of a concentrated animal feeding operation (CAFO) may be regulated under the NPDES permitting

²⁰ http://mda.maryland.gov/resource_conservation/Pages/farmer_information.aspx. Last accessed: December 15, 2014.

²¹ *ibid.*

²² Please note that this report was produced prior to the passage of regulations requiring the use of the phosphorus management tool by 2024. The implementation of the tool will assign pollution reductions to the private sector, which in effect will reduce the state's financing obligation in the long-term.

²³ http://extension.umd.edu/sites/default/files/_docs/articles/EB-405%20UMD%20Phosphorus%20Management%20Tool-Technical%20Users%20Guide.pdf. Last accessed: December 30, 2014.

program. The NPDES program regulates the discharge of pollutants from point sources to waters of the United States. CAFOs are point sources, as defined by the CWA [Section 502(14)]. To be considered a CAFO, a facility must first be defined as an AFO.

Maryland is home to at least 588 large animal farms that are defined as either CAFOs, or Maryland animal feeding operations (MAFOs). The distinction between the CAFO and MAFO designation determines how the farming operation will be regulated:

- Maryland Animal Feeding Operation (MAFO) Permit. Large animal feeding operations (AFOs) that do not propose to discharge pollutants to waters of the state are required to apply for a Maryland Animal Feeding Operation (MAFO) permit from the Maryland Department of the Environment (MDE). A small or medium-sized AFO may also be designated as an MAFO and require a permit if MDE determines that it poses a risk to water quality.²⁴
- Concentrated Animal Feeding Operation (CAFO) Permit. Medium or large animal feeding operations that propose to discharge pollutants, including but not limited to manure, poultry litter or process wastewater to waters of the state are required to apply for a Concentrated Animal Feeding Operation (CAFO) permit from the Maryland Department of the Environment. CAFOs are animal feeding operations with 37,500 or more animals per flock of chickens with dry manure handling; 25,000 or more laying hens with dry manure handling; 200 or more dairy cattle; 300 or more cattle (including heifers); 750 or more swine weighing more than 55 pounds; or 3,000 or more swine weighing less than 55 pounds. The regulations also include limits on the numbers of horses, veal cattle, sheep, lambs, ducks and turkeys.²⁵

To meet the TMDL, the state has committed to eliminating the discharge of 248,000 pounds-per-year of nitrogen and 41,000 pounds-per-year of phosphorus from all animal feeding operations in the state by 2025.²⁶

The regulatory gap. As described above, the primary regulatory tool associated with nutrient emissions from agricultural production is related to animal production. Maryland has committed to reduce 248,000 pounds of nitrogen and 41,000 pounds of phosphorus from animal operations annually, which is 5% and 22% of the total nitrogen and phosphorus load agricultural reduction goal, respectfully. Therefore, the regulatory gap associated agricultural WIP is 98% for nitrogen and 78% for phosphorus.

Section 2.2: Primary Financing Mechanisms

The financing mechanisms associated with agricultural water quality management are directly influenced by the regulatory structure. Specifically, nutrient reductions associated with MAFO and CAFO permits are the responsibility of the permittee, and are therefore primarily privately financed. We recognize that there are some subsidy or privately supported grant programs that may support projects directly related to permit compliance, but the owner/operator is still responsible for financing and implementation. In other words, if the grants are not available, then the owner/operator is responsible for the financing.

²⁴ http://mda.maryland.gov/plants-pests/Pages/mde_federal_permit.aspx. Last accessed: December 15, 2014.

²⁵ http://mda.maryland.gov/plants-pests/Pages/mde_federal_permit.aspx. Last accessed: December 10, 2014.

²⁶ Phase II WIP. Page 9

Pollution reductions from unregulated agriculture operations are primarily financed through state and federal cost share programs. Cost-share programs provide farmers with grants, subsidies, and rental payments to implement on-farm practices designed to improve environmental performance of farming activities. Some of these programs, such as the Maryland Agricultural Water Quality Cost-Share (MACS) Program and the state's cover crop program, specifically target water quality improvements or directly fund of nutrient pollution reductions. Others, such as the Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Enhancement Program, support reductions in nutrient pollution in combination with other desired benefits such as habitat protection or advanced on-farm practices. For the purposes of this analysis, we consider each of the state and federal cost share programs as directly financing agricultural nutrient load reductions, recognizing that the investments are not always so direct.

Estimated revenue flows. Revenues supporting nutrient reductions from agricultural practices are centered on two areas: regulated and unregulated agricultural activity.²⁷ For regulated activity, specifically MAFO and CAFO operations, we assume private financing of best management practices—understanding that there are available cost share programs—using a cost of \$26 per pound of a treated pound of nitrogen. Using the WIP target of 248,000 pounds, the total revenue flow addressing regulated activity is \$6,448,000 annually.²⁸

Revenue flows supporting nutrient reductions from unregulated agricultural activities are primarily in the form of cost-share or subsidy programs. These subsidy programs are implemented in partnership between the state and federal agencies and they address a broad range of best management practices and conservation/restoration activities. Though none of the subsidy programs address nutrient emissions directly (i.e., payments are not based directly on pollution reductions or performance) many do directly incentivize implementation of key water quality practices, such as manure management and cover crops.

Table 2.1 provides a summary of the FY2014 agricultural cost share and subsidy programs. The estimates are based on appropriated or allocated funds rather than actual contract values or expenditures. Total subsidy programs across all state and federal programs equaled \$61,472,630 in Fiscal Year 2014. Therefore, the total additional revenue flow from subsidy programs through 2025 is estimated to be \$737,671,560.

²⁷ Private philanthropic revenue makes up a third source of revenue flow. Because of the difficulty in determining the ultimate target or goal of philanthropic investments associated with Chesapeake Bay restoration, it is not possible to determine the level of investment in agriculture nutrient reductions. Therefore, we address philanthropic giving and investment in Section 6.

²⁸ This estimate is based on another key assumption, which is that investments in nutrient management from regulated activities is happening immediately, rather than being scaled up over time. We recognize that this assumption may prove to be incorrect due to lack of enforcement of CAFO permits.

Table 2.1: FY 2014 Agriculture Cost Share and Subsidy Expenditures

| MDA | | NRCS | | FSA | |
|--|---------------------|---------------------|---------------------|--------------------|----------------------------|
| MACS ²⁹ | \$4,000,000 | EQIP ³⁰ | \$11,474,350 | CRP ³¹ | \$ 7,400,000 ³² |
| Cover Crop | \$21,226,000 | AMA ³³ | \$149,550 | CREP ³⁴ | \$11,000,000 ³⁵ |
| Manure Transport | \$1,200,000 | ACEP ³⁶ | \$923,520 | | |
| Nutrient Management and Manure Incorporation | \$1,400,000 | CSP ³⁷ | \$1,077,260 | | |
| CREP Signing Incentive Payment | \$528,000 | CSP02 ³⁸ | \$1,082,960 | | |
| | | WRP ³⁹ | \$10,990 | | |
| Total | \$28,354,000 | | \$14,718,630 | | \$18,400,000 |

Section 2.3: Estimated Implementation Costs

Though agriculture continues to be a significant source of nutrient pollution to the Chesapeake Bay, the sector also has proven to be a very efficient source of investment in water quality restoration and protection, due to the relative efficiency of agricultural best management practices (BMP). In this section, we provide an assessment of the costs of addressing nutrient emissions, focusing specifically on the state's estimates during the WIP development process.

Our approach with the BMP cost estimates was to understand the relative scale of water quality investments that will be required within each key sector. To that end, we provided a range of estimates using a variety of tools and resources, including:

- Estimates generated by state agencies as part of the WIP process;
- Estimates generated through the Maryland Assessment and Scenario Tool (MAST); and,
- Estimates generated through other past studies and projects.

State generated estimates. Several presentations generated by state agencies report agricultural BMP cost estimates by sector (see: *Current Progress and Future Projections in*

²⁹ Maryland Agricultural Water Quality Cost Share Program

³⁰ Environmental Quality Incentives Program

³¹ The Conservation Reserve Program: 45th Sign Up Results. US Department of Agriculture.

³² According to MDA Maryland had 67,455 acres enrolled as of June 2013. However 9,911 acres expired on 9/31/2013. Using the Maryland average rental rate for Signup #45 of \$112.94/acre, total rental payments are between \$7.4 and \$8.5 million. The range reflects acres before and after 9/31/2013.

³³ Agricultural Management Assistance Program

³⁴ United States Department of Agriculture Farm Services Agency Fact Sheet: *Conservation Reserve Enhancement Program – Maryland*. March 2011.

³⁵ The USDA share for Maryland CREP is estimated to be \$165 million for rental payments to be made over 15 years, and about \$33 million for cost-share payments during the same period, for a total of \$198 million. These estimates suggest approximately \$11 million per year in rental payments for the State of Maryland.

³⁶ Agriculture Conservation Easement Program

³⁷ Conservation Stewardship Program

³⁸ Conservation Security Program (from the 2002 Farm Bill; no longer active)

³⁹ Wetlands Reserve Program

Implementing MD’s Blueprint for Restoration, October 2014). In order to replicate the state’s cost estimates, we assumed reductions overtime follow a linear trend. We recognize that this assumption most likely overestimated the sector’s aggregate reduction (and therefore, underestimated its cost per pound). From 2010 to 2017, the decline in nitrogen loads from agriculture is steeper than projected for the subsequent period of 2017 to 2025. Using the annual load figures and total cost estimates reported in the WIP, we estimated that the average cost per treated pound of nitrogen to be around \$26.

MAST generated estimates. Our next step was to compare the WIP cost estimates to MAST.⁴⁰ For the MAST analysis we used statewide WIP scenarios using 2013 (rather than 2010) as the base year. Following a similar process, we estimated aggregate loads and developed estimates of the cost per pound of reduced nitrogen by sector. We compared changes in annual loads from 2013 to 2025 and estimated aggregate reductions by assuming linear reductions through time. We then assumed that annual costs also follow a linear trend through time to estimate aggregate costs.

Table 2.2 provides a summary of the WIP and MAST analysis. Direct comparison across the two sources (WIP and MAST) is difficult. MAST does not report loads or costs as cumulative figures. It reports costs as annualized figures. However, calculating cost-effectiveness facilitates comparison and helps characterize the variability in projections. MAST-based cost-effectiveness estimates are lower for agriculture. The cost of reductions in nitrogen from the agriculture is \$17 per pound, about one-third that of WIP-based estimates.

Table 2.2: Nitrogen Loads and Costs from the Agriculture Sector

| Sector | Nitrogen Load | | Total Reduction | Total Cost | |
|-------------------------|--------------------------|---------------------|-------------------------|-----------------------|--------|
| | Base Year (M lb./yr.) | 2025 (M lb./yr.) | (2013-2025)* (M lb.) | (2013-2025)* (\$M) | \$/lb. |
| WIP (2010-2025) | 20 | 15.2 | 34.5 | \$928 | \$26 |
| MAST (2013-2025) | 17.5 | 14.7 | 17.0 | \$293 | \$17 |

*EFC estimates.

Looking more broadly in the literature, we find figures that highlight the variability of estimates. The Chesapeake Bay Commission provided the most recent source of estimates. The Commission reported cost effectiveness estimates for reductions in agriculture from 13 BMPs.⁴¹ Without trading, the cost per pound of nitrogen reduction by agriculture is around \$90. However the range around this estimate is very wide, not only for given BMPs, but across BMPs. This estimate is over three times higher than the WIP based estimate and over five times higher than the MAST based estimate.

⁴⁰ Maryland Assessment and Scenario Tool (MAST) allows users to develop restoration scenarios with varying best management practices (BMP). Output includes nitrogen, phosphorus, and sediment loads from all sectors and sources and the acres of each BMP for any area in the Chesapeake Bay Watershed. These loads are consistent with the Chesapeake Bay Program’s Watershed Model. MAST also provides inputs to the Chesapeake Bay Program computer models. Users can compare among scenarios to select the practices that reduce the most pollution and target these practices to the highest impact areas. Scenarios can be used for TMDL Watershed Implementation Plans, Milestones, or for local planning purposes.

⁴¹ *Nutrient Credit Trading for the Chesapeake Bay: An Economic Study*. Prepared for the Chesapeake Bay Commission by RTI International. May 2012.

Table 2.3: Total Estimated Cost of Nitrogen Removal for Agriculture

| | Cost per Pound Reduced | Total Cost |
|----------|------------------------|------------|
| | (\$/lb.) | (\$M) |
| WIP | \$26 | \$928 |
| Low * | \$17 | \$611 |
| High* | \$90 | \$3,193 |
| Average* | \$44 | \$1,577 |

* We construct a range (i.e., low, high, and average) based estimates from the WIP, MAST, Chesapeake Bay Commission (2012), “Nutrient Credit Trading for the Chesapeake Bay: An Economic Study”.

We used cost per pound figures from these three sources to estimate a potential range in total cost of achieving the 2025 target. Total cost for agriculture ranges from \$611 million to \$3,190 million. Table 2.3 details the range in estimates. Our analysis indicates that although the state’s WIP estimates are on the lower side of the range of cost estimates, they are in fact reasonable estimates for planning purposes. Therefore, in summary, the estimated costs for achieving 2025 agricultural WIP reductions is \$928,000,000.

Agricultural financing gap. Using the estimated costs and revenue flows we estimated the agricultural financing gap to be approximately \$190,328,440. Specifically, we compared total estimated implementation costs to the anticipated revenue flows:

| | |
|---------------------------------------|----------------------|
| Total estimated implementation costs: | \$928,000,000 |
| Total estimated annual revenue flows: | \$737,671,560 |
| Total estimated financing gap: | \$190,328,440 |

Section 2.4: Recommendations for Moving Forward.

As with each of the other four sectors, the state’s agriculture strategy must begin by enforcing existing regulations, specifically, existing MAFO and CAFO permits. Though permitted operations account for a relatively small percentage of the total agricultural pollutant load, point source discharges can have a significant local water quality impacts. In addition, every pound of pollution that is not appropriately addressed through permit requirements becomes the responsibility of the state, putting additional pressure on existing financing resources.

It is worth reiterating that agricultural emissions of nutrients and sediments are relatively unregulated and likely to stay that way for the foreseeable future. Therefore, the state’s primary financing role will continue to be to subsidize pollution reductions. In fact, investments in nutrient and sediment reductions from agricultural producers will almost certainly become a major cornerstone of the state’s water quality investment strategy.

As the gap analysis indicates, though there is a financing and revenue gap associated with agricultural water quality financing, there is also a significant amount of revenue flow supporting pollution reduction activities. Therefore, one of the most effective ways to reduce the gap is to make some structural changes to state financing in order to increase efficiency and maximize environmental return on investment. Most importantly, the state must shift its financing focus to environmental performance, thereby maximizing pollution reductions per dollars invested. This will be especially important as the state works to reduce implementation costs and to build growth capacity back into the system. We address this in more detail later in

the report, but for now we point out the fact that state investments could be much more focused and efficient in the long-term. The good news is, of course, the resources are sufficient to implement a very effective agricultural water quality restoration financing program.

Section 3: Urban Stormwater Management

Perhaps no issue better demonstrates the complexity, scale, and contentiousness of the Chesapeake Bay restoration effort than financing urban stormwater management. As stormwater regulations at all levels of government have become more restrictive, local communities are facing significant financing obligations. The challenge is especially acute for those communities struggling to retrofit existing urban environments and development. Though much of the stormwater financing obligation falls on local government, the existing structure of water quality regulations has effectively transferred much of that responsibility to the state.

Urban stormwater management accounts for just over 20% of the total 2010 base nitrogen load, and the state WIP requires a 20% reduction of 1.93 million pounds per year. Urban stormwater loads are actually increasing due to population growth. In addition, MDE reports that efforts by the state to finance urban stormwater management (as well as reductions from septic systems) have taken a back seat to wastewater and agriculture due to the relative inefficiency or cost ineffectiveness of urban reductions. At the current pace, urban stormwater management will not achieve either interim or final nitrogen reduction targets. In fact, as of 2013, the state had achieved 0% of the nitrogen goal in the urban sector, again a reflection of the fact that loads are actually on the increase. It should be noted that in 2013 phosphorus reductions were at 34% of the 2025 goal. There are a variety of reasons why this may be the case, the most important of which is the fact that urban communities are not required to reduce nutrients specifically; rather, regulated communities are required to mitigate the impact of impervious surfaces, which often means addressing issues associated with hydrology. As a result, sediments and phosphorus are addressed and mitigated more directly.

Section 3.1 Regulatory Structure

The regulatory and financing structures associated with urban stormwater runoff differ in regards to existing vs. new sources of emissions. As a result, stormwater management is regulated in one of two ways. First, emissions that are the result of new development are regulated through the Stormwater Management Act of 2007. Second, emissions that are the result of existing urban development (pre-1994) are regulated through the Municipal Separate Storm Sewer Systems (MS4) permitting system as part of the National Pollutant Discharge Elimination System (NPDES) regulatory program.

- *Stormwater Management Act of 2007.* Stormwater impacts from new development activity are regulated in Maryland through the Stormwater Management Act of 2007. Prior to this Act, which became effective on October 1, 2007, environmental site design (ESD) was encouraged through a series of credits found in Maryland's Stormwater Design Manual.⁴² The Act required that ESD, through the use of nonstructural best management practices and other better site design techniques, be implemented to the maximum extent practicable in any new significant development or redevelopment project. MDE was charged with implementing the new rules and therefore made changes to state's stormwater

⁴² Environmental site design (ESD) is a form of stormwater management that is intended to improve the health of water resources. Also known as low impact development or green infrastructure, the goal of ESD is to minimize the impact of land development on streams, rivers and the Chesapeake Bay by using natural and small-scale or distributed stormwater management practices to control runoff. (Source: American Rivers)

management regulations (COMAR 26.17.02) to address the new law; the changes became effective in 2009.

The 2007 rulemaking was a very important step forward. In effect, the law is pushing new development towards water quality sustainability. However, the law does not directly regulate nutrient and sediment emissions from developed lands. Therefore, other financing systems and structures must be put in place to address emissions in the future.

- *MS4 Permitting Program.* Stormwater by its very nature is a diffuse or nonpoint source of water pollution. However, amendments made to the Clean Water Act in 1987 expanded the federal permitting program to include emissions from stormwater. Polluted stormwater runoff is commonly transported through Municipal Separate Storm Sewer Systems (MS4s). An MS4 is a system of conveyances that include, but are not limited to, catch basins, curbs, gutters ditches, manmade channels, pipes, tunnels, and/or storm drains that discharge into water bodies. For these conveyances, or system of conveyances to be recognized as an MS4, a state, city, town, village, or other public entity must own them. These conveyances must also not be part of a Publically Owned Treatment Works and may not operate as a combined sewer. Operators of large, medium, and regulated small MS4 systems are required to obtain NPDES permit coverage in order to discharge pollutants.⁴³ These designations (large, medium, and small) are based on urbanized areas as determined by census counts.

In most cases, the NPDES permitting process is managed at the state level. Permits are applied to jurisdictions (and in some case agencies and facilities) based on a community's size:

- Phase I, issued in 1990, requires *medium* and *large* cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater discharges. In Maryland, the ten largest subdivisions (nine counties and the City of Baltimore) are Phase I MS4 communities, and they account for more than 75% of the state's total urban nutrient load to the Chesapeake Bay.
- Phase II, issued in 1999, requires regulated small MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges.

Generally, Phase I MS4s are covered under an individual permit and Phase II MS4s are covered by a general permit. Each regulated MS4 is required to develop and implement a stormwater management program (SWMP) to reduce the contamination of stormwater runoff and prohibit illicit discharges.⁴⁴

Phase I jurisdictions in Maryland are entering—or have entered—the third five-year permit cycle. Under the conditions of the new permits, regulated jurisdictions are required to possess the legal authority to control storm drain system pollutants, continue mapping its storm sewer system, monitor stormwater discharges, and develop and implement

⁴³ NPDES Permit- National Pollutant Discharge Elimination System; a national program under Section 402 of the Clean Water Act for regulation of discharges of pollutants from point sources to waters of the United States. Discharges are illegal unless authorized by an NPDES permit.

⁴⁴ <http://cfpub.epa.gov/npdes/stormwater/munic.cfm>. Last accessed: January 2, 2015

comprehensive management programs. The permits require the implementation of trash reduction strategies and environmental site design for new and redevelopment projects to the maximum extent practicable. The communities are also required to develop and implement plans to address waste load allocations established under EPA approved total maximum daily loads.⁴⁵

Perhaps the most significant change in this third permit cycle is the requirement to treat impervious surfaces. These new permits will require the urban counties in Maryland to treat 20% of the impervious surfaces that are not currently treated to the maximum extent practicable.⁴⁶ As we discuss below, this will have a significant impact on local stormwater financing efforts.

- *NPDES General Permit for Construction Activity.* An important component of stormwater runoff management is controlling emissions associated construction activities. An individual or general permit is required for all construction activity in Maryland with a planned total disturbance of one acre or more. Conditions of the permits include compliance with approved erosion/sediment control and stormwater management plans, self-inspection and record keeping. The permit authorizes stormwater discharges from these construction sites. The primary pollutant to be controlled is sediment.

Regulatory gap. The Phase II WIP indicates that regulated development accounts for 1.52 million pounds, or 78.7% of the total required urban pollution load reduction. Much of the remaining required load reduction comes from unregulated developed lands. In effect, this means that approximately 80% of the required urban pollution reduction and the associated financing responsibility falls on local government. However, an examination of the existing regulatory system indicates that the total level of regulated emissions is much lower. As described previously, the ten large MS4 Phase I urban jurisdictions will be required to treat 20% of the impervious surfaces that have not been treated to the maximum extent practicable. Analysis conducted by MDE indicates that this level of treatment will result in total nitrogen reductions of between 383,307 pounds and 858,607 pounds by 2025, with a probable reduction estimate of 505,965 pounds. Therefore, between 25% and 56% of the required pollution load reduction is associated with existing stormwater regulations. Conversely, between 44% and 75% of the necessary load reductions will fall outside permit requirements.

There are essentially two explanations for the gap between the WIP urban reduction requirement and the anticipated results of permitted activities. First, the MS4 permits require treatment of impervious surfaces, which can be achieved in a variety of ways using a variety of best management practices. The location and combination of those practices can have varying degrees of impact on pollution loads to the Chesapeake Bay. In other words, achieving permit compliance may or may not maximize pollution reductions to the Bay. Second, NPDES permits are issued on five-year cycles, and as a result, it will take multiple permit cycles beyond 2025 to treat the entire regulated impervious area.

This regulatory gap analysis has financing implications for state leaders. Though the state has the authority to regulate all of the nutrient and sediment emissions from local jurisdictions

⁴⁵http://www.mde.maryland.gov/programs/water/stormwatermanagementprogram/pages/programs/waterprograms/sedimentandstormwater/storm_gen_permit.aspx. Last accessed: January 2, 2015.

⁴⁶ The requirement is 30% in Montgomery County.

subject to MS4 Phase I and II requirements, it is unlikely that the state will require treatment beyond the existing 20% level.

Section 3.2: Primary Financing Mechanisms

Financing stormwater management has traditionally been the responsibility of local governments. Prior to the 1987 changes to the Clean Water Act, the primary local financing priority was often controlling and mitigating the impacts of flooding. The 1987 amendments resulted in a local financing shift towards regulatory compliance based on water quality management and improvement. As a result, urban communities in Maryland have been financing stormwater programs to some extent since 1990 when the MS4 permitting system was first implemented. New stormwater regulations also effectively assigned financing responsibility, and responsibility differs according to new and existing emissions.

The 2007 stormwater regulations require new developments to include state of the art stormwater management practices, which will reduce pollutant loads and benefit water quality. As a result, the responsibility for financing the construction of these practices is entirely on the developer or the private sector. There are certainly situations where local governments are in a position to upgrade public infrastructure, including stormwater infrastructure, as a result of new development activity, but stormwater controls that are required on the development site are the responsibility of the developer. However, an area of great concern in many urban communities is the long-term operations and maintenance of new stormwater practices. This responsibility can often fall on local governments, either explicitly through contractual agreements, or by default when practices are not appropriately maintained by private interests.

In contrast to new development practices, financing responsibility for existing development is primarily local. Municipalities have a variety of mechanisms to fund their stormwater programs. The two most common funding options are general fund appropriations and stormwater service fees (discussed below).

General Fund. Most communities have traditionally funded stormwater management from taxes paid into their general funds. The general fund is a government's basic operating fund and accounts for everything not accounted for in other funds, such as a special revenue fund or a debt service fund. There are, of course, advantages to using general funds to support stormwater programs. Most communities have established revenue and debt programs, which makes the process of supporting new and expanding programs familiar and uncomplicated. In addition, financing through the general fund allows local leaders to consider stormwater financing relative to other community priorities. There are, however, several significant drawbacks to expanding local stormwater management activities through general fund financing.

In most communities, municipal programs must compete for limited general fund dollars. Compounding resource availability issues is the fact that stormwater management improvements typically have a low priority in many communities, unless the municipality is reacting to a recent major storm event or regulatory action. Another deficiency of financing stormwater management through the general fund is the lack of transparency of the general fund financing system. The total cost of stormwater management is not readily apparent when these costs are dispersed among general fund departmental budgets. In addition, as stormwater management costs increase, general fund budgets are often not increased in

parallel to meet those needs.

Service Fees and Stormwater Enterprise Programs. In lieu of supporting stormwater programs through the general fund, many communities prefer to establish stormwater enterprise funds. This shift began in Maryland in 2002 when Montgomery County implemented their stormwater management fee.⁴⁷ A key advantage of fee systems is that fees are charged to taxpaying and tax-exempt properties alike. As a result, stormwater utilities address the shortcomings and inequities of funding stormwater management by property taxes or water/sanitary service fees. There are currently more than 1,500 fee-supported stormwater systems in operation across the country.

Regardless of the type of financing mechanism employed by local governments to address stormwater management costs, the use of fees and stormwater enterprise programs to address existing pollution from stormwater runoff changed dramatically in Maryland with the passage of House Bill 987, which created the Stormwater Management and Watershed Restoration and Protection Program in 2012.

- *House Bill 987: Stormwater Management and Watershed Restoration and Protection Program.* House Bill 987 established the Stormwater Management—Watershed Protection Restoration Program. The passage of that bill resulted in mandatory fee-based stormwater financing and revenue programs within urban communities across the state. Specifically, the bill applies to counties and municipalities subject to MS4 Phase I requirements and mandates the establishment of watershed protection and restoration programs. To fund the programs, each county and municipality must assess a stormwater remediation fee from property owners within its jurisdiction. The type of fee (flat, proportional or otherwise) may be determined by the county or municipality, but the fees must take into account on- and off-site facilities, systems and activities that a property owner has in place to manage stormwater discharge, and must make exceptions for property owners demonstrating financial hardship. The stormwater remediation fee must go into a local watershed protection and restoration fund where it may be used, among other things, to improve county and municipal stormwater management systems, restore streams and wetlands, fund stormwater management planning and provide grants to nonprofit organizations performing certain watershed restoration projects.⁴⁸

Estimated revenue flows. Stormwater management has perhaps the most complicated revenue flows of the four pollution sectors, involving public and private interests and stakeholders. Specifically, the source and extent of revenue flows differs in regards to new and existing pollution loads, as well as pollution from regulated and unregulated activities. We address new emission sources in the final section of the report; for the purposes of this analysis, we focus on existing regulated and unregulated urban stormwater emissions.

Keeping with our assumption that regulated institutions and communities are responsible for financing their own pollution reductions, our strategy was to estimate the level of stormwater management investment at the local level. In addition, our focus was on the ten large urban jurisdictions that are regulated as Phase I MS4 communities (i.e., those communities with

⁴⁷ It should be noted that Montgomery County was not the first community in Maryland to implement a fee. Takoma Park's fee has been in place since 1997.

⁴⁸ <http://www.saul.com/publications-alerts-830.html>. Last accessed: December 1, 2014.

populations greater than 100,000). Stormwater financing and revenue flows within these communities have two primary components: 1) general fund revenues, which have been the traditional source of support for stormwater activities; and, 2) stormwater fees that were established primarily in response to HB 987, which was described above.

To get a better understanding of the level of investment that is occurring within these communities, we implemented a two-part assessment process. First, we calculated the level of fee-based revenue that is being collected in the ten communities. The level of fee collection varies from community to community, but in aggregate there is approximately \$116 million being collected in stormwater fees within the ten Phase I jurisdictions.⁴⁹ Our next step was to assess the level of additional funding that is occurring within each community. One important feature of HB 987 is that the fee must be separate from any existing or future stormwater management charges that a jurisdiction establishes for new development, including fees for permitting, review of stormwater management plans, inspection, or monitoring. In addition, many communities that establish stormwater fees continue to co-finance stormwater activities through general fund appropriations. Therefore, we conducted an assessment of each of the ten communities' stormwater budgets to determine the actual level of annual investment. As Table 3.1 indicates, the total level of annual stormwater investment within the ten communities was approximately \$177,734,920 in FY 2014, resulting in an aggregate investment between now and 2025 of \$1,955,084,115.

Table 3.1: FY 2014 Local Urban Stormwater Investments

| Subdivision | Fee Revenue | Total Stormwater Budget |
|------------------|----------------------|-------------------------|
| Anne Arundel | \$13,168,000 | \$13,279,240 |
| Baltimore City | \$27,316,477 | \$27,316,477 |
| Baltimore County | \$24,670,197 | \$34,706,794 |
| Carroll | \$0 | \$1,103,542 |
| Charles | \$2,133,000 | \$2,133,000 |
| Frederick | \$490 | \$3,560,000 |
| Harford | \$1,065,725 | \$1,259,991 |
| Howard | \$10,376,000 | \$16,706,000 |
| Montgomery | \$23,629,219 | \$26,069,874 |
| Prince George's | \$14,000,000 | \$51,600,000 |
| Total | \$116,359,108 | \$177,734,920 |

State-based revenue. Though stormwater financing is primarily the responsibility of local government, the state has been making investments in urban areas for the past few years. Specifically, since 2009 the Chesapeake and Atlantic Coastal Bays Trust Fund (Trust Fund) has invested more than \$110 million in restoration practices, specifically focusing on urban and agricultural pollution reductions. The Trust Fund was designed to accelerate Bay restoration by focusing financial resources on cost-effective nonpoint source pollution control projects. Dollars

⁴⁹ Takoma Park, MD also collects approximately \$360,000 annually in fees.

for the Trust Fund are generated through Maryland's motor fuel and rental car taxes. It is anticipated that when fully-funded, the Trust Fund will generate \$50 million annually.⁵⁰

In Section 7 of this report, we provide specific recommendations for how state revenues can be invested more efficiently and effectively. For now, we focus on existing and planned investments in stormwater management. Specifically, the Trust Fund's 2015 Work Plan budgets approximately \$9.7 million in local WIP implementation, including stormwater management and stream restoration efforts.

The state has also made significant stormwater capital investments over the past few years. Specifically, in FY2014 and FY2015 the state invested more than \$50 million in stormwater infrastructure projects across the state. Though these investments were significant and impactful, the relatively uncertain nature of these types of capital appropriations makes it very difficult to predict to what scale these investments will continue. Therefore, given the expected capitalization rate of \$50 million, and an assumed split between urban and agricultural practices, approximately \$25 million of Trust Fund revenues will be invested in stormwater management annually. This results in an estimated aggregate investment of \$275,000,000 by 2025.

Beginning in 2018, the Bay Restoration Fund (BRF) will supplement the Trust Fund's investments in support of nonpoint source nutrient emissions across the state. The BRF was formed in 2004 through the passage of Senate Bill 320 and has since become a significant source for funding for wastewater treatment plant upgrades, which we address in detail in Section 5. However, during the 2012 legislative session House Bill 446 doubled the BRF fee for most users served by wastewater treatment plants that discharge into the Chesapeake Bay and Coastal Bay watersheds. The bill also requires that BRF fee billing authorities develop a financial hardship fee waiver plan for low-income households. Commercial and industrial users are charged at a similar rate (\$5.00 per month per equivalent dwelling unit (EDU)). In addition to filling gaps in the wastewater financing process, the additional revenue will be used to support stormwater management efforts across the state. By 2025, annual stormwater investments from the BRF will reach \$45 million with a total investment over the next 12 years of \$285 million. Therefore, the combined state investment (BRF and the Trust Fund) in urban stormwater management will be an estimated \$560,000,000 by 2025.

Section 3.3: Estimated Implementation Costs

Assessing the costs of reducing nutrient loads from urban stormwater is particularly challenging given their diffuse nature and dependence on projected land use patterns. In urban settings, it is often difficult to find appropriate vacant property and unconstrained physical space adjacent to individual development projects to mitigate water quality impacts. Location of on-site treatment is often not compatible with existing landscapes or land use contexts.⁵¹ Finally, the proliferation of many small water quality mitigation sites results in questionable environmental benefits, substantial project development and regulatory review cost and increased demands

⁵⁰ http://www.dnr.maryland.gov/ccs/funding/trust_fund.asp

⁵¹ *Stormwater Financing Cost Analysis*. Prepared for the Center for Watershed Protection by the Environmental Finance Center (EFC) at the University of Maryland. April 8, 2013. Page 2.

for maintenance.⁵² The stormwater management requirements associated with the Chesapeake Bay restoration effort will exacerbate these issues in urban communities.

Estimated costs for urban stormwater management is also complicated by the regulatory system that guides the implementation process. Specifically, Maryland’s MS4 permits require permitted communities to treat impervious areas that have not been treated to the maximum extent practicable. Therefore, by definition, the state is not directly regulating nutrient and sediment emissions, which requires a different approach for estimating costs. As a result, we conducted two cost assessments: 1) a cost estimate of achieving the WIP interim and final load reductions; and, 2) a cost estimate of achieving MS4 permit compliance, specifically in the ten Phase I communities.

WIP Cost Estimate. Several MDE presentations report cost-effectiveness estimates of WIP efforts by sector (e.g., *Current Progress and Future Projections in Implementing MD’s Blueprint for Restoration*, October 2014). MDE estimates that the cost to reduce a pound of nitrogen from urban stormwater areas is \$3,800, which is the least cost-effective of the four sectors. MDE’s estimate of reducing nutrients in urban stormwater is high compared to other research and data sources. Mirroring the our process for estimated agricultural implementation costs, we used data from the WIP and MAST to review MDE figures. We found reducing urban stormwater emissions of nitrogen continues to have the highest costs on a per-pound basis. However, our cost effectiveness estimates were significantly lower than those generated by MDE. We estimated that the average cost per pound of nitrogen removed for stormwater was \$510.

Again, mirroring the process used to estimate agricultural implementation costs, we compared changes in annual loads from 2013 to 2025 and estimated aggregate reductions by assuming linear reductions through time. We then assumed that annual costs also followed a linear trend through time to estimate aggregate costs. Table 3.2 summarizes our findings.

Table 3.2: Urban Stormwater Nitrogen Loads and Costs

| | Nitrogen Load | | Total Reduction | Total Cost | Cost-effectiveness |
|-------------------------|---------------|-----------|-----------------|-------------|--------------------|
| | Base Year | 2025 | (2010-2025)* | (2010-2025) | (\$/lb) |
| | (M lb/yr) | (M lb/yr) | (M lb) | (\$M) | |
| WIP (2010-2025) | 9.8 | 7.6 | 14.5 | \$7,388 | \$510 |
| MAST (2013-2025) | 9.3 | 7.0 | 13.7 | \$7,218 | \$526 |

* Total reduction estimates are EFC calculations.

Source: *Maryland’s Phase II Watershed Implementation Plan for the Chesapeake Bay TMDL*, October 2012.

Looking more broadly in the literature, we find figures that highlight the variability of estimates. Again, we compared the WIP and MAST estimates to the Chesapeake Bay Commission’s 2012 water quality trading study. Even without trading, the Commission’s estimate for stormwater treatment is significantly lower than the WIP and MAST estimates. The Commission reports

⁵² *Water Quality Mitigation Banking*. Final Report. December 2009. Submitted by: Anil K. Agrawal, The City College of New York, New York, NY 10031; Andreas Fekete, RBA Group; Fred Scherrer, RBA Group; Bryan VanderGheynst, RBA Group. Region 2 Transportation Research Center.

\$375 as the median cost per pound of nitrogen treated, which is about 25% lower than the WIP estimate.

We also compared the WIP and MAST estimates to recent studies produced by the Center for Watershed Protection (CWP). Specifically the CWP report *Cost-Effectiveness Study of Urban Stormwater BMPs in the James River Basin* (2013) provides cost estimates for implementing urban stormwater BMPs. The study considers 23 different BMPs ranging from new construction to retrofit. Considering only BMPs that could apply to retrofit settings (i.e., excluding BMPs explicitly labeled ‘new’), cost-effectiveness ranges between \$151/lb. and \$2,631/lb., with an average of \$1,122/lb. It should be noted that the CWP study was based on analysis conducted by King and Hagen.⁵³ The King and Hagen study was commissioned by MDE to provide local governments in Maryland with a tool for estimated urban stormwater restoration costs. The study has become the standard or baseline for estimating local stormwater costs in Maryland.

We use these cost per pound figures to estimate a potential range in total cost of achieving the 2025 target. Total cost for stormwater ranges from \$5,430 to \$16,244 million. Table 3.3 below details the range in estimates.

Table 3.3: Total Estimated Cost of Nitrogen Removal from Urban Stormwater

| | \$/lb | Total Cost (\$M) |
|-----------------|---------|---------------------|
| WIP | \$510 | \$7,388 |
| Low * | \$375 | \$5,428 |
| High* | \$1,222 | \$16,244 |
| Average* | \$633 | \$9,170 |

* We construct a range (i.e., low, high, and average) based estimates from the WIP, MAST, Chesapeake Bay Commission (2012), and Center for Watershed Protection (2013).

MS4 Compliance Cost Estimate. As we noted in Section 3.3 above, the cited studies provide estimates as cost per pound reduced. The WIP and MAST estimates, however, originally build from engineering costs estimated on a per acre treated basis. For example, WIP documentation notes that the “costs for urban stormwater were estimated for most BMPs, by applying an average cost-per-acre of \$12,500.”⁵⁴ MAST models total cost estimates based on the selected BMP and characteristics of the acres treated by the BMPs (e.g., number of acres and land use).

Table 3.4: MAST-based Treated Acres and Costs for Nitrogen Reductions for Stormwater: 2013 to 2025

| Acres Treated Per Year | Increase in Treated Acres | Total Cost |
|------------------------|------------------------------|------------|
|------------------------|------------------------------|------------|

⁵³King, D. and Hagan, P. (2011). *Costs of Stormwater Management Practices in Maryland Counties*. Maryland Department of the Environment. October 10. Ref. No. [UMCES] CBL 11-043.

⁵⁴ Maryland’s Final Phase II Chesapeake Bay Watershed Implementation Plan for the Chesapeake Bay TMDL, Appendix C: Cost Analysis and Funding Study. October 2012. http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Pages/FINAL_PhaseII_WIPDocument_Main.aspx

| | 2013 | 2025 | (2013-2025) | (2013-2025) | |
|------------|-----------|-----------|-------------|-------------|----------|
| Sector | (Million) | (Million) | (Million) | (\$M) | \$/acre |
| Stormwater | 0.763 | 1.37 | 0.605 | \$7620 | \$12,600 |

These cost estimates are consistent with the figures reported in King and Hagan (2011). King and Hagan provide estimates for 24 urban stormwater BMPs. When annualized over 20 years, their costs range between \$754 and \$19,830 per treated acre. Measures such as retrofitted bioretention, permeable pavement and impervious surface reduction are among the most expensive (averaging around \$11,000/acre treated). MDE estimated total urban stormwater management BMP costs by applying an average cost-per acre of \$12,500. This per-acre cost was derived by MDE based on three years of implementation and cost records reported by Phase I MS4 jurisdictions between 2009-2011.⁵⁵

According to MDE’s records, permitted jurisdictions expended a total of \$245,502,000 to operate and maintain their local stormwater programs and another \$172,302,000 for capital improvements between 2009 and 2011. During that time, 33,424 acres of developed land was retrofitted with a unit capital cost of \$5,155 per acre and the combined operating and capital unit cost was \$12,500 per acre.⁵⁶ Because stormwater practices may treat a combination of pervious and impervious land, the approximate cost for treating one acre of impervious area is estimated by MDE to be \$61,875. In addition, MDE estimated the likely level of impervious acres treated between 2015 and 2025 to be 43,587 acres statewide. Therefore, the total estimated costs for achieving MS4 permit compliance between 2015 and 2025 is \$2.7 billion.

These cost estimates are consistent with the figures reported in the King and Hagan study. King and Hagan provide estimates for 24 urban stormwater BMPs. When annualized over 20 years, their costs range between \$754 and \$19,830 per-treated-acre. Measures such as retrofitted bio-retention, permeable pavement and impervious surface reduction are among the most expensive (averaging around \$11,000 per-acre treated).

Maryland State Highway Administration. In addition to the Phase I and Phase II community-based MS4 permits across the state, the Maryland State Highway Administration (SHA) maintains MS4 permit coverage for the SHA roadway storm drain systems in all nine Maryland MS4 Phase I counties (Anne Arundel, Baltimore, Carroll, Charles, Frederick, Harford, Howard, Montgomery and Prince Georges) and in the two MS4 Phase II counties (Cecil and Washington).⁵⁷ The total estimated cost for achieving SHA WIP reductions is \$1.5 billion.

Urban stormwater financing gap. Using the estimated costs and revenue flows, we estimated the urban stormwater financing gap. Specifically, we compared total estimated implementation costs to the anticipated revenue flows:

| | |
|---|-------------------------------|
| Total estimated WIP implementation costs: | \$7,388,000,000 ⁵⁸ |
| Total estimated MS4 compliance costs: | \$3,387,839,674 |
| Total estimated revenue flows (Trust Fund and BRF): | \$ 560,000,000 |

⁵⁵ Maryland’s Phase II WIP – Appendix C. October 15, 2012. Page 3.

⁵⁶ Ibid.

⁵⁷ Appendix E: Maryland State Agency WIP Report. Page 2.

⁵⁸ This includes \$1.5 Billion cost estimate associated with the SHA MS4 permit.

| | |
|--|------------------------|
| Total estimated revenue flows (MS4): | \$2,642,923,789 |
| Total estimated WIP financing gap: | \$4,185,076,211 |
| Total estimated MS4 financing gaps: | \$ 744,915,885 |

It is important to note that the estimated WIP and MS4 compliance costs include the Maryland State Highway Administration’s required reductions. However, SHA does not yet have an MS4 permit that contains the requirement to treat impervious surfaces, though it is likely that will happen within the next year. Therefore, we estimate SHA permit compliance costs to be \$687,839,673.⁵⁹ In addition, the total estimated MS4 compliance costs will increase with the addition of SHA’s permit compliance needs. This in turn will add to the anticipated MS4 financing gap. However, the responsibility for financing permit compliance resides with the permitted community or institution. Therefore, the assumption is that over time MS4 compliance costs and revenue flows will come into balance with enforcement of permit requirements.

Section 3.4: Recommendations for Moving Forward

Because the financing responsibility for achieving regulated urban pollution reductions resides with local governments, the state’s primary financing role should focus on three priorities: 1) continuing to enforcement the third phase of the MS4 permits in the ten large urban jurisdictions; 2) focusing investments on projects and pollution reductions that fall outside the existing regulatory system; and, 3) ensuring that emissions from new development and significant redevelopment projects are completely offset in the future. We address each of these specifically.

- 1) *Enforcement of MS4 permits.* The foundation of the state’s urban stormwater financing strategy must be on enforcing the MS4 permits in the ten Phase 1 counties/subdivisions.⁶⁰ As we highlighted in the previous section, the advanced or third iteration of the stormwater permits will only achieve around 25% to 56% of the targeted urban nitrogen and phosphorus reductions. Therefore, it is essential that the state hold local government accountable for those regulated reductions. Failure to do so will add even more burden to the state’s financing obligation.

Enforcing local stormwater regulations has a direct impact on local financing efforts, the focus of which is now based on stormwater fee systems. This is the result of the passage of HB 987 by the Maryland legislature. For years many communities had been considering and debating the need for fee-based stormwater financing systems, yet there had never been the political momentum necessary for establishing these programs. By design, HB 987 changed that dynamic. The passage of HB 987 resulted in a debate that has been contentious, often visceral, and at times completely misinformed. While there are certainly legitimate normative arguments associated with the state’s roll in requiring specific local stormwater financing systems, there is no questioning that Maryland has been well behind

⁵⁹ This estimate is based on the assumption that MS4 permits will achieve approximately 46% of the urban WIP reductions by 2025.

⁶⁰ We recognize that in the long-term it will be necessary to address stormwater impacts in smaller communities as well, including enforcing the 20% impervious treatment requirement, which is part of the new Phase II MS4 permits. However, given the disproportionate level of the nutrient load from the large jurisdictions, the primary focus must remain on large Phase 1 communities.

the rest of the nation in implementing dedicated, sustainable fee-based financing systems, which has put stormwater management efforts behind where they should be. In fact, it could be argued that the lack of sustainable financing structures has been a primary contributing factor to the urban sector lagging behind wastewater and agriculture in achieving the WIP reduction goals.

Regardless of what has compelled each community to implement fee systems, it is clear based on the EFC's work over the past 20 years that there is little evidence to suggest that any of the urban communities in Maryland would have the capacity to implement existing and anticipated stormwater management requirements without dedicated and sufficient revenue sources. Without these fees it is hard to imagine how stormwater programs would be financed in the future. That said, ultimately it is the responsibility of urban communities themselves to develop sufficient financing systems and when that is accomplished, the debate over HB 987 will be moot.

We understand that not everyone supports the use of fees as a way of financing stormwater programs. We are sure, however, that everyone can agree that regardless of how the revenue is generated, it is essential that each community have the capacity to address stormwater issues effectively, and that each ensure that every dollar is invested in a manner that maximizes return on investment, keeping costs low, efficiencies high, and local water clean.

- 2) *Targeting state investments to unregulated emissions.* Because stormwater regulations will only achieve at best 56% of the urban pollution reduction target, and it is the state's responsibility to finance necessary reductions that fall outside regulatory authority, state investments should target only unregulated emission reductions. Though it may be tempting for state officials to provide financing relief to local governments for stormwater management activities, the state's financing responsibility and limitations necessitates focusing financial resources on reducing unregulated pollution emissions.

Accounting for growth. Finally, as is the case with each sector, we address the issue of mitigating the impact of new urban development and population growth across the state. In the final section of the report we provide specific recommendations for how the state can facilitate a more market-based approach to mitigating new emissions. For now we focus on why this is so important. Though water quality financing is a relatively dynamic process, reflecting the unique conditions and circumstances of each community, there are one or two financing truths that are common to virtually all communities and situations. Perhaps the most important of these truths is that it is cheaper to protect than it is to restore environmental resources, and there is no sector where this has more impact than urban stormwater. The most expensive and relatively inefficient urban reductions are associated with existing developed areas. Achieving reductions during the development process is significantly more efficient than making upgrades once development has occurred. Therefore, the state's long-term urban strategy must incorporate both incentives for minimizing the water quality impacts of new development while at the same time providing efficient mitigation options for unavoidable emissions.

Section 4: On-site Wastewater Management (Septic Systems)

Septic systems represent the smallest contribution to the pollution load at 3.00 million pounds annually, or 6.41% of the 2010 base load. The state WIP mandates an annual reduction of 38% or 1.15 million pounds. As with urban stormwater management, loads from septic systems are expected to increase overtime, and as a result the state is not on track to meet interim or final targets. There are approximately 420,000 septic systems in Maryland; of these, 52,000 systems are located within the “Critical Area,” which is defined as land within 1,000 feet of tidal waters. The typical septic system does not remove nitrogen, instead these systems deliver about 24.32 pounds of nitrogen per year to the groundwater.⁶¹

Section 4.1: Regulatory Structure

Septic systems have arguably been the least regulated of the four sectors, at least in regards to nutrient emissions. This began to change in 2009 with the passage of the Chesapeake Bay Nutrient Reduction Act, which regulates the type of septic technologies available to homeowners. In 2012 the Maryland legislature passed the Sustainable Growth and Agricultural Preservation Act, which addressed development patterns associated with on-site wastewater systems. Each of these laws has a unique impact on the restoration financing system.

- *Chesapeake Bay Nutrient Reduction Act of 2009 (Senate Bill 554)*. SB 554 provided the basis for addressing both existing and new nitrogen emissions from onsite wastewater systems. Effective January 1, 2013, a Best Available Technology (BAT) nitrogen-reducing unit (NRU) is required in place of a septic tank where a building addition, upgrade or new on-site sewage disposal system installation is made. The new requirements apply to permit applications for septic tanks, drainfields, drywells, sand mound systems, pressure dosed beds and any other type of on-site sewage disposal system on a property in the Chesapeake Bay watershed. Any property that falls within the Chesapeake Bay watershed must comply with the new requirements. However, repair or replacement of septic systems outside the Critical Area are not required to comply with the regulation.⁶²
- *Sustainable Growth and Agricultural Preservation Act of 2012*. The Maryland General Assembly approved the Sustainable Growth & Agricultural Preservation Act of 2012 (Senate Bill 236), also known as the septic bill, during the 2012 General Assembly session. The bill, among other things, seeks to impose strict controls on the future proliferation of septic systems, though ***the law does not directly regulate the nitrogen emissions from those systems***. The bill establishes four growth tiers based on specified land use characteristics, which may be adopted by local jurisdictions. As of December 31, 2012, a jurisdiction may not authorize a residential major subdivision served by on-site sewage disposal systems, community sewerage systems, or shared systems unless it adopts growth tiers consistent with the bill. A jurisdiction that does not adopt a growth tier may authorize either a residential minor subdivision served by on-site sewage disposal systems, or any subdivision in a "Tier I" area served by "public sewer". The bill establishes land use and sewerage criteria and restrictions applicable to each of the four tiers. The bill establishes exceptions

⁶¹ Source: MDE

⁶² <http://aahealth.org/programs/env-hlth/well-septic-systems/brf/senate-bill>. Last accessed: January 2, 2015.

from and conditions upon these restrictions, and it allows for the transfer of subdivision rights among specified agricultural property owners.⁶³

Estimated regulatory gap. Existing regulations only impact failing septic systems within the critical area. Assuming that a standard septic system will last on average 25 years, then state law will require 2,080 upgrades per year; therefore, 25,293 pounds of nitrogen reductions per year are the result of regulatory compliance. In other words, only 2% of the 1.15 million pound annual nitrogen load reduction is addressed through regulation.

Section 4.2: Primary Financing Mechanisms

SB 554 and SB 236 provided the basis for state and local efforts to reduce nitrogen emissions from septic systems. However, neither law directly regulates those emissions, nor do they compel property owners to address pollution from septic systems before a system fails. Therefore, the water quality restoration financing system associated with onsite wastewater management consists of two primary elements or characteristics. First, financing the replacement of existing failing systems within the critical area or new systems throughout the state is the responsibility of the property owner or developer, i.e. the private sector. Second, financing the upgrade of septic systems that are not subject to the regulations, i.e. systems within the critical area that are not failing, is entirely the responsibility of the state.

The primary mechanism for the state to finance septic upgrades is the Onsite Disposal Systems Fund.⁶⁴ Authorization to collect a fee for this fund was first introduced as part of the BRF in 2004. Effective July 1, 2012 a \$60 annual fee is collected from each user served by an onsite system. The total estimated program income is \$28 million per year. 60% of these funds are used for septic system upgrades and the remaining 40% are used for cover crops. To date, MDE has upgraded over 3,000 septic systems to nitrogen removing best available technology (BAT)⁶⁵ through the Bay Restoration Fund (BRF) Onsite Sewer Disposal System (OSDS) grant program. With priority given to failing septic systems in state designated critical areas, funds have traditionally been provided for upgrades of existing systems to best available technology for nitrogen removal or for the marginal cost of using best available technology instead of conventional technology.⁶⁶

Estimated revenue flows. By way of review, Maryland's strategy to reduce emissions from septic systems is based on two approaches: 1) upgrading failing systems to BAT systems; and, 2) connecting homes served by septic systems to centralized treatment plants. The revenue streams for these two approaches differ.

BAT upgrades. BAT septic systems essentially treat much of the nitrogen and therefore prevent about half of the nitrogen load from entering the water table.⁶⁷ Because septic upgrades are the responsibility of homeowners/property owners, the vast majority of revenue flows for upgrades to BAT are generated from the private sector and the marketplace. That said, there is

⁶³ <http://www.mdp.state.md.us/OurWork/SB236Implementation.shtml>. Last accessed: December 1, 2014.

⁶⁴ <http://www.mde.state.md.us/programs/Water/BayRestorationFund/OnsiteDisposalSystems/Pages/Water/cbwrf/index.aspx>. Last accessed: January 4, 2014.

⁶⁵ Ibid.

⁶⁶ Ibid.

⁶⁷ <http://www.mde.state.md.us/programs/Water/BayRestorationFund/OnsiteDisposalSystems/Pages/Water/cbwrf/index.aspx>. Last accessed: January 4, 2014.

one significant state-based grant program, i.e. the BRF Septic Fund, which will result in grants to homeowners of up to \$13.78 million per year for BAT upgrades (the remaining Septic Fund proceeds will support administrative costs, as well as septic conversions). Based on the expected level of septic system conversions each year, there will be approximately \$27 million in revenue flow each year targeting system upgrades, which will be financed through a combination of BRF Septic Fund grants and homeowner investments.

Connections to centralized treatment. Financing connections to sewer treatment plants is a bit more complicated than BAT upgrades. MDE estimates that the average cost of connecting a home to a centralized wastewater treatment plant is \$30,000. The responsibility for financing these costs is ultimately borne by property owners and includes: upfront charges for making sewer connections and building infrastructure; private plumbing charges for hooking up a home to the new sewer line; and sewer user fees, which cover the ongoing costs of wastewater management. Unlike BAT upgrades, converting septic systems to centralized sewer systems is not required by law, though there are occasions when homeowners are compelled by local governments or wastewater authorities to make connections. And, while many Maryland counties included septic conversions in their WIP strategies, the upfront revenue required to finance those connections are part of local capital improvement plans and are unlikely to be supported at scale for the foreseeable future. Therefore, there is essentially no existing revenue flow within this part of the onsite wastewater sector.

Section 4.3: Cost Estimates

The strategy to reduce pollution emissions from septic systems is based on two components or options: upgrading traditional septic systems to best available technology systems (BAT), or connecting houses or establishments on septic systems to centralized wastewater systems. Table 4.1 provides a summary of anticipated costs associated with these two options. Assuming equal implementation from 2010 to 2025, the total cost to achieve the annual reduction of 1.15 million pounds of nitrogen is \$3.719 billion, which equates to an average cost of \$311 per pound.

| | |
|---------------------------|----------------|
| Septic System Upgrades | \$2,358 |
| Septic System Connections | \$1,273 |
| Septic System Pumping | \$88 |
| Total: | \$3,719 |

Source: MD Phase II WIP.

Estimated financing gap. Using the estimated costs and revenue flows, we estimated the onsite wastewater systems financing gap.

| | |
|---------------------------------------|------------------------|
| Total estimated costs: | \$3,700,000,000 |
| Total estimated annual revenue flows: | \$ 297,440,000 |
| Total estimated financing gap: | \$3,402,560,000 |

Section 4.4: Recommendations for Moving Forward

Due to the relatively low efficiency of septic tank retrofits, we recommend that the state focus on enforcing existing regulations and allow septic conversions to occur based on the need to replace failing tanks within the critical area. This approach will result in approximately 2,080 tanks being retrofitted each year, which will reduce nitrogen emissions by an estimated 25,293 pounds annually. This strategy of course does not preclude local governments or the state from targeting restoration dollars to communities where septic impacts are unusually high. We are recommending, however, that no additional state revenue be invested in septic reductions if those reductions are not able to compete with alternative practices in regards to efficiency. In addition, this strategy does not preclude the state from investing in septic projects in the future that prove to be innovative and efficient in terms of reducing nitrogen emissions. Based on existing technologies and efficiencies, however, we believe that state-based investments should be targeted towards more efficient practices.

We do provide two additional observations related to Maryland’s existing septic financing strategy. First, according to MDE, the state currently focuses its revenues on providing subsidies for homeowners with failing septic systems. Though we recognize the political desire to provide financing relief to citizens facing costly system upgrades, the law is very clear in that property owners are responsible for financing replacement of failing septic systems. If the state were to focus its resources on incentivizing owners of functioning tanks to upgrade prior to tank failure, Maryland could increase annual pollution reductions by up to 26,000 pounds of nitrogen per year.⁶⁸

Second, we address the state’s restriction on installing traditional septic systems within the state’s critical area. There is no question that the most impactful septic systems in regards to water quality are those that are located nearest to tidal waters. However, the vast majority of the septic systems in Maryland are located outside the critical area, and these systems are having some if not equal impact on water quality. State leaders should consider expanding the BAT upgrade requirement at the point-of-sale to all systems. This would enable the state to leverage the existing marketplace and demand for septic systems to guide the implementation process across the entire state.

Table 4.2: Estimated Annual Septic Conversions to BAT

| | | Estimated Nitrogen Reductions |
|---|---------|-------------------------------|
| Septic Tanks in Maryland: | 420,000 | |
| Septic Tanks in Critical Area: | 52,000 | |
| Total Annual Conversions in Critical Area: | 2,080 | 25,293 |
| Total Annual Conversions Statewide: | 14,720 | 178,995 |

Assumptions: 25-year lifespan; average annual nitrogen reduction of 12.16 pounds.

⁶⁸ This assumes an average retrofit cost of \$14,000 and an average nitrogen reduction of 12.16 pounds per year.

As a result of the statewide approach, we estimate that there would be approximately 358,000 additional pounds of nitrogen removed or mitigated each year without the need for additional state financing. It also deserves mentioning that this type of market-based regulation would actually result in significant demand for BAT systems, which would in turn result in incentivizing innovative new practices and cost efficiency in the long-term.

Regardless of whether or not state leaders decide to address septic emissions statewide or just in the critical area, it is our recommendation that no new state funds be used to finance upgrades or connections from this point forward. We believe that more efficient nitrogen reductions can be identified in other sectors.

Section 5: Point Source Wastewater Management

Point source wastewater management is on target to exceed mandatory reductions. Specifically, the WIP requires reductions of 26% from 2010 loads (14.37 to 10.58). However, the aggressive approach by the state to upgrade the 67 major wastewater treatment plants to the limits of technology included provisions for growth in many of those plants. As a result, the state is on track to reduce point source wastewater emissions by 38%, or 5.4 million pounds annually. Reducing emissions from wastewater point sources has been a foundation of Maryland's restoration strategy for many years.

As of 2010, municipal wastewater treatment plants accounted for approximately 31% of the nitrogen loads and 23% of the state's phosphorus loads to the Chesapeake Bay. Financing upgrades to wastewater treatment plants has evolved over time with the responsibility shifting from wastewater treatment authorities to the state. Though the point source financing process has been relatively complex over time, reductions in pollutant loads from wastewater treatment plants has been one of the most important success stories of the restoration effort. It demonstrates how dedicated revenue coupled with firm consistent regulatory requirements can lead to real pollution reductions.

Section 5.1: Regulatory Structure

Because point source wastewater management has traditionally been the most regulated of the four key pollution sectors, the state has been able to take a very aggressive and successful approach to achieving pollution reductions. The basis of Maryland's management program is the US EPA's National Pollutant Discharge Elimination System (NPDES) permitting program.

As authorized by the Clean Water Act, NPDES permit program controls water pollution by regulating point sources that discharge into waters. In this regulatory context, point sources are discrete conveyances such as pipes or man-made ditches. Under NPDES, all facilities that discharge pollutants from any point source into waters of the United States are required to obtain a federal permit.⁶⁹ Two components of the permitting system in Maryland have had a profound impact on the state's efforts to achieve the interim and final pollution reduction targets. First, each wastewater treatment plant is assigned a load allocation as part of their permit. This allocation is the pollution cap that each plant must maintain over the life of the permit. The cap essentially provides each wastewater treatment plant with the right to discharge a certain number of pounds of pollutant per year. In aggregate, the load allocation from permitted wastewater treatment plants equates to the state's 2025 wastewater load reduction target.

In addition to the load allocation the 2004 Bay Restoration Fund legislation required the state's 67 major wastewater treatment plants to upgrade their systems to the limits of technology. As a result, the major plants ended up with pollution reductions that were beyond the load allocation in the permit. This essentially created a growth buffer for the plants, enabling them to increase discharges as population growth increased.

⁶⁹ EPA Office of Wastewater Management. Water Permitting 101. <http://water.epa.gov/polwaste/npdes/basics/upload/101pape.pdf>

Essentially every pound of pollution emitted from wastewater plants in Maryland is regulated. In other words, ***there is no regulatory gap associated with point source wastewater pollution reductions***. As a result, the financing structure is in place and functioning. Perhaps the most important aspect of Maryland's water quality regulations is the inclusion of systems for addressing population growth in the future. There are two important features in that regard. First, the NPDES permits for each of the major wastewater treatment plants includes growth capacity (some more than others). As a result, Maryland has been well ahead of pollution reduction targets within the wastewater sector. Second, and equally important, is the requirement that wastewater plants completely offset any pollution emissions that exceed their permitted cap. This feature of the regulatory process is unique to the wastewater sector and is a model for addressing pollution reductions in other sectors.

Section 5.2: Primary Financing Mechanisms

Traditionally the most significant source of financing for wastewater management has been the wastewater systems themselves and their associated ratepayers. Wastewater systems are administered and operated as utilities, thereby collecting fees for services provided. As a result, the costs associated with addressing water quality requirements involve covering those costs through fee revenue. Though in the past there have been a variety of grant programs designed to assist local wastewater financing, the vast majority of wastewater management costs were covered through fee systems. This changed in Maryland with the establishment of the Bay Restoration Fund in 2004.

Maryland's Bay Restoration Fund has become a very significant source of funding supporting Maryland's efforts to reduce nutrient loads from the wastewater sector.⁷⁰ Signed into law on May 26, 2004, Senate Bill 320 (Bay Restoration Fund) created a dedicated fund to upgrade Maryland's major wastewater treatment plants through a fee paid by domestic, commercial and industrial plant users. During the 2012 legislative session House Bill 446 doubled the BRF fee for most users served by wastewater treatment plants that discharge into the Chesapeake Bay and Coastal Bay watersheds. The bill also requires that BRF fee billing authorities develop a financial hardship fee waiver plan for low-income households. Commercial and industrial users are charged at a similar rate (\$5.00 per month per equivalent dwelling unit (EDU)).

In total, fees from wastewater treatment plant users generate an estimated \$100 million per year in support of the BRF. MDE uses the revenue generated by the BRF to back in full, or in part, bonds issued to fund wastewater plant upgrades with enhanced nutrient removal (ENR), which is considered the limits of technology. The 67 major publicly owned facilities discharging to the Chesapeake Bay met the criteria specified by the Bay Restoration Fund and have the priority for funding. The funding expedited implementation of their plant upgrades and will enable wastewater effluent quality of 3 mg/l total nitrogen and 0.3 mg/l total phosphorus by 2017. As a result of this financing strategy, Maryland will reduce annual nitrogen loadings to the Bay by over 7.5 million pounds and phosphorus loadings by over 260 thousand pounds.⁷¹

Estimated Revenue Flows. Of the four key pollution sectors, point source wastewater management is the only one where projected costs and revenues are actually in sync over time. This is due to two factors. First, wastewater systems are managed and administered through

⁷⁰ Source: MDE

⁷¹ Source: MDE

utilities and enterprise programs, where by definition infrastructure costs are financed directly through program fees. Second, the decision by state leaders to create the Bay Restoration Fund resulted in a codified revenue stream targeted specifically to upgrading the 67 major wastewater plants across the state to the limits of technology. As a result, pollution reductions were attached directly to a funding source, thereby directly connecting and balancing costs and revenues.

Section 5.3: Estimated Implementation Costs

The total cost of achieving wastewater load reductions is in effect the combination of a two-part strategy. The first part of the strategy was to retrofit wastewater systems to what is referred to as advanced treatment known as biological nutrient removal. As we discussed above, financing these upgrades was primarily the responsibility of the systems themselves, with the assistance of the state through the use of grants as well as subsidized loan programs to reduce the cost of capital and borrowing (i.e. through the SRF program). The second part of the strategy was to upgrade the major plants even further to enhanced nutrient removal (known as ENR); these upgrades were financed directly by the state through the BRF.

The Maryland’s pollution reduction strategy also includes upgrading ten of the largest minor plants, with an anticipated total cost of \$124 million, for a total point source wastewater cost of \$2.434 billion, which equates to an annual cost of \$43 to remove a pound of nitrogen. Table 5.1 provides a summary of the total costs.

Table 5.1: Total Costs to Upgrade Major Wastewater Treatment Plants

| | |
|--------------------------|------------------------|
| State BNR Grants | \$230,000,000 |
| State ENR Grants | \$1,230,000,000 |
| Local/System Financing | \$850,000,000 |
| Upgrades to Minor Plants | \$124,000,000 |
| Total: | \$2,434,000,000 |

Source: MDE Phase II WIP, Appendix C.

Estimated financing gap. Using the estimated costs and revenue flows, we estimated the wastewater financing gap.

| | |
|---------------------------------------|-----------------|
| Total estimated costs: | \$2,430,000,000 |
| Total estimated annual revenue flows: | \$2,430,000,000 |
| Total estimated financing gap: | \$0 |

As we’ve stated several times in this report, the aggressive efforts by the state to upgrade wastewater treatment plants will enable the state to achieve interim and final pollution reduction targets. In addition, it should be pointed out that the total implementation cost and revenue projections are associated with aggregate long-term capital costs. The actual financing cost to the state as of 2025 will be \$380,150,000, which reflects the total debt service costs.

Section 5.4: Recommendations

Wastewater treatment in Maryland represents a true water quality financing success. The combination of firm, enforceable regulations with a dedicated and consistent revenue stream in the form of the Bay Restoration Fund resulted in pollution reductions in the wastewater sector that went beyond TMDL and WIP requirements. In fact, it is the success of wastewater management nutrient reductions in combination with aggressive agricultural implementation that will enable the state to achieve interim and final pollution reduction targets in spite of the relative lack of progress in reducing loads in the septic and urban stormwater sectors.

However, while wastewater treatment plants have effectively been upgraded to the limits of technology, the sector still faces challenges in maintaining its aggregate load limit into the future, specifically post-2025. Pressures from population growth are expected to chip away at the sector's load allocations. As a result, the wastewater sector will need to plan for either adopting new technology as it becomes available and/or looking for opportunities to offset its nutrient loads as population growth pushes it toward the 2025 target levels.

Section 6: Summary Results and Analysis

The state’s restoration effort to date is a story defined in two parts. First, Maryland will achieve both the 2017 interim pollution reduction target as well as the 2025 final reduction target for phosphorus, nitrogen, and sediments. This success will be primarily the result of the state’s aggressive efforts to finance agricultural best management practices as well as advanced wastewater treatment, which enabled reductions in that sector to go beyond those required in the TMDL and the WIP. Stated another way, achieving the interim and final goals will occur in spite of the lack of progress in reducing loads in the urban stormwater and on-site wastewater management sectors. In addition, the state’s implementation estimates do not account for new population and economic growth. As a result, ultimately achieving and maintaining reduction targets will require a concerted effort on the part of the state to build growth back into the financing and implementation process.

Summary Results by sector. Table 6.1 summarizes the regulatory gap within each sector. In total, nearly half of the total WIP reduction goal falls outside the regulatory system. This regulatory gap has a direct impact on the financing system. As Table 6.2 indicates, there is a nearly \$7.8 billion financing gap associated with achieving the 2025 final WIP pollution reduction goal, and all of this gap is associated with the three sectors that have regulatory gaps.

Table 6.1: Regulatory Gaps by Sector

| | Annual WIP Nitrogen Load Reduction | Regulated Load | Regulatory Gap |
|-------------------------|------------------------------------|----------------|------------------|
| Point Source Wastewater | 5,450,000 | 5,450,000 | 0 |
| Onsite Wastewater | 1,150,000 | 25,293 | 1,124,707 |
| Agriculture | 4,730,000 | 248,000 | 4,482,000 |
| Urban Stormwater | 1,930,000 | 505,965 | 1,424,035 |
| Total: | 13,260,000 | 6,229,258 | 7,030,742 |

The gap estimate reflected in Table 6.2 is often referred to as the “everything, everywhere, everyone” implementation strategy. In turn, this strategy reflects the equity approach to implementation, thereby requiring maximum implementation within each sector. However, there is another way to view the implementation financing gap, which is to estimate what is likely to be implemented over time. This represents the state’s implementation strategy to date, whether intended or not, and in effect sets the foundation for the efficiency approach to implementation. This is demonstrated specifically in Table 6.3, which addresses likely implementation through 2025.

Table 6.2: Total Estimated WIP Financing Gap

| | Estimated Costs | Estimated Revenue Flows | Financing Gap |
|-------------------------|-------------------------|-------------------------|------------------------|
| Point Source Wastewater | \$2,430,000,000 | \$2,430,000,000 | \$ 0 |
| Onsite Wastewater | \$3,700,000,000 | \$297,440,000 | \$3,402,560,000 |
| Agriculture | \$928,000,000 | \$737,671,560 | \$190,328,440 |
| Urban Stormwater | \$7,388,000,000 | \$3,202,923,789 | \$4,185,076,211 |
| Total: | \$14,446,000,000 | \$6,668,035,349 | \$7,777,964,651 |

The level of likely implementation is a combination of two factors: levels of regulation within each sector, and the level of subsidized reductions outside of regulated activity. To that end, the total estimated financing gap is \$935,244,325. A couple of very important points need to be made in regards to the financing gap. First, and perhaps most importantly, the gap associated with urban stormwater management is based on EFC's analysis of existing revenue flows. In fact, if the state aggressively and equitably enforces the MS4 permits in each of the regulated communities, these communities (as well as SHA) will be required to implement financing systems necessary for achieving permit compliance. Therefore, this gap will in effect be removed with appropriate enforcement. We recognize that achieving stormwater permit obligations will require significant investment on the part of local governments. Again, however, the system is in place to allocate and invest resources necessary for achieving permit requirements.

Second, the gap associated with agricultural production represents pollution reductions that are in almost all respects the most efficient and effective available to state regulators and program managers. As a result, the financing gap is somewhat misleading. As we discuss the following section, ***the state has the fiscal resources to close this gap over the long-term***, specifically through the efficient investment of the BRF and Chesapeake and Atlantic Coastal Bays Trust Fund revenues. Therefore, based on our analysis, the state has the regulatory and financing systems in place to achieve necessary pollution reductions by 2025.

Table 6.3: Estimated Financing and Regulatory Gaps by Sector

| | Likely Annual Load Reduction (annual) | Implementation Cost (aggregate) | Financing Gap (aggregate) |
|-------------------------|---------------------------------------|---------------------------------|---------------------------|
| Point Source Wastewater | 5,450,000 | \$380,150,000 | \$ 0 |
| Onsite Wastewater | 25,293 | \$297,440,000 | \$ 0 |
| Agriculture | 4,730,000 | \$298,000,000 | \$190,328,440 |
| Urban Stormwater | 505,965 | \$3,387,839,674 | \$744,915,885 |
| Total: | 10,711,258 | \$4,363,429,674 | \$935,244,325 |

Section 7: Recommendations and Proposed Next Steps

The first two phases of the WIP implementation process effectively established the targets, goals, and responsibilities necessary for achieving required pollution reductions. The sector-specific strategies provided in the previous sections of this report will enable the state to achieve interim and final pollution reduction targets. The real challenge to state leaders, however, is building cost effectiveness into the financing system and closing the restoration gaps that will result from population and economic growth in the future. Though we recognize the considerable scale of this financing challenge, we believe that the resources, policies, and regulations are in place to achieve interim, final, and long-term pollution reduction targets while at the same time enabling population and economic growth across the state. This will require, however, that state leaders focus investments on those things that will ultimately reduce costs, incentivize efficiency, improve program and project effectiveness, and reduce implementation risk. In fact, if state leaders do not shift how resources are invested, it is likely that long-term pollution reduction goals will not be maintained. To that end, the following recommendations provide a framework for how the State of Maryland can make efficient and effective long-term investments in water quality.

In the previous sections of the report, we offered recommendations that provided the foundation for achieving the interim and final pollution targets. We now focus on the role of the state in ensuring long-term pollution reductions in the most efficient manner possible. To be sure, achieving pollution reductions targets will require the resources and engagement of multiple stakeholders and entities—public and private—working in concert over the coming years. However, the Bay States have a unique leadership role in the restoration effort and are thereby held responsible for achieving final pollution reduction goals. Therefore, the following recommendations are intended to address the capacity of the State of Maryland to lead the restoration effort. We begin with a set of fundamental aspirational goals that we feel should guide the restoration effort in general and the state’s water quality financing specifically.

Focus on unregulated emissions. Because the state is ultimately held responsible for achieving the WIP we feel it is essential that state fiscal resources focus primarily on addressing those emissions that fall outside the regulatory framework. We recognize the political concerns associated with this approach, but it will be necessary for long-term success.

Strive for efficiency and cost effectiveness. Regardless of whether or not state investments support regulated or unregulated activities, there must be a singular focus on achieving cost efficiency. The state’s priority must be to achieve and maintain pollution reductions in the most efficient manner possible.

Effectively engage the private sector. Directly associated with the need for efficiency is the need to effectively engage and leverage the resources and capacities of the private sector. In short, it is the private sector and the marketplace that will enable local, state, and federal governments to implement restoration programs efficiently and effectively. The state’s focus should be on creating the right incentives to move the private sector and markets to action.

It is with these aspirational goals in mind that we offer the following recommendations.

Recommendation 1: Create a new coordinated and dedicated state-based water quality financing process. Our primary recommendation is for the state to establish a new coordinated

financing process. The purpose of this new process should be to finance the most efficient and effective water quality restoration practices, and to incentivize innovative and efficient approaches to achieving pollution restoration goals. Maryland is in the unique position of having significant fiscal resources available for making water quality investments. Specifically, the Chesapeake and Atlantic Coastal Bays Trust Fund and the Bay Restoration Fund have the potential to generate more than \$800 million in combined revenues between 2015 and 2025. In addition, by 2025, the two programs will provide a combined annual revenue source of almost \$100 million.⁷² As a result, the state has the opportunity to create a truly innovative and effective water quality financing process unlike any across the country. Most importantly, if public monies are allocated and invested efficiently and effectively, the state is in a position to successfully finance and implement Chesapeake restoration and conservation activities statewide in a much more efficient and cost effective way than originally thought possible.

Though the financing opportunity and potential is significant, it is also very clear that how the program is designed, structured, and implemented will have tremendous impact on the success of state water quality financing into the future. Though it is beyond the scope of this exercise to provide a detailed business plan for how this financing system should be structured, we do offer key elements that must guide the financing effort from this point forward:

- Decision-making and leadership must be separated from political dynamics. For a program like this to be successful, it is essential that financing and funding decisions be made based on efficiency and effectiveness of projects rather than political outcomes and motivations. We recognize that the allocation of public revenue is by definition a political issue, but it is our opinion that once the decision to finance has been made, then decisions associated with the financing process should be left to the financing program leaders.
- The financing effort must directly and explicitly engage the private sector in the restoration process. Though the Bay States are ultimately responsible for achieving pollution reduction targets, success will require state leaders to effectively engage the private sector in each facet of implementation. This should include having the capacity to leverage public resources with private equity and debt. In addition, the state's financing system should effectively incentivize private investment in best management practices. There are a variety of financing mechanisms that the state could test and bring to scale, each with their own unique ability to leverage the efficiency, effectiveness, and innovation of the marketplace. What is important is that the state explicitly focus its financing policies and programs on leveraging the capacity of the marketplace and the private sector in advancing restoration goals.
- Financing decisions need to be divorced from fiscal year budgeting and appropriations processes. It is essential that the financing effort be enabled to function as a fund, making investments when they make sense, and conversely not making investments when they do not make sense, without reprisal or threat of losing public revenues. Financing leaders must have the capacity to make investments—and perhaps more importantly, to time those investments—based on specific project needs without concern for state budgeting cycles. The current financing system is inefficient in that funds must be expended within budgeting cycles, or they are lost or redirected to other needs. This in turn suppresses project

⁷² Sources: MDE and DNR.

performance, increases risk of project failure, and removes market signals designed to improve efficiency.

Recommendation 2: Establish a coordinated adaptive management financing system.

Building on Recommendation 1, the state's financing systems should be designed to react to new information and data as they become available. Again, state-based revenues targeting Bay restoration will soon approach and eventually exceed more than \$100 million annually. This will result, by any measure, in a significant public infrastructure investment. And, while state officials have significant experience and capacity to finance a variety of infrastructure needs, the primary focus of the state's water quality investments will be on nonpoint source or green infrastructure practices. Our collective understanding of the types of practices and efforts that will be necessary to achieve restoration goals continues to evolve, so effective implementation in the long-run will require state agencies to similarly adapt and evolve while advancing aggressive implementation strategies.

The very uncertain nature of water quality investments will require the state to establish a more adaptive decision-making system to guide water quality investments. Adaptive management and decision-making arose from the recognition that uncertainty is inherent in natural systems, yet management actions generally cannot be delayed until knowledge is complete and uncertainties resolved.⁷³ Such is the case with the state's restoration financing challenge. To achieve the pollution reduction targets, state leaders must implement a decision-making and financing system that simultaneously incentivizes action while promoting and facilitating advancement in the community's understanding of how well practices perform and function. This goal, of improving knowledge while at the same time guiding active decision-making, sets adaptive management apart from other natural resource management and financing policies and tools.

At its heart, adaptive management reflects the understanding that many ecosystem management decisions must be made in scenarios that are characterized by uncertainty.⁷⁴ And, given that greater levels of uncertainty lead to greater transaction costs, an adaptive management approach must be the foundation of the state's financing system. This type of financing approach will provide the state with the flexibility to make and adjust its decision-making as more complete information is available. The added bonus of this approach is that its inherent flexibility also allows for reaction to changes in social circumstances, including political, economic, and legal influences, as well as local conditions. It is clear that this type of adaptive implementation approach will be essential for making informed financing decisions, and make corresponding recommendations for program improvement.

Recommendation 3: Directly link state investments to water quality performance rather than implementation rates. Perhaps the greatest benefit associated with an adaptive decision-making system is that it will enable 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 and sediment emissions, it becomes more

⁷³ *Achieving Nutrient and Sediment Reduction Goals in the Chesapeake Bay: An Evaluation of Program Strategies and Implementation.* Committee on the Evaluation of Chesapeake Bay Program Implementation for Nutrient Reduction to Improve Water Quality. Water Science and Technology Board Division on Earth and Life Studies. 2011. Page 78.

⁷⁴ *Ibid.*

efficient to focus financing on that performance. This, of course, is in contrast to how we make investments now, where increasing units of practices installed is the primary financing goal.

The benefits of a performance-based financing system are significant. If investments are predicated on pounds reduced rather than practices installed, there is an inherent incentive built into the financing system to improve efficiency. 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.

By focusing on performance, the state will be in the position to incentivize two types of implementation efficiency. The first could best be referred to as inter-pollution sector efficiencies. In other words, by focusing on efficiency, the most efficient pollution reductions would be financed regardless of pollution sector. It has been well documented, for example, that pollution reductions achieved through agricultural conservation and restoration practices are significantly more effective than those in other sectors, including stormwater and onsite wastewater management. For example, our analysis indicates that mitigating a pound of nitrogen in an agricultural setting will cost between \$17 and \$90, while the cost of mitigating the same pound in an urban stormwater setting will likely exceed \$500. While just estimates, these dramatic differences in expected costs demonstrate that shifting resources among sectors to their most efficient and effective outcomes will generate significant efficiencies. This is especially important as it relates to state-based financing where regulatory (and perhaps political) restrictions on allocating resources do not exist.

The second type of efficiency can best be described as intra-pollution sector efficiency. In short, this refers to incentivizing cost-effectiveness within a particular sector. In other words, as we demonstrated in the previous sections, the costs of achieving pollution reductions from any given best management practice varies depending on a variety of factors. For example, in an urban stormwater setting, BMP cost is influenced by factors such as land value, site conditions, soil types, density of development, hydrologic and other physical factors, and issues related to long-term operations and maintenance. As a result, costs shift and vary from site to site. A performance-based financing system accounts for these variances and targets those outcomes that are most efficient and effective in achieving management goals.

Performance-based financing is a market-like system that incentivizes environmental outcomes, in the case of the Bay restoration, reductions in nutrient and sediment emissions, rather than specific actions or practices. Shifting investment focus toward the documentation and verification of outcomes and toward making payments contingent on those outcomes has the potential to significantly improve results of financing programs.

Perhaps the greatest advantage of performance-based financing systems is that they shift the responsibility for project measurement and monitoring from government agencies or programs to private entities or project managers seeking to create and sell pollution reductions.⁷⁵ Rather than require an acceptable suite of BMPs, state leaders should establish a minimum set of measurement standards. These standards, based on existing state-developed monitoring

⁷⁵ Stephenson, K., P. Norris, and L. Shabman, 1998. "Effluent Allowance Trading: The Nonpoint Source Challenge." *Contemporary Economic Policy* 16(4):412-421.

protocols, would provide effective baselines for measuring loads and would include requirements for documenting performance over the life of the project.

With the burden of proof on project managers to document performance, it will be up to them to determine how nutrients will be reduced. Rather than being confined to choose nutrient control actions from a preselected suite of BMPs, state leaders would be allowed to experiment with the most effective ways to reduce pollutant loadings. This would allow landowners and operators the flexibility to determine how best to prevent pollutants from entering waters – this type of choice is at the core of an effective and efficient financing solution.

An obvious challenge of a performance-type of system is the high cost of measurement and verification. However, as with the best management practices themselves, the current funding system creates no incentive to improve the effectiveness and efficiency of monitoring processes and practices. As a result, the responsibility of implementing monitoring processes is borne exclusively by the government, resulting in a system that keeps monitoring costs unnecessarily high. By taking a more market-like approach to funding projects, and thereby engaging the practitioners, landowners, and stakeholders with the most at stake, state leaders will incentivize a more efficient and effective monitoring system.

Finally, a performance-based financing system will require institutional and programmatic shifts at the state level. Many practices and projects supported by state investments are structural in nature, thereby providing pollution reduction services or benefits many years into the future. In a performance-based financing system, payments for these services will be made as the service is provided rather than in one lump sum based on implementation success. This approach will almost certainly require a shift in financing procedures and procurement processes at the state level.

Recommendation 4: Transition to a credit-based financing and accounting system. The previous three recommendations set the stage for what we believe to be the most important recommendation. Specifically, the state is in a position to establish a credit-based financing and accounting system that would serve as the foundation for water quality investments at all levels into the future.

As was discussed in detail in the full report, the use of water quality markets has been positioned by state, federal, and local leaders as instrumental for achieving Bay restoration goals. And, though water quality trading will have little impact on reducing existing sources of pollution to the Bay, offsetting the impacts of new economic and population growth will be essential for both achieving and maintaining pollution reduction targets. In addition, the state is in the unique position to accelerate market activity, reduce transaction costs, and to effectively mitigate implementation and financing risks through direct partnerships with the private sector. We begin by briefly describing some of the essential functions and benefits of environmental market systems.

Most economists are enthusiastic about markets and their role in local, regional, and global economies. In short, well-functioning markets have a variety of benefits and impacts:

- Functioning markets make both buyers and sellers better off;
- Markets result in efficient resource allocation, thereby directing scarce fiscal resources to their most efficient and effective use; and,

- Markets incentivize innovation and creativity, thereby establishing new approaches to solving entrenched problems.

These benefits have the potential to be applied to the environment. In other words, markets can help reduce the cost of achieving environmental goals, such as restoring and protecting the Chesapeake Bay. However, markets will not magically appear in support of Bay restoration; rather, the state must intentionally establish the appropriate property rights, market infrastructure, and rules of engagement for water quality markets to function effectively. Though it is beyond the scope of this project to address all of the details of a robust water quality market, we address several key elements that we believe will help the state advance a more efficient and effective financing system. Specifically, it is essential that the state clearly define the goals and desired outcomes of a market program. Though water quality trading has been included as an essential element of the WIP process, it is important for the state to clarify how markets are intended to materialize and their ultimate role in the restoration process. It is our opinion that the state's market program should focus primarily on three key elements:

1. The program should focus exclusively, if not myopically, on reducing the impact of new growth rather than facilitating the reduction of existing sources of pollution;
2. The state's market program should be designed to help guide public investments in water quality restoration to their most efficient and effective use; and,
3. The program should explicitly incentivize innovation and creative approaches for achieving water quality restoration and protection goals.

Given that these three elements should be the foundation of the state's market program, we now address the role of the state in establishing and facilitating the performance of that market.

Establishing market currency and a basis for transactions to occur. It is the state's responsibility to establish the currency that will be the basis for market transactions to occur. In effect, this means defining a "credit" in the market system. A credit-based accounting system establishes a consistent method and protocol for calculating the value of a "credit" – one pound of nitrogen, phosphorus, or sediment reduction per year. More precisely, it results in a consistent protocol for evaluating the number of credits associated with each practice being installed. This in turn allows for a much more consistent approach for calculating the cost-effectiveness of projects installed. This type of system will be essential for allowing new sources of pollution to be effectively offset into the future. In effect, by defining the structure of a credit, the state will be advancing the mechanism by which growth capacity can be built back into the implementation process. It will also enable growth to continue into the future while at the same time ensuring water quality goals are achieved and maintained. Defining and establishing a credit-based accounting system will enable the state to be much more transparent in how it finances restoration activity. More importantly, it will require the project implementers to also be transparent in accounting for cost and performance, which improves the efficiency ratio and results in greater conservation per dollar spent.

Establish and enforce pollution-offset requirements. It is the state's responsibility to assign and enforce obligations to offset the impacts of population and economic growth. It is through this regulation and enforcement mechanism that demand in the marketplace will materialize. Throughout this report we have stressed the importance of offsetting the impacts of new growth, and it is the state's responsibility to establish the system by which these offsets will be

measured, regulated, and enforced. Though it is beyond the scope of this project to define the details of that regulatory system, we would suggest that much of the discussion and debate associated with this issue and the details of growth offsets has already occurred as a result of the Accounting for Growth deliberations. Regardless of the politics that defined that process, we recommend that state leaders use the results of those deliberations as the foundation of establishing growth offset regulations and policies.

Establish necessary market infrastructure. Finally, it is the state's responsibility to provide the market infrastructure necessary for enabling transactions to occur. This infrastructure is essential for tracking transactions throughout the lifespan of water quality projects, and for ensuring that market investments are in fact benefiting water quality. To the state's and the market's benefit, the market infrastructure has been developed in Maryland and is ready to be implemented at scale.

Recommendations Summary

Implementing the above recommendations would enable the state to establish a water quality financing process with the power and potential to dramatically improve the performance, scale, and efficiency of the Bay restoration financing effort. Key features of this process should be highlighted and reinforced.

First, the state would simultaneously establish the framework and parameters of the marketplace, while also generating the most significant source of demand for pollution reductions. Market programs in Maryland have been languishing for years primarily because of the lack of demand in the system. State guidance and revenue would immediately transform the marketplace by generating demand for quality, efficient, and effective pollution reduction practices and projects.

Second, by establishing, managing, and administering the marketplace and market system, the state would be in a position to dramatically reduce risk to both buyers and sellers (i.e., communities, firms, governments, institutions, etc.) thereby reducing transaction costs and facilitating pollution offsets. To be clear, our recommendation is that the state directly control the function and process of the marketplace, thereby tracking and ensuring the performance and viability of all market transactions. We recognize that many market practitioners would suggest that there should be no public role in facilitating market activity; we disagree. The complexity and uncertainty associated with water quality restoration activity demands that the state assume the role of market facilitator, thereby ensuring that market activity is above all else in support of environmental uplift and water quality restoration. In effect, the state's financing system should serve as a water quality bank, thereby ensuring a steady flow of verified, certified, and environmentally beneficial credits in the marketplace.

Building on the previous point, the state's available revenue will enable it to rather quickly advance a system of fungible, water quality credits that can help accelerate water quality financing into the future. In addition, by assuming control the process, state leaders will be in a position to create innovative approaches for addressing entrenched restoration financing issues. For example, one of the most basic conundrums of the restoration effort has been how best to balance necessary investments in pollution reduction with long-term resource conservation, specifically forestlands and other essential habitat. This new process would enable the state to test and bring to scale innovative market approaches such as establishing

restoration credits that include conservation investments. The state alone is in the position to establish these types of financing mechanisms.

We conclude by anticipating and addressing some the debate associated with the state's role in advancing a market-based financing system. First, there is often the assumption that a publically controlled market will preclude private participation in the marketplace. On the contrary; because it is the state's responsibility to ensure restoration success, it is the state's responsibility to develop and advance the financing system, as well as the implementation of the marketplace. That financing system will be predicated on engaging the private sector throughout the process, including the design, construction, implementation, and at times the financing of water quality practices and projects. The state's role is to facilitate and incentivize private sector activity by providing the framework, parameters, and rules of engagement. In effect, the entire exercise will be through implicit and at times explicit public-private partnerships. Therefore, the state's role is to guide the engagement of the private sector and the market, not to preclude that engagement.

It should be noted that the state's investment would directly impact private investment and participation over the long-term. Specifically, when the state codifies its water quality investments, thereby ensuring consistent and long-term demand for restoration projects, there will be a flood of private investment activity in the coming years. There is no shortage of private capital available for financing environmental projects; what has been missing is the appropriate structure and risk profiles associated with the necessary investments. When the state sends the signals to the marketplace that it will be making water quality investments in the long-term, and at the same time defines what types of projects it will finance, there will be large-scale investment from the private sector. In short, the state's investments will result in potentially billions of dollars in investment from the private sector and the marketplace. Therefore, any discussion that the state's management of the marketplace will reduce private investment and participation in the market is unfounded and inaccurate.

Another potential concern related to a state-based market system is that it will preclude the development of local market programs. Again, this does not need to be the case. The state's priority (and the focus on these recommendations) is on reducing pollution loads to the Chesapeake Bay; therefore, it has a vested interest and unique obligation in establishing the systems for ensuring restoration success. However, a state-based system would not preclude local governments from establishing their own market-based programs to facilitate implementation of local water quality goals and requirements. In fact, the establishment of state-level market infrastructure would have the potential to reduce transaction costs to local governments. In short, rather than preventing local market programs, the state's system would in fact incentive the development of those programs.

Conclusion

Finally, we conclude where we began. Based on our assessment of the state's WIP process and the associated financing system, we believe that **restoration success is achievable**. Though the costs for achieving pollution reduction targets are significant, the state is on track to meet required pollution reduction goals. Very simply, this means that restoration success is indeed possible and likely assuming some strategic shifts in how resources are invested moving forward.

Restoration success is only possible if the implementation processes are resources are available and in place. In our opinion, we believe that the **resources are in place to achieve restoration success**. Our analysis indicates that the necessary revenue exists at all levels to achieve interim and final restoration targets. In other words, no new fees or taxes are required moving forward.

Finally, restoration success will require a **renewed focus on cost efficiency and effectiveness**. The State of Maryland has a unique opportunity to implement a financing system that incentivizes cost efficiency, innovation, and project effectiveness. By changing the foundation of how public resources are invested, the state is in a position to not only achieve pollution reduction targets, but to do so in the most cost effective way possible.