Maximizing Benefits of Stormwater Projects in the Baltimore Region

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Baltimore Metropolitan Council

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Baltimore Metropolitan Council

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Project Objectives

In this study, Field Guide Consulting was retained by the Baltimore Metropolitan Council to conduct a series of interviews and a literature review to consider opportunities for cooperative purchasing and workforce development in the growing field of stormwater management. The objectives of the study are to:

- **Create a profile of the stormwater labor force.** This includes a description of the types of contractors, non-profit organizations, governments, and other organizations that are directly engaged in stormwater management. For each category of employer, the profile identifies the occupations and key skills employers need as well as how those needs are likely to change over the future.
- **Describe the scope of opportunities for cooperative purchasing.** The study considers the scope of planned spending, the types of projects for which cooperative purchasing may bring savings, and the planned budget level for each type of project.
- **Recommendations.** Recommendations in the report are based on interviews as well as the FGC's knowledge and experience in the Baltimore Region's economy. While a formal economic impact study is beyond the scope of this project, economic impact studies on stormwater projects as well as economic assessments of each jurisdiction's economic base have been used to inform recommendations on how to (1) retain as much economic benefit as possible within the region and (2) leverage public spending to support workforce development and (3) reduce costs of stormwater projects through cooperative purchasing.

A total of 24 interviews were completed for the project including:

- Six (6) interviews with government managers and legal departments
- Sixteen (16) interviews with contractors based within and outside the region. Among these 16, there are contractors operating in each phase of stormwater project development (design, construction, and maintenance)
- One interview with Corvias, a large contractor managing the implementation of stormwater projects in Prince George's County
- One interview with a non-profit stormwater stewardship organization

These interviews provided a variety of points of view on stormwater projects, the availability of resources to perform stormwater projects, opportunities and challenges for cooperative purchasing, and opportunities and challenges for stormwater workforce development.

Background

Mandate for Stormwater Projects

In December 2010, the U.S. Environmental Protection Agency (EPA) established a Chesapeake Bay Total Maximum Daily Load (TMDL), as required under the federal Clean Water Act. The TMDL sets the maximum amount of nutrient and sediment pollution the bay can receive and still attain water quality standards. It also identifies specific pollution reduction requirements, which are expected to be met through a variety of load reduction strategies that are defined in Watershed Implementation Plans (WIPs), implemented at the local jurisdiction level. Implementation is managed through a three-phase process with Phase I already completed, Phase II in the implementation stages now. Phase III plans will be submitted to the EPA in 2018.

There are four main sources of pollution loads into the Chesapeake Bay, including agriculture, wastewater treatment plants, stormwater, and septic sources. Reduction goals are set for each source. The focus of this study is on stormwater sources and the projects being implemented to reduce loads associated with stormwater runoff. The costs of implementing stormwater load reductions in Maryland for Phase II are estimated at $7.4 billion, or approximately half of the total cost estimated to achieve Maryland's TMDL goals (Table 1).

Chesapeake Bay Total Maximum Daily Load (TMDL)
Pollution Reduction Goals and Estimated Costs for Maryland

Table 1 Maryland's Nitrogen Pollution Loads by Pollution Source (Million Pounds per Year) and Estimated Phase II Implementation Costs ($ Millions)

Source	2010 Loads	2013 Loads	2017 Loads	2025 Loads	Est. Cost 2010-2025
Agriculture	19.95	17.15	17.03	15.22	$928
Wastewater Treatment Plant	14.37	11.95	11.85	10.58	$2,368
Stormwater	**9.48**	**9.53**	**8.34**	**7.55**	**$7,388**
Septic	3.00	2.95	2.30	1.85	$3,719
Total	**46.8**	**41.58**	**39.52**	**35.2**	**$14,403**

Source: Analysis of the FY 2016, Maryland Executive Budget, 2015. Last Accessed June, 2016 at http://mgaleg.maryland.gov/pubs/budgetfiscal/2016fy-budget-docs-operating-CHESBAY-Chesapeake-Bay-Overview.pdf

Progress to Date

All reduction measures must be in place by 2025, with measures in place to achieve at least 60.0% of pollution reductions by calendar year 2017. In order to comply with TMDL regulation, jurisdictions in

the Baltimore Region, created watershed implementation plans (WIPs) that identify the measures that are being put in place to reduce pollution and restore the bay.

- ✓ In 2010, each jurisdiction submitted a Phase I WIP that details how it plans to achieve its pollution reduction goals under the TMDL.
- ✓ In 2012, jurisdictions submitted Phase II WIPs that establish more detailed strategies to achieve the bay TMDL on a geographically smaller scale.
- ✓ Each Baltimore Region jurisdiction created two-year implementation goals for 2012-2013 and 2014-2015. Most two-year plans describe stormwater efforts, including planning and identification of projects that can cost-effectively reduce loads through stream restoration, urban forestation, and other best management practices (BMPs).
- ✓ Most jurisdictions have released goals and plans for 2016-2017.[1] The two-year goals outline implementation BMPs and also report on pollution reduction progress. Counties are now actively implementing projects.
- ✓ A Phase III WIPs will be submitted to EPA in 2018, which will ensure that all practices are in place by 2025 so that restoration goals can be met.

Costs of Stormwater Management by Jurisdiction

While the total cost estimates for wastewater management have been estimated for the state, individual jurisdictions are in different stages of estimating their individual costs. Cost estimates also vary by source and time of estimate release. To date, most local cost estimates have focused on capital costs for stormwater design and construction, leaving the estimation of maintenance costs for future studies. Below is a summary of published cost estimates by jurisdiction.

Anne Arundel County: According to the Environmental Finance Center's Stormwater Management Economic Impact Study (2013), Anne Arundel County projected stormwater costs of $1.1 billion, of which 25% ($284 million) is expected to be spent on maintenance costs. According to the Anne Arundel NPDES - Municipal Stormwater Discharge Permit 2015 Annual Report, Anne Arundel County has spent or authorized spending for just $83.8 million in stormwater capital projects through FY 2016.

Howard County: In its Phase II WIP, released in 2012, Howard County reported that the cost of implementing urban stormwater projects could be over $800 million. In the recently released Howard County Countywide Stormwater Implementation Plan, project costs were estimated at just over $222 million (excluding maintenance and staffing costs). The change in cost estimate is attributable to a better understanding of the projects that are needed to meet state and federal guidelines.

[1] The 2016-2017 implementation goals are published for each jurisdiction by the Maryland Department of the Environment. They are available at the link below, with implantation plans being released as they become available from each county:
http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Pages/MD_Milestone_Goals_2016-2017.aspx

Baltimore County: According to its Phase II WIP, Baltimore County estimated its costs for stormwater projects at over $250 million for projects planned between 2013 and 2017. No estimates of the total cost of stormwater projects through 2025 were identified in a review of literature.

Baltimore City: According to the Environmental Finance Center's Stormwater Management Economic Impact Study (2013), Baltimore City is expected to spend $240 million on stormwater projects between 2014 and 2025, of which 18% ($42.5 million) is expected to be spent on maintenance costs. In the City's Phase II WIP, watershed restoration goals were estimated to cost a total of $250 million for 2013-2017 alone.

Harford County: According to its Phase II WIP, Harford County expected to incur "$15 million per year" in capital expenses for stormwater projects (excluding maintenance costs, staff overhead, and other stormwater expenses).

Carroll County: Carroll County's Phase II WIP reports and periodic two-year plan reports make mention of planned programs and projects, but no budget information is published in these reports.

Types of Stormwater Best Management Practices (BMPs) and Average Project Costs

Stormwater management goals are implemented through Best Management Practices (BMPs) and there are a wide variety of BMPs available to jurisdictions, each with different costs and ability to meet various load reduction goals. The actual resources required for each project varies from project to project, based on the project location, complexity, and extent (e.g. 300 ft. of stream restoration vs. 2 miles of stream restoration). The specific BMPs for each jurisdiction have mostly been identified and selected through the Phase II WIPs and the most recent 2-year plans, but opportunities for cooperative purchasing or workforce development differ by BMP due to differences in the scope of work for each.

Table 2 details the most common types of BPMs and the average "planning level unit costs" for each. These costs were estimated in 2011 and give an indication of the costs that counties could incur for each type of project. Lower cost projects include street sweeping, erosion and sediment control, vegetated open channels, new wet ponds and wet lands, urban grass and forest buffers and urban tree planting. Each of these BMPs is estimated to cost under $3,000 per year, per acre treated. Higher cost BMPs include projects such as permeable pavement, urban bioretention, and impervious surface reduction, each of which has high 20-year life-cycle costs at over $200,000 per acre treated. While lower cost BMPs are typically preferred, counties must select and plan stormwater projects taking into consideration the number and type of projects available, the amount of load reductions that the county must achieve, and the ability of any particular project to meet certain load reduction requirements, which include reductions in phosphorus, nitrogen, suspended solids, and other reduction goals – all of which are met differently by different types of projects.

Table 2 Planning Level Unit Cost Development for Stormwater Best Management Practices (BMPs): Life Cycle (20 years) and Annual Stormwater BMP Unit Cost Estimates

Stormwater BMP	Initial Costs		Average Annual Maintenance	Total Stormwater BMP Costs per Impervious Acre Treated	
	Total	Annualized Initial Costs		Costs (Over 20 Years)	Average Annual Cost
Street Sweeping	$6,049	$407	$451	$15,079	$754
Erosion and Sediment Control	$26,000	$1,748	$10	$26,207	$1,310
Vegetated Open Channels	$24,000	$1,613	$610	$36,207	$1,810
Wet Ponds and Wetlands (New)	$24,115	$1,621	$763	$39,368	$1,968
Urban Grass Buffers	$23,650	$1,590	$870	$41,057	$2,053
Urban Forest Buffers	$33,000	$2,218	$1,210	$57,207	$2,860
Urban Tree Planting	$33,000	$2,218	$1,210	$57,207	$2,860
Bioswale (New)	$42,000	$2,823	$931	$60,620	$3,031
Urban Nutrient Management	$61,000	$4,100	$31	$61,620	$3,081
Dry Detention Ponds (New)	$39,000	$2,621	$1,231	$63,620	$3,181
Dry Extended Detention Ponds (New)	$39,000	$2,621	$1,231	$63,620	$3,181
Infiltration Practices w/o Sand, Veg. (New)	$58,450	$3,929	$866	$75,770	$3,789
Bioretention (New - Suburban)	$46,875	$3,151	$1,531	$77,495	$3,875
Filtering Practices (Sand, above ground)	$49,000	$3,294	$1,431	$77,620	$3,881
Wet Ponds and Wetlands (Retrofit)	$63,998	$4,302	$763	$79,251	$3,963
Infiltration Practices w/ Sand, Veg. (New)	$61,250	$4,117	$906	$79,370	$3,969
Urban Stream Restoration	$64,500	$4,335	$891	$82,320	$4,116
Filtering Practices (Sand, below ground)	$56,000	$3,764	$1,631	$88,620	$4,431
Dry Extended Detention Ponds (Retrofit)	$67,500	$4,537	$1,231	$92,120	$4,606
Hydrodynamic Structures (New)	$42,000	$2,823	$3,531	$112,620	$5,631
Impervious Urban Surface Reduction	$96,250	$6,470	$885	$113,957	$5,698
Bioretention (Retrofit - Highly Urban)	$183,750	$12,351	$1,531	$214,370	$10,719
Permeable Pavement w/o Sand, Veg.	$239,580	$16,104	$2,188	$283,347	$14,167
Permeable Pavement w/ Sand, Veg.	$335,412	$22,545	$3,060	$396,603	$19,830

Source: Costs of Stormwater Management Practices In Maryland Counties, Maryland Department of Environment (King & Hagan, 2011)

Maintenance Costs for Stormwater

There is limited information from jurisdictions on their expected costs of maintenance of stormwater BMPs, but estimates on the 20-year lifecycle costs of BMPs from the Maryland Department of Environment suggests that maintenance costs can account for a significant portion of total stormwater management costs. For some BMPs, such as hydrodynamic structures, street sweeping, urban grass and forest buffers, and tree planting, maintenance costs account for between 42% and 63% of total costs (see Table 3). For stream restoration, one of the most common BMPs being implemented, maintenance costs are expected to account for approximately 22% of total project costs.

Table 3 Maintenance Costs as a Percentage of Total Costs, by BMP

BMP	Maintenance Costs as a Percentage of Total Costs
Hydrodynamic Structures (New)	63%
Street Sweeping	60%
Urban Grass Buffers	42%
Urban Forest Buffers	42%
Urban Tree Planting	42%
Bioretention (New - Suburban)	40%
Wet Ponds and Wetlands (New)	39%
Dry Detention Ponds (New)	39%
Dry Extended Detention Ponds (New)	39%
Filtering Practices (Sand, above ground)	37%
Filtering Practices (Sand, below ground)	37%
Vegetated Open Channels	34%
Bioswale (New)	31%
Dry Extended Detention Ponds (Retrofit)	27%
Infiltration Practices w/o Sand, Veg. (New)	23%
Infiltration Practices w/ Sand, Veg. (New)	23%
Urban Stream Restoration	22%
Wet Ponds and Wetlands (Retrofit)	19%
Impervious Urban Surface Reduction	16%
Permeable Pavement w/o Sand, Veg.	15%
Permeable Pavement w/ Sand, Veg.	15%
Bioretention (Retrofit - Highly Urban)	14%
Urban Nutrient Management	1%
Erosion and Sediment Control	1%

Source: Maryland Department of Environment Planning Level Unit Costs

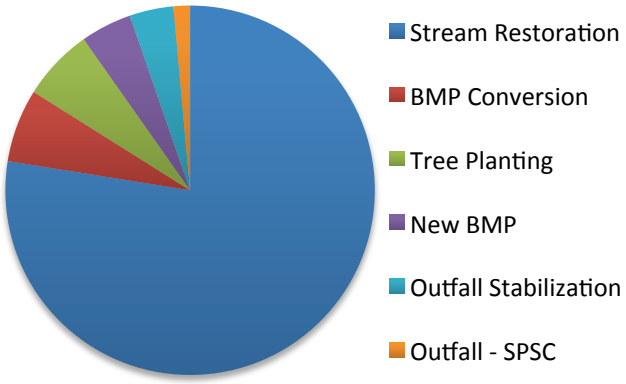
Top Planned BMPs for Jurisdictions in the Baltimore Region

Each jurisdiction has selected a planned mix of BMPs in the jurisdiction's Phase II WIP, based on the available projects, their ability to meet reduction goals, and differences in local geography (geography is a contributing factor to the BMPs that each jurisdiction is pursuing). Since the Phase II WIPs were published in 2011-2012, counties have implemented two-year plans that are designed to achieve load reductions. As cost saving opportunities are identified, jurisdictions sometimes identify BMPs in their two-year implementation plan that deviate from the planned BMPs identified in their Phase II WIPs, and therefore the specific BMPs implemented vary over time. The stormwater projects that are most common in the Baltimore Region include stream restoration, urban tree planting or reforestation, and street sweeping. These three BMPs account for the majority of estimated costs in Howard County. Based on a review of county and Baltimore City plans, these three BMPs likely account for the majority of spending at other jurisdictions as well (most jurisdictions do not publish cost estimates by type of BMP, although they give indications of cost, based on the size of projects, which are reported in number of acres treated or number of miles of streams restored). In addition to the top three BMPs, several jurisdictions have identified environmental site design (ESD), stormwater pipe outfall retrofits, inlet cleaning, removal of impervious cover, and stormwater BMPs conversions and new BMPs as common strategies.

Stream Restoration Projects

Stream restoration represents a large portion of the region's stormwater plans. Stream restoration is identified in the Phase II WIP for all jurisdictions in the Baltimore Region (with the exception of Carroll County) and stream restoration is the largest component of Howard County's Countywide Implementation Strategy, accounting for over $93 million in estimated costs, or about 78% of Howard County's estimated costs for stormwater projects, as published in its countywide implementation plan (see Figure 1).

Figure 1 Howard County Estimated Cost of Implementation by Category of Project



Howard County Countywide Implementation Strategy (2016-2027).
Note: Excludes costs of maintenance.

The estimated costs for stream restoration are not available for other jurisdictions but the number of miles of stream restoration in Baltimore County and Anne Arundel County are considerably higher than that of Howard County (See Table 4). According to the 2016-2017 two year plans, in the near term, Howard County intends to complete 1.5 miles of stream restoration projects, Anne Arundel plans to complete 6.1 miles of stream restoration projects, and Baltimore City plans to complete 2.65 miles of stream restoration projects. The scope of work in a stream restoration varies from project to project, so the amount of projects is not a precise indicator of costs, but it is reasonable to conclude that

construction for stream restoration will be a significant portion of the stormwater projects undertaken in the region in the next several years.

Table 4 Planned Investment in Stream Restoration: Stated Plans in Phase II WIPs and Stated Goals in 2016-2017 Two-Year Plans

Jurisdiction	Total Phase II WIP Plan		2016-2017 Two-Year Plan	
Anne Arundel County	122.7	miles	6.1	miles
Baltimore City	*		2.65	miles
Baltimore County	83.7	miles	+	
Howard County	20.3	miles	1.51	miles
Harford County	*		12	projects

Sources: Phase II WIPs and 2016-2017 2-Year Plans

* Stream Restoration is identified as a BMP in the plan, but no specific amount identified in the plan.

+ Baltimore County's 2-year plan was not yet available at the time of this report.

Urban Tree Planting/Reforestation Projects

Tree planting is a stated BMP in the Phase II WIPs for Anne Arundel County, Baltimore City, Baltimore County and Howard County. In Howard County, urban tree planting costs are estimated to cost $7.6 million in the Howard County Countywide Implementation Strategy (2015) for tree planting in 175.3 acres. In the county's Phase II WIP (2012), urban tree planting was expected to be performed in a total of 469 acres. Anne Arundel County's planned reforestation in the Phase II WIP is expected to be higher than that of Howard County, at 1,306 acres. Baltimore County expected its reforestation projects to cover 150 acres of upland reforestation and 50 acres of riparian buffer reforestation.

Table 5 Planned Investment in Tree Planting/Reforestation: Stated Plans in Phase II WIPs and Stated Goals in 2016-2017 Two-Year Plans

Jurisdiction	Tree Planting Description	Phase II WIP Plan		2016-2017 Two-Year Plan	
Anne Arundel County	Reforestation	1306	acres	135	acres
Baltimore City	Tree Planting			10,000	trees
Baltimore County	Upland Reforestation	150	acres		
	Riparian Buffer Reforestation	50	acres		
	Urban Tree Canopy	10,500	trees		
Howard County	Urban Tree Planting	469	acres		

Sources: Phase II WIPs and 2016-2017 2-Year Plans

In addition to tree planting, forest conservation is a stated component of the WIPs for Howard County (4,225 acres) and Harford County (the number of acres is unspecified).

Street Sweeping

Street sweeping is identified as a BMP planned in Phase II WIPs for Anne Arundel County, Baltimore County, Harford County and Howard County.

Table 6 Planned Street Sweeping: Stated Plans in Phase II WIPs and Stated Goals in 2016-2017 Two-Year Plans

Jurisdiction	Phase II WIP Plan	2016-2017 Two-Year Plan
Anne Arundel County	770 miles	350 miles
Baltimore County	Maintain Current Rate	
Harford County	Not Specific	
Howard County	508,202 pounds	

Sources: Phase II WIPs and 2016-2017 2-Year Plans

Other Common BMPs

Anne Arundel, Howard and Baltimore counties have each identified pipe outfall and inlet cleaning projects in their Phase II WIPs or 2016-17 two-year plans (Table 7). They have also identified removal of impervious cover as part of their suite of stormwater strategies (Table 8). Baltimore City and Anne Arundel County identified environmental site design as part of their stormwater projects (see Table 9). In addition to these common BMPs, counties have also stated plans for bioretention, rain gardens, bioswale, wet ponds and wetlands projects, and other new BMPs and BMP conversions, each to varying degrees.

Table 7 Planned Pipe Outfall Projects: Stated Plans in Phase II WIPs and Stated Goals in 2016-2017 Two-Year Plans

Jurisdiction	Project Name	Phase II WIP Plan	2016-2017 Two-Year Plan
Anne Arundel County	Retrofit of impaired pipe outfalls with regenerative SPSC filtering	1,936 outfalls	248 outfalls
	Inlet cleaning (annually)	12,625 Inlets	19,000 inlets
Howard County	Outfall stabilization		500 linear feet
Baltimore County	Storm drain cleaning	Current Rate	

Sources: Phase II WIPs and 2016-2017 2-Year Plans

Table 8 Planned Removal of Impervious Cover: Stated Plans in Phase II WIPs and Stated Goals in 2016-2017 Two-Year Plans

Jurisdiction	Phase II WIP Plan	2016-2017 Two-Year Plan
Anne Arundel County		5.98 acres
Baltimore City		5.8 acres
Howard County	108 acres	

Sources: Phase II WIPs and 2016-2017 2-Year Plans

Table 9 Planned Environmental Site Design: Stated Plans in Phase II WIPs and Stated Goals in 2016-2017 Two-Year Plans

Jurisdiction	Phase II WIP Plan	2016-2017 Two-Year Plan
Anne Arundel County	244 acres	
Baltimore City	35 projects	2.84 acres

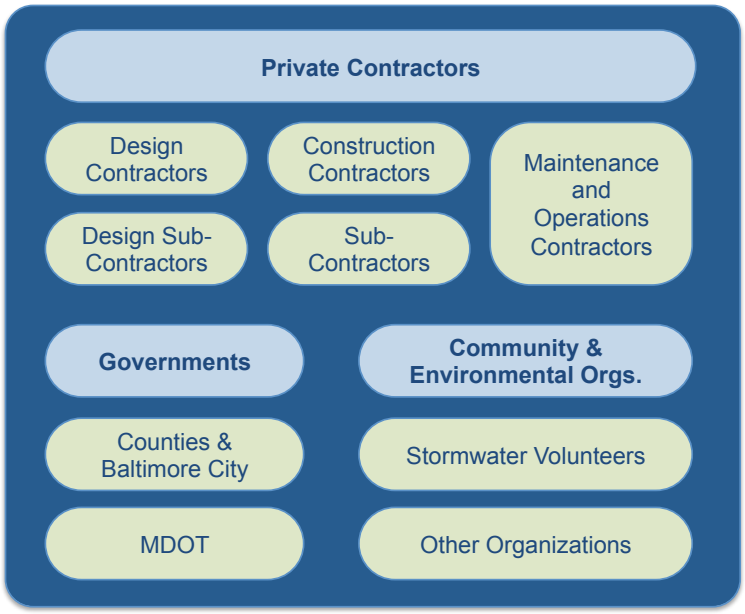
Sources: Phase II WIPs and 2016-2017 2-Year Plans

Understanding the Region's Stormwater Labor Force

Stormwater Employers

The key employers in the stormwater sector include governments, design contractors, construction contractors, operations and maintenance (O&M) employers, and community and environmental organizations (C.E.Os). Most stormwater projects being undertaken in the region require three phases of development: design, construction, and maintenance, which often require different types of contractors for each phase. Governments manage the three phases. The projects are designed and constructed by private contractors. Maintenance is managed jointly by governments (performing inspections) and contractors or volunteers performing maintenance.

Figure 2 Employers in the Stormwater Sector



There is considerable diversity among contractors in terms of the scope of services they offer. Some private contractors offer services in one phase and others in a combination of phases. Some contractors have long-standing relationships with sub-contractors who perform various aspects of construction (e.g. subcontracting of excavation, tree planting, etc.) and others have capability to perform all services under a single organization. Other contractors specialize in only a narrow component of the scope of a stormwater project and perform these services as a sub-contractor. In addition to private contractors, some stormwater projects are implemented by governments directly (e.g. stormwater BMPs at government-owned land or facilities) or by other institutions, such as universities. Some projects, such as tree planting, can be implemented by volunteers at community environmental organizations.

While most governments interviewed for this study report that there is a shortage of qualified contractors available to perform stormwater projects, the region does have a significant number of

stormwater contractors and organizations that have been actively hiring in the region in the last year. Table 5 contains a list of private contractors, governments, and community environmental organizations that have advertised stormwater job openings online between May 2015 and April 2016 in the Baltimore Region. Employers identified in Table 5 represent those who have actively hired for workers in which stormwater projects were identified in the job description. The table is not comprehensive, because a portion of stormwater jobs – in particular those in the construction phase – are performed by construction contractors who perform stormwater work, but do not do so exclusively (e.g. excavators who do some stormwater work, in addition to excavation for other types of projects) and therefore may not make mention of stormwater work in the job descriptions of job ads (making these job openings more difficult to identify). Interviews revealed that some construction contractors look for workers with some level of stormwater knowledge or skills, while others do not (the latter do not see many differences (if any) between the skills needed for a stormwater project and the skills needed for other types of projects). It is worth noting that the scope of work performed by design contractors also differ greatly from company to company with some firms placing environmental engineers and scientists in the field, managing the construction process, while others have workers that strictly perform design work, leaving construction contractors to implement their designs.

Table 10 Stormwater Employers in the Baltimore Region

Private Contractors			
1	AB Construction, Inc.	**36**	HDR, Inc.
2	ADTEK Engineers, Inc.	**37**	Highway & Safety Services, Inc.
3	Advanced Drainage Systems	**38**	Insituform Technologies LLC
4	AECOM	**39**	JLN Construction Services, LLC
5	Aegion Corporation	**40**	KCI Technologies, Inc.
6	ALVI ASSOCIATES, INC	**41**	LandStudies
7	Angler Environmental	**42**	LimnoTech
8	Apex Companies, LLC	**43**	Maser Consulting P.A.
9	Appalachian Stream Restoration	**44**	McDonnell Landscape, Inc.
10	Atkins North America	**45**	Meadville Land Service
11	Baker's Nursery & Tree Service	**46**	Milani Construction, LLC
12	Baltimore Pile Driving & Marine Construction	**47**	Monumental Paving and Excavating
13	Bartenfelder Landscape Service, Inc.	**48**	MRA
14	BayLand Consultants & Designers, Inc.	**49**	Oxborough Nursery Inc.
15	Ben Dyer Associates, Inc.	**50**	Patriot Land and Wildlife Management
16	Biohabitats	**51**	Pennoni Associates Inc.
17	Bourn Environmental LLC	**52**	Phoenix Engineering, Inc.
18	Brunswick Excavating, Inc.	**53**	Quality Staffing Services
19	Century Engineering	**54**	RealStreet
20	CJ Miller LLC	**55**	Spectrum Environmental Sciences
21	CLP Resources	**56**	Stambaughs Inc.
22	Comer Construction, Inc.	**57**	Stantec Consulting Services Inc.
23	Contech Engineered Solutions LLC	**58**	Stormwater Maintenance, LLC
24	Corinthian Contractors, Inc.	**59**	Straughan Environmental, Inc.
25	Dewberry	**60**	STV Inc.
26	Diversified Site Works, LLC	**61**	TDH Nurseries and Landscaping
27	Dixie Construction Co	**62**	The Ansell Group

Private Contractors			
28	Duffield Associates, Inc.	**63**	The Davey Tree Expert Company
29	Ecological Restoration & Management, Inc.	**64**	The Louis Berger Group, Inc.
30	Ecotone, Inc.	**65**	Underwood & Associates
31	Environmental Quality Resources,LLC	**66**	Urban Engineers, Inc.
32	Flyway Excavating Inc.	**67**	Versar Inc.
33	Furbish	**68**	White Pine Construction
34	Gannett Fleming	**69**	Whitney Bailey Cox & Magnani, LLC
35	Greenman-Pedersen, Inc.	**70**	WSP / Parsons Brinckerhoff
Governments & Institutions			
1	Anne Arundel County Stormwater Management		
2	Baltimore County Stormwater Management		
3	Baltimore County Watershed Monitoring		
4	City of Annapolis		
5	Harford County - Water Quality Monitoring		
6	Howard County Stormwater Management		
7	Maryland Department of the Environment		
8	Maryland Department of Transportation		
9	State of Maryland		
10	Towson University		
11	Baltimore Urban Water Coalition		
Community and Environmental Organizations			
1	Anne Arundel County Watershed Stewards Academy		
2	Blue Water Baltimore		
3	Chesapeake Bay Foundation		
4	Howard County Watershed Stewards Academy		
5	Irvine Nature Center		
6	Live Green Howard		
7	Neighborhood Design Center		
8	RSVP (Retired And Senior Volunteer Program) For Baltimore County		
9	The Izaak Walton League Of America (National Headquarters)		
10	Alliance of Chesapeake Bay		
11	Restoring the Environment and Developing Youth (READY)		

Sources: Maryland Workforce Exchange, Analysis by the Author

Stormwater Community and Environmental Organizations

Volunteer organizations and other environmental organizations play an important role in meeting a portion of the region's stormwater management needs. According to the most recent 2-year plan, the Anne Arundel Watershed Stewards Academy, for instance, will install 200 rain barrels, plant 12,000 native plants and trees, and install 400,000 square feet of new residential and community restoration. The watershed organizations operating in Anne Arundel County will restore approximately 2,650 linear feet of stream, construct 290 linear feet of living shoreline, create 5,800 square feet of tidal marsh/living shoreline, treat thirteen acres with bio-retention systems and 5,000 square feet bio-retention in Critical Area, implement one acre of wetland restoration and five acres of reforestation projects. Similar organizations in Howard, Baltimore and Harford counties will also play critical roles in implementation of stormwater projects. While much of the work of stormwater academies depends on local volunteers, these organizations can play key roles in helping to train a future workforce needed to complete the

construction of stormwater BMPs and, perhaps more importantly, support training and workforce development for stormwater maintenance activities.

Stormwater Occupations

Interviews with employers in the stormwater sector revealed that there are a variety of key occupations involved in stormwater management. These occupations fall into four broad categories:

1. Stormwater Design Professionals
2. Stormwater Technicians
3. Stormwater Construction and Operation Occupations
4. Stormwater Administration

Stormwater Design Professionals

These workers include civil engineers, water resource engineers, environmental scientists, geomorphologists, landscape architects, stream / wetland restoration specialists, and other occupations. These occupations typically require a minimum of a bachelor's degree, in combination with special training or experience that give workers the competencies needed to design a stormwater project or a portion of it. Employers reported that most design workers they have on staff possess significant years of experience in their field (environmental science, hydrology, geo-engineering, etc.), with an emphasis on years of experience in wetlands, ponds, stream restoration, vegetation, forestry or other practice areas specific to stormwater. Employers reported that without years of specific stormwater experience, workers typically are not qualified to perform stormwater design work (e.g. not all civil engineers are qualified to do civil engineering for a stormwater project).

There are a large number of employers who have job ads for stormwater professionals (a total of 515 job opening advertisements were found online in the Baltimore Region between 2015-16). These professionals are hired primarily to perform design services, but some jobs also include work duties that span construction, maintenance, project management, and other functions. Workers in these occupations are also hired directly by governments to perform program management roles or design projects for public sector facilities (e.g. at institutions like universities, or at county or municipal facilities, etc.).

Interviews with government managers and employers alike confirmed that most of these positions are difficult to fill due to a lack of qualified candidates with enough years of previous experience in stormwater management. Government managers also expressed the view that stormwater contractors performing design services may be reluctant to hire more of these workers either because they are unable to provide adequate management supervision for new projects (they don't want the firm to be stretched too thin) or because they are concerned that the increase in demand for stormwater design professionals is a temporary surge that will discontinue in a few years as projects move from design, through construction, and into maintenance and monitoring phases. Table 11 identifies the top stormwater design occupations in demand in the Baltimore Region, as evidenced by job ads online.

Stormwater Technicians

Stormwater technicians perform technical assignments for stormwater projects, stormwater programs, and field implementation and operations. Most of these positions are for CAD and GIS technicians, landscape technicians (various job titles), field consultants, inspectors, environmental compliance technicians, and other occupations. Requirements for these jobs vary by company and type of employer (government vs. private contractor vs. community environmental organization). Some employers require a Bachelor's degree or higher, while others only state requirements for prior experience or training, but do not state a degree requirement. Typically some specific stormwater knowledge is needed for these positions, in addition to other transferable skills such as GIS platforms, database skills, landscape implementation knowledge (e.g. knowledge of what the project is intended to achieve in terms of load reductions and how it must be implemented and maintained in order to achieve the desired effects), and other specialized knowledge and skills.

Analysis of job ads reveals that technicians are being recruited by contractors for design, construction and maintenance phases, as well as government and some non-profit organizations. These ads explicitly seek workers who have previous stormwater experience or depth of knowledge in regulations, compliance issues, or other special skills. Most job ads request workers with two or more years of experience.

Stormwater Construction and Operation Occupations

While stormwater design professionals, technicians, and administration occupations are involved in the construction of stormwater projects and programs, there is a subset of construction occupations that are commonly needed in the implementation of stormwater BMP conversions, stream restoration, outfall retrofits, street sweeping and other projects. Construction occupations include several management occupations such as construction managers, estimators, project managers and coordinators, job superintendents, and foremen. Job requirements for these occupations are more likely to require knowledge of stormwater design principles and ability to manage proper implementation of projects. Other occupations mentioned in interviews include equipment operators, drivers, equipment technicians/mechanics, pipe layers, excavators, and other occupations. These workers may require job-specific knowledge that is related to stormwater (e.g. knowledge of the environmental function or intent of a design), in addition to the training or education typically required in their field.

Stormwater construction employers interviewed in this study reported that laborers comprise a large portion of their workforce. These workers are typically hired for specific projects and on a temporary basis. Employers gave an indication that there is little need for much stormwater knowledge or skills for these workers, beyond an understanding of how a design functions and why it must be installed in a particular way. Employers did make mention of needs for OSHA training and other general construction experience. Employers reported that many of the workers in the construction and operation occupations are employed on a seasonal basis, when project work is being performed, mainly during the warmer weather months between March and December.

The number of job openings for stormwater construction and operation workers is unclear. Because the interviews with employers revealed that these positions might not require much or any stormwater-specific knowledge, "stormwater" job openings (i.e. job openings containing keywords such as "stormwater," "watershed," "water resources," etc.) will not give a complete indication of the number of workers needed. For this reason, no estimate of current/recent hiring demand for these occupations is provided in Table 11. However, there were a variety of private contractors and governments hiring for these positions and the common positions are identified in the table.

Stormwater Administration

There are a significant number of project managers employed by county governments, municipal governments, the Maryland Department of Transportation (for highway stormwater projects), and directly by the Maryland Department of Environment. In addition, similar jobs exist at some federal government agencies and non-governmental environmental organizations. Stormwater administration jobs require a high level of training and knowledge of BMPs, in addition to other skills in program management, project management, and other competencies.

In addition to project managers, governments hire program managers, watershed protection or restoration managers, and workers in similar specialist roles. Employers seek workers with experience in stormwater projects, knowledge of local watershed knowledge, or other special requirements that are typically attained through experience. There are a significant number of jobs in stormwater administration, in particular project managers, which ranked as the stormwater occupation with the third highest hiring demand, measured by job ads (see Table 11).

Inter-Occupational / Inter-Phase Continuity in Stormwater Management

While four distinct areas of occupations are evident in the stormwater labor force, workers across different phases of stormwater work require a shared set of knowledge and skills in stormwater management. In some interviews, employers reported that disconnection between the design and construction could lead to poor performing projects or higher maintenance costs. Several contractors pointed out that this was a reason for governments to hire contractors to manage the entire lifecycle of a stormwater project. (One contractor mentioned his stormwater clients out of state found that the costs of maintaining stormwater projects in wetlands accounted for 60% of their stormwater budget – a high cost that he claimed could be reduced through proper initial implementation/construction.) The need for continuity of skills and knowledge across the lifecycle of stormwater projects creates an opportunity for longer-term involvement in stormwater work for workers and companies interested in this field. While the field of stormwater careers is just beginning to be formalized in education and training, the need for common skills across the sector will support the potential for career mobility in the field of stormwater. Career paths in the stormwater field can potentially begin with lower-skilled workers, even at the laborer level, who progress into careers in construction, maintenance, or design by gaining experience in stormwater projects, coupled with specialized stormwater training or higher education. The scope of training available is discussed in the next section.

Table 11 Stormwater Hiring Demand in the Baltimore Region 2015-16, by Job Title and Type of Employer

Category & Job Title	Stormwater Job Ads May 2015-Apr 2016	Type of Employer				
		Private			Public/Non-Profit	
		Design	Const.	O&M	Gov.	C.E.O
Stormwater Design Professionals						
Civil Engineer/ Professional Engineer/ Engineer-Stormwater	157	X	X		X	
Stream Restoration Designer	78	X	X	X	X	
Environmental Scientist	51	X	X	X	X	X
Landscape Design/Architect	45	X				
Water Resources Engineer	42	X		X		
Resource Conservationist	42	X		X		
Environmental Protection (Specialists)	33	X		X		
Water Quality Inspector	31	X		X		
Highway Engineer	22	X			X	
Geomorphologist	14	X		X		
Total	**515**					
Stormwater Technicians						
CAD/GIS Technician	63	X		X	X	X
Landscape Technician	28	X	X	X	X	X
Field Consultant/Inspector	21	X	X	X	X	
Environmental Compliance Technician	12	X	X	X	X	
Drafter / Survey Assistant	6	X				
Total	**130**					
Stormwater Construction & Operation*						
Construction Manager	*		X		X	
Estimators	*		X		X	
Project Coordinator & Manager	*		X	X	X	
Superintendent	*		X	X		
Construction and Maintenance Foremen	*		X	X		
Equipment Operators	*		X			
Construction and Maintenance Laborers	*		X	X		
Truck Drivers/ Commercial Drivers/ Street Sweeper	*		X	X	X	
Vac Truck Technician	*		X			
Heavy Equipment Mechanic	*		X	X		
Pipe Layer	*		X			
Excavator Equipment Operator	*		X	X		
Laborer	*		X	X	X	
Stormwater Administration						
Program/Project Specialist/Manager	68	X	X	X	X	X
Watershed Protection / Restoration Manager	17				X	X
Administrative Support	9				X	
Accounting Professional	4				X	
Total	**98**					

Sources: Maryland Workforce Exchange, Analysis by the Author *Stormwater Construction and Operation occupations have been identified based on interviews with stormwater contractors.

Human Resource Training Standards

While the field of stormwater management has been growing over the past decade, professional qualifications for stormwater professionals, technicians, and maintenance workers are still under development. There are three key certifications or professional qualifications that are in different stages of implementation ranging from early development, to pilot phase, to early deployment. These include:

- Clean Water Certification and Workforce Development Program (Center for Watershed Protection)
- Chesapeake Bay Landscape Professional Certification
- Chesapeake Bay Stormwater Training Partnership

Other related certifications include (1) the State of Maryland Responsible Person Certification and (2) the National Green Infrastructure Certification Program that has recently been announced and is currently being developed by the Water Environment Federation.

Clean Water Certification and Workforce Development Program

The Center for Watershed Protection (CWP) is a Maryland-based, national nonprofit organization that works to protect, restore, and enhance streams, rivers, lakes, wetlands, and bays through research, planning, and public education on watersheds. In interviews, the CWP staff noted:

- **There is a lack of skilled workers who know how to construct, inspect and maintain stormwater BMPs.** According to CWP, there are only a few employers in the state that are deeply engaged in stormwater construction and maintenance and those few employers are experiencing rapid growth, due to the growing number of projects. As more projects are completed over the next decade, the need for maintenance services is expected to increase. Employers report to CWP that they have a desire to attract and retain staff who have a mix of work-readiness, an interest in stormwater and environmental work, and possess certain skills or credentials such as OSHA training, landscape training, or other skills that are specific to their firm's specific area of work.
- **There are currently no nationally-recognized credentials or training programs focused on construction, inspection, or maintenance of stormwater BMPs.** The lack of a standard results in considerable variation among workers and companies in their level of skills or knowledge of stormwater topics and can result in underperforming BMPs as a result of improper maintenance or installation. Development of a national standard would promote higher quality maintenance as well as higher recognition of stormwater occupations. By adding certifications or other stormwater credentials, workers could enjoy better job market mobility (their competency in stormwater work being demonstrated by a certification) and employers could more easily identify qualified candidates.
- **The gap in training and credentials for stormwater workers is particularly notable for workers in hands-on jobs that require less than a Bachelor's degree.** There are other credentials under

development or already in use for engineers, landscape professionals, and other highly-skilled workers, but nothing is currently in place for field workers who perform hands-on maintenance. Programs that bridge this gap are able to help low-skilled workers achieve family economic stability and earn higher wages by developing relevant skills and attaining a recognized credential.

CWP is currently in a process to develop a Clean Water Certification and Workforce Development Program to increase the skilled stormwater workforce. CWP is partnering with local workforce development organizations and agencies as well as a small group of stormwater construction and maintenance contractors to establish a national committee on stormwater practices as well as other topics such as illicit discharges, stormwater education and outreach, and industrial site inspection practices. This committee will determine the scope of certification (i.e. "What is being certified?"), create the standards for certification and the curriculum, and match up employers with future employees. CWP also plans to work with pilot communities to develop and deliver training and job placement in the stormwater field. CWP is currently in the first year of a five year project designed to prepare workers for clean water jobs, utilize the strengths of private and public partners to provide professional, technical, and life skills to 60-120 individuals and match them with careers and employment opportunities in technical areas of need.

Clean Water Certification and Workforce Program: Two-Phase Plan

Phase 1: National Committee on Clean Water Certification

- Task 1: Conduct a market analysis to help guide curriculum development and delivery in each pilot community.
- Task 2: Assemble the national committee on certification.
- Task 3: Determine national certification standards and the process for certification.
- Task 4: Deliver the national program to a network of local workforce development partners.

Phase 2: Workforce Development in Pilot Communities

- Task 1: Identify how the training program will be integrated with existing workforce development efforts in each community.
- Task 2: Develop curriculum and requirements for the Clean Water Training & Certificate Program.
- Task 3: Deliver the training in the pilot communities with local workforce development partners.
- Task 4: Use the results of the pilot communities to revise the Clean Water Certification Program

Major partners on this project include Civic Works, the Metropolitan Washington Council of Governments, District Department of Energy and Environment, and Corps Network. As this project progresses, other partners will be identified that will help bolster their existing programs and lend special expertise toward this effort.

Chesapeake Bay Landscape Professional Certification

The Chesapeake Bay Landscape Professional (CBLP) certification is a new certification in a pilot stage of development. The certification targets landscape architects and related degreed professionals and will provide a standardized evaluation and certification of the skills and knowledge of landscape contractors. The certification is focused on small-scale landscape restoration practices needed to meet nutrient and sediment reduction goals. These include:

- Rain Barrels and Cisterns
- Rain Gardens and Bio Swales
- Conservation Landscaping with Native Plants
- Tree Plantings (Buffers and Reforestation)
- Maintenance, including Turf and Invasive Management

The certification does not address large scale or "non-traditional" BMPs such as stream restoration.

The certification was created because the anticipated benefits of many small stormwater BMPs are not being realized as a result of being improperly designed, built, or maintained. The certification will help governments, non-profits and property owners identify qualified professionals to implement practices. CBLP certification will align with the State Stormwater Manual to ensure pollution credit compliance. Certification will require an application, demonstrated experience, and an exam with a hands-on component. Training will be required to pass the certification exam and preparatory trainings are expected to be offered by community colleges and non-profit organizations.

Two levels of certification will be offered:

Level 1 is a baseline certification for design, installation, and maintenance of stormwater practices. Level 1 will require previous experience and some previous certification in landscape, horticulture, or other field, prior to completing the CBLP certification.

Level 2 is an expert level certification for design and installation and will require more years of experience (the number of years is yet to be determined).

According to interviews, the CBLP does not target workers at the laborer level. The CBLP targets landscape professionals, contractors who are business owners, foremen, and field managers who are heads of a maintenance crew. An important focus of the program is to integrate design, installation and maintenance practice areas, and interdependent disciplines that must be coordinated for maximum effectiveness (according to interviews, the maintenance can fail because the maintainers have no connection with the designer; or because designers are trained without any experience in maintenance).

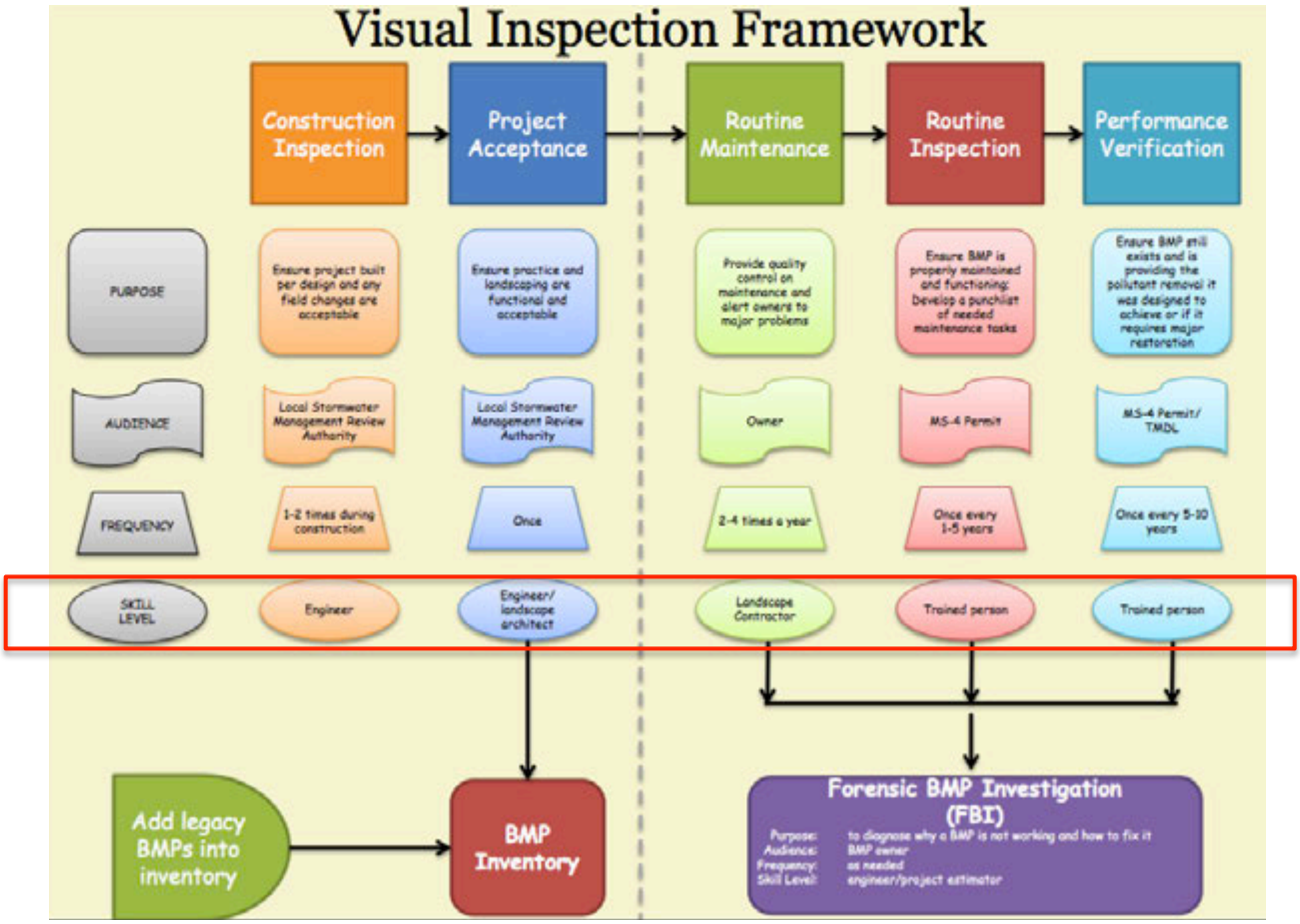
A pilot class of certifications will be launched during 2016 with an intention to certify 75 professionals by December of 2016.

Chesapeake Bay Stormwater Training Partnership

The Chesapeake Bay Stormwater Training Partnership conducts inspection and maintenance training workshops for bay jurisdictions on how to maintain, inspect, report, track and verify stormwater BMPs to comply with MS4 permits and the Chesapeake Bay TMDL. The training covers inspecting BMPs either during routine maintenance or routine regulatory inspections in order to ensure that low impact development practices are functioning as designed. In addition to inspection and maintenance training, the Chesapeake Bay Stormwater Training Partnership offers online training videos for local government staff and landscape contractors looking for information on how to properly maintain stormwater practices.

The training materials cover both how inspection and maintenance should be performed and what type of worker performs each stage, be that an engineer, landscape professional, or trained person (see excerpt in figure 3 below).

Figure 3 Stormwater Inspection - Visual Inspection Framework



Source: Chesapeake Stormwater Network, last accessed June, 2016 at http://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2015/11/APG-Inspection-Workshop-Prez-Compiled.pdf

The Chesapeake Bay Stormwater Training Partnership programs are provided free of charge and target program administration occupations, but the scope of training and educational materials could prove useful in the creation of training programs for workers in maintenance of stormwater projects.

Certification of Responsible Person

Maryland offers other programs that are related to stormwater erosion and sediment control, such as the Maryland Certification of Responsible Personnel. While this training is not specific to stormwater projects that are part of the region's MS4 permits, there are shared skills and knowledge between the Responsible Person Certification and other stormwater roles.

The Responsible Person is a foreman, superintendent, or project engineer who is in charge of on-site clearing and grading operations or sediment control associated with a construction project. Maryland's erosion and sediment control Certification of Responsible Personnel training was updated with an on-line version in March 2016 and the Responsible Personnel must have a certificate of training issued by MDE or an MDE approved training program. This program addresses stormwater management related to construction projects and certification as a Responsible Person may play a role in career paths for stormwater design professionals.

National Green Infrastructure Certification Program (Water Environment Federation (WEF))

In February of 2016, the Water Environment Foundation (WEF) announced it would begin work on a National Green Infrastructure Certification aimed at promoting skilled individuals who will install, inspect, and maintain green infrastructure (GI) systems. In addition, the program will help support community-based job creation in U.S. cities, and establish national standards for professionals seeking to work on GI projects. The certification is designed to meet international best practice standards and it will be housed within the WEF Stormwater Institute. It will verify that individuals performing the installation, inspection, and maintenance of GI have the required knowledge, skills, and abilities to support long-term performance and sustainability of these systems. The program components are expected to be developed on an expedited schedule, with the first certifications being granted in early 2017.

The exact occupational scope of the project is still being developed, but the program is expected to target careers in technical occupations, construction occupations, and maintenance occupations related to stormwater.

To provide a national perspective on stormwater management needs and green workforce goals, WEF is seeking partners to join a coalition of stormwater leaders that will assist with the creation of the program's vision and guide its implementation.

Trends in the Stormwater Labor Force and Stormwater Workforce Development

Labor shortage in Design Professionals

Interviews with private employers, governments, and other organizations all confirm that the demand for a stormwater labor force is growing. Shortages are particularly evident at the design professional level where employers report hiring difficulties and governments report there is an inadequate capacity of workers and companies to complete the projects that must be built. Because development of stormwater design qualifications requires years of experience and a minimum of a Bachelor's degree (if not higher level of education), it is difficult to quickly add to the supply of experienced, qualified design professionals.

Rising Costs of Stormwater Projects, due to Shortages in Qualified Firms and Workers

Government program managers report that the costs of individual projects have increased as the supply of qualified design contractors has been absorbed to work on projects. Many of the jurisdictions look for qualified contractors based outside of the Baltimore Region to perform work on stormwater projects, although those based outside the region can be difficult to recruit due to local contracting requirements, distance, or lack of effective outreach.

Limited Human Resource Development Capacity

As stormwater projects have grown in demand, there has not been enough early planning to assure the availability of a highly skilled stormwater design labor force in the region. For occupations at the technical level, construction level, and in project maintenance, the exact jobs in the field are being studied by workforce development and occupational standard-setting organizations who are still in the early phases of developing training and credentialing programs to address the workforce development needs of the region. In addition to a lack of training and educational capacity and pipeline, there is little connectivity between employers and workforce and educational service providers. Some employers hold the view that training in stormwater skills or knowledge is irrelevant to their workers' jobs or can be best obtained through on-the-job training, due to the fact that skills and knowledge needs are different from project to project. Some employers express a level of frustration with the level of requirements to perform on a stormwater contract (subcontracting requirements and comparatively low wage rates can make stormwater projects unattractive) and the notion of additional requirements for workers to obtain training or a certification is seen by these employers as an additional cost of doing business, rather than a benefit. The current low level of labor force skills and capacity development in the region contributes to the rising costs of stormwater projects, but securing employer engagement in workforce development may prove difficult for training providers unless they are able to develop strong relationships with selected, rapidly growing employers in the field, or able to partner with other organizations, such as Stormwater Academies, to provide workforce training that leads to job placements with governments and private employers.

In addition to the currently underdeveloped stormwater talent pipeline, the organizations involved in workforce development each have a separate focus in a narrow area (e.g. focus on landscape professionals or a focus on entry-level low-skilled adults). There does not appear to be a stormwater-wide approach that considers development of stormwater careers that span all levels of stormwater

projects. Such an approach is likely to be seen as beneficial to some employers who report that it is common for their stormwater workers to "wear many hats." In addition, such an approach would promote the potential for career paths that span many areas of stormwater work, supporting more effective projects from design through maintenance.

Challenges and Opportunities for Cooperative Stormwater Purchasing

Suppliers

The scope of work in stormwater projects can be divided into:

(1) design/engineering,
(2) construction/implementation and
(3) maintenance/monitoring.

Companies performing stormwater projects can offer services in any or all of the above three areas, but often the prime contractor for a project is an engineering or environmental consulting firm who designs a project and may later manage the implementation and construction of the project, either internally or as through a subcontractor.

Challenges

Interviews revealed that there are a variety of factors that shape the feasibility of a cooperative purchasing strategy. These factors span labor market supply-demand problems, local policies, internal contracting challenges due to differences in laws across jurisdictions, and other challenges.

The supply of qualified contractors is limited.

Each of the jurisdictions interviewed for this study reported that they encountered difficulties soliciting proposals from qualified contractors. A small set of contractors performs work across the region for many of the region's jurisdictions. This shortage may encourage jurisdictions to compete for limited contractor availability in order to meet MS4 mandates. Cooperative purchasing agreements in this context may contain inherent disadvantages to jurisdictions, as they may require contractors to ration their availability among jurisdictions. In a situation in which jurisdictions are legally obligated to meet program MS4 permit requirements with limited capacity to do so, the jurisdictions may find it difficult to cooperate because it may result in all jurisdictions missing critical targets. In a situation of shortage of design professionals, cost reductions may be more effectively obtained by increasing the supply of available capacity, either through workforce development, increasing the participation of local firms in the stormwater development field, or by recruiting capacity from outside the region to augment local capacity.

Experienced contractors have limited availability for 2016 and 2017

Contractors interviewed for this study varied in their current backlog of work, with some contractors indicating that they had little to no ability to add to their workload in 2016 and 2017. Most contractors are near capacity for 2016 and some experienced contractors had up to 30% capacity remaining for 2017. At the same time, some contractors without prior stormwater experience in the region indicated that they are actively seeking stormwater work in the region, albeit mainly as a subcontractor for a limited scope of work. Because of experience requirements in county regulations or policy, it is difficult for these firms to be a prime contractor. Sub-contracting is a possibility, but there may be little incentive for prime contractors in the region to sub-contract to other less-experienced firms, especially if the less experienced firms are not Minority Business Enterprises (MBEs) or do not otherwise fill a county contract requirement.

Design contractors face HR challenges that make it difficult to expand.

As previously noted, there is a shortage of engineers and environmental professionals in the region who possess enough years of past stormwater experience to be able to effectively design a stormwater project. The shortage of experienced workers effectively results in a limit to the number of projects that any particular company can complete. Recruitment of new workers is difficult because the region's increase in demand for stormwater projects is new, so there is not a pre-existing pool of people with past experience in the region.

Both government managers and contractors independently reported concern about capacity and the risk of becoming overextended and thereby unable to effectively perform on contracts. Small and mid-sized employers also reported that they find it difficult to expand because of the "many hats" that any new worker must be able to wear (one respondent reported that new hires "need to be a geomorphologist and a project manager with the adaptability to switch between tools for sampling, to working in AutoCAD, or designing a micro station -- and have the ability to use a lot of different tools. We are not employing people for 365 days a year in a single job."). Finding workers with an adequately broad set of past experienced and skills is difficult for these firms.

There are contractors interested in entering the market but contract disincentives and barriers to entry make it difficult.

A portion of the stormwater project work being performed in the region today is performed by contractors that are based outside Maryland in Virginia, Pennsylvania, or elsewhere. Larger contractors in the region include Hazen & Sawyer, Whitman, Requardt, & Associates, EBA Engineering, Arcadis, Brown & Caldwell, CH2M, Dewberry, all of which have a relatively large staff of experienced stormwater workers. Interviews with managers at these firms revealed these contractors have many opportunities to work on projects, both in the Baltimore Region and beyond, but projects within the Baltimore Region are less attractive due to:

(1) **Caps on the hourly rates** that firms are permitted to charge for engineering or design services (one firm reported that the cap in Baltimore City/County is currently $60/hr.), and
(2) **High requirements for subcontracting to MBEs/DBEs/SLBEs**, which they report can be as high as 40% of the scope of a contract.

These firms point out that there are too few qualified small businesses in the region that can perform work, something also confirmed by interviews with government managers. The combination of low pay caps and high sub-contracting requirements effectively discourages larger firms from working in the region.

Some smaller contractors in the region also expressed an interest in participating in stormwater projects. Barriers for these firms included:

(1) A lack of adequate stormwater experience to meet contracting requirements,

(2) A lack of size and scope of services – smaller contractors reported that they may be able to assist with a portion of a contract, but lack the scale and scope of services to perform as a prime contractor on a project, or

(3) Requirements for local work – in some jurisdictions, a MBE, Disadvantaged Business Enterprise (DBE), or Small Local Business Enterprise (SLBE) must have an office in the jurisdiction in order to meet a contract requirement. One respondent reported that they are able to perform a lot of work in Anne Arundel County but are unable to in Baltimore County or Baltimore City due to this policy.

There are many fields of stormwater work and development of expertise in any one area is a long-term commitment for contractors.

There is a different scope of competencies needed for design professionals, construction companies, and maintenance contractors working in each field of stormwater management. Employers report that it can take years for an experienced consulting engineer to acquire enough experience in a specific area (e.g. shoreline restoration, vs. wetlands management, vs. stream restoration, etc.) to become proficient in the practice area. To be considered qualified for a project, firms must typically have completed two to three years of work in the specified field, having completed at least three to five previous projects in the specific practice area for the project. As a result, expansion into a new field of stormwater work requires a multi-year commitment before the firm will be qualified to perform as a prime contractor in that field.

Most projects are on private land and jurisdictions prefer to select experienced contractors, with a prior work track record with the county, due to liability risks for construction on private land.

Stormwater projects span a variety of projects on both public and private land. Counties report that projects on public land were initiated earlier in the region's Phase II WIPs, but many of the projects

currently in planning and implementation are on private land. Some projects are in locations where access is limited to the project site (e.g. a site for stream restoration) making work difficult or complex. In these projects, counties prefer that the work be performed by qualified contractors with a demonstrated track record. Familiarity with contractors and previous direct experience influence the selection of contractors for specific jobs, while creating an unintended barrier for firms without prior local experience in the region or specific jurisdiction to effectively compete.

Competitive contractor selection is not an option for some projects.

Some landowners have voluntarily entered into contracts with stormwater contractors, agreeing that a specific contractor is the only contractor who will be permitted to perform work on the owner's land. In these cases, the county is faced with a sole source option and has limited leverage to negotiate price. Counties report that in these cases, they consider alternative projects that can achieve their nutrient load reduction goals at a lower cost per unit of reduction. These kinds of projects are less likely to be developed in the future because a state-wide nutrient trading program is likely to be developed. This type of program would no longer require the jurisdiction to have to sole source work.

Internal barriers can limit the effectiveness of cooperative purchasing.

Interviewees reported that cooperative purchasing for projects such as stream restorations may be impractical. Coo purchasing agreements typically seek to negotiate larger purchases at lower price. This is usually practical in a situation in which the services being purchased are equivalent across jurisdictions buying the services. However, in the case of stream restoration, the contracting choices are made not only based on price, but on scope of experience, demonstrated track record, and other factors. There is also considerable variation among projects, and each jurisdiction requires a separate contract (even if common pricing can be agreed upon). The growing demand for stormwater design services outside the region, combined with a limited capacity of design professionals, naturally puts the region at a competitive disadvantage with other regions if it implements a cooperative purchasing approach. The approach could help to cut costs with local suppliers, but for national/larger suppliers, it would make the Baltimore Region a less attractive place to work because of lower rates compared to other jurisdictions.

Opportunities for Cooperative Purchasing

Interviewees held mixed views of the feasibility and potential for effectiveness of a cooperative purchasing program. Those with more experience in cooperative purchasing held the view that a cooperative purchasing program could bring several benefits to the region including:

- Streamlining the prequalification of vendors
- Time savings for the contracting process
- Capacity to attract more vendors
- Potential to further engage volunteer and non-profit organizations in some projects

- Targeting of certain types of projects for cooperative purchasing

Streamlining the prequalification of vendors

Advocates argue that there are a limited number of stormwater vendors and a cooperative purchasing approach would simplify purchasing through a single pre-qualification process. Other interviewees were skeptical, however, that the prequalification would be effective because of the differences among regions on what constitutes a qualified vendor. A vendor who has successfully completed three projects in one jurisdiction may not be considered qualified to perform on a similar project in a different jurisdiction, due to differences in policy/laws and due to differences in requirements of any specific project (e.g. For a project in a location that is difficult to access, one vendor may have lower-impact equipment or better ability to access the site).

Time savings for the contracting process

Advocates note that because there is a finite pool of vendors and many vendors are involved in multiple jurisdictions, governments in the Region can save time in contracting by starting with a pre-established list of qualified vendors that can be hired at a pre-determined fixed price. While each jurisdiction would likely have a different contract with the vendor, the pre-qualification process would help the jurisdictions to move more quickly to a contracting agreement.

Capacity to attract more vendors

A cooperative purchasing agreement may add capacity for jurisdictions to reach beyond the region to attract additional contractors. In addition to issuing a cooperative purchasing solicitation, this would require that the cooperative purchasing entity (1) create inroads with vendors from outside, encouraging them to participate in projects in the Baltimore Region and/or (2) create a more efficient means for sub-contractors within the region to gain more experience and become more highly qualified.

To attract vendors from outside the region, the cooperative purchasing agreement would need to consider the market realities of those employers and reasons that they do not already participate in projects in the region (which include low hourly rate caps and high MBE/DBE sub-contracting requirements, both of which make projects in the region less appealing than more lucrative projects available outside the Baltimore Region). This approach also has the disadvantage of spending local tax dollars on services that are provided by companies that are not local to the region. This reduces the positive economic impacts that stormwater spending can have in the local economy.

Engaging local sub-contractors with less experience in stormwater projects may prove to be challenging for a cooperative purchasing program to achieve. The stormwater contracting model in Prince George's County has taken an approach that is designed to do this and thus far it has shown preliminary success with a high percentage of projects being performed by county residents and businesses. That program outsources the vast majority of all stormwater projects to a single vendor, Corvias. Corvias meets sub-contracting requirements through an aggressive engagement strategy (see Appendix A for a description

of this program). Given the current stage of development, it may be difficult for the Baltimore Region to implement a similar strategy for stormwater projects today, although some version of this approach may make sense for maintenance of stormwater projects, which is only today beginning to ramp up.

Potential to further engage volunteer and non-profit organizations in some projects

Community environmental organizations are already performing a significant portion of the region's stormwater projects. A cooperative purchasing organization that is coordinating purchases may be able to re-route a portion of projects away from private contractors, and let them instead be performed by community environmental organizations. The extent to which projects can be performed by Watershed Academies and similar organizations will depend on the location of the project, complexity, and scope of resources involved. Watershed academies have been able to perform projects such as:

- Installing rain barrels,
- Planting of native plants and trees,
- Installing some BMP upgrades,
- Performing some stream restoration projects,
- Creating tidal marsh/living shoreline,
- Treating bio-retention systems,
- Implementing wetland restoration,
- Performing forest conservation, and
- Other projects.

A centralized approach may help these organizations to expand and perform projects across the region, but they will be limited by the capacity of the organizations and their volunteers and other resources.

Targeting of certain types of projects for cooperative purchasing

Supply constraints and market dynamics described in the previous section may make it difficult for cooperative purchasing to be practical for complex, heavy civil engineering stream restoration projects and some other projects in which the purchasing criteria is dependent on the past experience and track record of past performance. However, cooperative purchasing may make sense for projects such as street sweeping, tree planting (cooperative purchases from nurseries) and other specific projects. The feasibility of cooperative purchasing, however, will be driven by the needs of the specific project. In interviews, governments reported that projects that include tree planting are not sub-divided into labor and materials and this would need to change in order to implement volume purchasing of local trees and plants.

Analysis and Recommendations

Cooperative Purchasing

Stormwater projects are set to continue implementation phases and ongoing maintenance that will likely go on far beyond 2025 as jurisdictions work toward maintaining water quality standards. Stormwater maintenance services will be a permanent, ongoing need across the region, and one that can benefit from cooperative purchasing.

Based on a review of the challenges of a cooperative purchasing program, the success of implementing one will depend on the a number of factors, but most importantly on the ability of the program to expand the supply of available contractors and ability to work collaboratively. In a situation of shortage of qualified contractors, it may be difficult to negotiate a lower cost, because it is to the advantage of jurisdictions to compete for limited contractors. Other means of lowering costs are likely to involve actions that are beyond the scope of a traditional cooperative purchasing program, in particular focusing on actions that increase the supply of available resources, either by:

- Diverting some projects to lower-cost means of implementation (e.g. volunteers),
- Increasing engagement with inexperienced local providers to help them gain experience and become qualified for other projects, and
- Engaging experienced contractors outside the region.

The approach taken by Prince George's County (described in Appendix A) achieves the above-mentioned strategies, but its success is dependent, at least in part, on a single source model to contracting all stormwater projects. In addition, this innovative approach is new and many of the outcomes of the strategy will not be fully understood for some time.

A cooperative purchasing agreement, if implemented, would also bring certain benefits through reducing duplication of efforts across jurisdictions. A cooperative purchasing agreement that uses a programmatic approach where there is a single prequalification process – coupled with open access to allow periodic prequalification of new entrants to the process – is likely to reduce the administrative burden that is duplicated in each jurisdiction.

Based on a review, the research team recommends that the jurisdictions in the region consider the following options for cooperative purchasing:

1. **Implement a limited cooperative purchasing program**, with a focus on cooperative purchasing for less complicated projects and projects that have intensive use of commodities such as native trees and plants, stone, riprap, etc.
2. **Implement a stormwater maintenance cooperative purchasing program**. Maintenance work is currently in an early phase and will grow in demand over time. The program could target more engagement with community environmental organizations, and may be developed in concert with a workforce development program that uses maintenance tasks to train workers on

principles of stormwater projects. The needs for annual maintenance on projects are expected to be relatively consistent from year to year, creating an opportunity to reduce costs through planned purchases.

3. **Implement a program designed to increase the availability of resources**, by engaging more employers and increasing the supply of qualified contractors available in the region. This could be implemented in several ways. Governments could directly recruit small firms in the region and larger firms outside the region to respond to cooperative purchasing solicitations. Governments could also review and potentially adjust policies that exclude firms without prior experience, by providing a way for firms with highly qualified workers to be considered for solicitations (perhaps based on a certification on the level of expertise or training of a company's workforce). In the current situation, a choice to enter stormwater work is a multi-year investment for a prospective contractor, and anything that governments do to reduce that investment barrier will likely increase the pool of companies available to perform the work.
4. **In lieu of a broader stormwater cooperative purchasing strategy, consider the Prince George's County model on a county-by-county basis.** This program is showing promising successes in the early phases, but the implementation is currently in the early years and the full scope of the results will not be understood for some time.

Workforce Development

There is a significant opportunity and need for workforce development in stormwater projects. There are significant needs for skills training and a variety of job opportunities that can support the development of multiple career paths in the stormwater field. Shortages of skilled workers and experienced contractors are evident and contribute directly to higher costs of stormwater compliance.

The research team recommends that a collaborative region-wide approach be considered for stormwater workforce development. The elements of a successful stormwater workforce development program would likely include:

- **Participation in national standards-setting for training and occupational competency standards**. The standards of training for stormwater work are currently being determined and developed by several organizations. A regional stormwater workforce development program will benefit from participating in a national dialogue and contributing to the standard-setting policy.
- **A focus on stormwater maintenance work.** Maintenance needs are likely to grow as the implementation of BMPs continues. From an occupational training perspective, maintenance projects involve a stable stream of work that can offer trainees access to a broad variety of stormwater BMPs in which they can receive training.
- **Partnership with local watershed stewardship academies.** These organizations have been entrusted with a scope of stormwater management projects that can provide a hands-on training context.

- **Engagement with employers.** Employers have needs for qualified workers at all levels from laborers, to technicians, to professionals, but the needs differ among employers. Relationships with employers will be critical to job placement, for understanding pre-employment skills needs, for creation of training and educational content, and for understanding of trends shaping careers in stormwater management.
- **Engagement with governments.** Governments are the ultimate buyers in many stormwater BMPs and are in the best position to directly influence the creation of a highly skilled workforce by deploying resources that result in increases in capacity that can lead to long-term cost savings for the region.
- **A coordinated, end-to-end Career Pathways[2] approach to stormwater career development** that encompasses workforce readiness training, technical training, contextualized learning environments, direct job placement, comprehensive wrap-around support services, incumbent worker skills upgrading and career advancement, and ongoing support for employers and workers. The development of clearly articulated career paths in stormwater management will help to build the infrastructure needed in an end-to-end Career Pathways program.
- **A cross-sector and cross-regional coordinating role** that connects governments, employers, training organizations and other career development service providers.
- **A focus on policy changes that encourage workforce development**. These policies can range from:
    - Requirements for contractors to work with workforce training providers,
    - Policies that allocate some projects to training organizations,
    - Stormwater procurement strategies that provide bonus points for contractors that include training or apprenticeships in their bids, or
    - Other supportive local government or contracting policies.
- **Include a small business development component in the program**. Contractors for stormwater projects are not selected based on the skills or experience of their staff, but rather the number of previous projects the firm has successfully completed in the past. A workforce development strategy that includes a small business development component will increase the number of companies that are qualified and available to complete projects.

[2] See http://www.cord.org/career-pathways/

Appendix A: Prince George's Approach to Stormwater Management Requirements

Prince George's County's Approach to

MEETING REGULATORY STORMWATER MANAGEMENT REQUIREMENTS

USING A COMMUNITY-BASED PUBLIC-PRIVATE PARTNERSHIP BUSINESS MODEL

APRIL 2016

Prince George's County
DEPARTMENT OF THE ENVIRONMENT

STORMWATER MANAGEMENT DIVISION

ACKNOWLEDGMENTS

The success of Prince George's County's Clean Water Partnership (CWP), a groundbreaking community-based public-private partnership (CBP3) program, is due to a collective effort of the Prince George's County's Department of Environment (DOE), Department of Public Works and Transportation (DPW&T), Department of Permitting, Inspection and Enforcement (DPIE), the County Executive, the County Council Members, and other experts who were consulted during the process. Thanks to the efforts of ***Mr. Adam Ortiz***, the Director of DOE, whose vision to interweave the County's environmental goals with economic and education growth led to the evolution of CWP. It was ***Mr. Larry Coffman***, the Deputy Director of DOE from 2012 to 2015, who took Mr. Ortiz's idea and ensured it was transformed into a program that would suit Prince George's County's needs.

The DOE is grateful for the support and guidance of County Executive ***Mr. Rushern L. Baker III*** and the County Council consisting of:

Ms. Mary A. Lehman (District 1)
Ms. Deni Taveras (District 2)
Ms. Dannielle M. Glaros (District 3)
Mr. Todd M. Turner (District 4)
Ms. Andrea C. Harrison (District 5)
Mr. Derrick Leon Davis (District 6)
Ms. Karen R. Toles (District 7)
Mr. Obie Patterson (District 8)
Mr. Mel Franklin (District 9)

The County Executive and Council saw the economic development, environmental restoration, and educational potential in the program proposed by Mr. Ortiz and Mr. Coffman and unanimously approved the program. Technical support was provided by U.S. Environmental Protection Agency (EPA) Region 3 in development of this program, especially ***Ms. Dominique Lueckenhoff***, Deputy Director, Water Protection Division.

At DOE, Mr. Ortiz was supported by ***Dr. Mow Soung Cheng*** (retired), Special Assistant to the Director; ***Mr. Jeff M. DeHan***, Associate Director of the Stormwater Management Division; ***Mr. Jerry Maldonado***, Section Head of Water Quality and Compliance, Stormwater Management Division; and ***Mr. Daniel O. Rybak***, Section Head, Construction, for initial technical analyses and investigations. The DOE staff were supported by personnel from DPW&T represented by ***Ms. Gwendolyn Clerkley***. The County also engaged URS Corporation (now AECOM) led by ***Ms. Mary Roman*** and subject matter experts on alternative financing, ***Mr. George Tapas*** and ***Mr. Chris Hanson***, who provided technical guidance during the proposal and contracting phases.

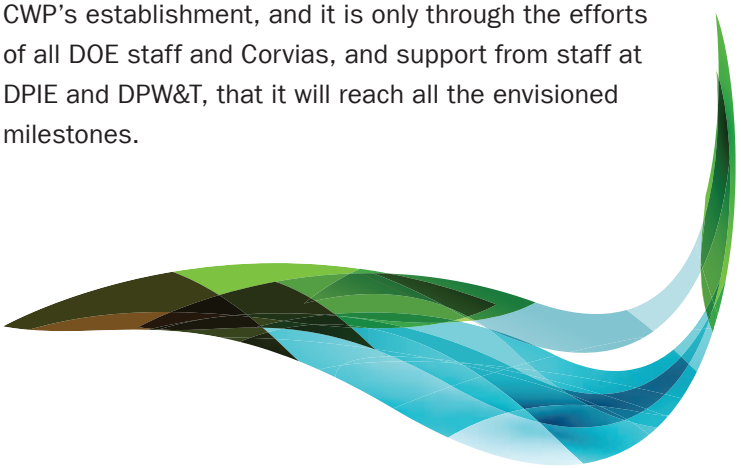
It was through the experienced guidance of ***Mr. Thomas Himler***, Deputy Chief Administrative Officer, Budget, Finance and Administration, that DOE could successfully navigate through the County's financial regulations when developing the CWP. Thanks to ***Mr. Roland Jones***, Director of Office of Central Services

and the County's Procurement Officer, ***Mr. Josue Pierre***, Deputy County Attorney, and ***Ms. Barbara Manley*** from the County's Contract Administration and Procurement Division for their efforts in representing the County's interests and in developing the contract with Corvias.

The DOE selected Corvias Solutions LLC, an appropriate partner that would help the County achieve its economic, environmental, and educational goals. The Corvias team, represented by ***Mr. Greg Cannito*** and ***Mr. Tim Toohey,*** offered a great partnership and a promise to meet the County's vision.

Mr. Jim Lyons, the CWP Program Manager at DOE, has been leading and managing the CWP since its establishment, and it is through his guidance that this document was developed so that other communities can learn from Prince George's County's experience when considering their own CBP3 programs. The County appreciates funding received from the Chesapeake Bay Trust (Grant Number 11921) to support development of this document. The document was authored by ***Ms. Mary Roman*** and ***Ms. Manasa Damera*** of AECOM.

The County is already seeing improvements since the CWP's establishment, and it is only through the efforts of all DOE staff and Corvias, and support from staff at DPIE and DPW&T, that it will reach all the envisioned milestones.



EXECUTIVE SUMMARY

Prince George's County is implementing hundreds of water quality improvement projects to meet state and federal regulatory water quality requirements, with deadlines as soon as 2017 to remove pollutants from stormwater runoff from currently untreated impervious areas. The magnitude of stormwater treatment needs and compressed timeframe to complete the requirements called for a more efficient project delivery system. The County therefore determined it needed a business model to accelerate implementation, increase affordability, improve program administration, and better address long-term operation and maintenance requirements, as well as promote social and economic development.

The Clean Water Partnership (CWP), created by the County's Department of Environment (DOE), is an innovative business model in the field of stormwater management that aims to meet regulatory requirements by leveraging private-sector resources and promoting operational efficiencies and innovation in design, construction, and maintenance. The CWP was designed to create "green jobs" that preserve and restore environmental quality, expand the County's small businesses, promote educational opportunities for students by collaborating with local colleges and universities, and develop partnerships with faith-based institutions and nonprofit agencies to achieve the County's goals.

The CWP is a Design-Build-Operate-Maintain community-based public-private partnership (CBP3) business model contract between the County

and private partner Corvias Prince George's County Stormwater Partners LLC (Corvias). Corvias is the program manager in partnership with the County, collaborating on the administration and decision-making process, and thus creating transparency in the program. Corvias is responsible for implementing best management practice (BMP) projects and their maintenance throughout their 30-year lifecycle as approved by DOE. The County provides funds to implement projects through the Clean Water Act Fee. The goals for implementing BMPs are listed in the Master Program Agreement, and the goals for the long-term maintenance of BMPs are listed in the Master Maintenance Agreement. Corvias is supported by contractors approved by the County for design, construction, and maintenance of BMPs. Corvias receives compensation, and potentially incentive fees, based on performance goals, which include socioeconomic goals. Corvias is responsible for maintaining the BMPs for 30 years.

With Corvias engaging with private residents, local businesses, homeowners associations, faith-based institutions, nonprofits, nongovernmental organizations, schools, and towns and cities, the County gains important partners for the environmental stewardship of its resources to efficiently achieve aggressive regulatory goals and continue to improve the water quality in the Chesapeake Bay.

"We determined that it is riskier to continue doing things the same way (regarding stormwater management compliance) versus trying something different."

— Mr. Adam Ortiz
Director, Prince George's County DOE

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ACRONYMS

AWS	Anacostia Watershed Society
BBO	Build, Buy, Operate
BMP	Best Management Practice
BOE	Board of Education
BOO	Build, Own, Operate
BOT	Build, Operate, Transfer
CBP3	Community-Based Public-Private Partnership
CIP	Capital Improvement Program
CWA	Clean Water Act
CWP	Clean Water Partnership
DB	Design, Build
DBFOM	Design, Build, Finance, Operate, and Maintain
DBFOMT	Design, Build, Finance, Operate, Maintain, Transfer
DBM	Design, Build, Maintain
DBO	Design, Build, Operate
DBOM	Design, Build, Operate, and Maintain
DOD	U.S. Department of Defense
DOE	Prince George's County's Department of the Environment
DPIE	Department of Permitting, Inspection and Enforcement
DPW&T	Department of Public Works and Transportation
EPA	U.S. Environmental Protection Agency
GI	Green Infrastructure
GIS	geographic information system

HOA	homeowners association
LID	Low Impact Development
LSMWVBE	Local, Small, Minority, Women, Veteran and Disadvantaged Business Enterprise
MBE	Minority Business Enterprise
MDE	Maryland Department of the Environment
MHPI	Military Housing Privatization Initiative
MMA	Master Maintenance Agreement
MOU	memorandum of understanding
MPA	Master Program Agreement
MS4	Municipal Separate Storm Sewer System
NDC	Neighborhood Design Center
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
OM&M	Operation, Maintenance, and Management
P3	Public-Private Partnership
RFQ	Request for Qualifications
ROW	right-of-way
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
UMD	University of Maryland
WIP	Watershed Implementation Plan

INTRODUCTION

The Clean Water Partnership (CWP) is an innovative community-based public-private partnership (CBP3) program adopted by Prince George's County, Maryland to modernize and retrofit its stormwater infrastructure. The CWP was set up to meet the goals of the U.S. Environmental Protection Agency's (EPA's) Chesapeake Bay Total Maximum Daily Load (TMDL) requirements by 2025 in a cost-effective way while furthering the County's commitment to promoting economic development, improving education opportunities, and restoring and protecting the environment. The Prince George's County Department of the Environment (DOE), with the help of the Department of Public Works and Transportation (DPW&T) and Department of Permitting, Inspection and Enforcement (DPIE), spearheaded this partnership to facilitate the design, installation, maintenance, and monitoring of stormwater management facilities to treat the stormwater runoff from approximately 4,000 acres of untreated urban impervious areas over the next 30 years.

The CWP follows a Design-Build-Operate-Maintain CBP3 process, which is a breakthrough from the County's traditional business model of Design-Bid-Build, which consists of individual contracting phases for design, construction, and maintenance. The CWP was developed in order to reduce the cost of stormwater management retrofits, reduce the implementation timeframe, promote innovative technologies in the field of stormwater management, and apportion the financial and legal risks while promoting a green economy to preserve County resources and encourage sustainability.

Overview and purpose of this document

This document describes the creation of the Prince George's County's CWP and the drivers that influenced program development. The operational structure of the CWP, responsibilities of the entities involved, and anticipated benefits from the program are also outlined. In addition, the role of partners such as schools, homeowners associations (HOAs), and businesses whose direct or indirect contributions would result in the development of a successful CWP is described.

FAQ

WHAT IS A STORMWATER MANAGEMENT RETROFIT?

Adding a Best Management Practice (BMP) or upgrading an existing BMP to treat stormwater runoff from developed areas that presently have no qualitative stormwater controls.

WHAT IS A BMP?

A BMP is a treatment technique adopted to reduce pollutants being discharged into waterbodies through filtering, infiltration, or other means. BMPs are used to minimize the adverse impacts of urbanization on natural resources.

WHAT THIS DOCUMENT PROVIDES:

- ✓ An insight into Prince George's County's experience in setting up the Clean Water Partnership (CWP) program
- ✓ A description of anticipated benefits from the CWP
- ✓ A description of the roles played by Prince George's County's partners
- ✓ Items to consider before setting up a public-private partnership (P3) program for your community

The purpose of this document is to share Prince George's County's experiences in implementing a CBP3 in the stormwater management sector with other municipalities who may be considering a similar approach for meeting stormwater or other regulatory requirements. It describes items to consider for municipalities who want to adopt a P3 for implementing large stormwater infrastructure projects.

Additional resources

In recent years, EPA Region 3 and has been championing the implementation of stormwater CBP3s as an alternative for restoring the environment and meeting regulatory requirements. More detailed information on CBP3s can be found in the EPA publication Community-Based Public-Private Partnerships and Alternative Market-Based Tools for Integrated Green Stormwater Infrastructure, April 2015.

FAQ

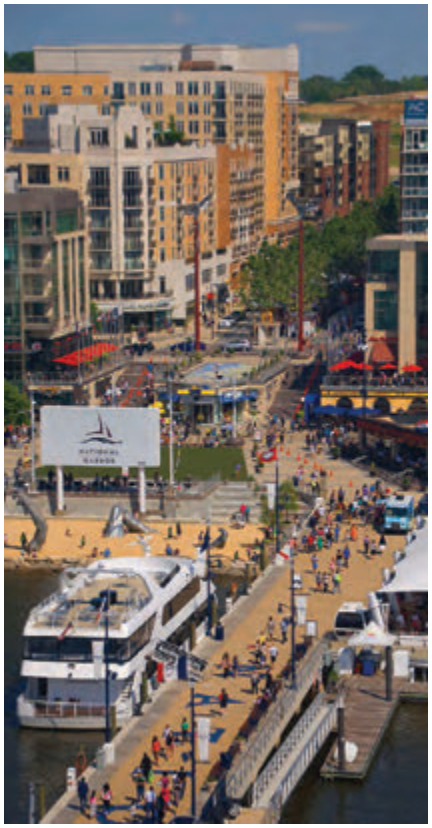
WHERE CAN I FIND ADDITIONAL INFORMATION ON P3?

Available at:
http://www.epa.gov/sites/production/files/2015-12/documents/gi_cb_p3_guide_epa_r3_final_042115_508.pdf

2

REGULATORY BACKGROUND

Prince George's County, with an area of approximately 500 square miles, is the second most populated county in Maryland, with residential areas occupying almost 60 percent of the land area. Development in the County dates back to the 1800s, and it has steadily increased over the years due its prime geographic location and proximity to both Washington, DC and Baltimore, Maryland. There are approximately 27 towns and cities in the County, the most of any county in Maryland, and as the area became increasingly developed, the open and forested areas decreased. As a result, stormwater runoff is not being filtered through soils and thus carries pollutants such as trash, chemicals, bacteria, dirt, and vehicle oil from the roads and other impervious surfaces to the County streams.



The County, as required by state and federal regulations, is working to improve water quality conditions in its streams and other waterbodies. Water quality in the streams has degraded over the years due to excess pollutants such as Total Nitrogen (TN), Total Phosphorus (TP), Total Suspended Solids (TSS), and trash, which are a direct effect of urbanization. The streams in Prince George's County flow into the Chesapeake Bay and transport these pollutants, thereby degrading the quality of the Bay. The regulations require states and municipalities to implement stormwater management techniques that improve water quality in the Chesapeake Bay, and the water bodies flowing to it, by making them suitable to support aquatic habitat and recreational activities.

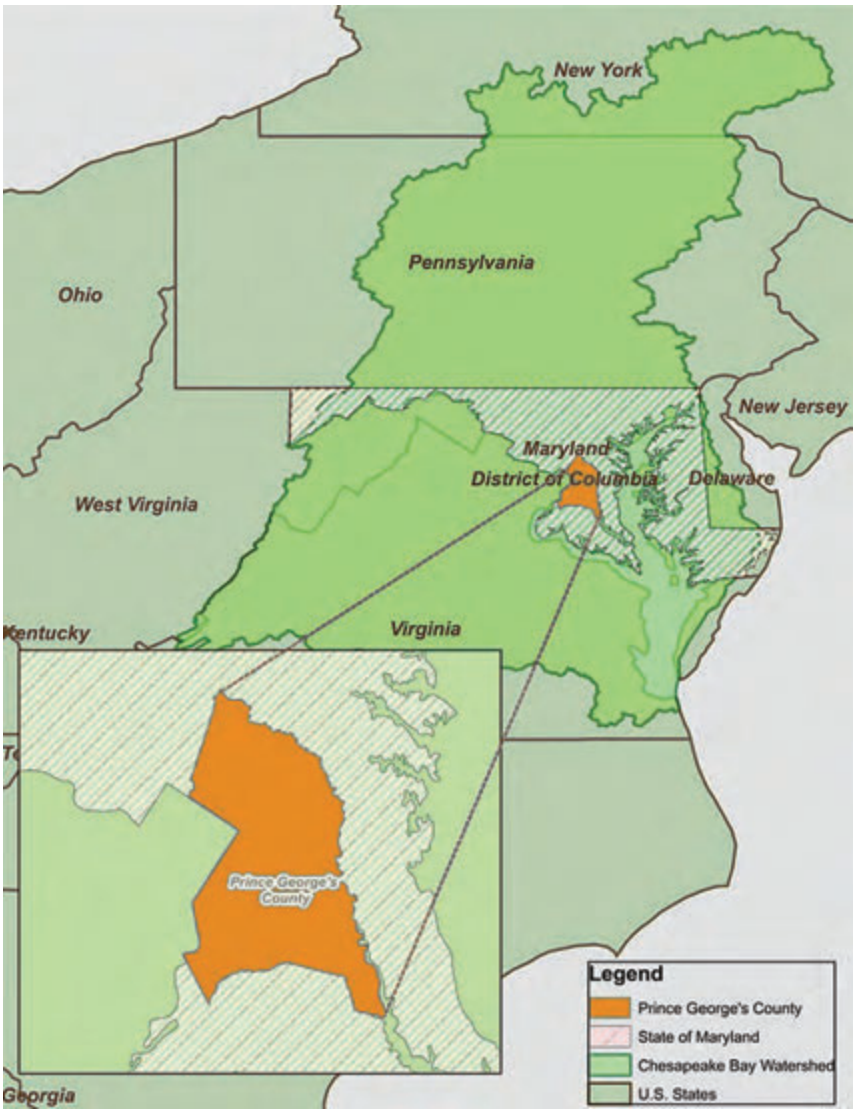
Regulatory drivers

Prince George's County, as an operator of a Municipal Separate Storm Sewer System (MS4), is subject to the requirements of a National Pollutant Discharge Elimination System (NPDES) MS4 Phase I Permit as authorized by the federal Clean Water Act (CWA). EPA has delegated the permitting authority of the NPDES MS4 program to the Maryland Department of the Environment (MDE) through a Memorandum of Agreement dated May 18, 1989. The County was issued an initial NPDES MS4 Permit in November 1993, and it has been reissued four times since then.

FAQ

WHERE CAN I FIND THE CURRENT PRINCE GEORGE'S COUNTY'S NPDES MS4 PERMIT?

http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/Documents/Prince%20George%27s%20county%20final%20permit%20January%202%202014.pdf



ABOVE: MAP OF PRINCE GEORGE'S COUNTY IN RELATION TO THE CHESAPEAKE BAY WATERSHED.

LEFT: EXAMPLE OF A BMP — BIOFILTRATION SYSTEMS LIKE THIS ARE DESIGNED TO CAPTURE AND FILTER POLLUTANTS FROM THE STORMWATER RUNOFF ON THE STREETS.

The requirements of the NPDES MS4 Permit have evolved with each permit cycle to include additional requirements to protect and restore natural and water resources in the County. The initial permit cycle required the County to develop programs to reduce pollution from storm drains; develop geographic information system (GIS) mapping for watersheds in the County; identify the characteristics of urban stormwater using chemical, physical, and biological monitoring; administer an effective urban stormwater management program to mitigate the water quality impacts of runoff from new development and significant redevelopment projects and construction sites; eliminate illicit stormdrain system connections; and develop public outreach and education programs to inform citizens on reducing stormwater pollution.

Subsequent permit cycles imposed additional requirements, including the need to assess water quality on a watershed level to establish stormwater retrofit requirements for 10 percent of the untreated impervious area in the County in each permit cycle.

The current permit, issued on January 2, 2014, added requirements such as enforcing more stringent stormwater management criteria, managing trash and litter, and developing restoration plans to meet Chesapeake Bay and local TMDLs. As a part of restoration plan requirements, the County is

required to implement TMDL restoration strategies to the maximum extent practicable by the end of the permit term (i.e., 2019). The County is also required to treat 20 percent of its currently untreated impervious area by implementing MDE-approved Best Management Practices (BMPs) by the end of the permit cycle to be in compliance with the CWA.

The permit also subjects the County to the Chesapeake Bay TMDL requirements established by EPA Region 3 in 2010. The Chesapeake Bay TMDL for TN, TP, and TSS requires all states whose stormwater drains to the Chesapeake Bay to work together to reduce the amount of pollutants being discharged into their waters. The goal is to achieve a cleaner Chesapeake Bay by 2025.

The responsibility for attaining these goals is allocated to the states in the Chesapeake Bay Watershed, which include New York, Pennsylvania, Maryland, Delaware, West Virginia, Virginia, and the District of Columbia. These states are required to meet the TMDL reductions by 2025, and 60 percent of the reduction requirements are to be met by 2017.

Each state has the flexibility to develop specific methods and means to delegate and enforce the TMDL reduction goals. To meet its own TMDL allocations, the State of Maryland developed Phase I and II Watershed Implementation Plans (Maryland WIPs), which present roadmaps for meeting the state TMDL goals.

There are five major watersheds in Maryland, and the 2025 pollutant load reductions for these watersheds are published in the Phase I and II WIPs.

In Maryland, the MDE assigned all jurisdictions, including Prince George's County, Chesapeake Bay TMDL reduction goals and required them to develop their own WIP to show how they would meet the pollution reduction goals. Prince George's County's final WIP was submitted on July 2, 2012 and is included in Section III of the Maryland's Phase II WIP. It provides a detailed description of strategies to be adopted by the County in the areas of agriculture, point source pollution/wastewater, septic system management, and urban stormwater management. Under urban stormwater management strategies, the County's WIP indicates that approximately 8,000 acres of untreated impervious area needs to be retrofitted to meet the 2017 goals, and an additional approximately 7,000 acres (for a total of 15,000 acres) of untreated impervious area needs to be retrofitted by 2025 to meet the Chesapeake Bay TMDL goals.

HOW MANY CHESAPEAKE BAY WATERSHEDS ARE IN MARYLAND?

There are five:

- Potomac
- Patuxent
- Susquehanna
- Western Shore
- Eastern Shore

IN WHICH WATERSHED IS PRINCE GEORGE'S COUNTY LOCATED?

Potomac

WHERE CAN I FIND MARYLAND'S WATERSHED IMPLEMENTATION PLANS?

Phase I: http://www.mde.state.md.us/programs/Water/TMDL/TMDLHome/Pages/Final_Bay_WIP_2010.aspx

Phase II: http://www.mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Pages/FINAL_PhaseII_WIPDocument_Main.aspx

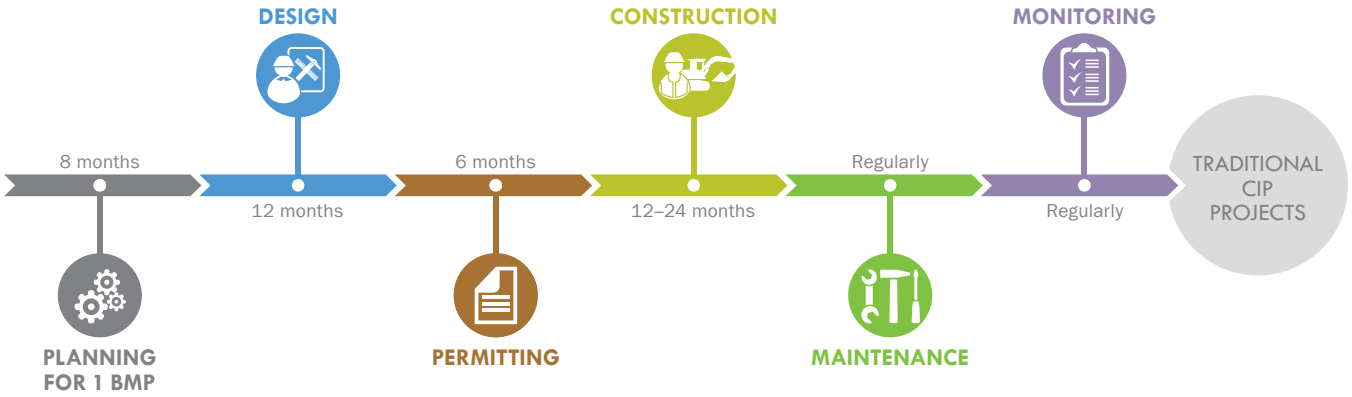
FAQ

WHERE CAN I FIND MORE INFORMATION ON PRINCE GEORGE'S COUNTY'S CLEAN WATER ACT FEE?

http://www.princegeorgescountymd.gov/sites/stormwaterManagement/Pages/default.aspx

The County's challenges in meeting regulatory requirements

About $1.2 billion will be required to retrofit the approximately 15,000 acres of untreated impervious area according to the County's final WIP. Even though the County has a steady source of funding through its Clean Water Act Fee via the Clean Water Program, it would be difficult to meet the restoration requirements if the stormwater projects or BMPs were implemented through its Capital Improvement Program (CIP). The County's CIP process is a traditional stormwater management program that involves the following phases and timelines to plan and implement each BMP:



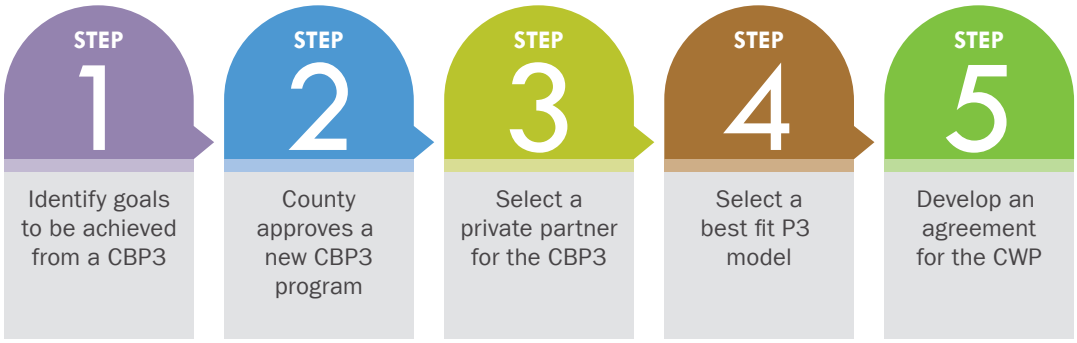
This conventional approach does not support the simultaneous implementation of projects. Additionally, upon implementation of the BMPs, the County also needed to maintain them to keep them functioning properly throughout their lifecycle, which is approximately 30 years. County staff and technical resources are limited, and more resources were needed to develop and implement an optimized stormwater retrofit program at the County level to implement and maintain BMPs. In addition, as these projects are funded through the County's Clean Water Act Fee, which is provided by County residents, the County needed to develop a process that obtained the maximum benefit by driving down the implementation costs for the BMPs and included economic development, environmental protection, and educational opportunities. The County determined that it was riskier to continue doing things the same way in stormwater management versus trying something different, and therefore had to explore other options.

THE CLEAN WATER PARTNERSHIP AS A SOLUTION

Because of the challenges posed by the large amount of impervious area to be treated by 2025, limited County resources, and the inability of the current CIP processes to handle the increased work flow, the County determined that it needed to develop a fast-tracked, efficient, and cost-effective program to meet the 2025 goals. Many options were considered. Expanding the traditional CIP program by adding more resources was considered; however, it was concluded that the program would not be able to achieve the goals by 2025, as the duration needed to implement a BMP using existing contracting processes would not support implementation of BMPs with accelerated schedules.

This need resulted in Prince George's County adopting an aggressive Urban Watershed Restoration Impervious Area Treatment Plan, which is a two-pronged approach consisting of 1) enhancing the County's traditional CIP to implement BMPs at a faster pace and, on a parallel track, 2) adopting the CWP to implement and maintain BMPs that would treat up to 4,000 acres of untreated impervious area. The CWP was envisioned to:

- Accelerate the implementation timeframe of BMPs
- Increase affordability of retrofits
- Reduce operation and maintenance costs of the impervious area retrofits
- Advocate for innovation in technology
- Achieve the County's mandate of promoting Education, Environment, and Economy



STEPS INVOLVED IN THE COUNTY'S ADOPTION OF CWP

WHAT IS A PUBLIC-PRIVATE PARTNERSHIP?

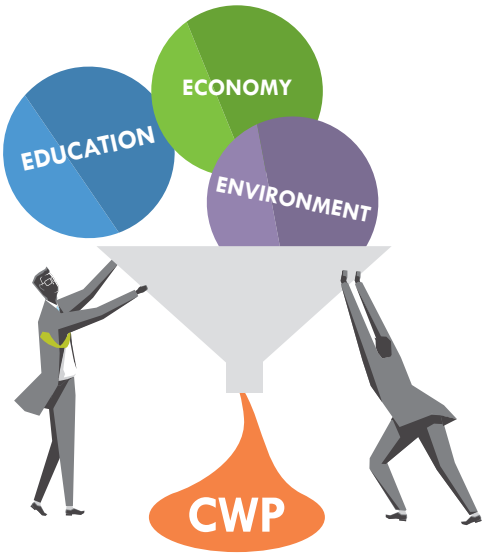
Public-private partnership business model

A P3 business model is typically established when the public sector requires private sector resources, experience, and innovation to implement needed public sector services. Even though the Prince George's CWP is the first P3 business model being adopted in a stormwater management arena, P3 models have been successfully implemented in various sectors by other federal, state, and local agencies, such as the U.S. Department of Defense (DOD), U.S. Forest Service, and the Port Authority of New York and New Jersey. Nationwide, multiple federal and state transportation projects are implemented using a P3 setup. Typically, P3 business models are established by a long-term contract between a private entity or entities and a government or public agency for delivering services such as planning, construction, or long-term maintenance of public infrastructure.

With a typical P3, the private entity bears the majority of the management responsibilities, and as a result accepts a greater risk. The public agency maintains oversight of the project, and payment of the private entities involved is based on meeting contract goals.

County approval of a new business model

County Council approval of the CBP3 was required since this contracting method deviated from the County's traditional CIP processes. Noncompliance with the permit requirements under the CWA is punishable by large federal fines, and the County DOE believed the CBP3 was needed to comply. However the County Executive and County Council required additional evidence that the CBP3 would also benefit County residents, businesses, and communities.



The County DOE recognized that meeting the stormwater requirements was also an opportunity to **promote economic development and improve education opportunities, while restoring and protecting the environment.** The County wanted to adopt a program that would intertwine achieving social and economic development with achieving environmental goals.

Economy would be promoted through the CWP by hiring the local workforce and promoting County-based and local businesses in all phases of BMP implementation.

Education programs envisioned would promote awareness among residents and students on the benefits of stormwater management and preservation of natural resources.

The County Council recognized the advantages of providing economic development, enhancing **environmental** stewardship, and educating residents, and unanimously approved the adoption of a CBP3 business model to implement stormwater management retrofits to treat approximately 4,000 acres of untreated impervious area to meet environmental goals.

Prince George's County's CBP3 partner selection

An important part of the success of the CBP3 program was to select the right partner who would embrace the County's goals. The County required its partner to have flexibility to work within the given financial limitation, be willing to accept as much legal and financial risk as possible, and be willing to put forth significant efforts to achieve the community's goals.

The County issued a Request for Qualifications (RFQ) as part of the selection process for a CBP3 partner. The RFQ requested extensive information on the team's public-private partnership experience and proposed approach to meeting Prince George's County's goals for the program. To help guide through the process, the County hired P3 subject matter experts (AECOM, formerly URS Corporation) to write the RFQ and develop an Evaluation Framework document to help the County Consultant Selection Committee evaluate the proposals received and select the best partner.

The County selected **Corvias Group LLC**, as they offered flexibility, and exhibited an adaptive management style to adjust to changing politics, regulations, and economic conditions for meeting the County's goals.

KEY QUALIFICATIONS THAT LED TO THE COUNTY'S SELECTION OF CORVIAS GROUP LLC AS A PARTNER:

- ✓ Flexibility
- ✓ Adaptive management style to changing politics, regulations, and economic conditions
- ✓ Depth and breadth of staff resources
- ✓ Commitment to the County's economic development goals to engage the local workforce

Selection of the best fit P3 model

The County studied several P3 business models used successfully throughout the nation to evaluate which was the best fit. The County already had experience using a P3 business model at two of its landfills for conversion of landfill gas to electricity.

The County contracted Brown Station Road Sanitary Landfill and Sandy Hill Landfill to private firms to design, build, finance, operate, and maintain (DBFOM) the infrastructure required to convert landfill gas to electricity. In this setup, the private firms are also responsible for marketing gas and electricity to the purchasers. Both of these P3s were recognized by EPA through its Landfill Methane Outreach Program award for excellence in innovation and creativity, for promoting renewable energy development,

SANDY HILL LANDFILL GAS PROCESSING PLANT
(SOURCE: HTTP://WWW.NASA.GOV/VISION/EARTH/EVERYDAYLIFE/ARCHIVES/0508LANDFILL_PRT.HTM)

FAQ

WHAT ARE OTHER KINDS OF P3s?

- ✓ Operations and Maintenance (O&M)
- ✓ Operation, Maintenance, and Management (OM&M)
- ✓ Design, Build (DB)
- ✓ Design, Build, Operate (DBO)
- ✓ Design, Build, Operate, and Maintain (DBOM)
- ✓ Design, Build, Finance, Operate, and Maintain (DBFOM)
- ✓ Design, Build, Maintain (DBM)
- ✓ Design, Build, Finance, Operate, Maintain, Transfer (DBFOMT)
- ✓ Build, Operate, Transfer (BOT)
- ✓ Build, Own, Operate (BOO)
- ✓ Build, Buy, Operate (BBO)

and achieving environmental and economic benefits. Both of these P3s resulted in substantial cost savings for the County.

The County also evaluated the successful P3 business model adopted by the United States DOD for the privatization of military housing, called the Military Housing Privatization Initiative (MHPI). The MHPI is a public-private partnership initiative adopted by DOD in 1996 where private firms were contracted to own, operate, and maintain military family housing. The two goals of this P3 were to provide quality residential homes for military service members and their families and to substantially decrease the cost of construction through privatization. In addition to improving the quality of construction and decreasing its timeframe, a savings of approximately 10 percent was expected over 50 years because of transfer of operation and maintenance costs to the private sector.

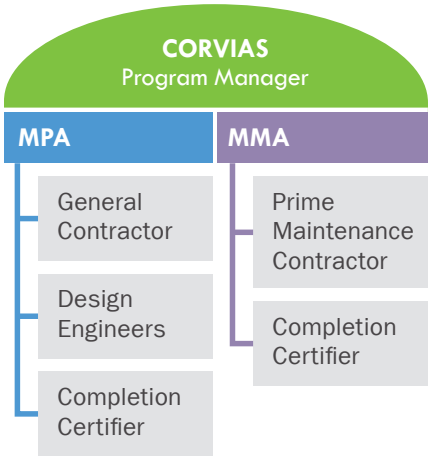
The MHPI program demonstrated significant cost savings and greater affordability, enhanced capacity to leverage public funds and expand services and benefits, a significant shift of program responsibilities and risks to the private sector, and expedited delivery of quality services and projects.

The County believed that the model adopted by MHPI could be a foundation for the P3 model for the **Clean Water Partnership**, but the County also needed a method for designing and building projects. Therefore, after evaluating specific needs and resources, the County selected a modified version of the DBFOM.

To meet the County's needs, Corvias Group LLC established **Corvias Prince George's County Stormwater Partners LLC** as the private partner for the CWP. The County's CBP3 program was also envisioned to include several other key partners. The key partners included community stakeholders such as universities, faith-based and nonprofit organizations, and environmental organizations.

Development of an agreement for CWP

The County developed a Master Program Agreement (MPA) and a Master Maintenance Agreement (MMA) with Corvias (Section 5 of this document) as the next step. The MPA document details Corvias' responsibilities for implementation of BMPs using Green Infrastructure (GI) technology in the next 3 years, and the MMA documents maintenance of the implemented BMPs for the next 30 years. Corvias will serve as program manager for both the MPA and MMA and be assisted by several subcontractors. The agreements also included a description of the compensation structure for Corvias, which is performance-based with a base fee for the successful implementation of all BMP projects and an incentive fee for meeting all County-established socioeconomic goals.



Factors to consider when developing a CBP3

Based on the County's experience developing a CBP3, factors to consider are outlined below.

IDENTIFICATION OF CBP3 GOALS

Identifying goals envisioned to be achieved by adopting a CBP3 is an important first step. The goals could vary from one community to another depending on specific needs. Some of these goals, such as improving water quality in surface water, are driven by state or federal regulatory requirements, whereas other goals, such as mitigating localized flooding, are driven by the desire to minimize impacts on properties and infrastructure in the community. In Prince George's County's case, the goal was to improve water quality conditions in the County's streams and achieve regulatory compliance.

FAQ

WHAT ARE THE GOALS THAT NEED TO BE ACHIEVED THROUGH THE CBP3?

Example goals include:

- ✓ Manage stormwater
- ✓ Improve water quality
- ✓ Maintain existing infrastructure
- ✓ Manage assets
- ✓ Reduce flood damages

INPUT FROM LEGAL COUNSEL

It is important to ensure that the municipality's legal structure allows a CBP3 to be implemented. Legislation in some communities might enforce restrictions on the type of CBP3 projects that can be implemented or restrict the role of private entities in a CBP3. It is important to determine whether the Community's legislative framework is flexible enough to allow a CBP3 to be implemented while protecting the municipality. Prince George's County's legislative framework allowed the DOE to transfer most of its responsibilities to a private entity. It is recommended that a municipality obtain input from both internal legal departments and an outside legal consultant to protect the municipality's interests.

FAQ

DOES THE COMMUNITY'S LEGAL STRUCTURE ALLOW THE ADOPTION OF A CBP3?

Check with legal counsel to obtain input on how much flexibility the community's legal structure has for adopting a CBP3.

(continued on page 12)

(continued from page 11)

FINANCIAL REVIEW AND INPUT

A CBP3 program typically requires a different financial arrangement from traditional CIP project implementation, and therefore the agreement needs to clearly define the payment process. The County also had to ensure that the financial processes in the CWP agreement between the County and Corvias were in accordance with the County's regulations and contained provisions that adequately protected the County. The County's Deputy Chief Administrative Officer, Budget, Finance and Administration, Mr. Thomas Himler, played an important role in reviewing the financial aspect of the CWP agreement to ensure it was in compliance with the County's regulations.

INDEPENDENT CBP3 GUIDANCE

If a municipality is entering into a CBP3 agreement for the first time, the community should consider hiring an independent subject matter expert with a wide range of P3 experience to guide and inform the technical aspects of selecting, hiring, and engaging a P3 partner. Even though Prince George's County had previous experience with P3 contracts, the consulting firm URS Corporation (acquired by AECOM in October 2014) assisted in establishing and guiding the County through the selection and contracting process.

DEDICATED FUNDING MECHANISM

Since CBP3s are generally long-term arrangements, it is important to identify a dedicated funding mechanism when setting up a CBP3. The CWP is set up to be funded through the County's Clean Water Act Fee, a stormwater utility fee implemented by the County on July 1, 2013. The County will fund all phases of the BMP projects and compensate Corvias with Base and Incentive fees for the services provided through this fund. Depending on the financial structure of the community, sources of funding could include public bonds, private activity bonds, private investments, a utility fee, or a grant program. For communities without any bonding authority, a CBP3 program with private financing may be a good option to pool the funding needed to implement CBP3 projects.

FAQ

WHAT WILL BE THE SOURCE OF FUNDING FOR THE CBP3?

Options include:

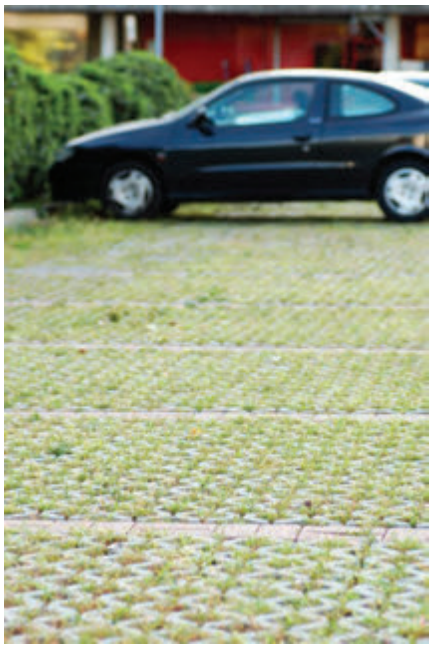
- ✓ Utility fees
- ✓ Public bonds
- ✓ Private investments
- ✓ Grant programs
- ✓ Private bonds

GOVERNANCE

With a CBP3, the role of the public agency evolves from project management to management of a performance-based contract. It is crucial that a streamlined process for managing and monitoring the CBP3 contract be established such that the risks transferred to the private entity are not transferred back to the public agency; if that happens, the financial and operational efficiencies are not maintained. To develop an effective governance program, the public agency should set performance standards. This should include defining interim and ultimate goals for private entities even before entering into an agreement with them. The public agency should set up monitoring procedures, including regular project meetings and intermittent audits from public agency personnel or a third party. Prince George's County developed an MPA and an MMA to define the responsibilities and goals to be achieved by Corvias (Section 5 of this document). According to these agreements, implemented retrofit projects are considered acceptable by the County only after they have been inspected and identified as "accepted" by the assigned Completion Certifier.

ANTICIPATED BENEFITS FROM THE CLEAN WATER PARTNERSHIP

The CWP is designed to mitigate a portion of the County's risk and delegate most stormwater retrofit responsibilities to Corvias. The CWP will help achieve the County's goal of treating 4,000 acres of untreated impervious area by implementing BMPs over 6 years. The CWP will not only function as an alternative source of BMP construction at an accelerated schedule, but will also be a means of introducing private sector technology and innovations into the County's stormwater management program. With the push for innovative technologies, it is anticipated that the CWP will elevate Prince George's County as the **center of excellence** for Green Infrastructure. The CWP will also be a vehicle for promoting job opportunities, and **green jobs** in particular, by employing County-based firms to provide engineering services and supply construction materials for the stormwater retrofit projects. Some significant anticipated advantages of the CWP are listed below.



PERMEABLE PAVEMENT

Lower costs and increased affordability through innovation and standardization

Adopting the CWP will increase the affordability of implementing BMPs by lowering the costs of materials and services. Due to the scale and long-term nature of CWP projects, Corvias can negotiate with contractors to lower the costs of materials and services, resulting in considerable savings for the County. The CWP requires the private partner to promote innovation and improve technology to enhance the pollutant removal efficiencies of the stormwater management retrofits and treat larger impervious areas, which lowers the cost per impervious acre treated.

Streamlining the CWP processes will reduce the cost by at least 30 percent per treated impervious acre. These processes include more efficient construction practices, greater flexibility to improve operational efficiencies based on lessons learned, and reduced resources due to overlapping design and construction schedules of multiple projects. Since the private partner is also responsible for the maintenance of constructed BMPs, the overall lifecycle costs should be considered when selecting BMP designs.

In addition, the County is collaborating with the private partners to use their technological resources to develop a toolbox of BMPs with high pollutant removal rates that can be implemented throughout the County. Creating this toolbox of standard BMP designs will reduce timeframes and costs for planning, design, and permit approval and enable multiple high-performance BMPs to be implemented. With standard BMP designs being used at the County level, the material, design, construction, and maintenance costs are anticipated to go down over the contract period due to economy of scale.

The CWP also requires the development of more efficient construction, maintenance, and program administration practices, which will also drive down the costs. With a high-volume, long-term maintenance program, the maintenance cost per unit will tend to decrease as the number of units to be maintained increases. In addition, the private partners' systems are more efficient than the County's in procuring supplies, construction and maintenance equipment, and services, and the significant cost and time savings are passed on to the County. The County will continue to monitor contractual requirements such as local and small business use.

Streamlined County administration program

With the CWP program, the private partner is responsible for program administration, enforcement, project management, inspection, certification, maintenance, and development of the NPDES MS4 annual report. The traditional County CIP program generally requires separate consultant contracts for each project and for each project phase (e.g., planning, design, construction, and construction inspection). Significant County resources are invested in program administration, procuring the contracts, managing the contracts, and dealing with contractual

County Staffing Resources: Traditional County CIP Program vs. CWP

STAFF RESOURCE	TRADITIONAL CIP PROGRAM		CLEAN WATER PARTNERSHIP	
	# OF STAFF	PURPOSE	# OF STAFF	PURPOSE
Project Manager (PM)	~15	Each County PM oversees several CIP projects	1	One County PM will track the progress of the program
Inspectors	~10	Each inspector is assigned to oversee several tasks on several projects	1	Completion Certifier will be required to inspect and certify the projects
Field Engineers	0	Not proposed	1	Completion Certifier will be required to approve any field modifications to the projects
Professional Service Contracts	13	Traditionally, the County hires consultants to design projects	1	Corvias Prince George's County Stormwater Partners LLC will manage all professional services

issues. In addition, County staff are typically responsible for certification, maintenance, and development of the annual report. With the CWP, the County's administration program is streamlined, and the amount of time and resources spent on contracting and procurement are drastically reduced, as the County has a contract with only one private partner. A comparison of staffing resources is shown on the previous page.

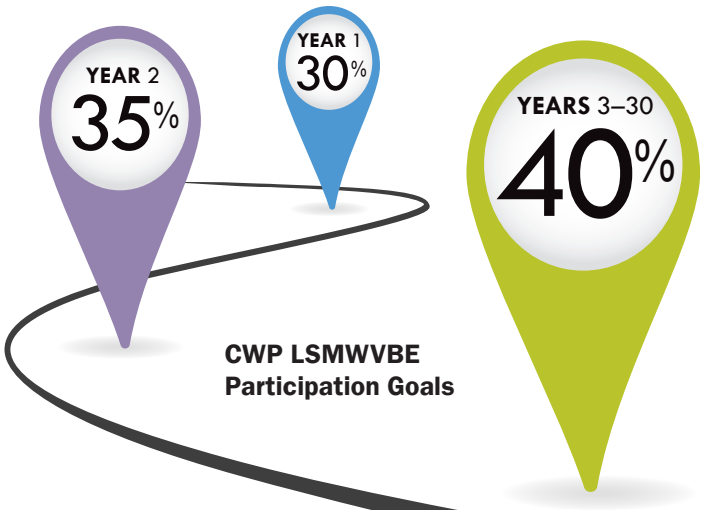
The CWP is streamlined such that the County can be directly involved to provide oversight in all phases of the program without the need for excess staff resources.

Economic development and job creation

The CWP provides an opportunity for local businesses to grow and create new jobs. Once a contractor is a part of the CWP and performs well, it is likely that the contractor would be retained by the private partner for the long term. This will allow the contractor to hire staff, because there will be more certainty about future work and a more continuous cash flow. This was not achieved through the County's traditional approach for bidding separate contracts for each BMP.

MBE/Small Business Outreach and Inclusion Program. Over the first 3 years of the program, approximately 40 County-based Minority Business Enterprises (MBEs) are anticipated to provide services in areas such as design, maintenance, material supply, and construction management, with hundreds more added to the eligibility roster. Through the MPA and MMA requirements of the CWP's MBE/Small Business Outreach and Inclusion Program, Corvias is helping Local, Small, Minority, Women, Veteran and Disadvantaged Business Enterprise (LSMWVBE) businesses obtain County certification so they can have new contract opportunities. The CWP's MPA and MMA are designed to expand the program to ensure that at least 40 percent of the work is subcontracted to the identified 300 County-certified LSMWVBEs.

Jobs First Act. In addition, the CWP anticipates that 51 percent of the labor hours that would be required for the CWP will be contributed by County residents, thereby meeting or exceeding the County's Jobs First Act. Some of the required personnel would include landscape architects, engineers, plumbers, and farmers, among many others.



Installation and Design

- **Landscape Architects**
- **Engineers**
- **Plumbers**
- **Contractors**
- **Construction Workers**
- **Administrative Staff**

Operations and Maintenance

- **Landscapers**
- **Plumbers**
- **Engineers**
- **Inspectors**
- **Contractors**

Supply Chain

- **Nursery and Greenhouse Workers**
- **Farmers**
- **Horticulturalists**
- **Truck Drivers**
- **Stock Clerks**
- **Administrative Staff**

Mentor-Protégé Program. One of the social and economic development program requirements of the CWP is to develop a Mentor-Protégé Program through which Corvias will train and guide the County workforce on business planning, staffing, purchasing, and marketing. The CWP recognizes the importance of participating in local and national organizations to gain recognition. Modules that would be implemented as a part of the Mentor-Protégé Program include:

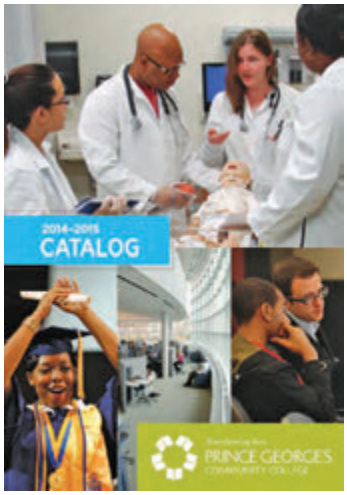
- Recruitment, screening, and referral services
- Job readiness training (e.g., soft skills and life skills training)
- Technical training (e.g., stormwater certificate training) and on-the-job training opportunities

» Supportive services / case management

» Continuing education and retention services

Community outreach and educational advancement

The CWP is developing a wide range of education and outreach programs to inform and engage schools, universities, County residents, community leaders, and other interested parties about different aspects of stormwater management and GI. As a part of CWP requirements, Corvias is required to develop a **Community Outreach Program** to inform the local residents during all phases of design and implementation of the projects in their respective areas. Renderings, animation, and other outreach materials will be developed by Corvias to inform the County residents of projects.



As a part of the **Work Development Program**, the County and Corvias will provide internships, scholarships, and grants and develop educational programs for interested students in the local community college and universities as a part of their career advancement program in the field of stormwater management and GI. Low impact development (LID) and GI will be included as a part of the curriculum in the local schools so that students can become stewards of the environment and learn about careers in the environmental field.

Opportunity for adaptive management and operational flexibility

The CWP's MPA and MMA are set up such that Corvias has flexibility to modify the approach and operations in all phases of project implementation (i.e., design, construction, and maintenance) to improve efficiency, lower implementation costs, and encourage innovation. However, the projects must still meet the County's performance goals. In contrast to the County's traditional contracting program, hundreds of BMPs will be implemented with a schedule lasting at least 3 years, which means Corvias has more flexibility to negotiate contracts with subcontractors and material suppliers to achieve lower costs with an optimized implementation schedule. The CWP is set up such that the County and Corvias can modify the requirements of the CWP without renegotiating the fee or services, as long as it does not disrupt the predefined CWP performance goals and is approved by the County's oversight committee consisting of representatives from various departments in the County.

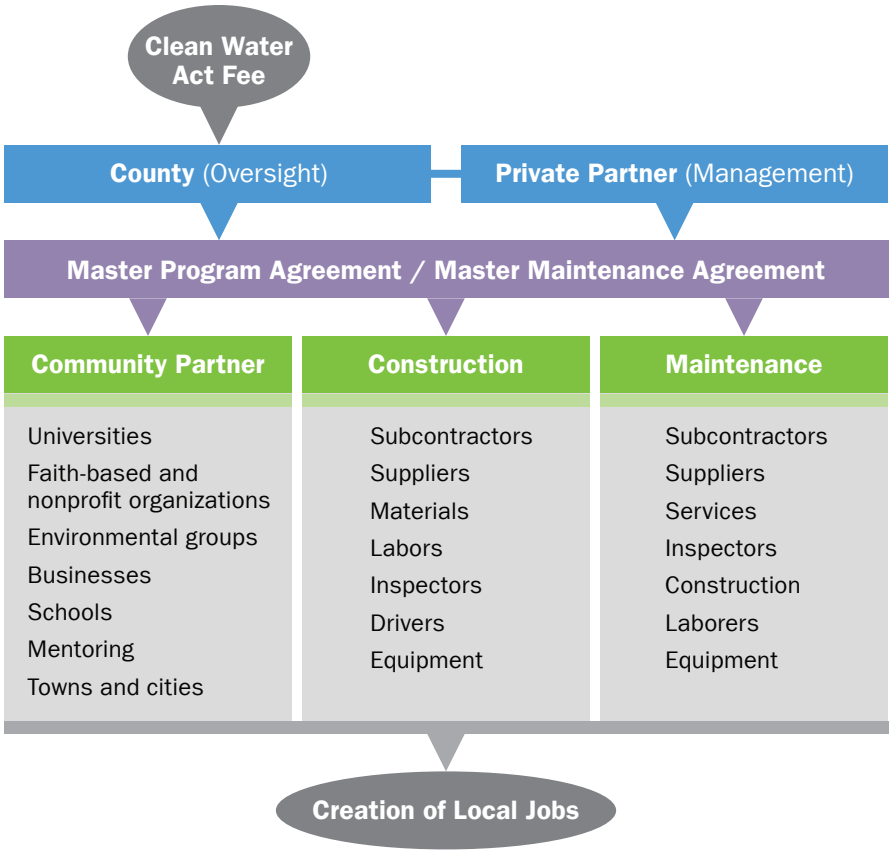
5

CLEAN WATER PARTNERSHIP OPERATIONAL STRUCTURE

Corvias acts as a program manager in partnership with the County through a contractual framework, which is different from the traditional corporate private entity agreement under a design-build-finance-operate-maintain arrangement. With both parties taking part in the administration and decision-making process, program transparency is created. In this scenario, Corvias is responsible for implementing the stormwater management projects/BMPs, and the capital costs for implementing the BMPs are provided by the County through the Clean Water Act Fee.

Other sources of financing, such as bonds, the State Revolving Fund, private financing sources, and grant proceeds, may also be considered by the County in the future. Corvias' revenue will be based on the negotiated performance-based fee, and Corvias will be required to meet all the performance goals set by the County in the MPA and MMA to receive payment. The County will also compensate Corvias with an incentive fee when Corvias meets the incentive fee criteria. The roles of County agencies and Corvias are well defined in CWP documents. Corvias is assigned the role of manager, and the DOE is the lead County agency responsible for the oversight of the CWP program, supported by DPW&T and DPIE. The CWP is upheld by two multi-year agreements: the MPA and the MMA. The MPA has an initial term of 3 years with a goal of retrofitting 2,000 acres of the County's untreated impervious area through implementation of BMPs. At the end of the 3 years, an additional 3 years and 2,000 acres will be added if Corvias achieves the program performance milestones.

The MMA is a 30-year operations and maintenance (O&M) agreement that includes maintenance, inspection, repair, and replacement of the BMPs installed under the MPA. The County has an oversight committee consisting of personnel from various County departments who are responsible for reviewing the incentive fee for Corvias based on the data they are presented. The oversight committee meets every two weeks to review progress of the CWP and all the projects in the pipeline. Prince George's County CWP organization is illustrated in the diagram on the next page.



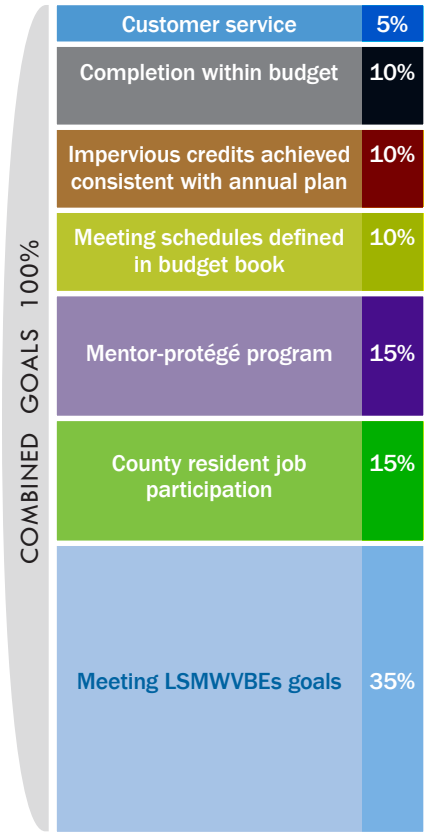
Operational responsibilities of the manager (Corvias)

As the manager, Corvias is responsible for a broad range of goals, illustrated in the figure to the right, set through the MPA and MMA. These are program performance milestone metrics, and if Corvias achieves 75 percent of the performance metrics, the County can retain Corvias for an additional 3 years to retrofit another 2,000 acres of untreated impervious area.

Master Performance Agreement

Under the MPA, Corvias, the program manager, is responsible for the following broad-range activities:

» Assisting the County in establishing CWP program priorities and preparing the "Annual Plan," which will include information for each project recommended to be developed in the next fiscal year. Once the Annual Plan is approved by the County, Corvias is responsible for developing the design and pre-construction phases of the approved projects and is required to develop a Budget Book that includes information on all approved projects.



FAQ

WHAT DOES AN ANNUAL PLAN INCLUDE?

- ✓ The project site
- ✓ Total number of acres to be retrofitted and number of impervious area credits
- ✓ Anticipated construction start date
- ✓ Anticipated acceptance date
- ✓ Estimated project cost
- ✓ Estimated base fee and estimated incentive based on the project cost and maximum design cost

- » Design and construction of stormwater management projects such that each project achieves acceptance. Upon completion of each County-approved project, Corvias is responsible for obtaining an "Impervious Area Credit Certificate" from the Completion Certifier.
- » As a part the MPA, Corvias is responsible for developing and implementing social and economic development programs, which include:
  - – Community Outreach Program: To provide information to, and obtain input from, County residents during all development phases of each approved project.
  - – MBE/Small Business Outreach and Inclusion Program: To increase participation of County LSMWVBEs in all aspects of project development to promote local businesses through training and informative sessions.
  - – Mentor-Protégé Development Program: To train and enhance the skill set of the County workforce such that they have an opportunity to be included in the CWP.
  - – Workforce Development Program: To train students in the local education institutions, including universities, community colleges, and public schools, to promote a future skilled workforce in the County.

CORVIAS SERVES AS THE PROGRAM MANAGER OF THE CWP AND IS ASSISTED BY:

- ✓ General Contractors
- ✓ Design Engineers
- ✓ Maintenance Contractor
- ✓ Completion Certifier

Corvias is also responsible for obtaining all access rights, servitudes, easements, and rights-of-way (ROWs) required for the construction of projects from all types of property owners except the County. As a part of the MPA, Corvias is responsible for contracting subconsultants and engineers required for successful implementation of the projects. For the MPA, Corvias is assisted by a highly qualified group of design engineers, general contractors, and other consultants approved by the County, and the Completion Certifier is responsible for issuing an "Impervious Area Credit Certificate" for the constructed BMPs. In addition, the County and Corvias may also select an independent engineer to review the work of the Completion Certifier as a last step toward the County's acceptance of a BMP project. Corvias is also responsible for conducting monthly meetings to update DOE staff on the status of planned projects.

Master Maintenance Agreement

Under the MMA, Corvias is responsible for the following activities:

- » Preparing a Project Maintenance Plan for the long-term maintenance of the implemented projects. The Budget Book developed under the MPA is also required to include the maintenance plan for every proposed BMP under each project.

» Preparing an Annual O&M Plan for County approval.

» Planning and overseeing the maintenance work performed on the projects. Similar to a property management arrangement, Corvias is not responsible for the actions of the prime maintenance contractor and subcontractors performing the O&M work. A prime maintenance contractor is responsible for performing and subcontracting all O&M work planned by Corvias. Once the scheduled O&M work is completed, the Completion Certifier will take on the role of maintenance monitor and be responsible for inspection and certification of the O&M work.

Operational responsibilities of the County agencies

As mentioned above, DOE is responsible for spearheading the CWP, and DPW&T and DPIE also have prominent roles for a successful CWP program. Responsibilities of each agency are summarized below.

DOE Responsibilities

DOE is responsible for approving the Annual Plan and Budget Book that Corvias will develop under the MPA and the Annual O&M Plan that Corvias will develop under the MMA. DOE has the right to reject any proposed project. The County DOE is responsible for approving compensation upon acceptance of the constructed BMPs and O&M work. Under the MPA, the DOE is required to grant the necessary access rights, servitudes, easements, and ROWs on all properties under the County's authority for no charge. Under the MMA, the DOE is responsible for granting the manager, prime maintenance contractor, and any other subcontractor access rights and right of entry to each project site to perform O&M work. In addition, the DOE is responsible for helping the manager and prime maintenance contractor obtain O&M permits. Through a memorandum of understanding (MOU) with DPIE, DOE will also act as the permitting authority to approve all BMP projects. DOE is currently developing specific instructions that are applicable for permitting BMP projects, which will help streamline the permitting process.

DPW&T Responsibilities

DPW&T typically operates and maintains BMPs constructed in County ROWs. However, through the MMA, Corvias is responsible for maintaining all BMPs constructed by the CWP, including those in the ROW.

Normal operations in the ROW may limit the type of facility that can be constructed there. Therefore, BMPs proposed for placement in County ROWs must be approved by DPW&T. DPW&T will approve the BMP location

FAQ

WHAT DOES AN ANNUAL O&M PLAN INCLUDE?

- ✓ All projects in development phase that would be certified as "Accepted" under the MPA
- ✓ A description of all activities developed as part of the Project Maintenance Plan
- ✓ A routine inspection schedule for each O&M project
- ✓ A list of potential Capital Repair and Replacement projects
- ✓ An implementation plan for Social and Economic Development Program requirements

FAQ

WHAT ARE DOE'S RESPONSIBILITIES IN THE CWP?

- ✓ Manage the partner's (i.e., Corvias') activities
- ✓ Approve the Annual Plan and Budget Book
- ✓ Approve compensation for successful projects
- ✓ Grant access rights, servitudes, easements, and ROWs on all County properties for installing BMPs
- ✓ Providing access rights and right of entry for O&M work
- ✓ Assist with O&M permits
- ✓ Permitting authority

and comment on the design and maintenance limitations of the facility. DPW&T will not conduct detailed review of plans and specifications. Any comments on designs, including BMP project tasks that are outside the limitations set by DPW&T, must be corrected by Corvias prior to initiating construction of the approved BMP.

DPIE Responsibilities

DPIE was created by the County government in 2012 to streamline County operations in the areas of permitting, business licensing, inspections, and property code enforcement. DPIE also has a Peer Review Program that has an option to expedite a permit approval process by selecting a DPIE-registered and -approved peer reviewer. Though DOE reviews and permits all CWP projects under the MOU mentioned above, DPIE will continue to provide guidance to DOE on all permitting aspects as needed.

THE IMPORTANT ROLE OF COUNTY PARTNERS

The CWP is anticipated to meet the bulk of the County's 2025 impervious area treatment goals, and the County acknowledges that collaborating with partners is essential for the program's success. Support from partners is crucial not only for the success of the CWP, but also for the success of the County's expanded CIP program. By partnering with private residents, local businesses, homeowners associations, faith-based institutions, nonprofits, nongovernmental organizations, schools, and towns and cities, the County gains important resources for meeting regulatory goals and continuing to improve the water quality in County streams and the Chesapeake Bay.

CWP Partners

Faith-based institutions

Faith-based institutions such as churches play an important role in communicating the County's clean water vision through their volunteer and outreach programs. Through its Alternative Compliance Program, the County is helping these organizations treat impervious areas on their

Prince George's County
ALTERNATIVE COMPLIANCE PROGRAM

properties by using BMPs such as rain barrels, rain gardens, and tree plantings. Faith-based institutions are also platforms for educating citizens on the importance of healthy streams and holding workshops for building rain barrels. With the help of volunteers, these institutions can encourage County residents to join stream and community cleanup programs, and are helping the County by conducting outreach programs to provide information on the County's Rain Check Rebate Program for which County residents can become eligible by implementing an approved BMP. Many churches have also unified to teach the importance of environmental stewardship by creating a green ministry. The County is promoting the participation of these organizations by reducing their Clean Water Act Fee. In this way, both the County and the faith-based institutions benefit. Incentives depend on the institution's contribution to the program as outlined below.

Incentives for Faith-Based Institutions

PARTICIPATION	INCENTIVE
Allow the County to use ROWs on properties owned by nonprofit and faith-based institutions to install BMPs	The Clean Water Act Fee is reduced by 50 percent
Assist the County with the Rain Check Rebate Program	The Clean Water Act Fee is reduced by 25 percent
Use green lawn companies that use fertilization application techniques that minimize impact to water quality	The Clean Water Act Fee is reduced by 25 percent

Nonprofit and nongovernmental organizations

The County is teaming up with various nonprofit and nongovernmental organizations such as the Anacostia Watershed Society (AWS), the Neighborhood Design Center (NDC), and the Low Impact Development Center (LID Center) by providing them with technical support and resources required to implement BMPs. The County has also partnered with Chesapeake Bay Trust to support the NDC in developing a new pilot program called "Stormwater Savvy," a community design process for stormwater management master planning in the County's neighborhoods. DPW&T collaborated with NDC to design over 85 individual sites for the Clean Up Green Up event in fall 2015, in which volunteers installed beautification projects in:

- schools,
- libraries,

» playgrounds, and
» neighborhoods.

The County has also teamed up with AWS to establish environmental programs. The AWS is an active group that supports Prince George's County environmental programs through public outreach and social media. AWS also conducts watershed stewardship programs such as stream/community cleanup events, native plant restoration projects, invasive species removal, and water pollution monitoring.

Similarly, the County has partnered with the LID Center by providing technical resources and grants to encourage their continued research for the advancement of BMP technology. For example, in 2014 Prince George's County, in partnership with Chesapeake Bay Trust, approved a grant of $55,895 through the Stormwater Stewardship Grant Program to the LID Center to develop a visible demonstration project for the seven stormwater management practices promoted by the County's Rain Check Rebate Program.

These County partnerships with nonprofit and nongovernmental organizations have improved the quality of stormwater conveyed to the County's streams.

Schools

The public school system is an important partner in garnering support for the County's environmental programs. School properties are high-priority project areas for BMP retrofits, as school campuses are often good demonstration sites for BMP projects. The DOE, in partnership with the Board of Education (BOE), has several ongoing environmental programs at school campuses across the County, such as building rain gardens, cisterns, and other small-scale BMPs, where both students and parents can participate and learn about ways to protect natural resources. In addition, the DOE, in collaboration with the BOE, is planning to develop a new program called "Teaching and Treating" focused on educating students about stormwater management and maintenance.

Private residents and local businesses

The County developed a Rebate Program as a part of its Rain Check Program to encourage private residents and business owners to abide by good environmental stewardship principles. The private resident or commercial owner will receive a rebate if he or she installs one of the seven practices promoted by the County's Rain Check Rebate Program.

FAQ

WHAT ARE ELIGIBLE STORMWATER PRACTICES FOR THE RAINCHECK REBATE PROGRAM?

- ✓ Cisterns
- ✓ Green Roofs
- ✓ Pavement Removal
- ✓ Permeable Pavement
- ✓ Rain Barrels
- ✓ Rain Gardens
- ✓ Urban Tree Canopy

More information can be found at: http://www.princegeorgescountymd.gov/sites/StormwaterManagement/Services/RainCheck/Rebates/Pages/EligiblePractices.aspx

The rebate amount varies depending on the type of project. To encourage more participation, the County's website provides guidance documents and fact sheets with information on how to implement these BMPs. In addition, the County also conducts hands-on workshops to train private owners on implementing BMPs.

Homeowners associations

A large percentage of the County's impervious cover is from residential land uses. Often HOAs have open areas where a BMP can be implemented, or they have an existing BMP that can be upgraded to treat more impervious area. Consequently, the majority of projects are planned on HOA-owned properties, and partnering with the HOAs is vital for the CWP.

Towns and cities in the County

There are approximately 27 municipalities in Prince George's County, the most of any other Maryland county. The City of Bowie is currently the only municipality that has its own stormwater management program. As the municipalities move toward implementing BMPs in their jurisdictions, the County is helping them with technical and financial resources for implementing effective stormwater improvements in their jurisdictions. The County conducts grant sessions and workshops to train municipal officials to submit successful grant applications. The County also supports the municipalities by conducting technical training on current BMP technologies.

County workforce

Development of the LSMWVBE workforce, to take on the role as contractor and maintenance personnel, is a high priority in Prince George's County. The County envisions that new workforce members graduating from the County's universities and colleges who focus on environmental programs as a part of their education will promote the green economy and contribute to the success of the CBP3. The County workforce is an important partner, therefore the County created programs such as Prince George's Green to train and grow a robust workforce that can contribute to meeting the goals of the CWP.

Academic research

Research is vital for the advancement of BMP technology to improve performance efficiency. The County is collaborating with academic institutions, such as the University of Maryland (UMD) and Prince George's County Community College, on various research-related activities, such as providing test sites for implementing different kinds of BMP filter media, and enlisting students from these academic institutions for BMP monitoring tasks. In addition, the County plans to develop an environment-focused curriculum and will be training teachers on the importance of stormwater management and natural resource conservation so these subjects can be included as a part of the curriculum at all academic institutions in the County.

UMD's Civil and Environmental Engineering Department is an important partner to the County. The County frequently collaborates with the department and awards grants to further BMP research to achieve higher pollutant removal efficiencies. For example, the County granted Dr. Allen P. Davis, a professor at the university, with a grant worth $632,000 to provide recommendations on the media that could be used in bioretention and sand filter type BMPs for enhanced removal of nitrogen and phosphorus from stormwater runoff. The DOE's office in Upper Marlboro will also be used by UMD as a test site to implement two of the test media, and DOE will be conducting monitoring to test their performance.

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INNOVATION AND COLLABORATION: MORE THAN JUST CLEAN WATER

Prince George's County's CWP is an innovative solution for stormwater management that departs from the traditional CIP program adopted by municipalities nationwide for the implementation of BMPs. Through extensive planning and analyses, and by collaborating with EPA and subject matter experts, the County developed a successful program using a public-private partnership business model whereby they are working to meet environmental requirements of the Chesapeake Bay TMDL and the NPDES MS4 Permit while promoting economic development, improving education opportunities, and restoring and protecting the environment.

This document describes the County's experience in adopting the CWP, with the hopes that it will serve as a stepping stone for other communities considering a CBP3 program—for stormwater improvements or any other purpose. The County's experience can be taken as an example that a CBP3 program can be used to intertwine socioeconomic development with the community's goals for environmental stewardship and well-being.

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