



PRIVATE CONSERVATION FINANCE

THE CHESAPEAKE BAY'S GLOBAL LEAD
AND HOW TO EXPAND IT



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The **Chesapeake Conservancy** believes that the Chesapeake is a national treasure that should be accessible for everyone and a place where wildlife can thrive. We use technology to enhance the pace and quality of conservation, and we help build parks, trails and public access sites. Our mission is to conserve and restore the natural and cultural resources of the Chesapeake Bay watershed for the enjoyment, education, and inspiration of this and future generations. The Chesapeake Conservancy serves as a catalyst for change, advancing strong public and private partnerships, developing and using new technology, and driving innovation throughout our work. We empower the conservation community with access to the latest data and technology.

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SUMMARY

Protecting and restoring the Chesapeake Bay is a core value of the majority of the public across the 64,000 square mile watershed. The restoration movement here is one of the most enduring and successful in the world, but our challenges continue to mount in the face of climate change, environmental injustice, biodiversity loss, increased pollution and continued urbanization. In summary, we have made progress, but we need to do more and so we need to think differently about how to do it.

Billions in local, state and federal funding have gone into restoring the Chesapeake Bay and the services it provides to the economy, diet, recreation, health, and prosperity of the region's 18 million people.

While private conservation finance has played a secondary role over the last 20 years in delivering more than \$4.2 billion in capital compared to tens of billions in public spending, private finance has significant room to grow over the next decade. It's also not just a funding source. Approaches through which private capital are deployed can dramatically improve the cost-effectiveness of public funding, can support innovation to a greater degree than public funds, and facilitate greater lending capacity so that restoration happens much faster. Each of these secondary strengths of private capital increase the long-term benefits of conservation action.

What is private conservation finance?

Private conservation finance is a set of approaches that can deliver conservation outcomes while generating a return for investors.

This report examines and describes programs and initiatives involving private conservation finance in Maryland, Pennsylvania, Virginia, and Washington D.C. We estimate that approximately \$4.2 billion of private investment has been deployed over the past 20 years to benefit Chesapeake conservation goals. This is likely an underestimate. Some of these programs are major multi-year initiatives. Others are just getting started. The following are some of the types of existing private finance that are important across the region:

\$1.7 billion. Transferrable tax benefits in Virginia and Pennsylvania have created a reward for hundreds of thousands of acres of forest and farmland preservation.

\$1.3 billion. Forest certification systems have thrived because consumers will pay more for sustainably certified products. Carbon credits are a rising income stream that could add momentum to the extensive working forest conservation investment that has already occurred in all Bay states.

\$620 million. Wetland, stream and nutrient mitigation banking depends upon private investment to restore ecosystems in one place to replace natural services and functions lost elsewhere; the investment would not occur but for strong and well-enforced regulatory systems with clear goals.

\$450 million. Pay for success contracts and public private partnerships use private capital to carry out green infrastructure construction, ecological restoration, or similar projects before being paid back in the future from government funds.

\$40 million. Environmental impact bonds are a small but growing area of financing that provides investor capital as a loan to public agencies, paid back at a rate that depends on the success of projects.

Chesapeake Bay states already have some of the most favorable conditions for investment in water quality and related work because the region has a well-defined regulatory system including quantitative pollution reduction targets, clear tools or currencies to quantify the expected benefits that will result from conservation activity, and significant consistent ratepayer and taxpayer revenue with which private capital can be blended. Investment conditions for carbon sequestration or wildlife conservation investment are weaker, however, they could easily be improved by importing ideas from other states that are ahead on investment in these resources.

Conservation programs built for an environment that pre-dated impact investment now need to be modernized so they embrace it.

In particular, action in the following four areas of state law and regulation are critical to a multi-billion dollar private conservation finance future for the Bay:

- Building outcome-focused state procurement policies.
- Adopting better tools to account for the full economic benefits of green infrastructure and disclosure of impacts to it.
- Expanding environmental public-private partnership authorities.
- Establishing policy preferences for completed private restoration projects to offset regulated impacts on natural resources.

With action in these areas, the Chesapeake Bay states and District of Columbia can ensure that the region attracts more private conservation finance to help create benefits for the environment and enhance the quality of life of residents throughout the Chesapeake watershed.

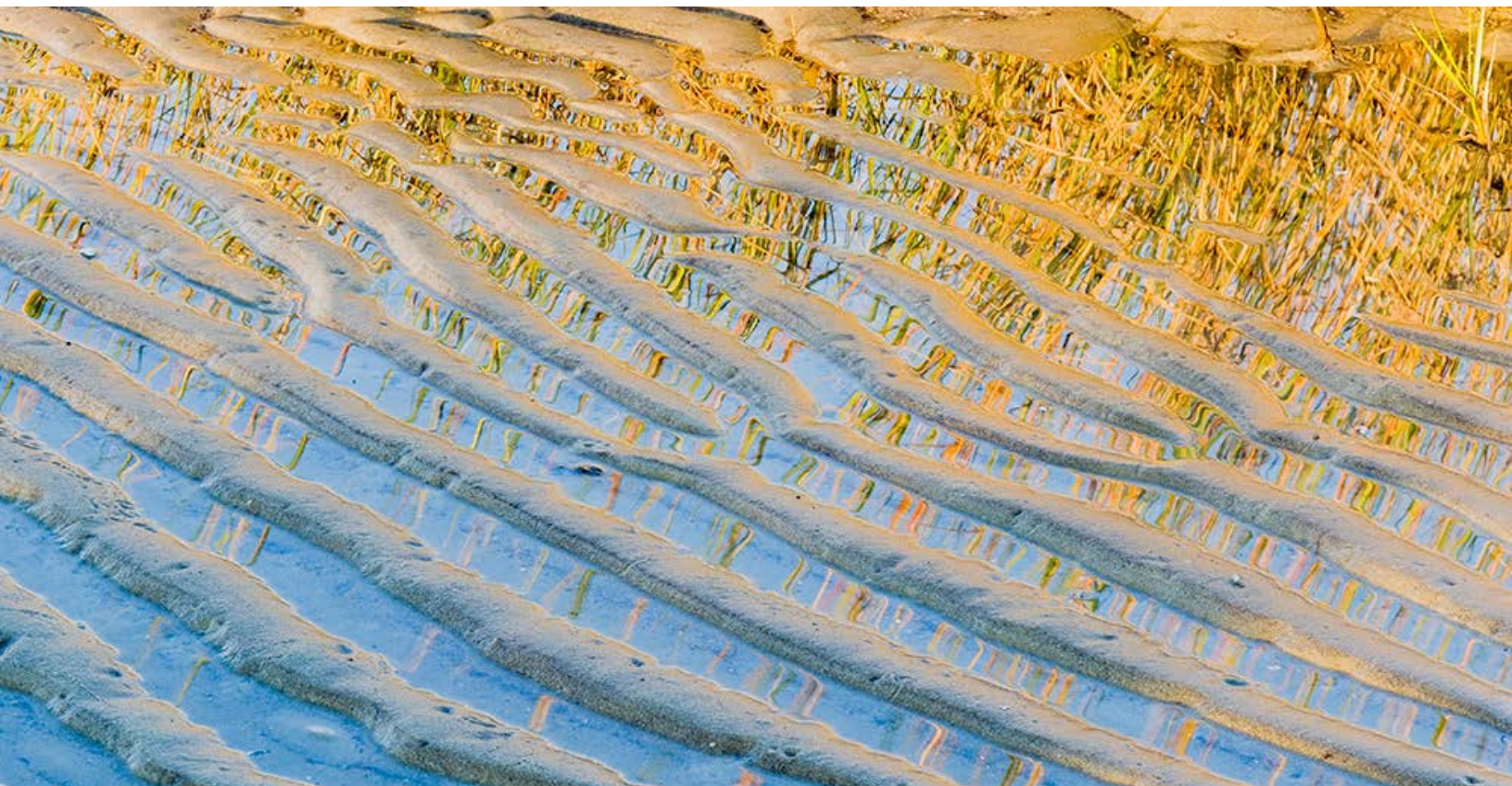


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FOREWORD: PRIVATE INVESTMENT IN THE CHESAPEAKE BAY

Early in our careers, it seemed like every dollar of funding for conservation came from taxpayers and generous private donors. A small amount was clawed from corporate polluters through enforcement actions after the damage was done.

We live in a changing world today. Historic public investments in Bay restoration and conservation will only stretch so far to meet and exceed our ambitious targets under the Chesapeake Bay Watershed Agreement.

Around the country, funding from private investors is flowing into projects that improve environmental outcomes on private forests and farms, store more carbon, or reduce flooding impacts.

Some of this investment has no connection to any public budget.

For example, sustainability standards like those adopted by hundreds of multinational companies are bending trillion-dollar investment portfolios toward actions with environmental benefits. Even during the pandemic, global investment in green assets in 2020 rose to \$288 billion, a 100% increase from 2019.

Other kinds of private investment depend on public dollars but through structures that allow the private financing to bear what would have previously been public risk and take better advantage of innovation and cost efficiencies.

For example, there is approximately \$4 billion in private investment in wetland restoration that private companies or public agencies can purchase to offset their development impacts on other wetlands and streams. Those projects can only be sold to a public agency after a third party has verified that the restoration has worked.

Maryland and Bay state initiatives are beginning to reflect this new reality partly because a few entrepreneurs in local government and the private sector found ways to work together.

For example, the \$250 million dollar partnership between Prince Georges County and the Corvias Corporation is one of the most successful clean water initiatives in the country. Corvias uses its own capital to rapidly install green infrastructure needed by the County to meet water quality requirements. More than 90 percent of the work is carried out by local, minority-owned businesses.

Meanwhile, Anne Arundel County has used an innovative contracting approach to get private companies to initially restore streams at their own expense. When the projects are successful, contractors are paid back by the County at prices that have been about 20 percent lower than previous approaches.

If private finance is growing by orders of magnitude, a review like this is helpful to understand what policy changes could allow the region to attract more of that capital to focus on Chesapeake Bay and climate goals. The prize for the state that gets this right is the ability to attract billions more in investment that supports climate and conservation goals, local jobs, and innovation.

We must think creatively to leverage private capital towards our public goals. We can improve state policy to bring in private finance in ways that do not increase taxpayer costs. In fact, some likely create long-term savings, and increase small business and local government revenues.

Here are a few ideas:

- Change procurement laws so it is easier to contract for environmental outcomes as a finished product instead of paying up front for each step in a process. Pay-for-success contracting, as it was named by the Obama Administration, depends upon private investment because until agencies pay up, someone else must foot the bill for the jobs and materials to restore streams, create green and blue infrastructure, and enhance forests. It is like what you do when you buy a car – you purchase it after it's built.
- Make it easier for private landowners to put carbon sequestration plans in place for forests and farmland and to bundle small amounts of carbon together across lots of properties to sell to investors and companies voluntarily trying to offset their emissions. The Biden-Harris administration is quickly taking steps to make soil and forest carbon projects financially attractive, but state policy should help too. One way to overcome this is by having state policies that direct agencies to help bundle together carbon credits across parcels so it is easier for companies to buy lots of them.
- Some of the biggest opportunities involve multi-year initiatives and partnerships like Prince George's Clean Water Partnership. New policies are needed to make it easier to combine funding from multiple state and private sources to achieve a bigger scale of restoration and climate action. Often little changes in these programs can help. For example, in 2021, Maryland's legislature passed changes that allow loan guarantees – which usually have no public cost – to be available to nonprofits and businesses to launch environmental impact and green bonds. Those guarantee helps private organizations and local government secure lower interest rates from private sources.

We have already agreed to reintroduce legislation in 2022 in Maryland that address each of these areas of policy. The legislation to do this - the Comprehensive Conservation Finance Act, SB 0737 -passed the Senate unanimously this year, but didn't have time to make it through the House. We expect that it will be enacted next year. It is the first legislation in any state to try to create conditions and policies to make our state more competitive in attracting private investment to supplement and accelerate our ongoing efforts to restore the Bay and address the climate crisis.

We are excited by where Maryland and the region can go with more private investment in and public support for the water, soil, climate resilience and communities of the Chesapeake Bay.

State Senator Jim Rosapepe

[District 21](#), Prince George's and Anne Arundel County

Delegate Dana Stein

[District 11](#), Baltimore County

Senator William C. Smith, Jr.

[District 20](#), Montgomery County

Senator Sarah K. Elfreth

[District 30](#), Anne Arundel County

INTRODUCTION

The full cost to restore our Chesapeake Bay to health is approximately \$6 billion per year.¹ Public and philanthropic funding is helping fill this need for restoration funding. For example, the White House Office of Management and Budget (OMB) reports that state and federal partners invested roughly \$1.5 billion in watershed restoration in 2019.² Local government spending is more difficult to track, but is unlikely to be more than \$500 million per year.³ Combining these estimates demonstrates a gap in needed funding of roughly \$3 billion annually. Public and philanthropic funding is unlikely to fill this gap.

While public investment remains critical, private profit-seeking capital can bolster restoration efforts in a way that has never before been seen in America's history of conservation.

Global Conservation Finance

Global investment in sustainable assets increased to \$288 billion between January and November 2020, a 96% increase from 2019. Similar increases have occurred in earlier years in the subset of sustainable investment focused on conservation.^{4,5} That such a substantial increase occurred in the midst of a global pandemic suggests opportunity for the Chesapeake Bay to attract these and other forms of private capital for conservation efforts. Whereas, the impact investing sector, driven by institutions and investors seeking social or environmental outcomes along with return, grew from \$25 billion in assets in 2013 to more than \$500 billion by 2018, public conservation agency budgets have not seen much growth at all.

A report from The Conservation Finance Network explains that two major trends are driving this expansion in impact investing: "1) a new era of resource scarcity that is beginning to change the drivers of value in the global economy and 2) the greatest intergenerational transfer of wealth throughout history. It is expected that the recipients of this new wealth, estimated at \$30 trillion, will care more about the impact of their investments than previous wealth holders. As a result, the management of some portion of this wealth will likely change to express certain social, political, and environmental values."⁶

The investment of private capital seems most likely to expand in three areas of conservation: agricultural conservation finance, regulatory compliance, and voluntary corporate offsets.



Agriculture: A recent report on sustainable agriculture identified 127 U.S.-focused investable strategies that explicitly integrate sustainable food and agriculture as criteria in their investment process⁷. The combined assets under management of these strategies is \$321.1 billion. Directing even a small portion of that capital to reducing agricultural runoff in the Chesapeake Bay states would make a meaningful difference for the health of the Bay. Developing private investment enables public funding to be allocated for projects with limited financial return that might not otherwise be prioritized.⁸



Regulatory compliance: Restoration of wetlands and streams and installation of stormwater pollution-offsetting green infrastructure is another growth opportunity for private investment. The Chesapeake Bay receives fresh water from a network of creeks, streams, rivers, and 1.5 million acres of wetlands. Private capital has played an important role in helping to conserve and restore these streams and wetlands. The U.S. wetland and stream mitigation banking

industry has developed as a means of compliance with federal law and regulations and derives substantial commercial and economic value from restored wetlands and streams. The market for wetland and stream offset credits is over \$4 billion per year and has been growing at an annual rate of 18% since 2010.⁹ But compliance needs go far beyond wetlands and streams to also include forest loss offsets, biodiversity offsets, and stormwater pollution offsets. Environmental restoration that offsets stormwater pollution is already happening at a large scale across the Bay. Changes in policy to support outcome or 'Pay for Success' contracting would stimulate more private investment to supply these kinds of offsets to meet the needs of any entity whose stormwater impacts are out of compliance. While regulatory markets for carbon offsets are few right now, this is likely to change in the future.



Voluntary offsets: Voluntary carbon markets allow businesses, governments, and individuals to offset emissions outside of a regulatory requirement to do so. This can be driven by shareholder pressure, personal interests, or anticipation of future interests. Companies, states and the country move toward stronger actions on greenhouse gas mitigation, including efforts to increase forest and soil carbon as offsets. According to the nonprofit organization, Forest Trends, airlines, oil companies, and individuals are increasingly using voluntary carbon markets to achieve net reductions in greenhouse gas emissions. Their most recent report, which draws on data from 2017 and 2018, documents transactions totaling \$295 million, a 50% increase from 2016. Early data suggests that volume has been surprisingly strong in 2020. Anecdotal evidence based on interviews with market participants indicates it may even exceed that of 2019, despite the prevalence of the COVID-19 pandemic.¹⁰

It's not just voluntary carbon offset markets that are growing – there is also increased demand for biodiversity offsets and water offsets. For example, users of Verde River water in Arizona have built an offset program with the help of nonprofits and government agencies to try to maintain flows of the river that the whole region depends upon. The Coca-Cola Company has build an offset program designed to benefit an equivalent amount of water resources to the water they use in beverages. If partners in the Chesapeake Bay can make it easier to define and transact voluntary credits for water, carbon, and biodiversity, there is likely some private demand to purchase them.

History of Private Investment in the Bay

The Chesapeake Bay already already supports more private finance-dependent conservation programs that any other region in the world. These are outlined in greater detail in the following sections. Many of these programs are not thought of as private investment, but in fact are successful because of it. State revolving funds and bond market borrowing under those programs to allow the upgrade of the region's major wastewater treatment plants is the best example. This source of funds borrowed to cover construction costs includes families, mutual funds, life insurance companies, and even international investors.¹¹ Dozens of other conservation programs in the Bay region have been paid for or financed by private investment.

We estimate that these programs have attracted a minimum of \$4.2 billion in private finance in the last 20 years (Figure 1). This is an extremely rough estimate based on a survey of experts, state reports, and review of publicly available information on transactions.¹²

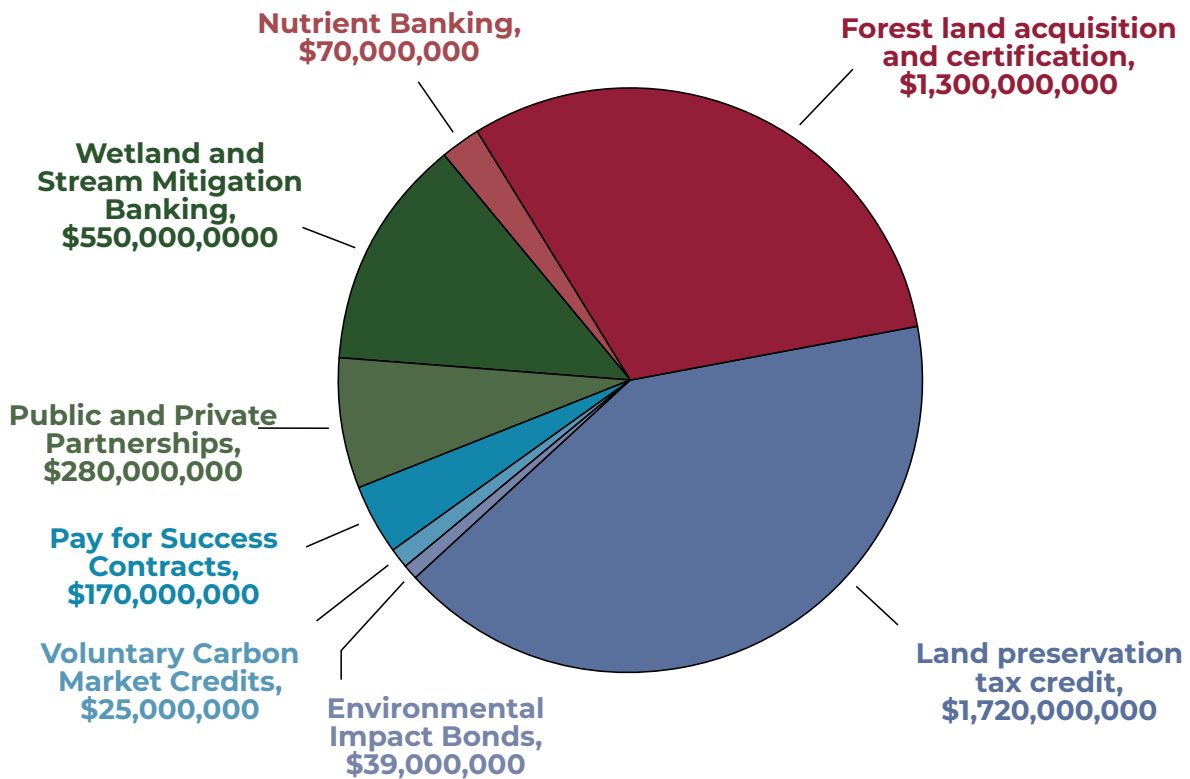


Figure 1. At least \$4.2 billion in private investment has already been deployed across the Chesapeake Bay watershed in ways that benefit water quality.

These are major categories of past investment and that we feature in this report:

- **\$1.7 billion.** Private investment in forest and farmland has been strongly incentivized in Virginia and Pennsylvania because of the transferrable tax benefits provided through state policy. These policies have contributed to hundreds of thousands of acres of land protection in the watershed. This is a conservative estimate that only includes the estimated public value (i.e. tax credit) of transactions in Virginia.
- **\$1.3 billion.** Private buyers will pay more for sustainably certified products. This consumer and wholesaler demand as well as other diverse opportunities to derive income from sustainably managed forests has led to major investment in forest land acquisition and forest certification in the Bay. Carbon credits are a new income stream contributed to further forest protection and restoration efforts.
- **\$620 million.** Wetland and stream mitigation banking typically involves a private company or nonprofit protecting and restored degraded water resources and later selling those protected resources to companies or agencies that need a permit under the Clean Water Act. In Virginia, nutrient banks operate through a similar model and structure. In Maryland, a very small investment in similar banks for forests has also occurred, driven by the state’s forest protection law and those in some counties.
- **\$450 million.** Payfor success contracts and public private partnerships involve private businesses (including nonprofit businesses) using private capital to carry out green infrastructure construction, ecological restoration, or similar projects at their expense before being paid back later by government agencies.

- **\$40 million.** Environmental impact bonds are a small but growing area of financing that provides investor capital to public agencies, paid back at a rate that depends on the success of projects.

Private firms are delivering privately financed conservation and ecosystem restoration in the Chesapeake Bay and around the country. For example, firms including RES, Lyme Timber, Quantified Ventures, and i2 Capital have formed an entire industry around structuring, attracting capital, and executing conservation projects. The Nature Conservancy created an investment unit that attracted \$1.3 billion in return-seeking capital. The Conservation Fund financed a \$150 million bond (at a 3.47% interest rate) to capitalize a revolving fund to support their and others' land protection projects. Corvias' public private partnership approach with Prince George's County is being replicated in a new \$20 million partnership in Milwaukee, Wisconsin. Hannon Armstrong, the first publicly traded company solely developed to climate investments including climate resilience and green infrastructure, is based in Annapolis, Maryland. These efforts are already a critical part of clean water solutions across the Chesapeake Bay.

Better Policy to Build Investment

While the growth in private conservation investment could be instrumental in helping to fill the funding gap for the restoration of the Bay, additional improvements in public policy must be a priority if state and local governments want to attract the substantial investment needed to protect green space, improve water quality, address environmental justice priorities, and meet regulatory environmental goals.

A push for more green infrastructure and climate resilience funding from the Biden-Harris administration and Congress, depending on how those government programs are structured, could also trigger more conservation investment in the Bay.

State laws and local rules are equally important. Most of our policies date from a time when private investment was small and poorly known and valued – that is no longer the case. A number of state legislative proposals are big steps in the right direction. In 2020, the Pennsylvania Senate passed the [Clean Water Procurement Program](#) (described below) which would create simplified state purchasing of clean water outcomes from projects on farmland in the state. [Virginia's legislature](#) passed a law in 2020 that allows carbon benefits from submerged aquatic vegetation restoration, like eelgrass restoration, to be sold in voluntary carbon markets.

Maryland's legislature debated three bills in its 2021 legislative session and passed two. [The Clean Water Commerce Act of 2021](#) amended a program first created in 2017. The new program will allow the state to purchase nitrogen pollution reduction outcomes from farms or urban and suburban properties and encourages both short-term and permanent conservation. The state clean water revolving loan fund [was amended](#) to allow loan guarantees to be offered to non-profits and for profits for impact bonds and pay for success programs. Maryland's legislature also debated passage of the [Comprehensive Conservation Finance Act](#) which, if adopted, would have made Maryland the first state to set up environmental Pay for Success contracting in its procurement code, and the first state to define (and prioritize) blue infrastructure that uses nature's services to enhance water quality or carbon sequestration. The bill would also open revolving loan programs and state grant programs

to multi-year partnerships. The bill passed the Senate unanimously but did not move fast enough to receive a vote in the House – it is expected to be reintroduced next year. Each of these proposals expands private investment.

Crafting policy that supports the formation of markets, encourages flexibility of financing, and recognizes co-benefits created by conservation projects like recreational benefits in lower income communities can be transformative for the health and vitality of the Chesapeake Bay.

State Overview

Building on the \$4.2 billion already invested in conservation by profit-seeking sources over the last 20 years, the Chesapeake Bay region is well-positioned to attract even more private conservation investment capital in the near future.

As detailed in this report, Chesapeake Bay states created many innovative programs which already drive private conservation investment dollars to the region. Compared to other parts of the United States, all Chesapeake Bay states have strong conditions for direct investment, market-based or finance-backed approaches. At least three factors contribute to this:

- 1) Rules.** The region's most important advantage is a well-defined regulatory framework. In 2010, when the EPA established the Chesapeake Bay Total Maximum Daily Load (TMDL), the agency created a comprehensive "pollution diet" to require states and local jurisdictions to achieve specified quantified reductions in nitrogen, phosphorus and sediment pollution. The numeric targets for pollution reduction provide a clear objective for conservation and restoration investments. The regulatory system is strong enough that it has withstood Supreme Court and other judicial challenges. Many other states across the country still lack clear requirements for water regulation. For example, many states lack quantitative nitrogen, phosphorus or sediment goals or plans to achieve them.
- 2) Rosetta Stone.** Bay states have standardized quantification tools through the Chesapeake Bay Program Model that allow outcomes from hundreds of best management practices and technologies to be estimated and translated into numeric water quality improvements in nitrogen, phosphorus, and sediment pollution reduction. Local and state governments throughout the Chesapeake Bay watershed have agreed on these methods and standards to measure and model anticipated changes in water quality that occur due to conservation and restoration practices. Clear quantification tools and numeric goals allow third parties to interpret what government wants and whether and how they can provide it. It also creates pricing transparency which over time can help drive down costs to repeatedly procure the same outcomes (like tons of nitrogen, phosphorus, or carbon pollution reductions).

The Bay is perhaps the largest ecosystem in the world to possess such universal agreement from multiple independent governments and agencies. It is easy to take the value of this model for granted if you live in the region, but in large parts of the rest of the country, there is little agreement on the currencies upon which water quality conservation progress can be based. This makes it extremely difficult to determine how to value projects and evaluate potential investments.

3) Ratepayers, taxpayers, and workforce. There is enormous state and local funding from water utility ratepayers, taxpayers, and developer fees that support water quality improvement throughout Bay states. For example, in Maryland, counties have documented spending more than \$1.3 billion in recent years to improve water quality. Ratepayer and taxpayer support in a region is a major driver of ongoing private investment because a number of new programs tie payment of government contracts to delivery of environmental outcomes. This payment structure has repeatedly been shown to achieve environmental outcomes more quickly and less expensively than intensively-managed public projects. The region also provides an abundance of human capital and creativity to pilot, demonstrate, and build programs driven by private investment. Philanthropic resources are also widely available to fund program development,

pilot initiatives and supply catalytic capital for ideas that may initially be too risky for mainstream investors.

This trifecta of a consistent currency, clear regulation, and strong public spending create conditions that are extremely conducive to private investment in water quality conservation, innovation, and restoration.

This report reviews programs in which profit-driven capital from one party seeks to support activity or outcomes paid for by another.



The buyer is usually a public agency, local government, regulated business or institution, or voluntary corporate buyer. This state-by-state review is comprehensive in its evaluation of water quality, wildlife, habitat, and land protection programs, while also recognizing that new programmatic approaches are developed every year. This report does not review air quality programs that may drive investment or rising GHG offset or climate mitigation programs.¹³



MARYLAND

HIGHLIGHTS:

Maryland has developed a range of programs to incentivize the private sector to invest in conservation outcomes, including nutrient runoff reduction, reforestation, and stream and wetland restoration. State agencies and various counties have experimented with approaches that use public funding to buy these outcomes after they are produced, rather than investing public dollars in up front grants or traditional pay-as-you-go contracts. Wetland mitigation banking is relatively limited in Maryland. Maryland is the only state in the country with a forest loss mitigation policy and many counties have set no net loss of forest goals. State law and county policies also encourage the use of private forest mitigation banks. Mitigation policy for wildlife and endangered species remains fragmented and unclear.

Forest or agricultural soil carbon projects are scarce. Maryland has created a nutrient trading program but most trades to date have been between or within point sources, such as by counties that operate wastewater treatment plants. A supply of agricultural nutrient trading credits has been slow to develop, in part due to a stringent interpretation of baseline requirements which has negated much of the potential credit value. However, aquaculture and oyster reef restoration credits are an evolving opportunity for nutrient credit trading. If adopted, new state legislation could make Maryland the best state in the region for private conservation finance.

Clean Water Commerce Act

Privately Funded Conservation Outcomes for Public Purchase, Pay-For-Success Contracting

In 2017, Maryland’s Clean Water Commerce Act (Figure 2) created a program that is the first of its kind in the nation for water quality. It is a non-regulatory program that uses public funding to purchase modelled water quality outcomes instead of paying for project costs. The program has made \$14 million available from 2018-2020 to purchase reductions in nitrogen, phosphorus and sediment in Maryland’s waterways.

The program uses an annual request for applications to find the lowest cost pounds of nitrogen or phosphorus reduction, as estimated through use of the Chesapeake Bay quantification models.¹⁴ Accepted applications receive payments over a 14-year contract period as these pollution reductions are documented. Unfortunately, the Maryland legislature excluded agricultural lands from participating in the program when the law was passed. This exclusion means that the program cannot buy what would likely be the most cost-effective nutrient reductions available, in turn increasing the price and slowing the pace of progress in cleaning up the Bay. This limitation also discourages private investment into working lands stewardship.

Most credits purchased through the program are credits generated by wastewater treatment plants that are available because the plants were built and are easily operated to exceed regulatory requirements.

However, the program has funded private investment-backed applications. For example, in 2017, a stream restoration project proposal was chosen for funding.¹⁵ The Clean Water Commerce program will set to sunset in 2021.

Clean Water Commerce Program

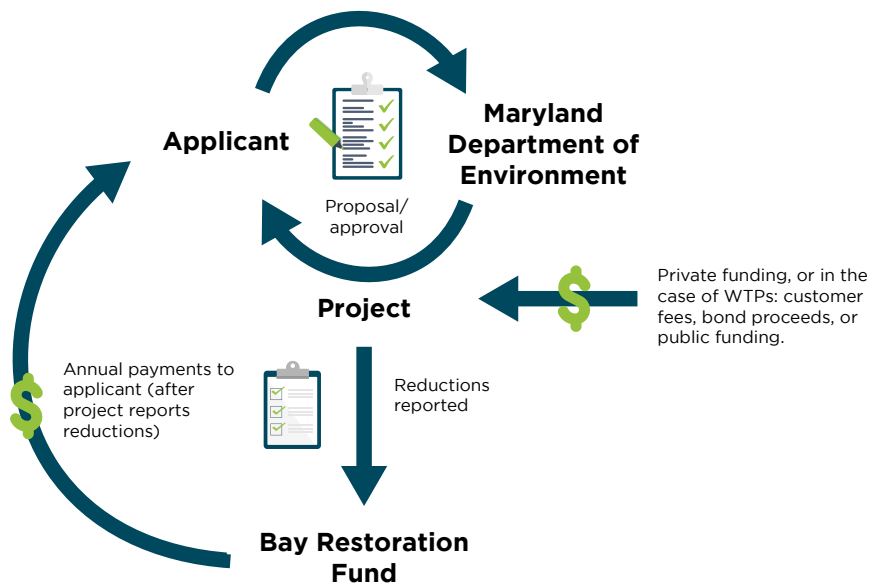


Figure 2. Clean Water Commerce Program



In 2021, legislation was introduced to extend the program, which will make it much more likely to attract private investment in water quality projects. [Senate Bill 119/House Bill 507](#) expands eligibility to agricultural and forest management activities, increases funding to \$20 million per year, creates a definition of environmental outcomes, and ties state payments to the times when verified outcomes are produced. If this bill passes, projects will depend upon private investment or other sources of capital to carry out and maintain the project until Commerce Act payments begin.¹⁶

Forest Banking Program

Economic Instruments, Banking & Trading Programs

Maryland and New Jersey are the only states in the country with policies designed to prevent a net loss of forests. While these states are not yet successful in achieving this goal, by implementing these policies, they have created a standard for performance and accountability to drive further progress. These policies additionally support an environment for private investment in activities that offset permitted losses of forests.

The Maryland Forest Conservation Act was adopted in 1991 to promote the retention of forestland and to plant new forests to offset the loss of trees from development.¹⁷ The Act created the [State Forest Conservation Fund](#), which collects fees when developers are not able to conduct on-site reforestation or afforestation. Money deposited in the Fund can only be used to offset forest losses and for future reforestation and afforestation.

The Act created the first ‘forest banks’ in the country, which are very similar to wetland or stream banks that protect and restore aquatic resources under the Clean Water Act.¹⁸ According to Maryland state code, forest mitigation banks may be created by an applicant afforesting or reforesting an area of land in accordance with a forest mitigation bank plan approved by the Department of Natural Resources (DNR).¹⁹ These banks generate credits which can be purchased by developers to mitigate their forestland impact.¹

The program has the potential for greater participation through improved state policy incentives for stronger forest outcomes.²⁰ The state’s current in-lieu fees were also not historically priced to reflect the real underlying cost of compensatory mitigation. As a result, alternative conservation approaches like reforestation or mitigation banking have not been a competitive option for developers or potential participants.²¹ If prices of in-lieu fee offsets were less subsidized it would create more incentive for forest mitigation banks credits.

The delegation to counties of much of the zoning and permitting that results in forest loss means that banking and no net loss progress differs from county to county. Most counties have one or fewer staff assigned to run their respective forest banking program. These staff members usually take on this role in addition to other responsibilities. In some counties, it can be difficult to obtain information about the program, and there is limited outreach or assistance for potential participants: for example, landowners and farmers are often unable to obtain the necessary information needed to participate.

¹ Maryland has also adopted the ability to use offsets like forest restoration banks to offset impacts to critical areas and even has special regulations requiring offsets for the loss of interior forest bird habitat.



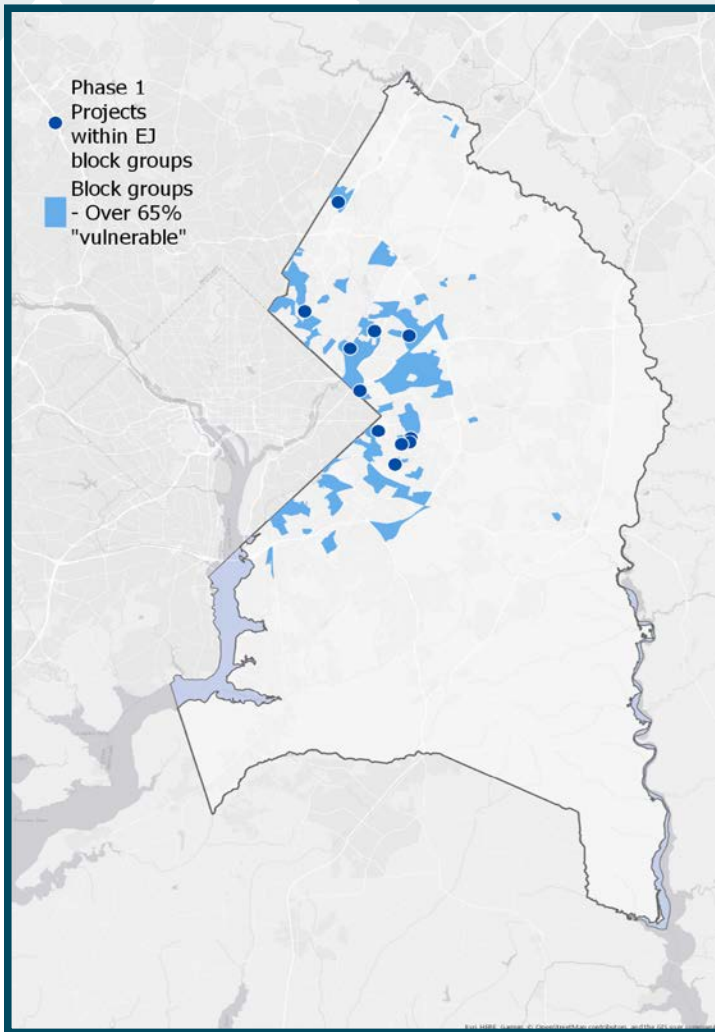


Figure 3. These 11 projects are in census block groups where 65% or more of the population falls within priority areas identified by an environmental justice demographic index. This work by the Corvias-Prince George's County partnership shows how programs can be structured to achieve additional community co-benefits side-by-side with clean water goals.

funding into green infrastructure and water quality projects to meet regulatory requirements. Anne Arundel County stands out among all counties for attracting private capital to pre-pay for the water quality outcomes needed by the county.

In 2017, Anne Arundel County created a \$5 million pay for success initiative for water quality improvement credits and has since invested additional millions in support for three more years of new projects. The county agreed to pay a pre-agreed price for project proposals that provide certified water quality outcomes that they could in turn count towards the county's MS4 compliance.

In 2019, the Watershed Protection and Restoration Program drafted contracts with three firms to restore 6,700 feet of stream and shoreline through its Full Delivery of Water Quality Improvements contract. The full award (\$5.43 million total) will only be paid upon completion of the projects and

Anne Arundel and Carroll Counties in Maryland highlight the different approaches taken by county governments.

Anne Arundel County and the Chesapeake Bay Trust jointly [manage an in-lieu fee program](#) that raises funds from developers and grants those funds to projects to satisfy mitigation requirements. In contrast, Carroll County has a [forest banking program](#) and does not permit in-lieu fee payments. Carroll County established one of the first forest banking programs in the state in 1992, one year after the Forest Conservation Act was passed.²² The forest banking program allows landowners to generate credits that can be purchased by developers who must offset their deforestation impacts. Credits are created by landowners who plant new trees and place permanent development restrictions on their property. [Frederick County recently adopted](#) its own no net loss policy and banking approaches are still developing there.

Anne Arundel County Purchase of Water Quality Improvement Credits

Privately Funded Conservation Outcome for Public Purchase, Pay-For-Success Contracting

Maryland counties are putting billions in



verification of the benefits (completed by Maryland Department of Environment). Although programs like these are ultimately still paid for by the public, projects depend on private capital until outcomes are delivered. Because of the structure of the contracts, contractors are incentivized to find cost savings that pass down to the public. For example, in its first year, this program delivered water quality outcomes at 40 percent lower prices than previous projects funded by the county.

Department of Transportation Full Delivery Initiative

Privately Funded Conservation Outcome for Public Purchase, Pay-For-Success Contracting

In 2017, the Maryland Department of Transportation State Highway Administration initiated a request for proposals for 150,000 linear feet (28 miles) of stream restoration in eleven counties to supply offsets required under the agency's 2015 MS4 permit for stormwater discharges.²³ The initiative is unlike many other DOT MS4 impervious surface offset projects because it is deployed on private lands. Project applicants also have long-term maintenance responsibilities for the stream restoration. Personal communications from MDOT staff indicate that the cost of these full delivery projects was less than 50% of the cost to taxpayers of projects funded through MDOT's traditional contracting approach in previous years.

Most of these contracted projects depend upon private capital to carry out all site planning, design, and construction. Two of the winning bidders were equity-backed restoration companies whose investors included public pension funds and global investment firms.²⁴ Like some forms of Pay for Success contract, the DOT full delivery contracts allow payment of up to 65% of project costs before stream restoration is fully certified. While there is likely no single answer on what payment structure optimizes taxpayer risk, investor risk, taxpayer cost, and investor return, allowing 65% of contract payments to occur before certification is mirrors the approach that [Louisiana](#) has taken to coastal marsh restoration. Construction and certification of most of the projects will be completed in 2020-2021.²⁵

Private Investment through Maryland's Chesapeake and Atlantic Coast Bays Trust Fund

Privately Funded Conservation Outcome for Public Purchase, Pay-For-Success Contracting

Sometimes private investment works through programs that are not structured to depend upon it. In 2016, private equity firm Ecosystem Investment Partners (EIP) partnered with the Cecil Land Trust on an innovative grant application to the state's Chesapeake and Atlantic Coastal Bays Trust Fund. The project involved a traditional contract whereby the state provided a grant to the land trust. It in turn had its own Pay for Success contract with EIP to deliver outcomes sought under the program. EIP identified multiple project areas along streams on private farmland that could be restored to reduce thousands of pounds of nitrogen, phosphorus, and suspended sediment through 8,215 linear feet of stream restoration and 24.8 acres of riparian buffers. The firm used its private capital to fund the entire project from the onset. The land trust pays the firm once the project meets pre-determined outcomes to Bay Model standards. Since the Trust Fund is a grant program only open to nonprofits, it normally funds projects before any results are achieved and thus no private investment is required. Projects of



this nature lower taxpayer risk and speed up project delivery by relying on private companies to fund and construct the project.

Clean Water Partnership – Prince George’s County and Corvias

Public-Private Partnership

In Maryland, Prince George’s County financed the nation’s largest environmental Public-Private-Partnership (P3) in the country. This partnership invested \$220 million into a collaboration that moved a county that was previously way behind its compliance schedule much closer to stormwater treatment compliance and stormwater management (MS4 permit) requirements. The P3, called the [Clean Water Partnership](#),²⁶ was signed in 2015 and is managed by an experienced P3 company called Corvias. The partnership’s environmental goal is to achieve stormwater retrofits that provide up to 4,000 acres of impervious surface treatment. Corvias also provides 30 years of maintenance services for the hundreds of projects installed, many of which benefit burdened neighborhoods (Figure 3).²⁷ Like some other examples in this report, private investments are ultimately paid back with public or ratepayer funds.

Prince George’s County’s Stormwater Management District Fund is used to partly fund the partnership. The county collects about \$14.5 million in revenue from this program. The P3 with Corvias allowed the county to use its stormwater fees as a revenue source to back borrowing, including from state revolving loan funds, to cover the costs of the work Corvias was contracted to manage.²⁸ The County’s estimated savings compared to traditional one-by-one project delivery costs were 40% through 2019. Corvias uses its own private capital to cover project planning, design, and permitting costs and early construction costs before invoicing and being paid back for projects by the County. More than 84% of funds and jobs are delivered to the local area and to minority-, woman-, or disabled person-owned businesses.

Department of Transportation Smart Ponds

Public-Private Partnerships

The Nature Conservancy, Walmart, and water technology company OptiRTC²⁹ teamed up with the Maryland Department of Transportation to take existing stormwater treatment ponds and retrofit them to capture much more water pollution. The partnership retrofitted existing stormwater ponds currently owned by Walmart to install sensors, drains, and other technology that allow pond water levels to be lowered based on anticipated storm events and current storage capacity. OptiRTC, the technology partner, developed sensors that can monitor real-time climatic conditions and automatically adjust and control the water levels without direct human involvement in the decisions. In a Philadelphia installation by the same company the technology was found to reduce 98% of wet weather stormwater flow, compared to a similar site without the technology that captured just 36% of stormwater runoff. The company has carried out 130 installations to date. Experimental installations funded by grants were carried out in Maryland and DC,³⁰ but the Maryland DOT is the first public agency to pay for installations that contribute to permit compliance.³¹ MDOT’s performance contract is set up to purchase the estimated 100 acres of impervious area treatment credits expected to be



generated by these ponds once the installations are certified, which includes 42,000 pounds of sediment, 6,000 pounds of nitrogen, and 3,800 pounds of phosphorus. This creates a financing need during planning, installation, and pre-certification operations. The expected cost to MDOT for these credits is about \$37,500 per acre, which is roughly 75% lower than the average construction cost of conventional stormwater devices of \$150,000 per acre. About three quarters of this cost goes to Opti for construction, operation, and maintenance of the smart ponds. The remaining quarter is paid to Walmart as a rental fee for using their stormwater ponds.³²

Baltimore Department of Public Works' Environmental Impact Bond

Risk Management, Environmental Impact Bonds

Environmental Impact Bonds is a financing approach through which public funders pay for water quality improvement projects by repaying the loan at an interest rate tied to the level of environmental outcome achieved. In 2018, a new environmental impact bond by the Baltimore City Department of Public Works and the Chesapeake Bay Foundation [was proposed](#) to help Baltimore complete 115 green-infrastructure projects in more than three dozen neighborhoods. Baltimore would issue \$6.2 million in impact bond financing (along with an additional \$11.3 million from a state revolving fund loan) to pay for the projects. Repayment to bond funders would depend on the performance of green infrastructure projects³³. Initial funding for developing the project was led by an anonymous donor and matched by the Kresge Foundation. The EIB transaction was being coordinated through Quantified Ventures, a Washington DC-based investment advisory firm, but the bond's future is unclear at this time.

Oyster Restoration Nutrient Credits

Trading Programs

Through filter-feeding, oysters can remove nutrients and sediments from the water by consuming and assimilating the nitrogen and phosphorous from what they eat into their tissue and shells.³⁴

In December 2016, the Chesapeake Bay Program recommended that nitrogen removal credits be given to aquaculture companies depending on the quantity of oysters harvested. Only a few oyster nutrient trading deals have happened thus far, but there is the potential for market growth Maryland and Virginia. One challenge for individual oyster companies is that MDE specifies that credits can only be sold in the watershed where they are generated, so that the benefits of oyster reef restoration are realized in areas where the pollution is produced. While no large-scale deals have been made, at least 10 different oyster farmers have listed credits for sale on MDE's trading board. Price per pound ranges anywhere from \$75 to a few thousand dollars. Blue Oyster Environmental is hoping that the Bay Program will also approve water quality credits for reef restoration (i.e. where the oysters are not harvested).³⁵ Maryland's Clean Water Commerce Program may provide funding for larger-scale oyster reef restoration in the future.





PENNSYLVANIA

HIGHLIGHTS:

Pennsylvania has coordinated use of its State Revolving Fund programs by bringing all water quality investment mechanisms under the umbrella of the Pennsylvania Infrastructure Investment Authority (PENNVEST) which functions much like a green bank. The Clean Water State Revolving Fund (CWSRF) made multiple investments in financing agricultural best management practices, both within the Chesapeake Bay watershed and in other parts of the state. That Revolving Fund has also financed significant headwater forest protection projects. These projects often involve partial private finance, which is paid back with voluntary or compliance credit revenue or revenue from sustainable forest management. Pennsylvania is also home (with Delaware) to the first private revolving water fund to certify water quality outcomes from privately financed projects that are available for purchase by municipal and other Clean Water Act permit holders. Several significant forest carbon projects have been privately financed in Pennsylvania.

PENNVEST

Green Bank

The [Pennsylvania Infrastructure Investment Authority](#), called PENNVEST is Pennsylvania's source for public capital funding for projects related to drinking water, wastewater, or stormwater. PENNVEST also manages the federal/state Clean Water State Revolving Fund and Drinking Water State Revolving Fund dollars (Figure 4). SRFs provide loans, grants, negative interest loans, or loan guarantees. PENNVEST also funds agricultural best management practices that provide cost-effective nutrient reduction benefits.³⁶

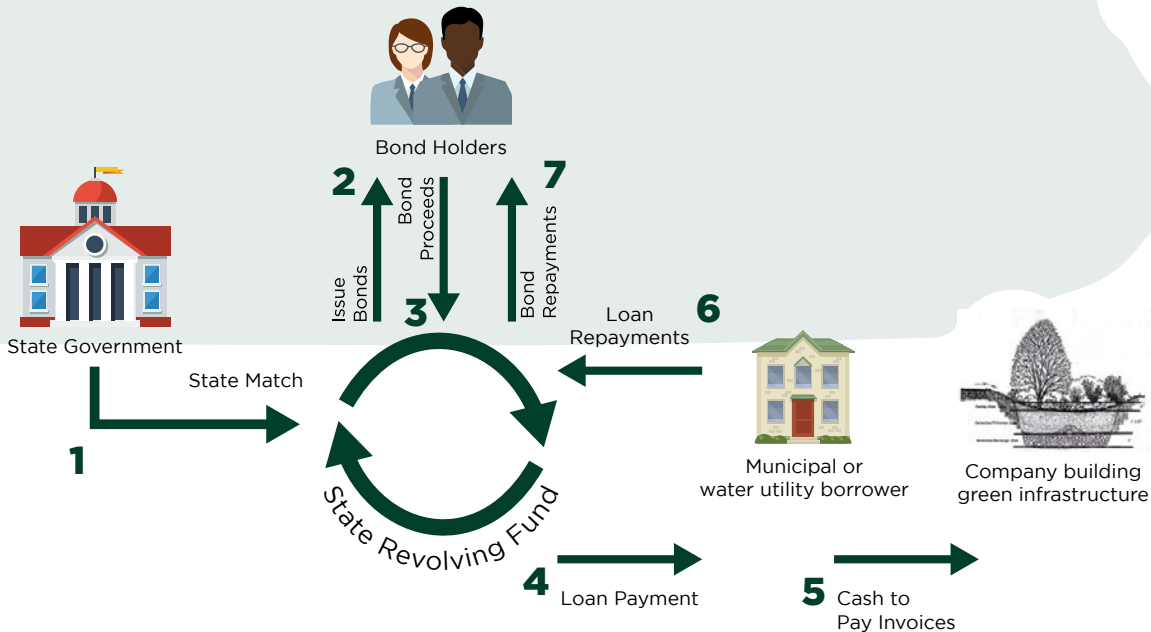


Figure 4. How State Revolving Funds Typically Fund Green Infrastructure

State Revolving Fund Forest Protection Loans

Blended Finance, Revolving Loans

Responsibly managed forested ecosystems are a source of high-quality fresh water provided at a fraction of the cost of gray infrastructure-based water treatment systems. This rationale fueled the Pennsylvania Infrastructure Investment Authority's (PENNVEST) 2018 decision to approve a \$50 million, 1% interest rate loan from the SRF to funds managed by The Lyme Timber Company LP for the acquisition of 63,500 acres of forestland in Pennsylvania.

In exchange for the loan, Lyme Timber granted the state a working forest conservation easement on approximately 9,200 acres. The \$750,000 loan funded remediation work on streams impacted by acid mine damage, as well as the right to purchase working forest conservation easements on 50,700 acres over the following seven years.³⁷ During the seven year "option period", Lyme agreed to forgo subdivision, sale, or development and manage the lands as if they were already subject to an easement.



Lyme Timber is a private timberland investment manager operating a portfolio that includes more than 1.5 million acres across the country, including 159,000 acres in Pennsylvania and SW New York. The total cost to Lyme of securing these lands was more than \$135 million. These include nearly 150 miles of streams designated as high quality. Forests naturally filter out sediments, moderate surface water temperatures, decrease runoff, and store water for later release. Proximity and adjacency with the Allegheny National Forest, state forests, and game lands creates a large, contiguous area producing high water quality as well as wildlife and public recreation. The lands are certified to SFI and FSC Forest Management Standards. This project is not in the Chesapeake watershed, but Pennsylvania's SRFs could be used in this same way in this part of the state.³⁸

For a fraction of the cost of the Commonwealth directly acquiring land, PENNVEST's loan secured immediate local clean water benefits and created the opportunity to realize more significant clean water benefits in the future through the purchase of additional working forest conservation easements. The concessionary loan provided by the SRF was critical to the transaction because it reduced the cost of capital to Lyme Timber, making this deal competitive with other potential uses of their funds' private capital.

Brandywine-Christina Healthy Water Fund (Pennsylvania and Delaware)

Blended Finance, Revolving Water Funds

Although not located in the Chesapeake, the [Revolving Water Fund](#) is the first private revolving water fund in the United States. The Water Fund leverages private financing and extensive relationships across the agricultural and conservation communities to: (i) develop agricultural water quality improvement projects on priority farmlands; (ii) quantify the pollution reductions resulting from such projects; (iii) incorporate such pollution reductions into municipal NPDES permits; and (iv) establish contracts with municipalities and other public and private entities who benefit from purchasing such reductions. The Revolving Water Fund provides ongoing maintenance and verification of these agricultural projects.

This Water Fund was developed by i2 Capital in partnership with The Nature Conservancy, University of Delaware's Water Resources Center, and Stroud Water Research Center. Development funding was provided by the William Penn Foundation, as part of its \$100 million Delaware River Watershed Initiative, and the USDA's Conservation Innovation Grants program, along with DuPont and the Bunting Family Foundation.³⁹ In May 2019, the Water Fund and the City of Newark, Delaware announced the closing of its first pay-for-success transaction. Since then, [two additional townships have signed agreements to purchase](#) pollution reduction credits.

The fund uses a blended approach to funding water infrastructure. The economic value of BMP conservation measures is monetized and these values become environmental service credits (i.e. nutrient credits, carbon credits, etc.). The fund can tap into public or private financing to provide the upfront capital needed to implement BMPs in targeted watersheds. As opposed to the state-based SRFs, Revolving Water Funds utilize Pay-for-Success-structured contracts. Therefore, a municipality is not responsible for securing the capital needed to fund the upfront costs of BMP implementation.



The Revolving Water Fund (Figure 5) and its implementing partners secure contracts with agricultural producers to construct or implement BMPs. The benefits of water quality and environmental services generated through each BMP are quantified and packaged into distinct environmental credits. The credits generated from projects are then sold to “beneficiaries” (municipalities, government agencies, private companies, etc.) according to pre-determined contract terms.

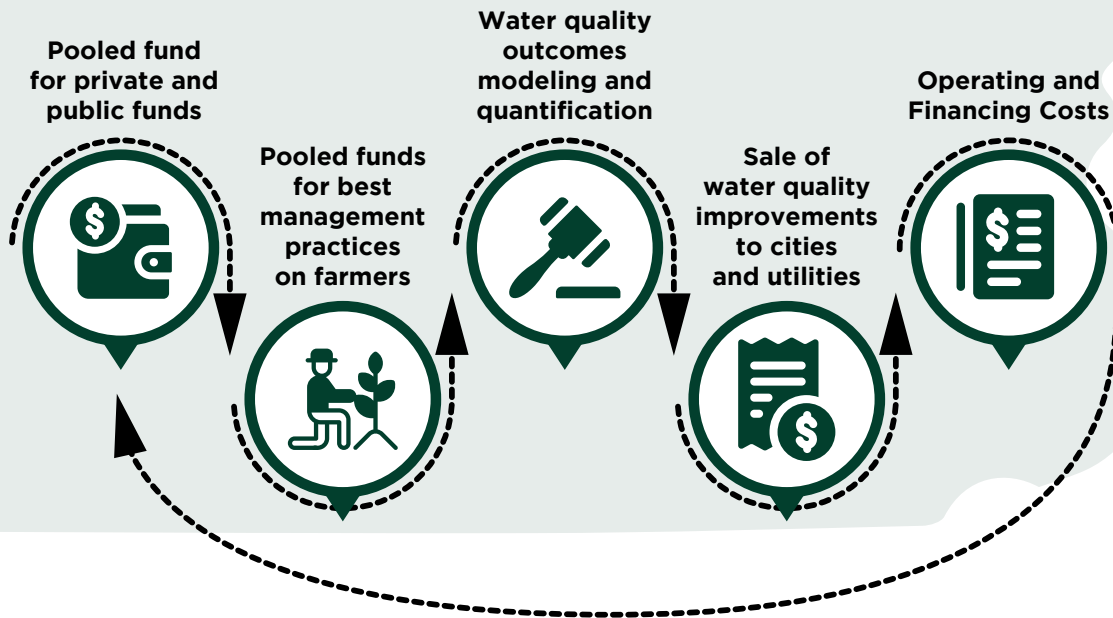


Figure 5. Revolving Water Fund

The Water Fund is backed by private investment, foundation support, and government grants. Future expansion of this or other revolving water funds could attract significantly greater private capital. The fund offers municipal managers cost-effective credits to meet their Total Maximum Daily Load (TMDL) Plan requirements without needing to learn or spend anything on the operation and maintenance of a watershed program. In other words, it allows city managers to stick to what they are trained to do and experts on agricultural BMPs to focus on what they are trained to do. For regulators, the Water Fund provides an independently developed, verified and maintained source of pollution reductions for municipal compliance.⁴⁰

Clean Water Procurement Program (Proposed)

Privately Funded Conservation Outcome for Public Purchase, Pay-For-Success Contracting

In the 2019-2020 legislative session, Pennsylvania’s General Assembly considered the creation of a Clean Water Procurement Program to purchase verified nutrient and sediment reductions through a competitive procurement process.⁴¹ In June 2019, Pennsylvania Senate Bill (SB) 575 passed that chamber with a vote of 33-17. It then moved to the House where it was referred to the State Government Committee. Following negotiations with stakeholders, an extensive amendment of the bill was drafted to clarify expectations of applicants and state agencies in the process, but no action was taken due to opposition from the Department of Environmental Protection over funding concerns. The bill did not identify a funding source.⁴²



The Program would have created a \$20 million/year Watershed Innovation and Improvement Fund to fund nutrient pollution reductions.⁴³ Project proponents would submit an application that included details about how many units of nutrient pollution would be delivered, the price for those pollution reductions, and a timeline for paying for them as they are verified. The program would reduce costs and risks to the taxpayer by requiring nutrient reductions to be verified by the Department of Environmental Protection before anyone is paid.⁴⁴ Unlike Maryland's Clean Water Commerce Program, the Pennsylvania legislation set aside at least 20% of funding for small farms. The proposed amendment would have removed the set-aside but included small farms as a priority when considering applications.

If adopted in a future year, the program will become one of the largest water quality outcomes purchasing programs in the country.

Department of Environment's Nutrient Trading Program

Trading Programs

Pennsylvania was the first state to embrace non-point source trading. In 2006, Pennsylvania approved a policy to allow nutrient trading among facilities or farmers to address state-wide water quality issues and to comply with Chesapeake Bay pollution reductions. To date, this policy is primarily used among wastewater treatment plants, but innovative trades between industrial and agricultural partners have also occurred. This policy provides a more cost-efficient way for parties holding a Clean Water Act water quality permit to meet their limits for nutrients.⁴⁵ The trading program establishes pollution caps per watershed area and allows for trading to occur within that watershed for a specific nutrient or sediment.⁴⁶ The trades must involve comparable credits; for example, nitrogen can only be traded for nitrogen or phosphorous for phosphorous.

Trading can only occur in a Pennsylvania Department of Environmental Protection-defined watershed. Trades may take place between any combination of eligible point sources, non-point sources, and third-party aggregators. Trades can take place through direct communication between credit buyers and credit generators, or parties may use [PENNVEST's Registry](#) to buy or sell credits. Program requirements for non-point source credit providers were revised in 2014 to create additional eligibility and credit calculation conditions that ensured the effectiveness of credits to meet the Chesapeake Bay TMDL.⁴⁷

Chester and Corvias's Public Private Partnership

Public-Private Partnership

In 2017, the stormwater utility of Chester, PA put together a \$50 million P3 that involves 30 years of project maintenance. This P3 will fund dozens of stormwater projects identified, planned, designed, and implemented by Corvias that will be paid back by Chester's stormwater utility. The project is estimated to have a \$149 million local economic benefit through the local jobs and property value appreciation. Chester financed its costs of the project by borrowing money through a loan from the state's Revolving Loan Fund. While this project is in the Delaware watershed (not the Chesapeake), it is a good example of the kinds of investment-backed partnerships possible in either watershed. Like Prince George's County's P3, this partnership also seeks to improve racial equity by focusing on



creating local, minority subcontracting jobs and benefits in burdened neighborhoods. The program is focused on creating 350 acres of impervious surface offsets.

Resource Enhancement and Protection Program

Transferrable Tax Credit Financing

A transferrable conservation tax credit program involves the exchange of tax credits and the ability of the credit recipient to sell their tax credits to other taxpayers. The credits can be used to reduce state tax liability. The transferability of these tax credits creates a market for conservation tax credits.

The Pennsylvania Resource Enhancement and Protection Program (REAP) was established in Act 55 of 2007. Unlike Virginia's program (below), Pennsylvania's REAP provides transferrable tax credits only for agricultural best management practices, not easements and land protection. The 2019 Pennsylvania Farm Bill, signed by Governor Wolf, expanded REAP to \$13 million in annual funding.⁴⁸ The program is administered by the State Conservation Commission and the tax credits are granted by the Pennsylvania Department of Revenue. Eligible applications may receive either 50% or 85% of project costs as state tax credits for up to \$250,000 per agricultural operation over a 7-year period. An investor can work with a farmer to finance a project and, in exchange for doing so, can receive the tax credits.

The program leads to private investment in conservation because farmers often have limited tax liabilities that do not allow them to benefit from large tax credits. By allowing farmers and investor-partners to finance, install, and receive tax benefits for much larger projects, more conservation of farmland and conservation practices are occurring. Since 2007, REAP has provided tax credits to over 2,500 farming operations throughout the commonwealth. Based on the Chesapeake Bay Program Model and estimates from DEP, the program helped produce 295,000 pounds of nitrogen, 14,750 pounds of phosphorus and 3,700 tons of sediment pollution reduction in 2018.⁴⁹

Endangered Species Banking

Trading Programs

Conservation banks are similar to wetland and stream mitigation banks, except they apply to endangered species protected under the Endangered Species Act. Land or water resources are permanently protected and credits from doing so are awarded by wildlife agencies, after which permittees impacting the same species elsewhere can buy credits to offset their impacts. Such banks have been infrequently used outside of California. However, the private restoration company, RES, created a statewide species conservation bank for the Indiana Bat in 2018 by protecting a 438-acre forested site that supports multiple bat breeding colonies. A [second bank](#) of 214 acres was created by the CleanWater Conservancy in 2020. Like wetland banks, private funding or other sources have to pay for conservation before credits are certified and released for sale. Endangered species banking is extremely small today, but this approach could be a more important driver for investment both in offsetting impacts to federally-protected endangered species and in offsetting impacts to state-protected species.





VIRGINIA

HIGHLIGHTS:

Virginia has a robust wetland mitigation market with many private mitigation firms that provide mitigation credits for wetland and stream impacts. Virginia was an early innovator in development of agricultural land-based nutrient trading, but this program has not triggered meaningful demand for credits. Nutrient banks in Virginia are unique in the country in creating a robust trading market through which conservation projects, typically involving permanent property protection and forest restoration, are purchased to offset small impacts on water quality from development projects like housing and highway projects. In 2019, the legislature passed a law allowing counties to help aggregate carbon credits from small farm properties that dominate most of the Chesapeake Bay watershed. Like Pennsylvania, forest carbon sequestration projects are currently being financed and supply offsets to voluntary carbon markets.

Virginia's Nutrient Banking Program

Trading Programs

Virginia has achieved something almost unknown around the world – it has created a regulatory program that addresses very small water quality impacts using an offset program approach. This program regulates impacts as small as those occurring from a single house development. In most other states, small impacts are either ignored, addressed exclusively onsite in ways that offer few environmental co-benefits, or are resolved with a fee which may not be funneled back into water quality work.

Virginia regulates phosphorus runoff from development sites, and since 2009 has allowed developers to achieve a portion of their phosphorus pollution reduction requirements by purchasing credits from nutrient banks elsewhere in the river basin. These banks are typically established on former agricultural lands, put under permanent conservation easements, and reforested with native trees. Some banks also include stream restoration and reforestation. Developers building on less than five acres of land can choose to offset 100% of water quality impacts by buying credits from a nutrient bank under the Virginia Stormwater Management Program. [State highway](#) construction and other government activities are required to reduce their impacts on stormwater runoff and can purchase credits as well.⁵⁰ In recent years, the program has generated approximately \$15 million in annual credit sales.

The benefits of Virginia's phosphorous market include its transparency (especially compared to many in-lieu fee programs), and fast transaction times. The sale of credits can generate \$15,000-\$25,000 per credit for landowners or bank owners in watersheds with strong development pressures. For example, the [Golden Knoll Nutrient Bank](#), run by RES, operated as a 50-acre pasture and hayfield property before being converted back into forest. This bank generates non-point nutrient credits for transfer under current and future federal, state, and local regulations.

Wetland and Stream Banking

Private firms establish wetland mitigation banks by restoring and protecting degraded wetlands that are then sold as credits to developers or public agencies who impact streams or wetlands.⁵¹ A clear need for wetland offsetting dates to President George H.W. Bush's 1989 "no net loss" policy. An EPA and Army Corps of Engineers' regulation in 2008 further clarified the no net loss policy and strengthened requirements for the mitigation of impacts to streams. This regulation also put in place a preference hierarchy for mitigation banks since they lower environmental risk by requiring completion and certification of restoration outcomes before credits can be sold.⁵²

Wetland and stream mitigation banks typically depend upon private financing because they are a form of advanced mitigation. The restoration and protection activity usually precedes the sale of credits by two to ten years that create revenue that pays back the investment.

Within the Chesapeake Bay region, such banks exist in all states. Virginia has the most active and successful wetland and stream mitigation banking efforts, with more than triple the number of banks in Maryland and Pennsylvania combined.²

² Maryland has only 12 banks, including three that are only available for sale to federal or state agencies. Pennsylvania has 32 banks, half of which were established to sell successful wetland and stream restoration only to the Pennsylvania Department of Transportation.



There are currently approximately 155 active, approved, or sold-out stream or wetland mitigation banks in Virginia.⁵³ Some of the private sector companies that operate mitigation banks include: Falling Springs, WSSI, GreenVest, Virginia Waters & Wetlands, Inc., Ecosystem Services, and Ecosystem Investment Partners. Virginia state policies are part of the reason that private investment in stream and wetland mitigation is occurring at a proportionately larger scale. For example, state transportation laws encourage the state Department of Transportation to use mitigation banks to offset impacts to aquatic habitats from road and highway projects.⁵⁴ The Unified Stream Methodology (USM), developed by Virginia DEQ and the Army Corps of Engineers, helps calculate the amount of compensation required for stream offsets.⁵⁵ The methodology can be used to more consistently and quickly categorize and quantify impacts and credits for projects that require stream compensation under the Corps' regulatory program and the DEQ's Virginia Water Protection Permit Program^{56 57}



Photo Credit: Ian Plant

Virginia state policies are part of the reason that private investment in stream and wetland mitigation is occurring at a proportionately larger scale. For example, state transportation laws encourage the state Department of Transportation to use mitigation banks to offset impacts to aquatic habitats from road and highway projects. The Unified Stream Methodology (USM), developed by Virginia DEQ and the Army Corps of Engineers, helps calculate the amount of compensation required for stream offsets. The methodology can be used to more consistently and quickly categorize and quantify impacts and credits for projects that require stream compensation under the Corps' regulatory program and the DEQ's Virginia Water Protection Permit Program

Land Preservation Tax Credit

Transferrable Tax Credit Financing

A transferrable conservation tax credit involves the exchange of tax credits for a conservation easement or partial cost of conservation best management practices. It also enables landowners to sell their tax

credits to other taxpayers. Virginia's Land Conservation Incentives Act created the Land Preservation Tax Credit which provides an income tax credit of up to 40 percent of the donated value of land or easements and taxpayers can use up to \$50,000 of that credit each year to offset state tax liabilities and are able to sell unused credits. Between 2000-2018, Virginia awarded tax credits for more than 900,000 acres of land protection in more than 4,000 projects. The protected status of the lands was appraised at \$4.28 billion, and \$1.72 billion in tax credits were provided. In 2018, the program provided \$50 million in tax credit benefits.⁵⁸ Water quality benefits come from the protection of forests (approximately 50% of donated lands in 2018), as well as requirements for forested or unplowed buffers along streams on donated working farmland.



Hampton Roads Environmental Impact Bond

Environmental Impact Bonds

In 2020, Hampton Roads became the first city in Virginia to use an environmental impact bond structure to finance \$12 million in stormwater management and flood risk-reduction projects. The projects are meant to provide 8.6 million gallons of stormwater storage capacity in the City. Development of the bond was financed with a grant from the Kresge Foundation. Investors purchased the bond, providing capital to fund three major projects in the city's Newmarket Creek watershed. After completion, an independent party will audit the projects to determine whether they have met water storage targets. The bond was underwritten by Morgan-Stanley and Wells Fargo and received an Aa1 bond rating from Moody's Investors Service.



Photo Credit: Ian Plant





WASHINGTON, D.C

Washington, D.C. was the first municipality to issue an Environmental Impact Bond to finance green infrastructure development. It is the only jurisdiction in the United States to use a floor price in a conservation program to incentivize the delivery of an adequate supply of stormwater credits to offset development impacts. The District developed a Stormwater Retention Credit Trading program, which helps achieve stormwater runoff water quality requirements on new development. The DC Green Bank is a Public-Private investment fund intended to reduce project risk and attract private capital for energy efficient and green energy developments. This bank may also be able to finance green infrastructure for clean water purposes.

DC Water's Environmental Impact Bond

Risk Management, Environmental Impact Bonds

In 2016, DC Water issued the first ever Environmental Impact Bond (EIB) to finance \$25 million of green infrastructure projects to manage stormwater runoff. At that time, DC Water was in the process of constructing two large gray infrastructure tunnels to reduce combined sewer overflows and bring the city back into Clean Water Act compliance.⁵⁹ DC Water negotiated with the U.S. EPA to amend their consent decree to replace a third planned tunnel with alternative green infrastructure. This revision significantly reduced costs but came with a greater level of uncertainty that objectives would be met, as the effectiveness of green infrastructure techniques at scale had not yet been measured.⁶⁰ Quantified Ventures served as the intermediary to design and guide DC water through the process of structuring the \$25 million tax-exempt municipal EIB with investors Goldman Sachs and the Calvert Foundation (Figure 6).

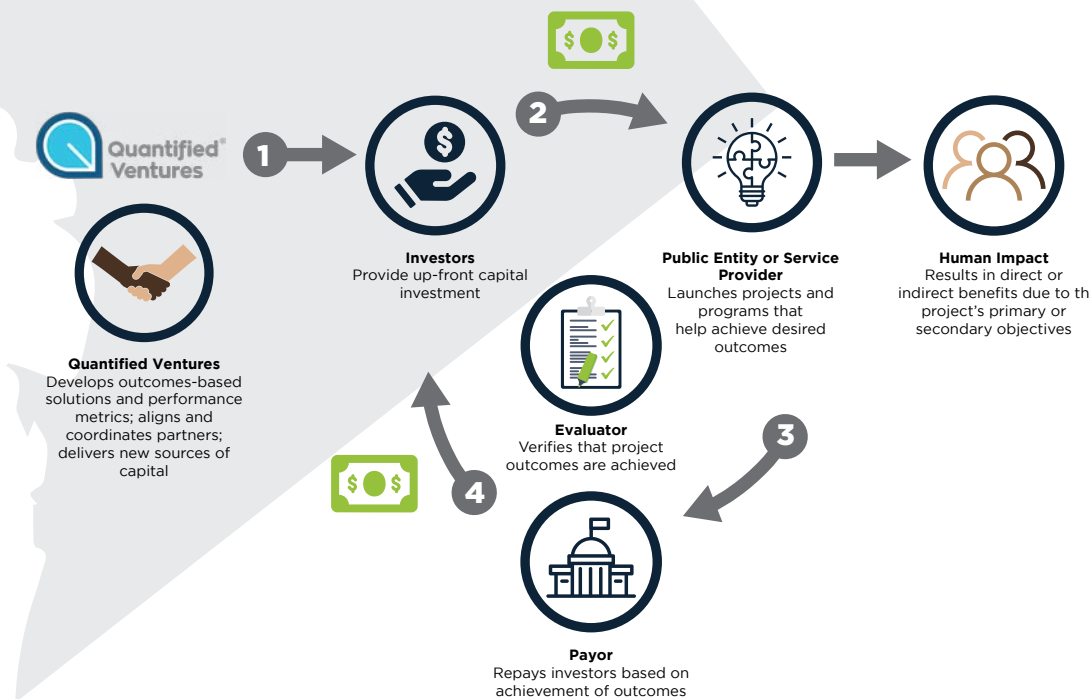


Figure 6. Diagram of how an environmental impact bond works.

Using the bond proceeds, DC Water paid for construction costs and the EIB structure was used to mitigate risks through a three-tiered outcomes payment approach. During the five-year construction and monitoring phase, the bond will pay investors a 3.43% interest rate, equivalent to DC Water's 30-year cost of capital. After project completion, an independent third party will measure the project's performance of reducing stormwater runoff from entering the system. The bond will then be paid back by DC Water at a rate dependent on the project's performance (Figure 6). If the highest performance tier is achieved (greater than 41.3% runoff reduction), DC Water will make a payment to investors in the amount of \$3.3 million; if the middle performance tier is achieved (18.6% to 41.3% runoff reduction), no adjustments are made to bond repayments; and if only the lowest performance tier is met (less than 18.6% runoff reduction), investors will receive \$3.3 million less in interest from DC Water⁶¹.



Department of Energy & Environment Stormwater Credit Trading Program

Trading Programs

In 2013, the District of Columbia's Department of Energy and Environment (DOEE) established the [Stormwater Retention Credit \(SRC\) Trading Program](#) incentivizing the voluntary installation of green infrastructure in the areas of the city where it's most needed to address stormwater runoff impacts in the Anacostia, Potomac, and Rock Creek watersheds. Landowners and investors can partner with specialized SRC Aggregators to build green infrastructure and generate SRCs that can be purchased by developers who must meet stormwater management requirements. Large development and redevelopment activities can comply with a portion of their regulatory requirement by buying SRCs from this voluntary program. The majority of projects must meet at least fifty percent (50%) of their stormwater requirement on-site, but projects located in the area of the city that drains to combined sewer system storage tunnels have the flexibility to meet 100% of their retention requirements by purchasing SRCs generated from green infrastructure located in the MS4.

DOEE's program is relatively unique among trading programs in that it requires annual offsets instead of a permanent offset credit or fee; DOEE recertifies SRCs up to every three years to make sure that green infrastructure projects continue to perform as designed. It is also unique because SRC generators can sell credits to developers, but are also able to sell credits to DOEE at a set floor price.

Department of Energy & Environment SRC Price Lock Program

Credit Price Floor

In 2017, DOEE launched the [SRC Price Lock Program](#), which guarantees the city will purchase SRCs that have not found a buyer. The program uses \$11.5 million in public funds to back future potential purchase of credits.⁶² The program helps increase investment because of the presence of the District government as a guaranteed buyer.⁶³ This ensures that SRC generators will always be able to sell their credits, improving access to private capital and spurring investment in a supply of stormwater offset projects that provide the highest water quality outcomes for the city.

SRC generators can lock in an SRC sale price by entering into a Purchase Agreement with DOEE before construction begins, but they always retain the option to sell credits on the open market at a higher rate. DOEE expects its funding for its SRC Price Lock Program will be a cost-effective investment in green infrastructure, costing less than if DOEE conducted the work itself.⁶⁴ SRC price floor purchase prices will vary from \$1.77 to \$2.03/credit during the first years of the program.

According to the DOEE's SRC and Offset Registry there have been 40 credit transactions in the last 12 months totaling over \$900,000.⁶⁵



Washington, D.C.'s Green Bank

Public-Private Lending Partnerships

In some ways green banks are very similar to SRFs for water infrastructure. They provide lower cost loans or guarantees, and help borrowers secure better loan terms, conditions, and credit access. Established in 2018, the DC Green Bank is a green investment vehicle for Washington, D.C.-based entities to pursue energy efficiency and clean energy project finance. The bank intends to use public funds to reduce project risk and attract outside private capital.

For the first several years

it is expected to have a capitalization of \$105 million. One of the bank's first products is financing to support the Property Assessed Clean Energy program (PACE). PACE helps homeowners and businesses finance the installation of clean energy projects (e.g. solar panels) and make payments in installments rather than paying 100% of the costs for projects upfront.³ The DC Green Bank partnered with D.C.-based firm Flywheel Development to fund a project called Solar For All Installations in 2020. The project is a re-roofing and solar development effort. The project will save D.C. residents millions of dollars in utility bills, reduce carbon dioxide emissions by 1,100 tons annually, create jobs for residents, and encourage collaborative partnerships.

While this green bank is not focused on clean water or climate resilience and water benefits, similar structures could be set up to scale up clean water projects and attract private investment to those projects by lowering lender risks and helping cover or reduce transaction costs.



Photo Credit: Ian Plant

³ Montgomery County, Maryland, also has a similar green bank focused on energy.





BAY-WIDE MECHANISMS



BAY-WIDE MECHANISMS

Wetland and Stream Mitigation Markets

Trading Programs

America's wetland and stream mitigation banking market is one of the largest environmental markets in the world, with more than \$4 billion in estimated transactions. This report describes wetland and stream mitigation in the Virginia section as Virginia's level of investment and volume of transactions eclipses other states in the region. Private investment backed stream and wetland protection and restoration efforts could potentially expand in all of these states, depending on the pace of regional development, population trends, and shifts in transportation technologies. Maryland amended its non-tidal wetland mitigation laws in 2016 in ways that make state policy more similar to Virginia and national policy, but it is unclear if investment activity has changed since that time.

Nonpoint Nutrient Trading

Trading Programs

Virginia, Maryland, and Pennsylvania have all made efforts to build state-run programs with centralized credit registries that allow regulated point sources that create water pollution to offset that pollution by purchasing documented and verified nutrient pollution reductions from unregulated nonpoint sources. The registries, clearinghouses, and programs create a marketplace that facilitates connections between supply and demand. The beginnings of programs in Pennsylvania and Virginia date back approximately [20 years](#). Non-profits like the [World Resources Institute](#) have helped describe and guide the potential for these markets for more than a decade. In Virginia, USDA Secretary Tom Vilsack heralded purchases of agricultural credits provided by farmers and purchased by Virginia DOT [back in 2014](#). However, whereas point-to-point source trading (which does not depend upon private investment) is well established in Pennsylvania and Virginia and is underway in Maryland, nonpoint trading which could be backed by investment, is not yet common. While trading approaches with centralized 'marketplaces' that create supply/demand matching and efficiency have not yet materialized, many of the programs and initiatives described in this report (e.g. Maryland DOT full-delivery purchasing and Anne Arundel County contracting) are narrower versions of the same thing and are thriving.

State Revolving Loan Funds

Public- and private finance-backed loans

State Revolving Funds (SRFs), established under both the federal Water Quality Act of 1987 and the 1996 Safe Drinking Water Act Amendments, are resources available to every state to help fund water infrastructure projects. Public utilities are able to obtain low-interest, no-interest, or negative-interest loans or grants for water infrastructure projects. States differ in how they administer their SRFs and how creative or innovative projects can be. Some states focus their SRF funding on traditional grey infrastructure, while others incorporate forest conservation and green infrastructure into the allowable uses of SRF funds. This includes distributing funds to private or public entities to purchase conservation land to ensure source water protection. We describe Pennsylvania's program above, but Virginia has also allowed their SRFs to be used to finance landscape-scale land protection

projects. Maryland's Comprehensive Conservation Finance Act (SB0737), if enacted into law, would further expand the ways that its SRFs encourage or partner with private investment to deliver green infrastructure benefits, including for the benefit of burdened communities.

Sustainably Managed Institutional Timberlands

Sustainable commodity production with conservation co-benefits

Institution investment in timberlands in the U.S. has been estimated at more than [\\$100](#) billion. A large portion of this is focused on sustainable forestry, where Forest Stewardship Council (FSC) or Sustainable Forestry Initiative (SFI) certifications and conservation easements are common. Water quality benefits and other outcomes should typically be higher from these properties than forestry lands without such management certifications or easements. The [Global Impact Investing Network](#) (GIIN) analyzed survey results from more than two dozen sustainable forest fund managers primarily focused on the United States and Canada and held \$9.4 billion in forestry assets. These managers reported median return expectations of 8% per year, derived from sustainable forestry, sale of other forest products, carbon offset sales, land leasing, or conservation easement sales.

We are not aware of any estimate of the level of investment in timberlands across the Chesapeake Bay region over the last 20 years, but interviewed experts and made our own estimate that at least \$2 billion of investment has occurred (\$1.3 B of which we estimate is in certified or similar sustainable forest management). This investment is paid back with higher wood product price premiums, tax benefits, carbon credits, and through the sale of conservation easements. For example, while not describing a private investment-backed program, [a report](#) to the Pennsylvania legislature in 2012 concluded that FSC certification of 2.1 million acres of state forest lands resulted in \$7.7 million in higher prices for wood received by the state over five years.

Compliance Greenhouse Gas Offset Markets

Trading Programs

In Virginia, more than 4.5 million metric tons of carbon credits were sold into the California compliance market. Investment-backed efforts created these credits by preserving and setting up sustainable management for Virginia forests. Other Chesapeake region projects, like methane capture from livestock operations in Pennsylvania have also been sold under California's market. Projects like these often have a water quality co-benefit alongside the greenhouse gas benefits sold to meet regulatory requirements. However, California's legislature made changes that reduced the use of offsets overall and rewarded projects located in the state.

Voluntary Carbon Markets

Trading Programs

Investment in the management and certification of lands to meet carbon credits protocol requirements and sale of those credits to voluntary buyers is a growing driver of private investment in land and water protection and management.⁶⁶ Demand for these credits is growing because consumers or shareholders want to see companies offset their own environmental damage. Voluntary markets also allow companies to gain experience in offsetting programs in advance of future potential regulatory requirements. Michigan recently became the first state to pilot a voluntary carbon project

on state land, working with carbon developer Bluesource on a zero-cost contract to generate credits on the 108,000 acre Pigeon Improved Forest Management project.⁶⁷ The Comprehensive Conservation Finance Act mentioned above would also direct Maryland DNR to pilot at least one voluntary carbon credit sale on state forests. In 2019, the total dollar value of global voluntary carbon transactions resulting from forestry and land use projects was [\\$159.1 million](#).

Especially in Maryland and Virginia but also in parts of Pennsylvania, small properties make up the largest share of forest and agricultural land ownership and are often excluded from the carbon market simply due to high fixed development costs for registering a single carbon project that makes carbon credits they could produce much more expensive than those from other states (or countries) that have larger properties. Two national programs that are active in the Chesapeake Bay are helping landowners overcome this barrier.

- **SilviaTerra and Natural Capital Exchange:** [SilviaTerra](#) is a precision forestry company that uses remote sensing to create a high-resolution base map of every forest acre in the United States. This provides even small family forest owners access to high quality data on their forest properties. Combined with this satellite imagery, SilviaTerra acts as a broker to connect landowners of any size to carbon credit purchasers through its Natural Capital Exchange Program (NCAPX). SilviaTerra piloted its first offset model in 2019, selling carbon credits from landowners in [six Pennsylvania counties](#) to Microsoft, who acts as their corporate sponsor⁶⁸. This model could be implemented elsewhere in the Chesapeake Bay watershed, particularly considering its success thus far in Pennsylvania. Unlike other programs, SilviaTerra uses annual payments and contracts and just raised \$4.4 million in investment funds.
- **Family Forest Carbon Program:** [The Family Forest Carbon Program](#) is another new forest carbon program focused on the problem of quantifying, registering and verifying improvements in carbon storage on small properties. It was created by the American Forest Foundation and The Nature Conservancy with funding from Amazon, Inc. Similar to SilviaTerra, the Family Forest Carbon Program launched its pilot in Pennsylvania, enrolling eligible landowners with incentive payments to implement sustainable forestry practices to carbon sequestration and storage while improving forest health⁶⁹. This program departs from traditional carbon offsets by paying incentives for land management practices as opposed to estimated carbon inventories. This new methodology is currently being [vetted and validated](#) by Verra, a non-profit organization that oversees the Verified Carbon Standard.

Wastewater Plant Trading Programs

Trading Programs

While these programs rely on ratepayer funds, not private investment, Pennsylvania, Maryland and Virginia all created nutrient trading programs that allow wastewater treatment plants with greater-than-required nutrient reductions from facility upgrades to sell that extra pollution reduction to others that have not yet been upgraded.⁷⁰ Virginia's program, which involves a closed market of point-to-point trades among wastewater facility operators, is the largest and most successful program. Virginia's Chesapeake Bay Point Source Nutrient Trading Program regulates and assists municipal and industrial wastewater treatment plants within the Chesapeake Bay watershed. Existing sources may buy point source credits to meet their waste load allocation. New sources must offset all loads and may buy credits from point sources (or nonpoint sources if there are no available point source credits)⁷¹. In 2019,



Photo Credit: Peter Turcik

the Virginia program had 317,000 pounds of nitrogen credit transaction volume and 87,664 pounds of phosphorus credit transaction volume.⁷² A state law created the nonprofit [Virginia Nutrient Credit Exchange Association](#) to coordinate nutrient credit trades among wastewater treatment plants.⁷³ Like Virginia, Pennsylvania's program is open to non-point source trades but almost exclusively sees point-to-point source activity. [Pennsylvania's program](#) transacted 320,000 pounds of nitrogen credit and 28,000 pounds of phosphorus credit in 2020.⁷⁴ Pennsylvania's program dates from 2005 but important regulations were issued in 2010 and 2015.⁷⁵

INCREASING PRIVATE INVESTMENT IN THE BAY

The region's success in achieving Bay conservation goals can be significantly improved by policies that encourage further expansion of private investment for ecosystem restoration, conservation, and water quality improvement. Even now with record public investments, there will not be enough public funding to pay for Chesapeake Bay restoration in coming years. Private investment in conservation and related activities is growing rapidly. Publicly-funded programs do many things well, but often discourage innovation, speed of action and efficiency. And private investment does not operate alone: public programs, philanthropic and private entrepreneurship, and private investors have been building creative and effective methods to achieve conservation outcomes together.

What shifts in policy might be most important to expand the ways that private investment works to restore the Chesapeake Bay? The following four broad areas of policy are among the most promising spaces for reform that could unlock more private capital for Chesapeake Bay conservation.

1) Procurement

One of the most important policy changes needed throughout the region is to shift public procurement so that it focuses on the purchase of environmental outcomes and use of Pay for Success (PFS) types of contracting. Both Maryland and Pennsylvania legislatures have taken steps in this direction. These approaches are most appropriate in either of two situations:

First, when a conservation activity has already been carried out many times and experts are very comfortable that it works, outcomes procurement and Pay for Success contracts can deliver dramatic cost savings that will allow public conservation funding to go further. In this report, we document 20-70 percent reported savings by Bay programs when they switched contracting approaches. This approach depends upon private finance to pay for activities before projects are complete and makes the use of public funds more efficient.

Given local government's need to meet stormwater and other permit requirements, state policies should also allow those governments to piggy-back on outcome purchasing contracts set up by the state. If, for example, the state has secured pricing for contractors to deliver an indefinite quantity of impervious acre equivalent offsets for \$25,000/acre, allowing local government to use those same contracts at the same price both scales up the market, and thus the investment in those activities, and likely results in a cost savings for local government. Investors are looking to back \$100 million restoration portfolios, not \$2 million single projects. These contracting approaches can help scale up the opportunity to attract the funding that, right now, is directed elsewhere.

Second, when an activities benefits are speculative, but there is a reasonable chance of achieving more conservation progress, Pay for Success procurement allows the private sector to take the risk that it will do so. This innovation is important if we are going to keep finding ways to achieve our ambitious restoration goals. Few government agencies in the region have managed to 'let go' of program and project control in ways that encourage innovation and isolate the public from the risks of doing so; relinquishing some control would make it possible for procurement reforms to accelerate the creative use of finance to advance the practice of conservation in the Bay.

2) Assessing, tracking, and disclosing economic benefits of green infrastructure and costs of harming it

The Chesapeake Bay Foundation has estimated the economic benefits of a restored Chesapeake Bay is more than \$5 billion per year in recreation, property value, health and other benefits. Severe storms and sea level rise associated with climate change are already triggering billions in economic damages to the region. However, consideration of benefits and costs are not built into state and local budgeting, zoning decisions or offset policies that accurately try to replace damages. Especially important is valuing how green infrastructure can be deployed to reduce legacy environmental justice impacts of pollutants and redline development on the health and prosperity of burdened communities throughout the region. All states in the region can do far more to advance the accounting of natural capital and green infrastructure assets—climate resilience, flood reduction, water quality and community wellbeing and justice—to communities throughout the region and put in place policies that try to maximize those values and minimize changes that harm them.

3) Public Private Partnerships

Complex environmental problems with lots of co-benefits and complicated solutions are ever more abundant. In the Bay, these include the large-scale deployment of blue infrastructure to protect the Bay's flood risk zones and coastal areas from climate change; mitigation of environmental impacts in burdened communities in ways that create economic, health and Bay benefits; dramatically expanded storage of carbon, in partnership with farmers and forest landowners, in soils and forests; and large scale installation and maintenance of thousands of green infrastructure projects. To address problems like these--where there is a blend of a profitable opportunity, a public funding-dependent opportunity, and significant and costly transactional complexity--there is a need for governments to consider how they can play a new role as facilitator or advocate. A facilitator or advocate in government agencies can help find solutions to small, often trivial problems that get in way of large efforts. Shifting within offices or agencies from a regulator mindset to a facilitator one is a hard but a critical step in what is needed to really scale up private investment in the Bay's biggest challenges.

The spread of green banks is one clear sign that policymakers are ready to consider this change. A green bank is one version of a structure that puts public capital and leadership capacity into a subset of projects that achieve a public goal. The P3 in Prince George's County is another example showing that these approaches are gaining traction in the region. However, whereas most of the country's green banks are energy-focused, Bay

states should establish 'Chesapeake Bay Green Banks' to coordinate public capital with private capital and create bureaucratic capacity to help large restoration and resilience projects move forward.

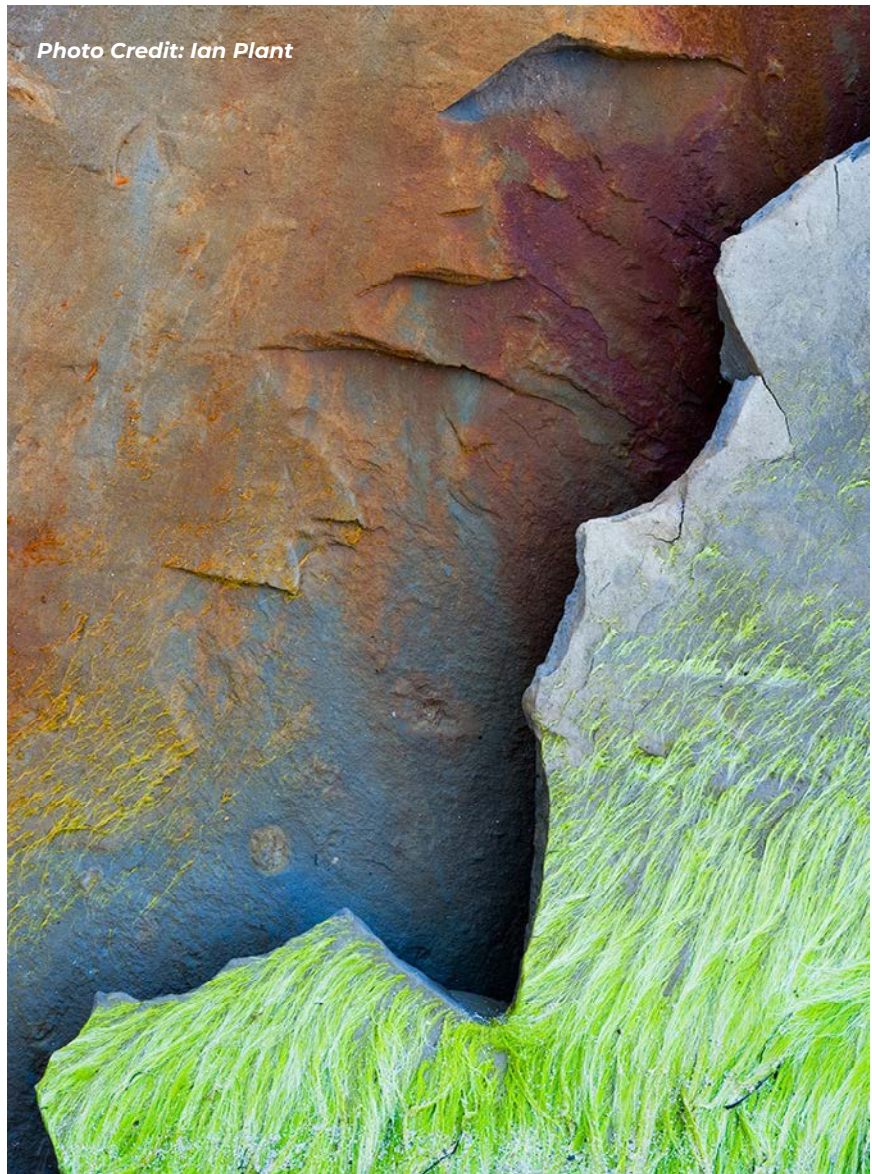


Photo Credit: Ian Plant

4) Let private companies offset private environmental impacts

Virginia's nutrient banking program and strong and clear regulatory caps on nutrient pollution impacts from new development should be a global model. The program puts state and local government in the unconflicted role of regulating harmful impacts and certifying that beneficial ones need government standards while keeping government out of the conflicted role of pricing the payments that flow between.

Across the country and in the region, programs that attempt to offset a regulated impact by having the regulated party pay into a government account (1) consistently fail to correctly price the cost of offsetting the environmental harm (underpricing), (2) lag in spending money on offset projects while net environmental impacts accumulate over time and (3) corrode government decision-making by connecting approval decisions to streams of funding received by agencies. Underpricing often results in both taxpayer and philanthropic funding being redirected to offset what should be an internalized cost to the impactor. Bay states and local government should build more programs around the approach of allowing the private sector to preemptively provide the offsets for impacts to water quality, wildlife habitat, carbon resources or recreational benefits. Doing so will lead to more private investment in efforts to supply those offsets and to ensure that they are priced to pay for the full costs of providing them, while removing the internal government conflicts of interest.

These are by no means the only area where state and federal policy change could help bring more private investment to the Chesapeake Bay, but they are among the most important ways that leaders can help build on the region's lead in the deployment of private capital to achieve public conservation goals.

ENDNOTES

¹ “The Economic Benefits of Cleaning Up the Chesapeake: A Valuation of the Natural Benefits Gained by Implementing the Chesapeake Clean Water Blueprint,” Chesapeake Bay Foundation, (2014): 3. <https://www.cbf.org/document-library/cbf-reports/the-economic-benefits-of-cleaning-up-the-chesapeake.pdf>

² “Chesapeake Bay Restoration Spending Crosscut: Report to Congress,” Office of Management and Budget, (2019) <https://www.chesapeakeprogress.com/files/2019-Chesapeake-Bay-crosscut.pdf> and <https://www.chesapeakeprogress.com/?/funding>

³ In May of 2018, The Maryland Association of Counties reported an estimated \$250 million per year was spent by counties in Chesapeake Bay restoration over the preceding five years. This figure does not include the City of Baltimore or localities in Virginia or Pennsylvania. The \$500 million estimate provided above is extrapolated from this figure.

⁴ Conservation investing includes intentional investments in companies, funds, and organizations with the goal of generating both a financial return and a measurable environmental result.

⁵ Kelley Hamrick, “State of Private Investment in Conservation 2016: A Landscape Assessment of an Emerging Market,” Forest Trends’ Ecosystem Marketplace, (2016) https://www.forest-trends.org/wp-content/uploads/2017/03/doc_5474.pdf.

⁶ Leigh Whelpton and Andrea Ferri, “Private Capital for Working Lands Conservation,” The Conservation Finance Network, (2017): 4. https://www.conservationfinancenetwork.org/sites/default/files/Private_Capital_for_Working_Lands_Conservation.pdf.

⁷ “Soil Wealth: Investing in Regenerative Agriculture across Asset Classes, Croatan Institute and Delta Institute, (2019) <http://www.croataninstitute.org/soilwealth>.

⁸ “NRCS and Investment Capital: Investing in America Together,” Encourage Capital, (2017): VII. http://encouragecapital.com/wp-content/uploads/2017/09/EC_Private-Capital-Report_Reduced-Size_091417.pdf

⁹ Genevieve Bennett Melissa Gallant, “State of Biodiversity Mitigation 2017 Markets and Compensation for Global Infrastructure Development,” Forest Trends’ Ecosystem Marketplace (2017) https://www.forest-trends.org/wp-content/uploads/2018/01/doc_5707.pdf.

¹⁰ Donofrio et al., “State of the Voluntary Carbon Markets 2020: Voluntary Carbon and the Post-Pandemic Recovery,” (2020). <https://www.forest-trends.org/publications/state-of-the-voluntary-carbon-markets-2020-2/>

¹¹ Wells Fargo Municipal Securities Research. 2015. https://www.institutionalinvestor.com/images/519/94682/holders_of_municipal_bonds_072715.pdf

¹² This does not attempt to calculate the investment level associated with sustainable or regenerative agriculture.

¹³ This paper does not cover programs that may involve a market or trading but don't involve private capital, such as Virginia's point source nutrient trading program.

¹⁴ <https://www.chesapeakebay.net/what/programs/modeling>

¹⁵ <https://mde.maryland.gov/programs/Water/BayRestorationFund/Documents/CWCA%20FY-19%20Proposals.pdf>

¹⁶ <https://mde.maryland.gov/programs/water/TMDL/TMDLImplementation/Pages/key-initiatives.aspx>

¹⁷ Maryland Code Natural Resources Title 5, Forests

¹⁸ [https://govt.westlaw.com/mdc/Browse/Home/Maryland/MarylandCodeCourtRules?guid=NE2A66B-209CC111DB9BCF9DAC28345A2A&originationContext=documenttoc&transitionType=Default&contextData=\(sc.Default\)](https://govt.westlaw.com/mdc/Browse/Home/Maryland/MarylandCodeCourtRules?guid=NE2A66B-209CC111DB9BCF9DAC28345A2A&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default))

¹⁹ <http://www.dsd.state.md.us/comar/comarhtml/08/08.19.04.09-1.htm>

²⁰ Interview with Craig Highfield, Director of Forest Programs, Alliance for the Chesapeake Bay

²¹ Payment into the state forest conservation fund, for a project inside a priority funding area, will be calculated at 30.5 cents per square foot of the required area. For a project outside a priority funding area, the rate increases to 36.6 cents per square foot.

²² https://www.conservationfund.org/images/resources/sustainable_chesapeake/Sustainable-Chesapeake-Chapter4-Forest-Banking-Carroll-County.pdf

²³ <http://www.bidnet.com/bneattachments/?/452969366.pdf>

²⁴ Washington state pension announcement of ecological restoration investment: <https://www.ai-cio.com/news/washington-state-investment-board-commits-1-billion-private-markets/>

²⁵ <https://www.kci.com/kci-about-us/>

²⁶ https://www.corvias.com/sites/default/files/Insights/Prince_Georges_County_CWP_05-2017.pdf

²⁷ Outside of the Chesapeake Bay, Corvias has also recently signed a performance contract and P3 agreement with Milwaukee's Metropolitan Sewerage District whereby Corvias provides upfront financing for design and construction of green infrastructure projects, to be paid \$2.37/gallon of stormwater storage certified that it produces, up to \$20 million.

²⁸ <http://policyinnovation.org/wp-content/uploads/2018/11/StormwaterInnovation.pdf>

²⁹ Opti website: <https://optirtc.com/>

³⁰ National Fish and Wildlife Foundation study of smart pond water quality benefits: <https://d1qmd-f3vop2l07.cloudfront.net/merry-lime.cloudvent.net/hash-store/9f52777942c03cc451ecbb646ac87c48.pdf>

³¹ Information from interview with Sandy Hertz and John Dennison, of MDOT.

³² Stormwater credits are credited based upon treatment of 1 inch of rainfall over a certain number of acres. Partial credits will be granted if BMPs only treat less than 1 inch of rainfall. This is often the case for dry stormwater ponds; they may receive less than 100% of the available credits compared to wet ponds. Two out of the three smart ponds are dry ponds. MDOT is currently waiting to hear what percentage of available credits dry ponds will receive.

³³ https://www.bayjournal.com/news/pollution/environmental-bonds-a-new-way-to-finance-green-stormwater-projects/article_f4fa9ab5-77e3-5fbc-810e-574b0c480688.html Bay Journal. 2018. Environmental bonds a new way to finance 'green' stormwater projects

³⁴ <https://oysterrecovery.org/water-quality-improvement/>

³⁵ <https://oysterrecovery.org/water-quality-improvement/>

³⁶ <https://www.pennvest.pa.gov/Information/Funding-Programs/Pages/default.aspx>

³⁷ <http://www.replawrence.com/Display/SiteFiles/133/OtherDocuments/IssueCorrespondence/002.pdf> (Lyme Loan PENNVEST Q&A, page 6).

³⁸ Virginia has recently financed a similar loan for forest land protection and management with The Nature Conservancy in the Clinch River Valley – also not a part of the Chesapeake watershed.

³⁹ <http://paenvironmentdaily.blogspot.com/2017/08/brandywine-christiana-watershed-pay-for.html>

⁴⁰ <https://www.conservationfinancenetwork.org/2019/08/28/revolving-water-fund-pilots-pfs-approach-for-water-quality-improvements>

⁴¹ The bill passed through the lower house of the legislature but was still under consideration by the state senate as of the date of this report's publication

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⁴³ <https://www.senatorgeneyaw.com/2019/06/04/senate-ere-committee-advances-four-bills-to-the-full-senate/>

⁴⁴ <https://www.watertechonline.com/wastewater/article/16223859/pennsylvania-clean-water-procurement-act-would-create-nutrient-trading-program-in-order-to-improve-water-quality>

- ⁴⁵ <https://www.dep.pa.gov/Business/Water/CleanWater/NutrientTrading/Pages/default.aspx>
- ⁴⁶ <http://nsglc.olemiss.edu/WQT.pdf>
- ⁴⁷ <http://files.dep.state.pa.us/Water/BPNPSM/NutrientTrading/NutrientTradingSupplementTo-Phase2WIP.pdf>
- ⁴⁸ <https://www.edf.org/sites/default/files/documents/innovative-state-led-efforts-finance-agricultural-conservation.pdf>
- ⁴⁹ 2018 REAP Annual Report.
- ⁵⁰ <https://www.linkedin.com/pulse/most-efficient-environmental-market-youve-never-heard-timothy-male/?trackingId=4FTK2vHP7NLTpFwdwalnsQ%3D%3D>
- ⁵¹ VA Tech Extension report
- ⁵² <https://ribits.ops.usace.army.mil/ords/f?p=107:158:9482900551017::NO>
- ⁵³ <https://ribits.ops.usace.army.mil/ords/f?p=107:158:9482900551017::NO>
- ⁵⁴ Virginia code section 33.2-247. Wetlands mitigation banking <https://law.lis.virginia.gov/vacode/title33.2/chapter2/section33.2-247/>
- ⁵⁵ https://www.deq.virginia.gov/Portals/0/DEQ/Water/WetlandsStreams/USMFinal_01-18-07.pdf?ver=2012-05-18-033556-000
- ⁵⁶ <https://www.deq.virginia.gov/Programs/Water/WetlandsStreams/Mitigation.aspx>
- ⁵⁷ <https://www.sciencedirect.com/science/article/pii/B9780128050910000049>
- ⁵⁸ <https://rga.lis.virginia.gov/Published/2020/RD6/PDF>
- ⁵⁹ <https://www.quantifiedventures.com/dc-water>
- ⁶⁰ https://www.epa.gov/sites/production/files/2017-04/documents/dc_waters_environmental_impact_bond_a_first_of_its_kind_final2.pdf
- ⁶¹ http://policyinnovation.org/wp-content/uploads/2020/03/Strengthening-Urban-Rural-Connections_PDF.pdf
- ⁶² https://doee.dc.gov/sites/default/files/dc/sites/ddoe/release_content/attachments/DOEE%20Announces%20%2412.75M%20for%20SRC%20Purchase%20Agreement%20Program.pdf
- ⁶³ <https://doee.dc.gov/src>

⁶⁴ <https://doee.dc.gov/release/doee-announces-12750000-innovative-program-incentivize-cost-effective-green-infrastructure>

⁶⁵ <https://octo.quickbase.com/up/bjkxxcfcg/rb7/eg/va/levels.html?sitelevel=2&pagerecord=90&user-role=Everyone%20On%20the%20Internet>

⁶⁶ The Regional Greenhouse Gas Initiative could be a compliance market for investment-backed offsets; the program has an offset program that allows agricultural and other offsets to be purchased by regulated GHG emitters. However only one project has been registered since its inception, a land-fill capturing methane in Maryland that was established in 2017.

⁶⁷ <https://www.detroitnews.com/story/news/local/michigan/2020/09/20/michigan-dnr-launch-carbon-dioxide-credit-program-reduce-greenhouse-gas/5827245002/>

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⁶⁹ <https://www.forestfoundation.org/family-forest-carbon-program>

⁷⁰ <https://www.chesapeakebay.net/issues/wastewater>

⁷¹ Virginia Cooperative Extension

⁷² <https://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/Watershed%20GP/2019%20Nutrient%20Trades%20Report%2006262020%20Final.pdf?ver=2020-06-26-163751-320>

⁷³ <https://law.lis.virginia.gov/vacode/title62.1/chapter3.1/section62.1-44.19:17/>

⁷⁴ http://files.dep.state.pa.us/Water/BPNPSM/NutrientTrading/NutrientCreditRegistry/2020_Buyer_Summary.pdf

⁷⁵ <https://www.dep.pa.gov/Business/Water/CleanWater/NutrientTrading/Pages/default.aspx>