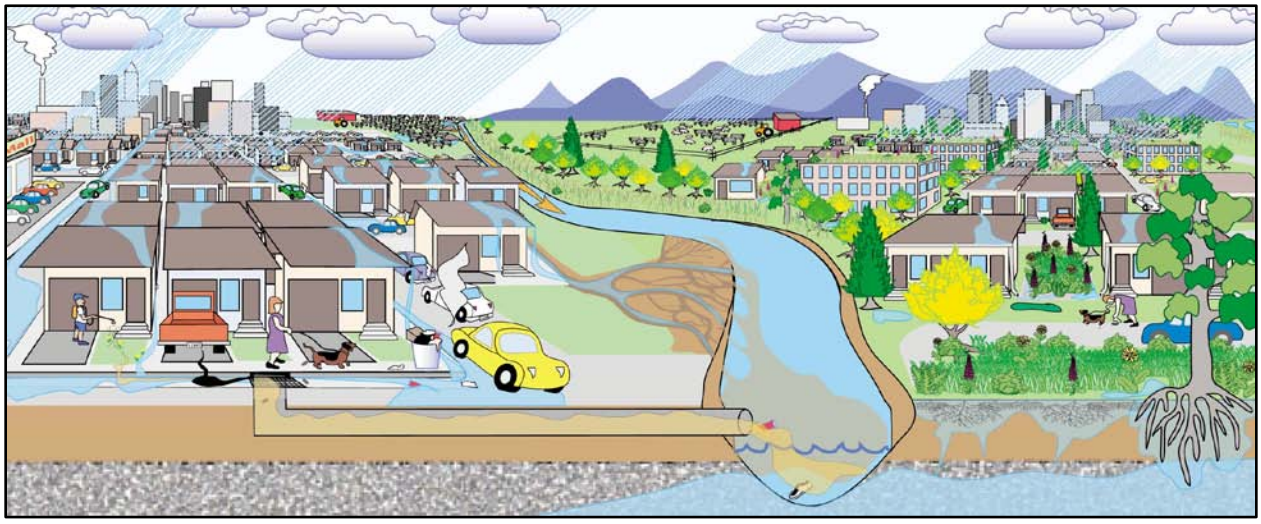
Exemplary Strategies to Protect and Restore Urban Watersheds: Preparing for the Chesapeake Bay TMDL and Watershed Implementation Plans

A Workshop Report from the
Chesapeake Bay Program's
Scientific and Technical Advisory Committee



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About the Scientific and Technical Advisory Committee

The Scientific and Technical Advisory Committee (STAC) provides scientific and technical guidance to the Chesapeake Bay Program (CBP) on measures to restore and protect the Chesapeake Bay. Since its creation in December 1984, STAC has worked to enhance scientific communication and outreach throughout the Chesapeake Bay Watershed and beyond. STAC provides scientific and technical advice in various ways, including (1) technical reports and papers, (2) discussion groups, (3) assistance in organizing merit reviews of CBP programs and projects, (4) technical workshops, and (5) interaction between STAC members and the CBP. Through professional and academic contacts and organizational networks of its members, STAC ensures close cooperation among and between the various research institutions and management agencies represented in the Watershed. For additional information about STAC, please visit the STAC website at www.chesapeake.org/stac.

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Executive Summary

Introduction

This workshop grew out of discussions between the Bay Program's Local Government Advisory Committee (LGAC) and STAC to explore ways in which the two committees could collaborate. LGAC represents the priorities of local governments in the Chesapeake Bay watershed and STAC provides in-depth scientific and technical support to the Bay Program, often in the form of workshops.

LGAC has identified stormwater management as one of its key priorities. The regulatory climate in the Bay watershed is rapidly changing, with Bay Total Maximum Daily Loads (TMDLs), Watershed Implementation Plans (WIPs), Two-Year Milestones and related Municipally Separate Storm Sewer System (MS4) permits leading to profound changes in local stormwater programs. Accordingly, it was decided to conduct a workshop providing for an exchange of program and policy information among local governments and other stakeholders.

The main purpose was to introduce participants to: the Bay-driven regulatory climate and its potential effects on urban stormwater programs; several exemplary local stormwater programs; and several "state of the science" presentations. The afternoon was designed to enable a more in-depth discussion of participants' key concerns. It was also felt that this workshop could point the way to future joint, collaborative workshops.

This summary of the workshop presents the highlights of the individual presentations including why they were selected to be in the workshop and suggests future topics that may be of interest based on those presentations. It also provides a summary of the afternoon session which was an integral part of the workshop.

Focus for the Case Study Presentations

Prior to the workshop a set of questions was compiled to help provide focus to each of the presenters. Divided into four broad categories, these are the type of concerns that stormwater program managers confront as they prepare for the future. As there was not time to cover each of these in depth, each presenter was asked to supplement their presentation with a handout providing additional information. The following is the guidance provided to the presenters:

Part 1 – Program History, Focus and Structure

i. Please provide an overview of the history of your program, and organizationally how it functions within your current government/utility organization.
ii. What geographical and watershed boundaries does your program cover?
iii. Please provide a summary of what the goals of your program are (i.e., flood protection, water quality, etc.).

Part 2 – Working with State Laws and Regulations

iv. How much authority do you have to create your own local government stormwater management programs?
v. Do you have to go to the State government for permission to create your own programs? It would be helpful to understand the varying legal authorities that exist among states, and among local governments within states. (E.g. multiple units of local government in PA)
vi. Do you have any suggestions as to how to coordinate local government programs with state stormwater management requirements?
vii. What is your viewpoint with respect to potential Bay wide nutrient TMDL implementation?
viii. What has been your experience with local (non Bay) TMDL implementation?

Part 3 – Program Management and Funding

ix. What is the size of your program in terms of staff (Full time equivalents), capital expenditures, O&M expenditures, etc.?
x. How is the program funded (please be specific if there are a variety of revenue sources).
xi. A current focus of many of the urban stormwater programs is the extent of Low Impact Development (LID) retrofits. These are expensive, but provide real reductions in loading to the Bay. Can you provide an estimate of what your current and planned retrofit activities are, in terms of % of the area under your jurisdiction?
xii. What are the current critical needs that your program has to 1) survive, and 2) thrive?
xiii. Where do you see the program going in the next 10 years?

Part 4 – The Role of Local Elected Officials and the Public

xiv. How important is the local political climate in trying to establish innovative and effective programs?

xv. What role should local elected officials play in implementing new requirements or new programs?
xvi. What are the most significant barriers to overcome in order to get public acceptance for strong and innovative stormwater management programs?

Conclusions and Recommendations

The following topics emerged as potential subjects for future STAC-LGAC workshops:

- The connections between The Bay TMDL, Local TMDLs, the Phase II Watershed Implementation Plans, MS4 Permits and Local Watershed Plans.
- Using Side-by-Side Monitoring to Examine the Effectiveness of Retrofitting LID and Environmental Site Design (ESD) in Ultra-Urban Areas.
- Ongoing Operation and Maintenance Requirements and Costs for LID & ESD.
- The Economics of Stormwater Management: Pay-as-you-go (Paygo) vs. Bonding; Allocating Costs; Retrofit Costs.
- Can Stormwater Management Achieve and Maintain Water Quality Standards?
- Developing, Funding and Implementing Watershed Protection in a Suburban Setting.
- Using Watershed Models to Equitably Determine Wasteload Allocations (WLAs) for MS4 Jurisdictions.
- Designing a Stormwater Monitoring Program for Local Governments.
- Stormwater Monitoring as a Component of Adaptive Management.
- What are the Non-water Quality Benefits of Implementing ESD/LID Technology?
- Making the Watershed Models User Friendly and User Accessible.

Part 1 – Presentation Summaries

Chesapeake Bay TMDL and What it Means for Stormwater

Katherine Antos, Coordinator, Water Quality Team
U.S. Environmental Protection Agency (EPA) Chesapeake Bay Program Office (CBPO)

Purpose of the Presentation: This presentation was included in the workshop because the Bay TMDL will have a far-reaching impact on all permitted entities, including urban stormwater programs with MS4 permits.

Summary: Ms. Antos covered the focus and schedule for the TMDL; and the related WIPs which will serve as the "Reasonable Assurance" that the TMDL will, in fact, be implemented; and the Two-Year Milestones that are to add a measure of accountability to implementation. The overall timeframe calls for completion of all actions necessary to meet water quality standards by 2025.

EPA is responsible for the development of the Bay TMDL which will, in fact, be a collection of TMDLs for each of 92 impaired tidal segments throughout the Bay and its tidal tributaries. Separate TMDLs will be prepared for total nitrogen, total phosphorus and total suspended sediment. EPA is committed to completing the TMDL by December 2010.

The WIPs are the responsibility of the states to prepare and will be done in three stages. The Phase I WIPs are to be completed by November 29, 2010. They will guide implementation at a relatively large scale, i.e., the intersection of states and major tributaries. The Phase II WIPs are to be completed by November 1, 2011 and will address implementation at a much finer scale, generally at the county level. They will address the implementation steps necessary to reach 60% of load reductions by 2017. The Phase III WIPs will be prepared in 2017 and will address how to achieve the remaining 40% load reduction by 2025.

The important thing for urban stormwater programs to consider is that MS4 permits, for the most part, are part of the Wasteload Allocation (WLA) of the TMDL and the requisite load reductions will be reflected in the relevant MS4 permit. Thus MS4 program managers can expect their regulatory requirements to become increasingly prescriptive in future permitting cycles.

Further Consideration:

- The connection between the Bay TMDL, WIPs, MS4 permits and local watershed plans.

Case Study #1 – Ultra-Urban Retrofits in Baltimore City

William P. Stack
Center for Watershed Protection (Formerly with Baltimore City)

Purpose of the Presentation: The case study format was chosen so that the participants could interact with their peers – managers from other local governments who have stormwater program responsibility. The four case studies all are "mature," well-respected programs. Baltimore City was selected because it's a very highly urbanized city where improvements on stormwater controls depend heavily on retrofitting existing impervious surfaces in a densely developed area.

Summary: Bill Stack posed the question: "How do we develop a watershed restoration plan with active community leadership for an area of enclosed streams where the environmental quality and social fabric of the watershed are both impaired." He provided an in-depth

presentation of a project that retrofit a small sub-catchment area in Baltimore, called Watershed 263. Watershed 263: covers 935 acres; is home to 21,000 people, mostly minorities; is entirely urbanized with 75% imperviousness and 5.5% tree canopy; and has over 2000 vacant lots. The key pollutants are nitrogen, phosphorus and sediment and there is also a downstream impairment for PCBs and Zinc.

The city's approach is to develop a plan that integrates both community quality of life and environmental restoration goals. They evaluated thirteen distinct BMP practices including regional facilities (e.g., extended detention wetlands), non-structural practices (e.g., street sweeping) and small scale practices (e.g., rain gardens and sidewalk bioretention. For each of these they determined the total "quality of life benefits" with street sweeping rated 7 and corner bioretention rated 14. They also assigned "water quality benefits" for each, determined a cost per impervious acre and finally a "cost per benefit point." This enabled them to rank the practices. Infiltration Basins scored the best at $255 per benefit point; Sidewalk bioretention ranked last at $6,340 per benefit point.

Watershed 936 was further broken down into 36 sub-catchment areas with plans to pair two of them with comparable size, about 39 acres. One, Pilot Area F, was retrofitted with a suite of projects and both are to be intensely monitored. Project selection was influenced by the presence of trees, utilities, very compacted soils and space considerations. 35 sites were investigated in detail and the list of potential BMP sites was trimmed to about 5, including bioretention, a tree box inlet with curb extension and bioretention, and a Filterra unit and impervious cover removal. The plans were approved in November 2008. Six projects were built, controlling 4.3 acres at a total construction cost of $317,103.

Baltimore's experience to date provides good cost information for ultra-urban retrofitting for stormwater controls. The data they are collecting comparing the two sub watersheds will be invaluable for future ultra-urban stormwater retrofit planning.

Further Consideration:

- The results of the side-by side monitoring.
- Ongoing maintenance requirements and costs.

Case Study #2 – Montgomery County Stormwater Program

Steve Shofar, Chief, Watershed Management Division
Department of Environmental Protection
Montgomery County, Maryland

Purpose of the Presentation: Montgomery County has one of the most advanced stormwater programs in Maryland.

Summary: Mr. Shofar provided a comprehensive overview of Montgomery County's stormwater program, its history, its regulatory framework, its structure and management and the role of elected officials and the public within the Department of Environmental Protection (DEP). The scope of DEP's responsibilities includes Planning and Monitoring; Facility Inspection and Maintenance and the Capital Improvements Program for stormwater retrofits and stream restoration. DEP's responsibilities do <u>not</u> include the stormwater plan review and sediment control which are the responsibility of the Department of permitting Services. These are not addressed in the presentation.

An overarching goal of Montgomery County's program is to improve all watersheds in the county to good biological condition and reducing pollutant loadings to meet TMDLs. The program's history is marked by several key milestones:

- The first retrofit project in 1989;
- Receipt of the first MS-4 permit in 1996; and introduction of the Water Quality Protection Charge (WPCP) in 2002 to fund stormwater facility inspection and maintenance.

The county's most recent MS4 permit was issued in February 2010. Among its provisions it calls for retrofitting 20% of the impervious acres not treated to the "maximum extent practicable," i.e., areas built before 1986. It also requires developing TMDL implementation plans for all approved TMDLs and to show progress toward meeting those TMDLs. It also has a provision so that the county demonstrates its commitment to the Potomac Trash Treaty which calls for a "Trash-Free Potomac River" by 2013.

In round numbers, Montgomery has a population of nearly 1 million and it covers about 500 square miles. In FY 2011, the stormwater program has 38 positions, a capital budget of $8.8 million covered by bonds with debt service covered by the WPCP. The operating budget for FY 2011 is $10.4 million, paid for by the WPCP.

The WPCP is a key component of the county's program. It is an excise tax included with the annual property tax bill and is based on impervious surface. For FY 2011, the charge is $49 per "equivalent resident unit." Originally intended to cover inspection and maintenance, it has been expanded to cover all the county's water quality programs.

Further Consideration:

- Economics of stormwater management: Paygo vs. bonding; allocating costs; retrofit costs.
- Prospects of achieving water quality standards.

Case Study #3 – Stormwater Management Program

Fred Rose, Department of Public Works and Environmental Services
Fairfax County, Virginia

Purpose of the Presentation: Fairfax County has one of the most advanced stormwater programs in Virginia.

Summary: Fairfax County, Virginia covers 400 square miles and has a population in excess of 1 million people. Over the years Fairfax County has had to address just about any urban stormwater issue that a suburban jurisdiction is likely to face. Mr. Rose presented a comprehensive view of both management issues – history, organizational structure and funding – and technical issues – aging infrastructure, coping with imperviousness, redevelopment, stream conditions, deficient riparian buffers – and how Fairfax County is addressing each.

Major milestones since then include: 1970s - requirements for onsite detention; 1980s - water quality BMPs in areas draining to the water supply reservoir; 1990s – BMPs required for all new development throughout the county; 2000s – preparation of the Stream protection Strategy and focusing on stormwater management at a watershed scale. The evolution of the County's program has come at a price - since FY 2006, the county's stormwater program has had an annual average cost of $30 million. The lion's share has gone to Operations (36%), project

Implementation (22%), and Infrastructure Reinvestment (18%). The balance has gone to Regulatory Compliance (9%), Dam safety (8%) and Watershed Planning (7%).

Fairfax County has segregated and quantified a range of stormwater related issues. These include:

1. Existing imperviousness (some areas exceed 40%);
2. Stormwater infrastructure age (more than 50 years old in some areas);
3. Watersheds with "deficient" riparian buffers (more than 54% in some areas);
4. Controlling stormwater in areas where major redevelopment is anticipated (In Tysons Corner commercial development will double from 46 to 84 million square feet);
5. Assessment of stream conditions;
6. Inventorying the stormwater infrastructure (including 3,300 private stormwater management facilities); and
7. Inventory of impaired streams (Including bacteria and sediment).

They have structured their overall program to address these issues coupled with key regulatory requirements:

1. A non-traditional "flow" TMDL where flow is being used as a surrogate for sediment;
2. A new MS4 permit, with anticipated significant changes for new and redevelopment plus requirements from the Bay TMDL; and new
3. State and federal stormwater regulations.

The scope of the Fairfax County stormwater program offers a lot for others to learn from. In response to the above topics, the county has undertaken:

1. An expanded maintenance and operations effort (including inspection of 18% of the privately maintained stormwater facilities in 2009);
2. Infrastructure reinvestment
3. Flood mitigation;
4. Continued implementation of its Watershed Management Program (where chemical and biological conditions, human health and safety and protection of property all play a part);

Mr. Rose cited a variety of planning results, public outreach efforts and the value of the application of new technology, from bioretention to green roofs. One green roof retention system project on a county-owned office facility retained 38% of the incident rainfall.

Further Consideration:

- Fairfax County's approach to local watershed planning.
- Measuring after-the-fact effectiveness of ESD/LID technology.

Science Topic #1 – Climate and Stormwater: Targets. Systems, Scenarios

Chris Pyke, Ph.D., Director of Research
U.S. Green Building Council

Purpose of the Presentation: Climate change is likely to have a range of important consequences for the protection and restoration of the Chesapeake Bay. This presentation described some of the consequences of climate change for the Chesapeake Bay with an emphasis on implications for the design and operation of stormwater infrastructure.

Summary: Some consider climate change a distant threat to the Bay watershed. However, stormwater infrastructure is designed to perform for decades into the future based on explicit assumptions regarding climatic conditions. Designs presume that historic conditions are a reliable guide to the future. Yet, the best available science suggests that rising sea level, warming temperatures, and changing precipitation patterns are more likely than a repeat of conditions observed over the last century. In this presentation, Dr. Pyke identified three elements to begin to identify stormwater-related decisions that might be sensitive to changing climatic conditions. The framework presented included (1) management objectives and thresholds, (2) climate scenarios, and (3) system sensitivity.

The first element, goals and management objectives, was hypothesized to be the most important. Management objectives (e.g., requirements for a certain number of sewer overflow events) or physical thresholds (e.g., material strength) set the foundation for climate vulnerability. These goals define the preferred state of the system. In the absence of these goals, it is impossible to assess vulnerability or the need for adaptation. The second element, climate scenarios, reflects the range of plausible conditions across the anticipated performance lifetime of the measure under consideration. This is particularly acute for stormwater infrastructure, where expectations are often for infrastructure to function essentially indefinitely. This means that today's decisions are expected to perform for decades into the future. Non-stationary climatic conditions require anticipating future climates during this period. Third, system sensitivity, reflects the response of a natural or engineered system to the anticipate range of future conditions. Some systems will demonstrate little or no performance degradation across the range of future conditions (e.g., many treatment processes. Other systems will exhibit strong, non-linear degradation (e.g., combined sewer systems to increasing precipitation intensity). These three factors (goals, scenarios, and system sensitivities) can be used together to identify and prioritize climatic vulnerabilities and adaptive opportunities. Climatic vulnerabilities are situations where systems could potentially be degraded to the degree that they cross key management goals. Adaptive opportunities present the chance to manipulate goals or evaluate system sensitivity to increase the likelihood of achieving performance objectives across the full range of future conditions.

These considerations may be new to stormwater professionals, but they not outside the range of current skills and technical capabilities. Fundamentally, they require realistically anticipating the range of conditions possible for the performance period of any give measure and taking action to design and operate resilient systems.

Further Consideration:
A Method to Assess Climate-Relevant Decisions: Application in the Chesapeake Bay (External Review Draft) Global Change Research Program, National Center for Environmental Assessment, US EPA. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=227483

Adapting to Climate Change through Neighborhood Design. CTG Energetics, Inc. White Paper http://www.ctg-net.com/content/upload/publications/3/pyke%20etal%20adapting%20to%20climate%20change%20051807.pdf

Science Topic #2 – Modeling the Urban Stormwater (and the Rest of the Watershed)
Katherine Antos, Coordinator, Water Quality Team
U.S. EPA Chesapeake Bay Program Office

Purpose of the Presentation: There are 92 impaired segments of the Chesapeake Bay and its tidal tributaries. Thus the "Bay TMDL" will actually consist of 92 distinct TMDLs for phosphorus, nitrogen and sediment. The development of load allocations and wasteload allocations throughout the 64,000 square mile watershed is accomplished by the application of the Bay Program's Watershed Model. As MS4 stormwater programs are subject to WLAs, it is incumbent on MS4 managers to understand the basis for such allocations and their use in the development of MS4 permit conditions.

Summary: Ms. Antos provided an overview of the development and application of the Bay Program's watershed Model (WSM). The Phase 5 version consists of 308 land segments and 1,063 river segments covering the 64,000 square mile Bay watershed. It uses 25 distinct land uses and simulates 20 years of rainfall.

She summarized how the WSM works with hourly inputs related to weather (e.g., rainfall and cloud cover) and annual or monthly inputs related to land use and loading information such as fertilizer and point sources. The hourly output is summed over 10 years of hydrology resulting in annual average flow-adjusted loads.

The important urban land use categories of concern to urban stormwater programs are: high density pervious; high density impervious; low density pervious and low density impervious. There are a suite of approved BMPs (e.g., wet ponds and wetlands and infiltration practices) that are part of the input mix with load reduction efficiencies. The resulting simulated loads provide the starting point for disaggregating loads and determining the implementation strategies with their associated level of BMP implementation throughout the watershed necessary to achieve water quality standards. Whether or not water quality standards are met is determined in "modeling world" by using WSM load outputs as inputs to the Bay Program's water quality model.

Further Consideration:
- The link between WSM WLAs and MS4 permit requirements.

Science Topic #3 – The Value of Monitoring in Stormwater Management

David Sample, Assistant Professor
Virginia Tech Biological Systems Engineering
Occoquan Watershed Monitoring Laboratory

Purpose of the Presentation: This presentation, which was perhaps the most technical of the presentations, included a review of stormwater quantity and quality issues from urban development, stormwater monitoring, watershed monitoring, stormwater Best Management Practice (BMP) treatment functions, BMP performance monitoring, traditional BMP performance monitoring, Low Impact Development (LID) and ultra urban BMP performance monitoring, and a summary on the value of monitoring in stormwater management.

Summary: Dr. Sample presented a short summary of stormwater quantity and quality impacts from urban development. This begins with the generation of impervious cover and results in large increases in runoff peak and volume, and decreases in base flow (Potomac Conservancy 2008). Negative impacts occur immediately downstream as streams seek to accommodate a new balance in energy and flows (Metropolitan North Georgia Water Planning District 2003).

Next, Dr. Sample covered the state of the science in stormwater sampling, and the use of terms to describe the washoff of pollutants from the land during storm events, which is often described as a load (mass/volume multiplied by flow, or mass per unit time), or load per unit area (mass/area/time), or Event Mean Concentration (EMC) expressed as a concentration (mass/time) averaged over the hydrograph (Grizzard 2010a). The best methods of programming automatic samplers to collect composite samples were described. Flow measurement is correctly measured using primary hydraulic control such as flumes and weirs; of these, flumes are more robust in operation (Davis 2005). Different stream and conveyance geometry must be evaluated, considering the velocity distribution, so that the dominant flow path is used for sample collection (Grizzard 2010b). Since stormwater transports solids that also associate with pollutants, the sediment fraction and particle size distribution (PSD) should be assessed with any sampling program. The analysis of phosphorus is particularly challenging, the dissociation of phosphorus into multiple species was described and the laboratory measurement technique was provided.

A review of some contemporary watershed monitoring programs was provided. First, the Occoquan watershed monitoring program in Northern Virginia was described. This program, which covers 12 monitoring stations over the 570 mi^2 (1,477 km^2) watershed upstream of Occoquan Dam has been in existence for over 35 years. A summary of the sources and generation of loads from 1983 to 2008 was presented. Two other watershed monitoring programs near the mid Atlantic region include the Long Term Ecological Site (LTER) programs in Baltimore, MD and Plum Island, MA. The Baltimore LTER monitors base flows from a wide range of urban and suburban watersheds ranging in size from 7.8 to 16,278 ha (19.2 to 40,200 ac), with impervious coverage ranging from 1% to 41%. The Plum Island site monitors watersheds from 60 to 420 ha (148-1,037 ac) across a range of urban development, with impervious of 1.3-28.6%. USGS monitors streams across the nation, but has developed a specific program to assist Fairfax County in assessing the effectiveness of their stormwater management program, typical sizes are on the order of a few square miles. Lastly, the collection of data associated with the National Urban Runoff Program (NURP) was described. This data, now about 30 years old, is still the most comprehensive data on urban runoff water quality; several examples in Virginia and Maryland were presented.
Dr. Sample described various techniques in monitoring BMPs and LID, both individually and collectively within a watershed. We use this data in a variety of means. These include: 1)

Assessing individual BMP performance, 2) Assessing implementation across a watershed, 3) Assessing particular new technologies, such as Manufactured BMPs, and 4) Using data to calibrate watershed models. For the 3rd item, there exists a critical need for monitoring protocols to verify manufacturer's claims. It is critical that this protocol be able to provide for assurance of water quality at a minimum of cost, balancing innovation and investment risk so that all stakeholders benefit (Sample et al. 2010). A Venn diagram was presented with the competing objectives, later used by D. Vizzini. For the 4th item, we are extending the performance predictions provided by the monitoring data with the water quality model, thus leveraging the model.

A summary of the current conditions of watershed improvement was provided. Local governments focus upon implementation with their limited funds, in a process that starts with assessment, then planning, leading to design and construction. Local governments in the Bay region have made substantial investments in planning and implementation. State agencies focus upon implementation with their limited funds. Federal agencies, through their grant programs, also focus upon implementation. None of these programs explicitly includes monitoring, which is essential for adaptive management in support of design, a potential model of how this can work was presented. Monitoring of processes and performance is essential to improving designs. However, it is often ignored or unfunded. Also, we often leave out the other side of the cost effectiveness relationship: capital and operation and maintenance costs, which are essential to measurements of progress.

In summary, Dr. Sample stated that in the era of limited funds we must target our monitoring resources. The intent of the presentation was to demonstrate the wide applicability and value of monitoring programs. Selective monitoring is essential to improving BMP design. It is clear that insufficient resources are currently dedicated to monitoring our designs and watersheds; this data is essential to mark progress and improve our designs, assess progress on implementation, and calibrate models.

Further Consideration:

- Designing a stormwater monitoring program for local governments.
- Stormwater monitoring as a component of adaptive management.

Case Study #4 – Restoring Watershed Health – Integrating Stormwater Management and Watershed Restoration in Portland Oregon

Dan Vizzini
Bureau of Environmental Services
City of Portland, Oregon

Purpose of the Presentation: Portland, Oregon has a well-deserved reputation as one of the nation's leaders in innovative stormwater management. This is an opportunity for practitioners in the Chesapeake Bay region to hear firsthand the nature and scope of Portland's program.

Summary: Mr. Vizzini provided a comprehensive look at Portland's approach to restoring watershed health by addressing "Integrating TMDLs, Stormwater Management and Watershed restoration." He provided an orientation to Portland which, today, covers 145 square miles and has a population of 576,000 residents. It lies at the confluence of the Columbia and Willamette Rivers. The Bureau of Environmental Services has 547 employees and operates under a "Sustainability" philosophy that combines Environmental, Social and Economic benefits.

In FY 2009-2010 the Bureau budget was $572 million, of which $239 million was for capital outlays and $150 million for operations. The Stormwater utility budget was $81 million: 39% for capital and debt service; 21% for O&M, 18% for watersheds, 11% for Indirect and Overhead, 8% for Regulation and 3% for Engineering. User Fees accounted for 85% of the utility's revenues. The typical Portland household paid $19.80 per month in FY 2009-2010, reflecting an 11% annual average increase since 1977-1978.

The roots of Portland's environmental degradation date to the decision in 1888 to build a combined sewer system. The first wastewater treatment plant did not go on line until 1955, long after the Willamette River was declared an "open sewer." The list of environmental imperatives is long, including:

- Infrastructure Maintenance and Reliability
- CSO controls and management of sewer system capacity
- Water Quality Improvements driven by MS4 permits
- Groundwater protection
- Portland Harbor Clean Up
- River and stream restoration
- Endangered Species restoration
- Wastewater treatment improvements, including those in wet weather

The city's philosophy of sustainability focusing on watershed management is reflected in the MS4 Stormwater management Plan the elements of which include:

- Public Involvement
- O&M
- Industrial and Commercial Runoff Controls
- Illicit Discharge Controls
- New development Standards
- Structural Controls
- Natural Systems
- Environmental and Program Monitoring and
- Program management

The responsibilities for each of these are spread over seven separate agencies.

Mr. Vizzini cited numerous examples where Portland is making multi-purpose improvements, some large and some small, to address TMDLs while advancing watershed goals. For example in the Willamette River thee city is both completing a 20-year, $1.4 billion "Big Pipe" project to control CSOs and also building a green street facility and wetland at the headwaters of one of its tributaries Its approach to sustainable stormwater management incorporates the following principles:

1. Manage runoff as close as possible to its source
2. Mimic natural hydrologic functions.
3. Integrate runoff into the built environment
4. Design for multiple and sustainable benefits
5. Act early to avoid costly mitigation and restoration

He concluded his presentation with numerous examples where these principles have been applied to specific projects

Further Consideration:

- Watershed planning and watershed management.
- TMDLs as a watershed management driver.
- The costs and benefits of green technologies.
- The limits of ESD in controlling stormwater in CSO areas.

Part 2 – Open Discussion

The open discussion was moderated by Penny Gross who is a member of the Fairfax County, Virginia Board of Supervisors and is a member of LGAC. The individual presenters comprised the panel.

Purpose of this Portion: During the earlier presentations the attendees were invited to submit questions for consideration by the presenters in a panel format in the afternoon. These reflect many of the concerns that LGAC's members and other local government staff have regarding the future of their stormwater programs. The highlights of the Q&A session follows.

Question - How is the maintenance of LID devices addressed? Do property owners have the primary responsibility for maintenance of LID devices on their property or, does the county do the maintenance and charge the property owners?

Response: None of the three local jurisdictions has a complete answer to that question. Montgomery County feels it's important to differentiate between structural and non-structural BMPs. The county expects property owners to maintain raingardens. The county is required to inspect non structural facilities and is still assessing whether to do a sample or inspect all of them. In Fairfax County there is not a lot of LID on private property, but the few that are there must have a private maintenance agreement. In the city of Baltimore, maintenance is a huge issue not just for LID, but in general for the under- funded water and/or storm water systems. Every week there seems to be another street collapse attributable to a storm drain that's failed. Maintenance is a big factor to implement a storm water utility.

Ms. Gross noted that elected officials have to deal with budgets and the budgetary implications of implementing LID. The Northern Virginia Soil & Water Conservation District reviewed about 20 LID practices put out in the last five-years and found a disturbingly high rate of failure or degradation. Maintaining LID on private property is a serious issue that is still unresolved.

Question - Are there opportunities or barriers for statewide or region-wide funding sources for stormwater?

Response: There is federal legislation being considered for reauthorizing the Chesapeake Bay program. It includes authorization (but not appropriation) for stormwater grants. There are modest opportunities for some funding support through the Chesapeake Bay Implementation Grants. The WIPs should provide good information regarding the scale of the stormwater funding required to meet the Bay TMDL requirements. This, in turn, can help inform a strategy to address funding.

Question - (Note that the question prefaced by a comment thanking Bill Stack for making the connection between water quality and quality of life.) Please elaborate on:

- The effects of ESD (Environmental Site Design) on property values;
- Whether ESD helps reduce stormwater retrofit costs;
- The socio economic component of "ultra urban;"
- What environmental result has the Baltimore project realized;
- What kind of maintenance is required for the Baltimore installation; and
- Who is doing this project?

Response: Bill Stack responded that the Watershed 263 project in Baltimore city was all about trying to increase the quality of life by restoring some natural ecological system that would double the benefit for reaching the storm water management mandates as well. If you walk down some of the streets that we have greened, it's rather transforming: a lot of these streets, have been and remain blighted, but there is an oasis in the middle.

More evidence is needed assess the "triple bottom line" or the full societal benefits of the green infrastructure. In cities like Portland and Philadelphia the driver of reducing the storm water into the combined sewer system helps increase the benefit of LID. Increased economic development is also a potential benefit.

Baltimore has not fully come to grips with the maintenance issues. The city council in looking at the options of meeting environmental mandates picked these LID green infrastructures practices over the more conventional practices in part because they like the look of the LID projects.

In Portland there was a study done on trees and green facilities and property values. Baltimore has done survey work on people's sense of place and quality of life issues with the projects that we are doing that is available. In general, there are very positive responses because it softens the urban landscape

Related Comment from the Audience (Professor of biochemistry at Norfolk State University in Virginia): Improving quality of life in the urban community affords an opportunity to reach out to HBCU's (Historically Black Colleges and Universities) where there is a real interest in the kind of project described in Baltimore. Norfolk State is in an urban environment where water, especially stormwater is an issue. In Norfolk, When it rains it is like a flood. One of the things we discovered in the aftermath of Katrina in New Orleans was that the head of public health there decided to take a green approach to redoing the city. Students from Norfolk State did an urban renewal project with them. Among other things, there was s strong interest in such greening among older people, who historically have not been a part of the stakeholders

This type of project could benefit from partnerships with those in the academic community (e.g., Morgan State and Johns Hopkins in the Baltimore area) with an interest in quality of life including public health and public safety. In New Orleans, they showed when they increased the public green space, that crime went down significantly that's been published.

Question - Does anyone have a "Chesapeake Bay for Idiots?" We at the local level need materials to discuss with constituents. A comprehensible and sensible guide would be a big help.

Response: Ms. Gross noted that this is a question that might be best addressed by the Citizens Advisory Committee (CAC) because it is a suggestion for additional information easily accessible to the public. Ms. Antos noted that there are various online resources that have a wealth of information including the Chesapeake Bay program website and EPA's Chesapeake Bay TMDL website.

It was also noted that there is the need for a guide on how to engage. The message will change depending on where you are and the local conditions that. It's often hard to talk to about the Chesapeake to those more interested in the trout stream in their backyard. This would be an interesting topic for CAC to look at.

Question - In 3 weeks Executive Council will meet. Are there 2 or 3 storm water recommendations that might be made to them?

Dr. Sample pointed out the need for more monitoring resources.

Question – (From a research scientist standpoint). In focusing most of our attention on nitrogen, phosphorus and sediment, we fail to look at the part of this system affected by thrown away medicines; nano particles; heavy metals attributable to cleaning of ship holds; and other pollutants that will not go away? When do we start talking about these things? When will it be a part of the conversation?

Response: It's a very big challenge that we are dealing with. Toxics and toxic strategies were a part of the Chesapeake 2000 Agreement. There is a need to move this up on the priority list.

Question (Access to the Bay program's Modeling Tools) - Is the scenario builder available? Is the scenario builder available as a module which can be used or integrated into a course such as intro to ecology or botany? Can the scenario builder be used to explore changes to get a climate change impact, and increases in temperature and seasonal rainfall in its scenario runs?

Response: The Watershed Model is not user accessible. Within the coming year EPA envisions a web interface for it so that more people can be able to work on it. We would like the universities as well as and any interested citizens to be able to work on that targeted outreach when it first goes out is a good idea.

Second, to get a climate change impact, the questions about temperature and seasonal rainfall would actually fit more within in the water quality module, than within the watershed module.

Question - What is needed to bring the cost down for LID approaches to storm water management such as economies of scale?

Response: We really did need to move to looking at soil amendment and plants. We really need to figure out a way to drive down the costs of these facilities and their design and making it transparent and part of the landscape. Land Grant Universities might take a lead in making plant modifications and developing plants for these purposes.

Question - What are the best strategies to use to create and manage a strong stormwater program pertaining to organizational goals and responsibilities?

Response: At the top of the list, recognize storm water high in the organization. In Fairfax County there was a fractured organization comprising several different layers and branches. Over time it was elevated to where it has its own identify within the county government. Other important components include strategic planning and outreach; branding; and reliance on a dedicated force lest you be forced to compete with other issues. Finally, take advantage of the regulatory process environment to achieve program goals.

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Workshop Web Site

http://www.chesapeake.org/OldStac/stormwater.html

Workshop Attendees

Attendee Name	Attendee Affiliation
Jenn Aiosa	Chesapeake Bay Foundation
Katherine Antos	EPA-CBPO
Daniel Baldwin	Maryland Department of Planning
Gary Belan	American Rivers
Bidari Rajendra	Prince William County, VA Government
Heather Bourne	LimnoTech
Bill Brooks	McCrone Inc.
Craig Carinci	Fairfax County, VA Stormwater Planning Division
Clark Deirdre	Rappahannock-Rapidan Regional Commission
Hillary Colt Cahan	Konterra
Cary Coppock	USDA-ARS
Mike Crocker	City of Wanesboro, VA
Diane Davis	DC Department of the Environment
Kevin DeBell	EPA-CBPO
Patricia Dietz	Prince William County, VA Public Works
Lee Epstein	Chesapeake Bay Foundation
Normand Goulet	Northern VA Regional Commission
Ted Graham	Washington Council of Governments
Mark Graham	Albemarle County, VA Government
Penny Gross	Fairfax County, VA Supervisor
Lisa Hair	EPA Office of Water
Kate Heilman	Carroll County Government
Megan Hughes	University of Maryland Environmental Finance Center
Tim Karikari	District Department of the Environment
Rick Keister	LGAC/Alliance for the Chesapeake Bay
Stella Koch	Virginia Audubon Naturalist Society
Jesse Maines	City of Alexandria, VA Government
Michael Majestic	Neighborhood Design Center
Jane McDonough	AECOM
Chuck McNamara	Design Center, Prince George's County, MD
Daniel Medina	PBS&J
Alexander Middleton	Arlington County, VA Government
Madan Mohan	Prince William County, VA Government
Rob Mooney	Hyrologic Data Collection, LLC
Christopher Moore	EPA Office of Watershed Management
Urbie Nash	Waynesboro, VA Stormwater and Flood Commission
Camellia Okpodu	Norfolk State University
Jason Papacosma	Arlington County, VA Government
Jonet Prevost-White	Richmond, VA Public Utilities
Chris Pyke	US Green Building Council
Laura Rankin	Carroll County, MD Government
Matt Robinson	DC Department of the Environment
Jake Romig	York County, PA Government
Kate Rosenfeld	Responsible Industry for a Sound Environment
Glynn Rountree	National Association of Home Builders
Robert Ruth	Lancaster, PA Public Works
David Sacks	VA DCR
Dave Sample	Virginia Tech Occoquan Laboratory
Stuart Schwartz	University of Maryland – Baltimore County
Sarah Scott	Loiederman Soltesz Associates, Inc.
Kevin Sellner	Chesapeake Research Consortium
Mary Sherrill	Fauquier County, VA Government
Steve Shofar	Montgomery County, MD Government
Jeff Sholly	York Township, PA Government
Mark Symbroski	Montgomery County, MD Planning Department
Jackie Takacs	Maryland Sea Grant
Sally Thomas	Rivanna River Basin Commission
Elizabeth Van Dolah	Chesapeake Research Consortium
Dan Vizzini	Portland, OR Government
Lisa Wainger	UMCES-CBL
Ian Whitlock	Joyce Engineering, Inc.
Donald Williams	USDA-ARS
Dan Wilson	Imbrium Systems Corp.
Julie Winters	EPA-CBPO