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Stormwater Financing Economic Impact Assessment: Anne Arundel County, MD, Baltimore, MD, and Lynchburg, VA

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This project was managed and directed by the ***Environmental Finance Center (EFC)*** at the University of Maryland in College Park. For twenty years EFC has served the Mid-Atlantic region and is one of ten regional centers located throughout the country that comprise the Environmental Finance Center Network. These centers were established to assist communities in addressing the how-to-pay issues associated with resource protection. One of the EFC's core strengths is its ability to bring together a diverse array of individuals, agencies, and organizations to develop coordinated, comprehensive solutions for a wide variety of resource protection problems. The EFC has provided assistance on issues related to energy efficiency, stormwater management, source water protection, land preservation, green infrastructure planning, low impact development, septic system management, waste management, community outreach and training. Working to facilitate this process is at the core of the EFC's mission and skill set.

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The IMPLAN modeling process was directed and implemented by the ***Business Economic and Community Outreach Network (BEACON)***, of the Franklin P. Perdue School of Business at Salisbury University. BEACON offers business, economic, workforce, and community development consulting and assistance services to a variety of organizations, including businesses, government agencies, and non-profit community-based organizations. BEACON has a dual mission of: 1) providing Perdue School students with a wide variety of experiential learning opportunities; and, 2)providing our region's public and private sector decision makers with the business and economic development data, information, skills and know-how they need through targeted outreach programs, applied research, trend and scenario analyses, demand forecasting, strategic planning, feasibility studies, and modeling for resource allocation, process improvement, and economic impact studies.

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Part 1: Background

In October 2011, the Environmental Finance Center (EFC) located at the University of Maryland, College Park was awarded a grant by the National Fish and Wildlife Foundation (NFWF) to implement a stormwater financing technical assistance project in three urban communities across the region. While the overarching goal of this effort is to expand the ability of local governments to achieve water quality restoration goals through more efficient stormwater financing, the project focused on three primary objectives:

- To create a better understanding of both the costs and economic impacts associated with effective stormwater management in urban communities, specifically as they relate to pollution reductions associated with the Phase 2 Chesapeake Bay Watershed Implementation Plans (WIPs);
- To demonstrate how water quality restoration activities can benefit and add value to other community priorities, thereby improving financial efficiencies; and,
- To demonstrate how effectively engaging the private sector in stormwater management programs can incentivize innovation, create efficiencies, and accelerate restoration activity across the community.

This two-year project will be completed in the fall of 2013 and is being implemented in three phases:

- Phase 1: Assessing the economic and fiscal impacts associated with implementing stormwater management programs;
- Phase 2: Assessing the community capacity necessary to achieve aggressive urban water quality goals and requirements; and
- Phase 3: Developing recommendations for improving the effectiveness, efficiency, and expediency of the jurisdiction's stormwater financing system.

The project is being implemented in three urban communities located in the Chesapeake Basin: Baltimore, MD; Anne Arundel County, MD; and Lynchburg, VA. Three different criteria were used to select these communities. First, the communities had to be regulated for stormwater, thereby being compelled to implement stormwater management programs. Secondly, at least two of the chosen communities needed to be large urban jurisdictions with more advanced stormwater programs. The reasoning behind this was to get a better sense of how their stormwater programs would change with the new Watershed Implementation Plan (WIP) requirements. Finally, the three communities had to agree to provide resources in the form of time and in-kind services towards the completion of the project.

This report summarizes our work in Phase 1 of the project, thereby providing an assessment of the estimated economic impacts associated with implementing stormwater management programs.

The impact of stormwater. Perhaps no issue better demonstrates the complexity, scale, and contentiousness of the Chesapeake Bay restoration effort better than financing urban

stormwater management. As stormwater regulations at all levels of government have become more restrictive, local communities are facing significant financing obligations. The challenge is especially acute for those communities struggling to retrofit existing urban environments and development.

Urbanized areas contain large expanses of impervious surfaces such as roads, rooftops and parking lots. These areas prevent runoff from soaking into the ground and channel stormwater directly into local streams, rivers, and other water bodies. Improperly managed stormwater runoff can damage streams, cause significant erosion, and carry excessive nutrients, sediment, toxic metals, volatile organic compounds, and other pollutants downstream.[1] In the United States, stormwater runoff is responsible for 45% of impaired estuaries and 21% of impaired lakes.[2] In the Mid-Atlantic region, stormwater is responsible for over 4,000 miles of impaired streams, including the Chesapeake Bay.

The adverse effects of stormwater are not limited to the water quality impact of the pollutants carried in the runoff; the quantity of water moving during peak flows can be just as concerning. Unnaturally high volumes of runoff during storm events can erode soil and redeposit sediment in streams, clouding water and degrading aquatic habitats.[3] These volumes also scour stream banks and alter river channels, potentially damaging public infrastructure like roads and bridges, as well as private property.

Polluted stormwater runoff is commonly transported through Municipal Separate Storm Sewer Systems (MS4s). An MS4 is a system of conveyances that include, but are not limited to, catch basins, curbs, gutters ditches, manmade channels, pipes, tunnels, and/or storm drains that discharge into water bodies. For these conveyances, or system of conveyances to be recognized as an MS4, a state, city, town, village, or other public entity must own them. These conveyances must also not be part of a Publically Owned Treatment Works and may not operate as a combined sewer. Operators of large, medium and regulated small MS4 systems are required to obtain NPDES permit coverage in order to discharge pollutants.[4] These designations (large, medium, and small) are based on urbanized areas as determined by census counts.

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

- Phase I, issued in 1990, requires *medium* and *large* cities or certain counties with populations of 100,000 or more to obtain NPDES permit coverage for their stormwater

[1]Green Environment News: EPA, DC Showcase Recovery Act Funded Green Roof. http://www.greenenvironmentnews.com/Environment/Water/EPA%2C+DC+Showcase+Recovery+Act+Funded+Green+Roof. Last accessed on January 30, 2013.

[2]Ibid.

[3]Ibid.

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

discharges. Baltimore City and Anne Arundel County are both Phase I communities.

- Phase II, issued in 1999, requires regulated small MS4s in urbanized areas, as well as small MS4s outside the urbanized areas that are designated by the permitting authority, to obtain NPDES permit coverage for their stormwater discharges. Lynchburg, VA is a Phase II community.

Generally, Phase I MS4s are covered under an individual permit and Phase II MS4s are covered by a general permit. Each regulated MS4 is required to develop and implement a stormwater management program (SWMP) to reduce the contamination of stormwater runoff and prohibit illicit discharges.[5]

Stormwater Management and the Chesapeake Bay: Watershed Implementation Plans.
Though communities all across the country are required to reduce stormwater emissions, regulations within the Chesapeake Bay Basin are becoming particularly stringent. These new restrictions are based on water quality requirements stipulated in the Clean Water Act.

The Clean Water Act (CWA) sets an overarching environmental goal that all waters of the United States be "fishable" and "swimmable." More specifically it requires states and the District of Columbia to establish appropriate uses for their waters and adapt water quality standards that are protective of those uses. The CWA also requires that jurisdictions develop a list of waterways that are impaired by pollutants and do not meet water quality standards. For those waterways identified as impaired, a TMDL, or total maximum daily load, must be developed. A TMDL is essentially a pollution diet that identifies the maximum amount of a pollutant that a waterway can receive and still meet water quality standards.

The U.S. Environmental Protection Agency's (EPA) Chesapeake Bay Total Maximum Daily Load (TMDL) uses "caps" to limit the amount of nitrogen, phosphorus and sediment that can be discharged into the Bay by the jurisdictions whose tributaries drain to it. A portion of the cap falls under NPDES permits and are said to be point sources that are regulated and permitted, while the remainder of the cap is said to be non-point sources and are not subject to federal regulation or permitting. The goal of the TMDL is to accelerate the restoration efforts that have been underway for three decades with the ultimate goal of restoring water quality and aquatic habitats throughout the Bay.

As part of this process, action plans that define how each state, in conjunction with local and federal partners, will achieve and maintain the required nutrient reductions over time. These action plans are referred to as Watershed Implementation Plans (WIPs). WIP development has been a two-phase process. Phase I WIPs identified statewide strategies for reducing nutrients and sediments. In 2011, the Bay states worked with their local jurisdictions to develop plans for achieving statewide goals. These Phase II WIPs are designed to guide local-level nutrient reduction activities, with at least 60% of the necessary nitrogen, phosphorus and sediment reductions attained by 2017.[6]

[5] http://cfpub.epa.gov/npdes/stormwater/munic.cfm. Last accessed on January 31, 2013.

[6] When compared to 2009 levels.

While the WIPs target multiple pollution sources, including wastewater treatment facilities and agricultural land uses, the urban sector WIPs and their associated pollution reduction requirements are almost exclusively stormwater related. And, while stormwater financing has always been an expensive issue for urban communities, the WIPs have compounded financing needs in communities across the region. This in turn has led to more advanced stormwater financing programs. Specifically, many communities are dedicating funding in support of stormwater programs, often through the implementation of enterprise programs. For example, the State of Maryland has legislatively required urban jurisdictions, including Baltimore and Anne Arundel County, to establish fee-based stormwater financing systems. The result will be presumably billions of dollars invested in stormwater management practices over the coming years.

Though achieving stormwater restoration goals will obviously come with fiscal costs to communities, these investments will be made within a complex economic system and thereby become part of the economic engine that drives and sustains our way of life. Economic impact assessments, enabled through the application of sophisticated models, provide local leaders with an understanding of the role that these types of investments will have on their communities, the jobs supported through the investments, and the industry sectors and skill sets necessary for supporting stormwater investment activities. These types of studies are important for developing and implementing strategies to ensure that achieving environmental goals and measurable outcomes can be done symbiotically with economic and community development.

Part 3: IMPLAN and Economic Impact Assessments

Economic impact assessments (EIA) examine the effect of a policy or activity—such as Watershed Implementation Plans—on the economy of a given area. The area can range from a neighborhood to the entire globe; in the case of our study, we analyzed the impact of the WIP process at the county and municipal levels. Our study measured the economic impact in the pilot communities in terms of changes in economic growth (output or value added) and associated changes in jobs (employment). As is typical of EIA studies, our goal was to measure or estimate the level of economic activity that will occur as a result of implementing stormwater management practices within the three pilot communities.

There are several input-output models commonly used by economists to estimate indirect and induced economic impacts. Because of the difficulty of measuring these effects, all of the models have limitations. Still, economists generally agree that the models can provide an approximate measure of the jobs impact and personal income generated by a given amount of direct spending in a particular geographic area. To calculate the effects of stormwater investments in our pilot communities, we used an input-output model developed by the U.S. Department of Agriculture (USDA) known as IMPLAN (IMpact Analysis of PLANning).

The IMPLAN model organizes the economy into more than 500 separate industries and has comprehensive data on every area of the United States. IMPLAN combines a set of extensive databases concerning economic factors, multipliers and demographic statistics with a highly refined and detailed system of modeling software. IMPLAN allows the user to develop local-level input-output models that can estimate the economic impact of public and private spending and investment.

Economic multipliers. IMPLAN is able to estimate economic impacts by identifying direct impacts by sector, then developing a set of indirect and induced impacts by sector through the use of industry-specific multipliers, local purchase coefficients, income-to-output ratios, and other factors and relationships.[7] In other words, the model assesses the relationship between different economic sectors and describes how investments among those sectors work their way through the local economy. All of this is done through the use of economic and fiscal multipliers.

Economic multipliers essentially define the pattern of purchases by industries and the associated distribution of jobs and wages by industry. Input-output models identify, for example, all the industries from which a stormwater management construction contractor purchases its supplies and in what proportion. In turn, the model then identifies the industries that are suppliers to these suppliers, or "second generation" suppliers. This continues until all major purchases are accounted for contributing to the construction contractor's original purchases. These original purchases are called "direct sales" and account for the direct impacts

[7] RESI of Towson University. Thursday June 15th, 2006. http://www.cier.umd.edu/RGGI/documents/IMPLAN.pdf. Last accessed on January 30, 2013.

that spending will have on the local economy.[8]

In addition to the direct impacts on local economies, investments in stormwater infrastructure will also have indirect and induced impacts. Indirect impacts are the changes in inter-industry purchases as they respond to new demands of directly affected industries. In the case of green infrastructure and stormwater management, this would mean purchasing machinery, supplies, plant-stock, etc. Induced impacts typically reflect changes in spending from households as income increases due to additional production. This would include things such as food, housing, transportation, etc. It is in effect the composition of these indirect and induced impacts that create the multiplier effect in an economy, where a dollar invested works its way through that economic system.

The size of these indirect and induced effects depends upon the definition of the region being looked at as well as the nature of the economy within the region. A large region with a closed economy, which means that most needs are being met by industries located within the region, would keep many of the sales, earning, and job impacts within the region. In regions like these, the multiplier effects would be relatively large, with a large share of the effects captured within the region. In contrast, a small region with an open economy, which means an economy with a limited array of producers providing goods and services, would leak sales to other regions. Because many purchases would be made from industries outside the local economy, the multiplier impacts on the local economy would be minimized.[9]

Like all models, the accuracy of analysis provided by IMPLAN is directly related to the quality of the data that is fed into the model. In the case of our analysis, it is the anticipated cost or estimated level of investment each community will be making in stormwater management practices. As a result, the process of assessing the potential economic impacts associated with stormwater investments required us to address what is perhaps the most contentious issue associated with the Chesapeake Bay restoration effort: implementation costs.

The relationship between economic impact or activity and costs is both intuitive and direct. Ultimately, many of the costs in an economic system are associated with the cost of labor required for supporting necessary levels of production. As a result, it intuitively makes sense to measure economic activity in terms of jobs supported and employment. However, this direct relationship between costs and output means that there is also an inverse relationship between economic impact and fiscal impact. In other words, in the case of public investment like stormwater management, the higher the level of investment, or cost to the community, the higher the level of economic impact.[10]

Estimating Fiscal Impacts. Economic impacts also lead to fiscal impacts, which are changes in government revenues and expenditures. Economic impacts on total business sales, wealth or

[8] A Study of the Economic Impact and Benefits of UC San Diego. Fiscal Year 2006-07. Prepared for: UC San Diego by CBRE Consulting, Inc. July 2008. Appendix A, page 2.

[9] Ibid.

[10] Again, that impact can be mostly local, in the case of higher multipliers, or spread out among various communities due to leakage.

personal income can affect government revenues by expanding or contracting the tax base. Impacts on employment and associated population levels can affect government expenditures by changing demand for public services. Yet while they are related, fiscal impacts—including those associated with the operations and maintenance of stormwater practices—are not the same as economic impacts.[11] Therefore, we also conducted an analysis of the net fiscal impacts that estimated economic activity associated with stormwater management would have on local, state, and federal tax receipts.

Economic Impact vs. Benefit. This project did not include traditional cost-benefit analysis, which typically assesses the broader non-economic, or non-market benefits associated with an activity, such as the value of effects on personal travel time savings, safety, security and quality of life improvements. Though these values are important for the broader policy community to understand, we chose to focus this study on assessing the economic impacts of local investments in stormwater management (as measured by resulting spending multiplier impacts) as well as the quantifiable collateral community benefits associated with these investments.

There has been some discussion and debate surrounding the issue of the presumed benefits associated with urban green infrastructure and stormwater management. It is important to clarify the distinction between benefit and impact. The benefit of stormwater management is improved water quality, restored habitats (sometimes) and improved quality of life in urban communities. These are the benefits that define why it's important to finance stormwater management programs. In addition, the investments required to achieve these benefits will have economic impacts—often significant impacts—within (and sometimes outside of) urban communities. To that end, our intent with this project was to establish a better understanding of the economic impacts associated with urban stormwater management with the goal of charting a course for communities to maximize that impact to the greatest extent possible.

Jobs supported vs. jobs created. One of the more controversial and perhaps least understood issues associated with economic impact assessments is the relationship between jobs supported and jobs created. Our assessment provided an estimate of the number of jobs supported as a result of stormwater investments. We do not suggest that jobs will (or will not for that matter) be created as a result of these investments. To understand the distinction between the two, the following hypothetical example is provided.

Suppose that an urban community that up until now had invested very little money into stormwater management systems and programs. It then makes the decision to invest $100 million into urban green infrastructure projects spending equally ($10 million) each year. It is certainly possible that in the first year the investment would create green infrastructure-based jobs where none existed before. However, it is equally possible that the investments in the subsequent years are supporting the jobs created in the first year. This means that there are no new jobs created in years 2-10, but there are certainly jobs supported.

[11] Glen Weisbrod; Burton Weisbrod. *Measuring the Economic Impacts of Projects and Programs.* Economic Development Research Group; April 1997. Page 2.

Essentially, IMPLAN does not make a distinction between jobs supported vs. jobs created. Therefore, while this report is not suggesting that stormwater investments create jobs, neither is it being suggested that supporting jobs in the economy is unimportant. On the contrary, this study demonstrates that rather than removing money from the economy as many opponents of local stormwater fees and taxes suggest, local financing of stormwater management efforts can be an important part of local economic engines. And, this economic activity results in cleaner environments and more livable communities.

Finally, two comments and observations are offered related to economic impact studies and their influence on the policy debate associated with stormwater financing and watershed restoration efforts. First, there is often a temptation to compare the anticipated economic impacts of one activity to those of another. For example, a 2011 report by the organization Restore America's Estuaries suggests that the jobs created (their word, not ours) by restoring coastlines are more than twice that of oil and gas and road construction industries combined.[12] Though this study does not intend to dispute their findings, this type of comparison does not appear to be helpful to most community leaders. While it is certainly true that many communities are faced with tough spending choices among multiple community desires and needs, it may create a false dichotomy to suggest that communities must chose between addressing stormwater infrastructure over other needs. The fact is, there are many investments—both public and private—that are essential for maintaining an overall high-quality of life the region enjoys. Education, transportation, public safety, human health, and economic development are all essential in every community. Rather than rank one priority higher than the other, the approach used for the purposes of this project were related specifically to better understanding the linkages between community needs and being able to establish strategies for achieving multiple community goals. This includes restoring and protecting water resources.

Second, it is not our intention to engage in the debate about the appropriate role of government in financing stormwater management efforts. Rather, it is our intention to offer processes, tools, and policies that can improve the efficiency and effectiveness of government programs designed to achieve aspirational environmental and community goals and outcomes. ***An important first step in this process for many communities will be to understand the economic impact that investments will have in the community and how effectively communities are in maximizing those impacts***.

[12] Jobs and Dollars: Big Returns from Coastal Habitat Restoration. Restore America's Estuaries. September 14, 2011. Page 1. A copy of the report can be found on the Restore America's Estuaries website: http://www.estuaries.org/reports/.

Part 4: Results of Economic Impact Assessment

As previously explained, the goal of this study was to measure the anticipated level of economic activity associated with implementation of stormwater management practices within the three pilot communities. To that end, we assessed the impact of *construction activities*, which are one-time impacts on a community's economy, as well as *operations and maintenance* activities, which tend to impact local economies over time. In addition, our study was focused on the three pilot communities; as a result, we did not analyze how the entire region's economy will be impacted by stormwater investments from each community. Though it is reasonable to assume that investment leakage, especially in the case of Baltimore, MD, is positively impacting the economies of surrounding communities, it was beyond the scope of this study to measure that impact. Rather, we focused on assessing how each community would be impacted specifically.

We presented the economic impact assessments in terms of levels of implementation rather than estimated total financing costs. For construction activities, we assessed the economic impact in each community associated with each $100 million invested. For operations and maintenance, we assessed the impact associated with each $10 million invested. We presented the findings in this manner due to the uncertainty associated with each community's WIP. Each of the three communities has estimated very different expected levels of activity in their stormwater programs. Therefore, rather than trying to predict what the final level of implementation will be (a prediction that would almost certainly turn out to be inaccurate) we based our findings on levels of implementation.

Construction Impacts. The impacts from construction are one-time impacts occurring during the construction period. As Tables 1 – 4 indicate, the economic impact from construction activities in Baltimore will be lower than other communities in the region. The comparison to Anne Arundel County is especially important given the proximity of the two jurisdictions. And, though Baltimore experiences lower impacts in each of the three IMPLAN components—direct, indirect, and induced impacts—the City's indirect and induced impacts are significantly lower than those associated with the other two communities. This means, of course, that the impact of stormwater investments in all communities will be determined by local economic conditions. There remain opportunities, however, to maximize the direct impacts of these investments by focusing economic development activities on key industries associated with designing and constructing stormwater BMPs.

One of the striking results of the assessment was the relatively high impact associated with stormwater investments in Lynchburg, VA. Though there are multiple reasons why this would be the case, two stand out as being important for this study. First, Lynchburg is a well-established urban community in a relatively rural region of the state of Virginia. In other words, the city's economy is in some respects rather "closed" when compared to the other two pilot communities. Baltimore and Anne Arundel County are part of a very large economic metropolitan region with a significant amount of interaction among local economies. As a result, leakages will certainly be higher in these two communities than in Lynchburg. Second, the modeling data associated with BMP costs and industry designations for Lynchburg were

based on literature reviews and studies of other communities rather than on expenditures data, as was the case in Baltimore and Anne Arundel County. Therefore, it is certainly possible that the actual impact may be lower in Lynchburg over time. However, as our study indicates, Lynchburg can expect a healthy economic multiplier associated with its stormwater management investments.

Table 1. Estimated impact per $100 million invested in stormwater BMP construction.

Lynchburg, VA	$ 315.9 million
Anne Arundel County MD	$ 220.2 million
Baltimore, MD	$ 145.0 million

Table 2. Estimated jobs supported per $100 million invested in stormwater BMP construction.

Lynchburg, VA	1,411
Anne Arundel County MD	776
Baltimore, MD	344

Table 3. Direct, indirect, and induced impacts per $100 million invested in stormwater BMP construction.

	Lynchburg	Baltimore	Anne Arundel County
Direct	$ 186,138,948	$ 119,596,600	$ 134,906,126
Indirect	$ 71,862,242	$ 16,896,723	$ 38,795,636
Induced	$ 57,928,686	$ 8,536,405	$ 46,499,275
Total	$ 315,929,876	$ 145,029,732	$ 220,201,036

Table 4. Fiscal impacts per $100 million invested in stormwater BMP construction.

	Federal	State and Local
Lynchburg	$ 12,400,140	$ 4,825,892
Anne Arundel County	$ 8,949,926	$ 4,584,773
Baltimore	$ 5,006,511	$ 3,930,586

Impacts of specific best management practices. One feature of the WIPs that makes comparing results difficult is the relative difference in stormwater management approaches being taken by the three communities. The problem is not unique to assessing economic

impacts. Recent efforts to better understand the anticipated costs associated with implementing stormwater management practices have created a tremendous amount of confusion about how those costs will manifest themselves in specific communities. And, as the IMPLAN model demonstrates, the impacts of those costs and associated investments can vary also.

To get a better understanding of how particular practices impact different communities, we applied the IMPLAN model to a recent cost study conducted by Dennis King and Patrick Hagen, economists at the University of Maryland Center for Environmental Sciences, on behalf of the Maryland Department of Environment (MDE). In their report, *"Costs of Stormwater Management Practices in Maryland Counties,"*[13] King and Hagen assess the estimated costs of implemented specific stormwater best management practices in Maryland counties. Using this report as a foundation of this part of our analysis, we set out to better understand the differences between the estimated economic impacts on the two Maryland communities—Anne Arundel County and Baltimore.[14] As we stated earlier, each geographic location has a unique set of multipliers that determines the portion of the economic impact that stays within that area and the portion of the economic impact that leaks to surrounding communities. Additionally, each location has a unique multiplier that determines the percentage of goods and services that are purchased locally from the study area within each industry.

Using the estimated per unit costs associated with each practice, as determined by King and Hagen, we calculated a return on investment (ROI) for the construction of each best management practice within each of the three pilot communities. The ROI was calculated as the total economic impact minus the cost (adjusted using the indexes provided in Table 3a of King's report)[15] divided by the cost. As an example, for every dollar invested in construction projects designed to reduce impervious urban surface area, Anne Arundel County will realize an additional $1.37 in economic impact. Tables 25 through 26 provide the estimated economic and fiscal impacts associated with each best management practice assessed in the King and Hagen report.[16]

When comparing specific BMPs, in all but two cases—urban grass buffers and urban bioretention—the ROI was higher in Anne Arundel County than in Baltimore. This would indicate that regardless of the suite of BMPs employed by the two communities, Baltimore will experience more leakage, and therefore a lower economic multiplier. This is consistent with the WIP economic impact assessment provided above. However, this analysis also demonstrates that the relative economic impact of best management practices is not

[13] King, D. and Hagen, P. "Costs of Stormwater Management Practices in Maryland Counties." Prepared for Maryland Department of the Environment Science Services Administration (MDESSA). University of Maryland Center for Environmental Science (UMCES). Ref. No [UMCES] CBL 11-043.

[14] Detailed tables are provided in Appendix 3. Because the King and Hagen report focuses exclusively on Maryland Counties (including Baltimore City) we did not apply this analysis to Lynchburg.

[15] King and Hagen, Page 24.

[16] Because the Kind and Hagen study focused on Maryland counties, we had to make assumptions for Lynchburg. To that end, we applied the Anne Arundel County costs to the Lynchburg BMP impact estimates.

necessarily connected to the total costs of constructing those practices. For example, in Baltimore, the least expensive best management practice—street sweeping—has a relatively high return on investment when compared to other BMPs.

Operations and Maintenance Impacts. Recurring operations and maintenance activities associated with these stormwater projects have annual economic impacts. To that end, the following is based on the impacts per $10 million invested in operations and maintenance activities. Obviously, the actual levels of annual investment may be lower, or in large urban jurisdictions like Anne Arundel County even higher, than these estimates. The relative impacts will be the same, however.

Table 5. Estimated annual impact per $10 million invested in stormwater O&M.

Lynchburg	$ 22.5 million
Anne Arundel County	$ 33.6 million
Baltimore	$ 22.9 million

Table 6. Estimated jobs supported per $10 million invested in stormwater O&M.

Lynchburg	90
Anne Arundel County	118
Baltimore	75

Table 7. Direct, indirect, and induced impacts per $10 million invested in O&M.

	Lynchburg	Baltimore	Anne Arundel County
Direct	$15,115,420	$14,950,079	$20,745,186
Indirect	$ 3,547,828	$ 3,794,157	$ 4,085,823
Induced	$ 3,876,330	$ 4,225,402	$ 8,813,986
Total	$22,539,589	$22,969,639	$33,644,996

Table 8. Fiscal impacts per $10 million invested in O&M.

	Federal	State and Local
Lynchburg	$ 974,917	$ 626,917
Anne Arundel County	$ 1,585,104	$ 798,990
Baltimore	$ 940,933	$ 560,265

Impacts on Specific Industry Sectors. Assessing the economic impact associated with stormwater investments required understanding the various activities necessary for designing, planning, constructing, and maintaining best management practices (BMPs). The project team dissected anticipated stormwater spending over time in each community and assigned spending activities to specific industry classifications to the fullest extent possible given the level of detail in the data.[17] In the case of Baltimore and Anne Arundel County, the industry classifications were based on a detailed analysis of past stormwater projects financed and implemented within the pilot communities. In the case of Lynchburg, VA where expenditures data was limited, the project team used industry classifications associated with the two other pilot communities.[18]

This process established the basis for the economic impact assessment. As stated above, input-output models like IMPLAN, quantify relationships among industries by examining the pattern of purchases by industries and the associated distribution of jobs and wages by industry. This serves as the basis for calculating the multiplier effect in an economy. In addition, this process of dissecting past stormwater investments into industry sectors provides the community with an understanding of the businesses and industries that will be directly impacted by stormwater investments.

Industry data associated with past project implementation for Baltimore City were provided by the Department of Public Works Surface Water Management Division as well as the City's Chesapeake Bay TMDL Phase II Watershed Implementation Plan.[19] Data for Anne Arundel County was obtained directly from the Anne Arundel County Department of Public Works Engineering Department, as well as the County's Chesapeake Bay TMDL Phase II Watershed Implementation Plan. [20] Specifically, the EFC filed a Freedom of Information Act (FOIA) request

[17] It is important to note that our study was based on existing industry sectors within the IMPLAN model. This is especially important as it relates to stormwater construction activities, which we classified as non-residential construction. Though it is certainly possible that designing, constructing, and maintaining stormwater best management practices has unique characteristics that would warrant a unique industry classification, there was not enough data available to establish that new classification at this time.

[18] Both Baltimore and Anne Arundel County are MS4 Phase 1 communities; as a result, their associated stormwater programs are more comprehensive in terms of scale than Phase 2 communities like Lynchburg, VA. As a result, much of the activity associated with the WIP requirements will mirror many of the projects and practices that the communities have been financing over the past 20 years. Therefore, we used existing data from these two communities to develop industry classifications.

[19] A copy of the City's Phase II WIP can be found at:
http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/DRAFT_PhaseII_Report_Docs/County_Docs/Baltimore_City_DraftPhIIWIP.pdf

20 A copy of the County's Phase II WIP can be found at:
http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/DRAFT_PhaseII_Report_Docs/County_Docs/AnneArundel_DraftPhIIWIP.pdf

to obtain project invoices associated with past stormwater financing projects financed by the county.[21]

The following table lists the primary industries directly impacted by stormwater investments, including their associated IMPLAN Sector Code:

Table 9. Industries Directly Impacted by Stormwater Investments.

IMPLAN Sector Code	
369	Architectural, engineering, and related services
380	All other miscellaneous professional, scientific, and technical services
319	Wholesale trade businesses
36	Construction of other new nonresidential structures
375	Environmental and other technical consulting services
426	Private household operations

There are two important issues to highlight here. First, as the research in these communities shows, there are specific industries that will be directly impacted by increased stormwater investments in urban communities. In addition, over the next few years, there will be a massive build up of stormwater investments across the region, especially in Maryland where the largest jurisdictions (referring to population) have been required to establish dedicated stormwater funding and financing programs. As a result, communities need to take proactive action to ensure that they have the capacity within specific industries to manage increased spending so that it has the maximum impact on their community.

Second, there are unique interactions between the industries that are directly, and even indirectly, impacted by stormwater investments; and community leaders should ensure that the infrastructure is in place to guarantee these interactions occur effectively and efficiently. Stormwater management activities impact a broad variety of industries and disciplines across local economies. A recent study conducted by the Philadelphia's Green Economy Task Force indicates that constructing and maintaining stormwater infrastructure will require the engagement and interaction of industries in manufacturing and service industries, including: manufacturing and distribution; site design; construction; monitoring; and operations and maintenance.[22] Within each of these activities, there are many more associated sub-activities

[21] Due to the lack of expenditures data in Lynchburg, VA, industry classifications were determined by coupling the City's Phase II WIP with information on industry sectors derived from Baltimore and Anne Arundel County.

[22] *Gray to Green: Jumpstarting Private Investment in Green Stormwater Infrastructure* (Philadelphia SBN's Green Economy Task Force).

that will influence the impact that investments have on a local economy. An important part of future economic development activities in these pilot communities, as well as other communities across the region, will be to develop a clearer understanding of these industry interactions in their own community and to establish processes for strengthening and securing those connections.

Part 5: Conclusion

Addressing increasingly aggressive stormwater management needs will create new financing challenges at the local level. And though the primary focus in most communities will be to generate sufficient revenues and contain program costs, it will be essential for local leaders to coordinate stormwater financing activities with other community priorities and efforts. By better understanding the impacts associated with stormwater investments, it is imperative that local communities are able to improve the linkages between water quality restoration programs and requirements with other community priorities, specifically economic development and growth.

The benefits of protecting water quality are significant in urban communities. More importantly, effective stormwater management will create and maintain the quality of life that is essential for the growth and development of communities throughout the region. And, as this study has demonstrated, stormwater management activities have the potential to become significant contributors to local economies and their associated businesses and industries.

The economic impact of stormwater investments in local communities across the Chesapeake Basin has the potential to be significant. As this study has demonstrated, every dollar invested in stormwater management and restoration activities will directly support jobs in a variety of industries and businesses, including product development, engineering, manufacturing and distribution, site design, and construction. The additional indirect and induced impacts will also be significant, affecting myriad activities, businesses, and industries at the local level.

The results of this study provide a platform for the three pilot communities to structure stormwater programs that advance broader community goals, while at the same time creating and expanding other community programs, such as economic development, that take advantage of significant stormwater investment activities. This will serve as the basis for our work with the three pilot communities over the coming year.

Appendix 1: Data and Assumptions

Lynchburg. All industry and cost estimate data come from Table 3 in Technical Memorandum #2: Assessment of Current Stormwater/Wet Weather Program developed by Camp Dresser & McKee (CDM) for the City of Lynchburg. The cost estimate data for Lynchburg for projects falling under the WIP was pulled from Chesapeake Bay TMDL and Final Phase I WIP Urban Stormwater Cost Estimates for City of Lynchburg by Greeley and Hansen. It was assumed that no private land would be purchased for implementation of the BMPs.

Baltimore City, MD. All industry and cost data for Baltimore City were developed from project information provided by the Department of Public Works, Surface Water Management Division as well as the City's Chesapeake Bay TMDL Phase II Watershed Implementation Plan.[23] In the construction estimate land acquisition costs are included only for private land that will be purchased for BMP implementation. Private land cost data was obtained from Maryland Department of Business and Economic Development's Brief Economic Facts for Baltimore City.

Anne Arundel County, MD. All industry and cost data were obtained directly from the Anne Arundel County Department of Public Works, Engineering Department, as well as the County's Chesapeake Bay TMDL Phase II Watershed Implementation Plan. [24] Specifically, EFC filed a Freedom of Information Act (FOIA) request to obtain project invoices associated with past stormwater financing projects financed by the county. The associated cost and industry classifications were used to develop data inputs.

[23] A copy of the City's Phase II WIP can be found at: http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/DRAFT_PhaseII_Report_Docs/County_Docs/Baltimore_City_DraftPhIIWIP.pdf

[24] A copy of the County's Phase II WIP can be found at: http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/DRAFT_PhaseII_Report_Docs/County_Docs/AnneArundel_DraftPhIIWIP.pdf

Appendix 2: Detailed Model Results

The following tables provide detailed modeling results for each of the three pilot communities. All construction impacts are based on one-time investments of $100 million. Operations and maintenance impacts are based on annual investments of $10 million.

City of Baltimore, MD

Table 1. Estimated Impacts from Construction: Baltimore

Impact Type	WIP Projects
Direct Effect	$119,596,600
Indirect Effect	$ 16,896,723
Induced Effect	$ 8,536,405
Total Effect	$145,029,732
Total Employment	344
State and Local Fiscal Impact	$ 3,930,586
Federal Fiscal Impact	$ 5,006,511

Table 2. Estimated Annual Impacts from Operations and Maintenance: Baltimore

Impact Type	WIP Projects
Direct Effect	$ 14,950,079
Indirect Effect	$ 3,794,157
Induced Effect	$ 4,225,402
Total Effect	$ 22,969,639
Total Employment	75
State and Local Fiscal Impact	$ 560,265
Federal Fiscal Impact	$ 940,933

Table 3. Estimated Economic and Employment Impact of Construction Projects: Baltimore

Impact Type	Employment	Labor Income	Value Added	Output	Total
Direct Effect	262	$ 20,238,110	$ 36,630,498	$ 62,727,993	$ 119,596,600
Indirect Effect	51	$ 3,116,526	$ 4,652,749	$ 9,127,447	$ 16,896,723
Induced Effect	31	$ 1,592,537	$ 2,356,780	$ 4,587,087	$ 8,536,405
Total Effect	344	$ 24,947,172	$ 43,640,030	$ 76,442,529	$ 145,029,732

Table 4. Estimated Annual Economic and Employment Impact of O&M: Baltimore

Impact Type	Employment	Labor Income	Value Added	Output	Total
Direct Effect	48	$3,020,735	$4,546,804	$7,382,541	$14,950,079
Indirect Effect	12	$774,113	$1,155,240	$1,864,804	$3,794,157
Induced Effect	15	$799,774	$1,322,541	$2,103,088	$4,225,402
Total Effect	75	$4,594,622	$7,024,585	$11,350,433	$22,969,639

Table 5. State and Local Fiscal Impacts from Construction Projects: Baltimore

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations
Dividends	$0	$0	$0	$0	$328,572
Social Ins Tax- Employee Contribution	$7,372	$0	$0	$0	$0
Social Ins Tax- Employer Contribution	$31,717	$0	$0	$0	$0
Indirect Bus Tax: Sales Tax	$0	$0	$1,100,752	$0	$0
Indirect Bus Tax: Property Tax	$0	$0	$1,197,498	$0	$0
Indirect Bus Tax: Motor Vehicle Lic	$0	$0	$29,431	$0	$0
Indirect Bus Tax: Severance Tax	$0	$0	$0	$0	$0
Indirect Bus Tax: Other Taxes	$0	$0	$421,544	$0	$0
Indirect Bus Tax: S/L NonTaxes	$0	$0	$69,629	$0	$0
Corporate Profits Tax	$0	$0	$0	$0	$152,621
Personal Tax: Income Tax	$0	$0	$0	$478,064	$0
Personal Tax: NonTaxes (Fines - Fees)	$0	$0	$0	$88,598	$0
Personal Tax: Motor Vehicle License	$0	$0	$0	$15,229	$0
Personal Tax: Property Taxes	$0	$0	$0	$7,161	$0
Personal Tax: Other Tax (Fish/Hunt)	$0	$0	$0	$2,398	$0
Total State and Local Tax	$39,089	$0	$2,818,854	$591,450	$481,194

Table 6. Federal Fiscal Impacts from Construction Projects: Baltimore

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations
Dividends	$1,169,013	$364,963	$0	$0	$0
Social Ins Tax- Employee Contribution	$1,182,226	$0	$0	$0	$0
Social Ins Tax- Employer Contribution	$0	$0	$270,283	$0	$0
Indirect Bus Tax: Sales Tax	$0	$0	$125,873	$0	$0
Indirect Bus Tax: Property Tax	$0	$0	$207,777	$0	$0
Indirect Bus Tax: Motor Vehicle Lic	$0	$0	$0	$0	$737,036
Indirect Bus Tax: Severance Tax	$0	$0	$0	$949,340	$0
Indirect Bus Tax: Other Taxes	$2,351,239	$364,963	$603,933	$949,340	$737,036

Table 7. State and Local Annual Fiscal Impacts from Operations and Maintenance: Baltimore

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations
Dividends	$0	$0	$0	$0	$978
Social Ins Tax- Employee Contribution	$2,581	$0	$0	$0	$0
Social Ins Tax- Employer Contribution	$5,981	$0	$0	$0	$0
Indirect Bus Tax: Sales Tax	$0	$0	$164,279	$0	$0
Indirect Bus Tax: Property Tax	$0	$0	$180,854	$0	$0
Indirect Bus Tax: Motor Vehicle Lic	$0	$0	$4,434	$0	$0
Indirect Bus Tax: Severance Tax	$0	$0	$0	$0	$0
Indirect Bus Tax: Other Taxes	$0	$0	$41,740	$0	$0
Indirect Bus Tax: S/L NonTaxes	$0	$0	$16,421	$0	$0
Corporate Profits Tax	$0	$0	$0	$0	$16,605
Personal Tax: Income Tax	$0	$0	$0	$102,067	$0
Personal Tax: NonTaxes (Fines - Fees)	$0	$0	$0	$19,418	$0
Personal Tax: Motor Vehicle License	$0	$0	$0	$2,855	$0
Personal Tax: Property Taxes	$0	$0	$0	$1,386	$0
Personal Tax: Other Tax (Fish/Hunt)	$0	$0	$0	$665	$0
Total State and Local Tax	$8,562	$0	$407,728	$126,392	$17,583

Table 8. Federal Annual Fiscal Impacts from WIP Operations and Maintenance: Baltimore

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations
Dividends	$236,987	$22,423	$0	$0	$0
Social Ins Tax- Employee Contribution	$233,622	$0	$0	$0	$0
Social Ins Tax- Employer Contribution	$0	$0	$43,035	$0	$0
Indirect Bus Tax: Sales Tax	$0	$0	$16,883	$0	$0
Indirect Bus Tax: Property Tax	$0	$0	$28,749	$0	$0
Indirect Bus Tax: Motor Vehicle Lic	$0	$0	$0	$0	$136,109
Indirect Bus Tax: Severance Tax	$0	$0	$0	$223,126	$0
Indirect Bus Tax: Other Taxes	$470,609	$22,423	$88,667	$223,126	$136,109

Anne Arundel County, MD

Table 9. Estimated Impacts from Construction: AA County

Impact Type	WIP Projects
Direct Effect	$134,906,126
Indirect Effect	$38,795,636
Induced Effect	$46,499,275
Total Effect	$220,201,036
Total Employment	776
State and Local Fiscal Impact	$4,584,773
Federal Fiscal Impact	$8,949,926

Table 10. Estimated Annual Impacts from Operations and Maintenance: AA County

Impact Type	WIP Projects
Direct Effect	$20,745,186
Indirect Effect	$4,085,823
Induced Effect	$8,813,986
Total Effect	$33,644,996
Total Employment	118
State and Local Fiscal Impact	$798,990
Federal Fiscal Impact	$1,585,104

Table 11. Estimated Economic and Employment Impact of Construction Projects: AA County

Impact Type	Employment	Labor Income	Value Added	Output	Total
Direct Effect	442	$26,290,178	$35,196,475	$73,419,474	$134,906,126
Indirect Effect	135	$8,670,461	$11,606,596	$18,518,579	$38,795,636
Induced Effect	199	$7,941,310	$15,338,478	$23,219,487	$46,499,275
Total Effect	776	$42,901,948	$62,141,549	$115,157,539	$220,201,036

Table 12. Estimated Annual Economic and Employment Impact of O&M: AA County

Impact Type	Employment	Labor Income	Value Added	Output	Total
Direct Effect	64	$5,774,957	$6,159,603	$8,810,626	$20,745,186
Indirect Effect	16	$849,258	$1,276,063	$1,960,503	$4,085,823
Induced Effect	38	$1,505,264	$2,907,470	$4,401,252	$8,813,986
Total Effect	118	$8,129,479	$10,343,135	$15,172,382	$33,644,996

Table 13. State and Local Fiscal Impacts from Construction Projects: AA County

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations
Dividends	$0	$0	$0	$0	$8,254
Social Ins Tax- Employee Contribution	$11,686	$0	$0	$0	$0
Social Ins Tax- Employer Contribution	$27,076	$0	$0	$0	$0
Indirect Bus Tax: Sales Tax	$0	$0	$1,027,762	$0	$0
Indirect Bus Tax: Property Tax	$0	$0	$1,131,457	$0	$0
Indirect Bus Tax: Motor Vehicle Lic	$0	$0	$27,740	$0	$0
Indirect Bus Tax: Severance Tax	$0	$0	$0	$0	$0
Indirect Bus Tax: Other Taxes	$0	$0	$261,133	$0	$0
Indirect Bus Tax: S/L NonTaxes	$0	$0	$102,730	$0	$0
Corporate Profits Tax	$0	$0	$0	$0	$140,093
Personal Tax: Income Tax	$0	$0	$0	$1,414,359	$0
Personal Tax: NonTaxes (Fines - Fees)	$0	$0	$0	$348,923	$0
Personal Tax: Motor Vehicle License	$0	$0	$0	$52,088	$0
Personal Tax: Property Taxes	$0	$0	$0	$18,882	$0
Personal Tax: Other Tax (Fish/Hunt)	$0	$0	$0	$12,590	$0
Total State and Local Tax	$38,762	$0	$2,550,822	$1,846,841	$148,347

Table 14. Federal Fiscal Impacts from Construction Projects: AA County.

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations
Dividends	$2,007,583	$278,218	$0	$0	$0
Social Ins Tax- Employee Contribution	$1,979,069	$0	$0	$0	$0
Social Ins Tax- Employer Contribution	$0	$0	$203,869	$0	$0
Indirect Bus Tax: Sales Tax	$0	$0	$79,981	$0	$0
Indirect Bus Tax: Property Tax	$0	$0	$136,192	$0	$0
Indirect Bus Tax: Motor Vehicle Lic	$0	$0	$0	$0	$1,148,336
Indirect Bus Tax: Severance Tax	$0	$0	$0	$3,116,679	$0
Indirect Bus Tax: Other Taxes	$3,986,651	$278,218	$420,042	$3,116,679	$1,148,336

Table 15. State and Local Annual Fiscal Impacts from Operations and Maintenance: AA County.

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations
Dividends	$0	$0	$0	$0	$871
Social Ins Tax- Employee Contribution	$2,187	$0	$0	$0	$0
Social Ins Tax- Employer Contribution	$5,067	$0	$0	$0	$0
Indirect Bus Tax: Sales Tax	$0	$0	$171,581	$0	$0
Indirect Bus Tax: Property Tax	$0	$0	$188,893	$0	$0
Indirect Bus Tax: Motor Vehicle Lic	$0	$0	$4,631	$0	$0
Indirect Bus Tax: Severance Tax	$0	$0	$0	$0	$0
Indirect Bus Tax: Other Taxes	$0	$0	$43,595	$0	$0
Indirect Bus Tax: S/L NonTaxes	$0	$0	$17,150	$0	$0
Corporate Profits Tax	$0	$0	$0	$0	$14,791
Personal Tax: Income Tax	$0	$0	$0	$268,209	$0
Personal Tax: NonTaxes (Fines - Fees)	$0	$0	$0	$66,167	$0
Personal Tax: Motor Vehicle License	$0	$0	$0	$9,878	$0
Personal Tax: Property Taxes	$0	$0	$0	$3,581	$0
Personal Tax: Other Tax (Fish/Hunt)	$0	$0	$0	$2,387	$0
Total State and Local Tax	$7,255	$0	$425,851	$350,222	$15,663

Table 16. Federal Annual Fiscal Impacts from Operations and Maintenance: AA County.

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations
Dividends	$375,734	$56,580	$0	$0	$0
Social Ins Tax- Employee Contribution	$370,397	$0	$0	$0	$0
Social Ins Tax- Employer Contribution	$0	$0	$34,035	$0	$0
Indirect Bus Tax: Sales Tax	$0	$0	$13,353	$0	$0
Indirect Bus Tax: Property Tax	$0	$0	$22,737	$0	$0
Indirect Bus Tax: Motor Vehicle Lic	$0	$0	$0	$0	$121,243
Indirect Bus Tax: Severance Tax	$0	$0	$0	$591,025	$0
Indirect Bus Tax: Other Taxes	$746,132	$56,580	$70,125	$591,025	$121,243

City of Lynchburg, VA

Table 17. Estimated Impacts from Construction: Lynchburg

Impact Type	WIP Projects
Direct Effect	$186,138,948
Indirect Effect	$71,862,242
Induced Effect	$57,928,686
Total Effect	$315,929,876
Total Employment	1,411
State and Local Fiscal Impact	$4,825,892
Federal Fiscal Impact	$12,400,140

Table 18. Estimated Annual Impacts from Operations and Maintenance: Lynchburg

Impact Type	WIP Projects
Direct Effect	$15,115,420
Indirect Effect	$3,547,828
Induced Effect	$3,876,330
Total Effect	$22,539,589
Total Employment	90
State and Local Fiscal Impact	$626,917
Federal Fiscal Impact	$974,917

Table 19. Estimated Economic and Employment Impact of Construction Projects: Lynchburg.

Impact Type	Employment	Labor Income	Value Added	Output	Total
Direct Effect	877	$33,825,076	$43,980,539	$108,333,333	$186,138,948
Indirect Effect	268	$15,025,604	$21,087,586	$35,749,052	$71,862,242
Induced Effect	266	$10,095,819	$18,069,706	$29,763,160	$57,928,686
Total Effect	1,411	$58,946,500	$83,137,831	$173,845,545	$315,929,876

Table 20. Estimated Annual Economic and Employment Impact of O&M Projects: Lynchburg.

Impact Type	Employment	Labor Income	Value Added	Output	Total
Direct Effect	57	$2,642,972	$4,776,242	$7,696,206	$15,115,420
Indirect Effect	14	$615,578	$1,078,624	$1,853,626	$3,547,828
Induced Effect	18	$675,116	$1,208,565	$1,992,650	$3,876,330
Total Effect	90	$3,933,666	$7,063,442	$11,542,481	$22,539,589

Table 21. State and Local Fiscal Impacts from Construction Projects: Lynchburg.

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations
Dividends	$0	$0	$0	$0	$9,530
Social Ins Tax- Employee Contribution	$24,165	$0	$0	$0	$0
Social Ins Tax- Employer Contribution	$55,988	$0	$0	$0	$0
Indirect Bus Tax: Sales Tax	$0	$0	$1,183,184	$0	$0
Indirect Bus Tax: Property Tax	$0	$0	$1,571,072	$0	$0
Indirect Bus Tax: Motor Vehicle Lic	$0	$0	$29,073	$0	$0
Indirect Bus Tax: Severance Tax	$0	$0	$756	$0	$0
Indirect Bus Tax: Other Taxes	$0	$0	$282,255	$0	$0
Indirect Bus Tax: S/L NonTaxes	$0	$0	$188,628	$0	$0
Corporate Profits Tax	$0	$0	$0	$0	$129,134
Personal Tax: Income Tax	$0	$0	$0	$1,151,150	$0
Personal Tax: NonTaxes (Fines - Fees)	$0	$0	$0	$122,209	$0
Personal Tax: Motor Vehicle License	$0	$0	$0	$40,582	$0
Personal Tax: Property Taxes	$0	$0	$0	$25,676	$0
Personal Tax: Other Tax (Fish/Hunt)	$0	$0	$0	$12,493	$0
Total State and Local Tax	$80,152	$0	$3,254,967	$1,352,108	$138,665

Table 22. Federal Fiscal Impacts from Construction Projects: Lynchburg.

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations
Dividends	$3,213,698	$218,086	$0	$0	$0
Social Ins Tax- Employee Contribution	$3,168,054	$0	$0	$0	$0
Social Ins Tax- Employer Contribution	$0	$0	$373,351	$0	$0
Indirect Bus Tax: Sales Tax	$0	$0	$146,473	$0	$0
Indirect Bus Tax: Property Tax	$0	$0	$249,413	$0	$0
Indirect Bus Tax: Motor Vehicle Lic	$0	$0	$0	$0	$1,414,599
Indirect Bus Tax: Severance Tax	$0	$0	$0	$3,616,468	$0
Indirect Bus Tax: Other Taxes	$6,381,752	$218,086	$769,236	$3,616,468	$1,414,599

Table 23. State and Local Annual Fiscal Impacts from Operations and Maintenance: Lynchburg.

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations
Dividends	$0	$0	$0	$0	$1,178
Social Ins Tax- Employee Contribution	$1,585	$0	$0	$0	$0
Social Ins Tax- Employer Contribution	$3,677	$0	$0	$0	$0
Indirect Bus Tax: Sales Tax	$0	$0	$186,793	$0	$0
Indirect Bus Tax: Property Tax	$0	$0	$248,037	$0	$0
Indirect Bus Tax: Motor Vehicle Lic	$0	$0	$4,591	$0	$0
Indirect Bus Tax: Severance Tax	$0	$0	$121	$0	$0
Indirect Bus Tax: Other Taxes	$0	$0	$44,565	$0	$0
Indirect Bus Tax: S/L NonTaxes	$0	$0	$29,780	$0	$0
Corporate Profits Tax	$0	$0	$0	$0	$15,974
Personal Tax: Income Tax	$0	$0	$0	$77,163	$0
Personal Tax: NonTaxes (Fines - Fees)	$0	$0	$0	$8,191	$0
Personal Tax: Motor Vehicle License	$0	$0	$0	$2,719	$0
Personal Tax: Property Taxes	$0	$0	$0	$1,717	$0
Personal Tax: Other Tax (Fish/Hunt)	$0	$0	$0	$837	$0
Total State and Local Tax	$5,262	$0	$513,875	$90,628	$17,152

Table 24. Federal Annual Fiscal Impacts from Operations and Maintenance: Lynchburg.

Description	Employee Compensation	Proprietor Income	Indirect Business Tax	Households	Corporations
Dividends	$210,881	$17,328	$0	$0	$0
Social Ins Tax- Employee Contribution	$207,886	$0	$0	$0	$0
Social Ins Tax- Employer Contribution	$0	$0	$58,943	$0	$0
Indirect Bus Tax: Sales Tax	$0	$0	$23,119	$0	$0
Indirect Bus Tax: Property Tax	$0	$0	$39,380	$0	$0
Indirect Bus Tax: Motor Vehicle Lic	$0	$0	$0	$0	$174,969
Indirect Bus Tax: Severance Tax	$0	$0	$0	$242,411	$0
Indirect Bus Tax: Other Taxes	$418,767	$17,328	$121,442	$242,411	$174,969

Appendix 3: Economic Impact Associated with Specific Best Management Practices

Table 25. Baltimore City Economic Impact Estimates BMP: Impact from Construction.

BMP	Total Construction Costs	Economic Impact			Total Economic Impact	Total Fiscal Impact		ROI
		Direct	Indirect	Induced		State and Local	Federal	
Impervious Urban Surface Reduction	$ 144,934	$191,185	$40,603	$76,966	$308,754	$617,510	$1,235,018	$1.13
Urban Forest Buffers	$ 32,703	$41,825	$11,556	$12,708	$66,089	$957	$2,543	$1.02
Urban Grass Buffers	$ 23,437	$29,974	$8,281	$47,364	$85,619	$687	$205	$2.65
Urban Tree Planting	$ 181,353	$246,387	$31,384	$34,952	$312,723	$10,891	$12,991	$0.72
Wet Ponds and Wetlands (New)	$ 25,880	$34,095	$4,831	$10,435	$49,361	$867	$2,094	$0.91
Wet Ponds and Wetlands (Retrofit)	$ 65,404	$87,391	$21,816	$28,816	$138,023	$2,141	$5,508	$1.11
Dry Detention Ponds (New)	$ 43,604	$57,582	$14,041	$17,147	$88,770	$1,519	$3,511	$1.04
Hydrodynamic Structures (New)	$ 41,622	$53,952	$14,529	$16,966	$85,447	$1,251	$3,325	$1.05
Dry Extended Detention Ponds (New)	$ 43,604	$57,582	$14,041	$17,147	$88,770	$1,519	$3,511	$1.04
Dry Extended Detention Ponds (Retrofit)	$ 71,848	$96,174	$23,409	$30,837	$150,420	$2,451	$6,014	$1.09
Infiltration Practices w/o Sand, Veg. (New)	$ 62,879	$87,249	$21,469	$27,328	$136,046	$2,227	$5,409	$1.16
Infiltration Practices w/ Sand, Veg. (New)	$ 65,654	$83,576	$20,519	$26,113	$130,208	$2,140	$5,178	$0.98
Filtering Practices (Sand, above ground)	$ 53,514	$71,184	$17,312	$22,017	$110,513	$1,848	$4,397	$1.07
Filtering Practices (Sand, below ground)	$ 55,496	$73,444	$18,998	$24,281	$116,723	$1,732	$4,621	$1.10
Erosion and Sediment Control	$ 25,896	$33,776	$8,900	$10,917	$53,593	$790	$2,105	$1.08
Urban Nutrient Management	$ 60,451	$76,058	$21,673	$22,111	$119,842	$1,718	$4,543	$0.98
Street Sweeping	$ 5,995	$7,542	$2,149	$2,192	$11,883	$171	$450	$0.98
Urban Stream Restoration	$ 63,920	$85,287	$21,709	$28,729	$135,725	$2,025	$5,409	$1.12
Bioretention (New - Suburban)	$ 49,426	$64,719	$16,543	$19,787	$101,049	$1,611	$3,968	$1.04
Bioretention (Retrofit - Highly Urban)	$ 185,069	$329,656	$80,190	$122,995	$532,840	$11,537	$23,001	$1.88
Vegetated Open Channels	$ 25,766	$33,598	$8,579	$10,003	$52,180	$847	$2,041	$1.03
Bioswale (New)	$ 43,604	$57,851	$14,525	$18,519	$90,895	$1,432	$3,606	$1.08
Permeable Pavement w/o Sand, Veg. (New)	$ 237,424	$303,648	$83,899	$92,263	$479,810	$6,955	$18,455	$1.02
Permeable Pavement w/ Sand, Veg. (New)	$ 332,393	$425,106	$117,458	$129,168	$671,732	$9,736	$25,838	$1.02

Table 26. Anne Arundel County Economic Impact Estimates BMP--Impact from Construction.

BMP	Total Construction Costs	Economic Impact			Total Economic Impact	Total Fiscal Impact		ROI
		Direct	Indirect	Induced		State and Local	Federal	
Impervious Urban Surface Reduction	$ 145,665	$ 236,575	$49,563	$59,323	$345,461	$10,485	$14,219	$1.37
Urban Forest Buffers	$ 32,868	$ 47,613	$13,545	$17,755	$78,914	$1,670	$3,307	$1.40
Urban Grass Buffers	$ 23,555	$ 34,123	$9,707	$12,725	$56,554	$1,197	$2,370	$1.40
Urban Tree Planting	$ 182,268	$ 342,180	$44,314	$40,532	$427,026	$18,537	$17,058	$1.34
Wet Ponds and Wetlands (New)	$ 26,011	$ 41,624	$10,359	$15,054	$67,037	$1,561	$2,880	$1.58
Wet Ponds and Wetlands (Retrofit)	$ 65,734	$1 09,620	$26,912	$42,906	$179,437	$3,996	$7,881	$1.73
Dry Detention Ponds (New)	$ 43,824	$ 70,784	$17,114	$24,614	$112,514	$ 2,723	$4,817	$1.57
Hydrodynamic Structures (New)	$ 41,832	$ 63,337	$17,286	$24,273	$104,897	$ 2,234	$4,473	$1.51
Dry Extended Detention Ponds (New)	$ 43,824	$ 70,784	$17,114	$24,614	$112,514	$ 2,723	$4,817	$1.57
Dry Extended Detention Ponds (Retrofit)	$ 72,210	$ 121,294	$28,977	$45,693	$195,964	$ 4,538	$8,578	$1.71
Infiltration Practices w/o Sand, Veg. (New)	$ 63,196	$ 103,953	$25,188	$38,203	$167,343	$ 3,910	$7,259	$1.65
Infiltration Practices w/ Sand, Veg. (New)	$ 65,985	$ 108,462	$26,345	$39,996	$174,804	$ 4,069	$7,585	$1.65
Filtering Practices (Sand, above ground)	$ 53,784	$ 88,733	$21,281	$32,149	$142,164	$ 3,369	$6,160	$1.64
Filtering Practices (Sand, below ground)	$ 55,776	$ 90,188	$23,150	$35,874	$149,211	$ 3,207	$6,516	$1.68
Erosion and Sediment Control	$ 25,896	$ 40,644	$10,726	$15,903	$67,273	$ 1,440	$2,906	$1.60
Urban Nutrient Management	$ 60,756	$ 83,239	$24,955	$29,900	$138,094	$ 2,897	$5,654	$1.27
Street Sweeping	$ 6,025	$ 8,254	$2,474	$2,965	$13,694	$287	$560	$1.27
Urban Stream Restoration	$ 64,242	$ 106,521	$26,709	$42,936	$176,167	$ 3,800	$7,759	$1.74
Bioretention (New - Suburban)	$ 49,676	$ 77,925	$19,932	$28,369	$126,225	$ 2,884	$5,398	$1.54
Bioretention (Retrofit - Highly Urban)	$186,003	$329,656	$80,190	$122,995	$532,840	$11,537	$23,001	$1.86
Vegetated Open Channels	$ 25,896	$ 40,121	$10,289	$14,174	$64,583	$1,502	$2,740	$1.49
Bioswale (New)	$ 43,824	$ 71,569	$17,772	$27,209	$116,550	$2,630	$5,069	$1.66
Permeable Pavement w/o Sand, Veg. (New)	$238,622	$ 345,672	$98,336	$128,905	$572,912	$12,122	$24,010	$1.40
Permeable Pavement w/ Sand, Veg. (New)	$334,070	$ 483,941	$137,671	$180,466	$802,078	$16,972	$33,615	$1.40

Appendix 4: Glossary

Best Management Practice- **methods or techniques found to be the most effective or practical means for reducing pollution.**

Direct Effects- **The set of expenditures applied to the predictive model (i.e., I/O multipliers) for impact analysis. It is a series (or single) of production changes or expenditures made by producers/consumers as a result of an activity or policy. These initial changes are determined by an analyst to be a result of this activity or policy. Applying these initial changes to the multipliers in an IMPLAN model will then display how the region will respond, economically to these initial changes.**

Economic Impact-**The economic impact is the economic value created by one activity in the totality of the area under study. When an economic activity generates a variety of transactions in an area, those transactions churn in that area in a variety of predictable and measurable ways. Once these additional ripple effects area added to the original activity, the so called "Economic Impact" of that activity can be estimated.**

Employment Impact- **When an economic activity generates a variety of transactions in an area, those transactions support a predictable number of jobs in that area. The jobs supported by such an activity is referred to as its Employment Impact.**

Indirect Effects- **The impact of local industries buying goods and services from other local industries. The cycle of spending works its way backward through the supply chain until all money leaks from the local economy, either through imports or by payments to value added. The impacts are calculated by applying Direct Effects to the Type I Multipliers.**

Induced Effects- **The response by an economy to an initial change (direct effect) that occurs through re-spending of income received by a component of value added. IMPLAN's default multiplier recognizes that labor income (employee compensation and proprietor income components of value added) is not a leakage to the regional economy. This money is recirculated through the household spending patterns causing further local economic activity.**

Input/Output (I-O) Analysis- **A type of applied economic analysis that tracks the interdependence among various producing and consuming sectors of an economy. More particularly, it measures the relationship between a given set of demands for final goods and services and the inputs required to satisfy those demands. (BEA).**

Labor Income- **All forms of employment income, including Employee Compensation (wages and benefits) and Proprietor Income.**

Multipliers- **Total production requirements within the Study Area for every unit of production sold to Final Demand. Total production will vary depending on whether Induced Effects are included and the method of inclusion. Multipliers may be constructed for output, employment, and every component of Value Added.**

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

Output- **Output represents the value of industry production. In IMPLAN these are annual production estimates for the year of the data set and are in producer prices. For manufacturers this would be sales plus/minus change in inventory. For service sectors production = sales. For Retail and wholesale trade, output = gross margin and not gross sales.**

Total Impact-**The total impact is the sum of Direct, Indirect, and Induced effects.**

Value Added- **The difference between an industry's, or an establishments, total output and the cost of its intermediate inputs. It equals gross output (sales or receipts and other operating income, plus inventory change) minus intermediate inputs (consumption of goods and services purchased from other industries or imported). Value added consists of compensation of employees, taxes on production and imports less subsidies (formerly indirect business taxes and nontax payments), and gross operating surplus (formerly "other value added"). (BEA); Gross value added is the value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry or sector; gross value added is the source from which the primary incomes of the SNA are generated and is therefore carried forward into the primary distribution of income account. (SNA).**