VII: STORMWATER

Stormwater management decisions will be made within a watershed-based system of knowledge based on the best available scientific data, regulatory requirements, watershed and development needs, economic, and environmental impacts, and local opportunities and constraints.

Stormwater runoff refers to rain that falls on impervious areas (hard surfaces such as paved streets, parking lots, and rooftops) or areas with limited permeability (lawns, decks, patios) and flows to the stormwater drainage system and/or local waterbodies. Impervious areas do not allow rainfall to soak or infiltrate into the soil; therefore, precipitation becomes stormwater runoff. Stormwater runoff affects water quantity and quality and is closely associated with land use. Because stormwater pollution is the result of everyone's everyday activities and existing land uses, the management of stormwater pollution requires a watershed-based effort and participation from a number of stakeholders.

Understanding the impacts of development on water quality continues to remain an undefined variable; however, there are known benchmark standards to assist in evaluating existing and proposed development. One such benchmark acknowledges that stream water quality declines when impervious cover in watersheds exceeds ten percent and is severely degraded when imperviousness exceeds 25 percent.[1]

Efforts to improve water quality have traditionally focused on reducing pollutants from point source discharges such as industrial facilities and municipal sewage treatment plants. Congress amended the Clean Water Act in the late 1980s and early 1990s, increasing the focus on stormwater pollution. According to EPA, stormwater pollution is the leading cause of water quality impairment in the United States.[2] Similarly, watershed impairment in the Chesapeake Bay basin and Prince George's County is attributed to stormwater pollution.

[1] Chesapeake Bay Program, a Watershed Partnership

[2] http://www.epa.gov/owow/nps/whatis.html

STORMWATER LAND DEVELOPMENT REQUIREMENTS

The Prince George's County's landscape has changed dramatically over the past century along with other areas of the Chesapeake Bay watershed around the Washington metropolitan area. The land use changes in Prince George's County and their impact are outlined in greater detail in the sections on Watershed and Land Use Planning. Changes in the landscape and the intensity of development can cause a number of stormwater-related challenges, if not properly mitigated, including:

- Increased flooding and/or flood frequency.
- Increased the velocity of streamflow.
- Increased stream bank and instream erosion.
- Changed stream geometry.
- Reduced groundwater recharge and baseflows during drought periods.
- Altered stream hydrology.
- Impaired aquatic habitat and recreational uses of water resources and the bay.
- Reduced quality of life for Prince George's residents.

Stormwater runoff reaches streams very quickly following storms, allowing for minimal infiltration and causing decreased stream baseflows during dry times, thus increasing the frequency and intensity of flooding and accelerated stream erosion. Figure 1 shows graphically how changes in land uses impact the volume of stormwater runoff. As land cover changes from natural conditions to suburban and urban development, the percent of runoff increases. In addition to the increase in stormwater runoff, there is a corresponding decrease in deep groundwater recharge and interflow. Depressed levels of interflow can lead to dramatic changes in stream flows; flows are very heavy following rain events and very low during dry periods. The fluctuation in stream flows can stress aquatic life and aggravate stream bank erosion. Groundwater recharge is important in the rural areas of Prince George's County that rely on groundwater supplies to meet many of their water needs, including agriculture and fire suppression.

As stormwater runoff travels across the land, it picks up pollutants that can adversely affect water quality. The pollutants can negatively impact water quality, threaten drinking water supplies, impair aquatic habitat, and impact recreational uses of streams and the bay. In addition to stormwater pollutants, the increased velocity and quantity of stormwater increases streambank and in-stream erosion, adding additional sediment loads to local waterbodies. As the land use changes in the suburbanizing areas of Prince George's County, erosion can add sediment loads if construction sites are not properly protected during and after development. Topsoil also provides for infiltration and treatment of rainfall that is not achieved by impervious areas and the clay below the topsoil that can be exposed during the development process.

Past land use changes in Prince George's County have resulted in an increase in higher density residential areas, commercial, industrial, and institutional land uses that are more likely to produce potential stormwater pollutants. Similarly, agricultural lands that do not follow best management practices (BMPs) for nutrient application, erosion and sediment control, and waste management also add polluted stormwater runoff. The clearing of trees, alteration of natural topography, and stripping of top soil can result in changes to the natural underlying hydrology. Seeps and perched water

Baseflow:
The proportion of water flowing in streams and rivers that comes from ground water. River flow during dry weather conditions may be virtually all baseflow. At least 40 percent of all the annual flow total of rivers in the U.S. is derived from baseflow.

Accelerated Erosion:
Erosion of soil and sediments at a much more rapid than (geologic) erosion, usually resulting from land use influences or natural catastrophes, such as fire, that expose soil surfaces.

Interflow:
Water that infiltrates the soil surface and then moves laterally through the upper soil layers toward stream channels and other water bodies (lakes and wetlands). Interflow occurs on slopes where lower soil horizons (layers) are less permeable.

tables can and may have resulted from this activity in Prince George's County. It is recommended that reports of flooding be geographically documented and aligned with a soils and topography layer to identify patterns and hot spots. Current regulations for development practices, as well as additional practices recommended in this section, help protect water quality during future land use changes.

Mitigating Impact of Development—A key to protecting watershed health is to maintain as close to the natural hydrologic and water quality conditions and water balance as is achievable and practicable. This should be achieved through one or more of the following:

- Developing land in a way that minimizes its impact on a watershed and reduces both the amount of runoff and volume of pollutants generated.
- Using the most current and effective erosion and sedimentation control practices during the construction and post-construction phases of development.
- Controlling stormwater runoff peaks, volumes, and velocities to prevent both downstream flooding and streambank/channel erosion.
- Treating post-development stormwater runoff before it is discharged to a waterway.
- Implementing pollution prevention practices to prevent stormwater from becoming contaminated in the first place.
- Using various techniques and practices to maintain groundwater recharge.

It is important to assess various scaled watersheds during the evaluation of existing land use and land use planning. On a smaller local or site-level scale, there are a variety of structural, nonstructural, and site design measures that can be used for achieving the goal of water quality improvement.

> ***"Development itself is not necessarily harmful to water quality; it is the way that land is developed—where new roads and buildings are located and how they're built—that can have a lasting negative impact on the natural environment. Clearing removes the vegetation that intercepts, slows, and returns rainfall to the air through evaporation and transpiration. Grading flattens hilly terrain and fills in natural depressions that would otherwise slow and provide temporary storage for rainfall. The topsoil and sponge-like layers of humus are scraped and removed and the remaining subsoil is compacted. Rainfall that once seeped into the ground now runs off the surface. The addition of buildings, roadways, parking lots, and other surfaces that are impervious to rainfall further reduces infiltration and increases runoff. "***
>
> **– Chesapeake Bay Program Site**

Best Management Practice (BMP): Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources.

Hydrology:
The scientific study of the properties, circulation, and distribution of water as it occurs within the atmosphere and at and below the earth's surface. Hydrology generally includes hydrologic aspects of ground water, rivers, and wetlands.

STORMWATER RESPONSIBILITY

Stormwater pollution results from developed land and the daily activities that occur on the land. Because of the vast number of sources of stormwater pollution, there are a number of departments within Prince George's County that have responsibility for stormwater management. A watershed-based approach to stormwater management provides a logical foundation for cooperation between these programs. The various departments, agencies, and working groups' roles and responsibilities are outlined below.

Department of Environmental Resources (DER)—The mission of DER is to protect and enhance the natural and built environments of Prince George's County by enforcing federal, state, and county laws to create a healthy, safe, and aesthetically pleasing environment for all the residents and businesses of the county. DER is responsible for the following stormwater related programs: municipal separate storm sewer system permits, floodplain studies and management, watershed assessments and planning, and pollution prevention. The extent of these programs is summarized below:

Municipal Separate Storm Sewer System Permit—DER is the permit administrator for compliance with the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Phase I permit, including annual reporting. Prince George's County has operated under a MS4 permit (MD0068284) since 1993, with the permit updated most recently in 2004. The MS4 permit is a requirement under the Clean Water Act to address stormwater water quality in the county. DER is responsible for compliance oversight with the MS4 permit requirements, including annual permit reporting. The permit requires the following program elements:

> **Source Identification**—Sources of pollutants in stormwater runoff will be identified and linked to specific water quality impacts on a watershed basis. This involves maintaining a Geographic Information System (GIS) database that includes the storm drain system, urban BMPs, impervious surfaces, monitoring locations, and watershed restoration projects. This process will be used to develop watershed restoration plans that effectively improve water quality
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> **Discharge Characterization**—Discharge characterization involves monitoring to assess the effectiveness of stormwater management programs and watershed restoration projects developed by the county.
>
> **Management Programs**—These included all areas served by the county's municipal separate storm sewer system implement programs designed to control stormwater discharges and include stormwater management, erosion and sediment control, illicit discharge detection and elimination, county property management, road maintenance, and public education and outreach.

The MS4 program is routinely evaluated by MDE and the permit is renewed every five years. In October 2009, DER's NPDES permit will be renewed. At this time, MDE will incorporate additional requirements related to impervious cover restoration and TMDLs, as well as the new requirements of the 2007 Stormwater Act. This review and update affords an opportunity to reexamine county MS4 standards in light of additional understandings regarding the impacts of stormwater as well as BMPs to manage those impacts.[3]

[3] When MDE renews the permit they will provide guidance.

Floodplain Management—DER is responsible for many aspects of floodplain management within the county including delineating the floodplain boundaries and permitting development activities related to flood prevention. DER is currently studying several watersheds and updating flood maps based on hydrologic and hydraulic models. The DER manages the County's participation in FEMA's National Flood Insurance Program (NFIP) and Community Rating System (CRS). Prince George's County currently holds a Class 5 rating, which is in the top 2 percent of over 1,000 communities nationwide that participate in the CRS.

Under Prince George's County Code Subtitle IV, Group 4, the Department of Environmental Resources has the responsibility to conduct watershed-based flood studies in order to:

- Determine the magnitude and frequency of potential flood events based on existing conditions.
- Determine the magnitude and frequency of potential flood events based on development that is planned for the future.
- Define the possible alternative management techniques to control floods and minimize flood damage.
- Coordinate appropriate stormwater management strategies to alleviate the flooding impacts of land development and stream channel erosion consistent with federal, state and county programs and regulations.

Flood Management Studies—DER has performed watershed studies on 12 individual watersheds that serve multiple purposes including looking at existing flooding challenges and future flooding challenges based on build-out conditions and identifying opportunities to reduce flooding challenges.

Permitting Functions—DER oversees building review and zoning inspections for residential and commercial construction.

Citizen Drainage Complaint Response—DER staff investigates approximately 500 citizen complaints regarding drainage problems per year. Approximately 45 new drainage remediation projects are initiated each year as a result of either homeowner complaints, referrals by other agencies, or requests by county council members.

Department of Public Works and Transportation (DPW&T)—The mission of DPW&T includes maintenance, improvements, and beautification by dedicated, diverse professionals who use innovative technologies to stimulate livable communities through vibrant development.[4] The DPW&T has responsibility for several stormwater management programs including development plan review, maintenance of public stormwater facilities, erosion and sedimentation control inspections, the Livable Communities Initiative, the enforcement of woodland conservation, and the Chesapeake Bay Critical Areas compliance. DPW&T is responsible for most of the aspects of floodplain management as it relates to any proposed development, floodplain studies, and delineation approval.

Development Plan Review—DPW&T is responsible for review of all proposed development plans including the stormwater management conceptual approval through the issuance of site development grading permit. The quantity of

[4] http://www.co.pg.md.us/Government/AgencyIndex/DPW&T/

stormwater discharge must satisfy the Stormwater Act of 2007 for water quality, channel protection, and recharge volume using environmental site design (ESD) practices. The Maryland Stormwater Act requires that each county and municipality adopt ordinances to implement a stormwater management program with a focus on mitigating post-construction stormwater runoff. The DPW&T review development plans for compliance with the 2000 Maryland Stormwater Design Manual to ensure that development activity does not negatively impact the stormwater system or the environment.

Stormwater Maintenance—DPW&T is responsible for the road right-of-way maintenance and repairs of the stormwater infrastructure. DPW&T responds to customer complaints and performs routine maintenance and emergency repairs to the system as needed. Services include maintenance of the public storm drainage and flood control facilities; the flood control pumping stations and their grounds; and stabilization of eroded stormwater channels.

Erosion and Sediment Control—DPW&T is responsible for inspecting county-permitted active construction sites for compliance with erosion and sediment control plans. The authority for erosion and sediment control is delegated to the county from the Maryland Department of the Environment (MDE) with the authority being renewed every two years. DPW&T coordinates with the Soil Conservation District (SCD) to ensure that active construction sites are properly maintained to reduce sediment entering the storm drainage system and local waterbodies. The municipalities of Bowie, Laurel, and Greenbelt provide inspection and maintenance for erosion and sediment control in their communities. The State Highway Authority is responsible for erosion and sediment control for all state highway projects within the county.

Woodland Conservation Program—As part of the construction process, DPW&T is responsible for the enforcement of the approved tree conservation plans (TCPs) and associated regulations of the Woodland Conservation Ordinance (WCO). The WCO applies to all sites containing at least 40,000 square feet in area or 10,000 square feet or more of woodlands that do not have a previously approved TCP. If woodland conservation targets cannot be provided on-site, off-site areas must be provided. The woodland conservation program supports The Countywide Green Infrastructure Plan and also supports the Chesapeake Bay Program agreement signed in 2000 (Chesapeake 2000),with a goal for permanent preservation of 20 percent of the land area in the watershed by 2010.

Livable Communities Initiative and Litter Control Programs—DPW&T oversees the Livable Communities Initiative (LCI), which began with an evaluation of environmental problems facing the county and identified opportunities to enhance existing successful programs and develop new programs to enhance livability. One of the LCI initiatives includes expanding the existing roadside debris management program with more expansive litter reduction programs. The DPW&T also manages the Adopt-A-Road/Median program that supports volunteers who routinely clean debris and trash from their adopted area. DPW&T provided logistical support to over 10,000 volunteers during Gorgeous Prince George's Day in FY 2009. The litter reduction programs, in part, are associated with the 2007 Trash Free Potomac Watershed Initiative that is committed to creating a trash free Potomac River by 2013. Prince George's County, as part of the Potomac River Watershed Trash Treaty, has committed to:

- Supporting and implementing regional strategies aimed at reducing trash and increasing recycling.
- Increasing education and awareness of the trash issue throughout the Potomac watershed.
- Reconvening annually to discuss and evaluate measures and actions addressing trash reduction.

Prince George's Soil Conservation District (SCD)—SCD reviews all construction plans for conformance with the 1994 Maryland Standards and Specifications for Soil Erosion and Sediment Control as well as the 2005 Prince George's Soil Conservation District Soil Erosion and Sediment Control-Pond Safety Manual. SCD also administers the county's agricultural land preservation and easement programs.

Prince George's County Cooperative Extension—The Prince George's Cooperative Extension is a countywide educational system. It is sponsored jointly by the University of Maryland, the Prince George's County government, and the U.S. Department of Agriculture. Among its other services, the Cooperative Extension provides education and outreach services to youth, home gardeners, and commercial agriculture. The Cooperative Extension agents are currently working on a number of recertification and certification programs related to this Water Resources Plan including; pest control, nutrient management, and landscape technician. These certification programs ensure that professionals are knowledgeable in their fields to protect the environment.

Office of Management and Budget—The Office of Management and Budget is responsible for budget formulation; fiscal control; program and project control and evaluation; and management and policy analysis. Although not directly responsible for stormwater management, the Office of Management and Budget is involved with the formulation of the budgets that support the departments who actively manage the stormwater infrastructure and the stormwater regulatory requirements. With county revenues expected to decline over time, budgets for both DER and DPW&T are decreased from previous funding levels. DER and DPW&T share a stormwater management enterprise fund through a combination of tax revenues and permit fees that include in-lieu of stormwater fees. Both departments also receive grant funds that assist with funding for special projects.

Maryland Department of Transportation (MDOT)—In Maryland many federal processes have been delegated to MDE or combined with MDE's in a joint review process. There are also several requirements that are unique to Maryland. Since MDOT projects are linear in nature, MDE allows MDOT to consolidate stormwater management features along the linear project to meet the state stormwater requirements.

Transportation projects are subject to review and approval by federal and state agencies responsible for regulating various aspects of the environment. These requirements begin in the earliest stages of planning and continue until a project is complete. In some cases there may also be post-construction processes, required maintenance, or operating permits that take effect after project completion.

STORMWATER REGULATIONS

Anticipated Regulatory Requirements

The watershed management framework discussed in Chapter V, Environmental Resources and Land Management, provides a format to ensure all water resource regulations are being met with consideration of the diversity of county departments involved in meeting these regulations. In addition to the existing stormwater-related requirements outlined in Chapter III, Planning Context, as part of the planning context, there are a number of new regulatory requirements that are anticipated in the near-term future.

Overall, the county has met the intent of all of the stormwater regulations including those related to their current NPDES MS4 permit. The county has developed a Watershed Restoration Action Strategy (WRAS) for the Upper Patuxent River and Western Branch watersheds; however the county still needs to continue developing restoration strategies to meet the impervious surface treatment goals. A lack of funding has slowed efforts toward implementing watershed restoration projects, although five restoration projects were completed within the 2006 MS4 permit reporting period.

The existing MS4 stormwater permit will be renewed in 2009 and several additional requirements are anticipated. Currently, Prince George's County must identify projects and programs to reduce by ten percent the county's current impervious area. MDE is likely to require an increase in the reduction levels to 20 percent of the impervious surface area to the maximum extent practicable. The renewed MS4 permit will likely provide further support to the Trash Free Potomac Treaty and development of total maximum daily load (TMDL) implementation plans as defined in MDE's TMDL guidance document.[5] Currently, the emphasis is shifting from establishing TMDLs to implementation strategies. Whether the resources exist to actually accelerate implementation is not yet evident. Like wastewater treatment plants (WWTPs), MS4s are treated as point sources and are subject to receiving a waste load allocation (WLA) as a part of a TMDL. Although the explicit permit link between TMDLs and WWTPs is well established, the permit link between TMDLs and MS4s is still evolving and the specifics remain unclear. What is clear is that the legal requirements are increasing and that WLAs are anticipated. It is likely that this will be managed with BMP translators to quantify the necessary load reductions. The implementation guidance plan documents the strategies that will be incorporated to reduce pollutant loads based on the numerical reduction outlined in the TMDL. EPA notes that "effluent limitations in NPDES permits must be numeric unless such limits are infeasible to calculate, in which case they may be expressed as BMPs." The BMP approach appears to be pretty universally accepted for MS4 permits. However, linkages and quantification of some level of expected pollutant load reductions from a prescribed suite of BMP controls will likely be developed in order to satisfy the need to develop local load allocations. By 2011, baywide TMDLs for nutrients and sediment are scheduled for completion. These will, in effect, overlay and adjust localized TMDLs to assure restoration of local and downstream conditions in the lower river estuaries and the bay.

[5] http://www.mde.state.md.us/assets/document/final_TMDL_Implementation_Guidance_for_LG.pdf

Table 16: Prince George's County TMDLs as of February 25, 2009		
TMDL	**DNR 8-digit Basin Number**	**Status**
Draft Total Maximum Daily Loads of Phosphorus and Sediments for Triadelphia Reservoir (Brighton Dam) and Total Maximum Daily Loads of Phosphorus for Rocky Gorge Reservoir, Howard, Montgomery, and Prince George's Counties, Maryland	02131107 Patuxent River	August 20, 2007 (submitted to EPA on Sept. 26, 2007)
Total Maximum Daily Loads of Nutrients/Biochemical Oxygen Demand for the Anacostia River Basin, Montgomery and Prince George's Counties, Maryland and The District of Columbia	02140205 Anacostia River	Approved June 5, 2008
Total Maximum Daily Loads of Fecal Bacteria for the Nontidal Piscataway Creek Basin in Prince George's County, Maryland	02140203 Piscataway Creek	Approved Sept. 20, 2007
Total Maximum Daily Loads of Sediment/Total Suspended Solids for the Anacostia River Basin, Montgomery and Prince George's Counties, Maryland and The District of Columbia	02140205 Anacostia River	Approved July 24, 2007
Total Maximum Daily Loads of Fecal Bacteria for the Anacostia River Basin in Montgomery and Prince George's Counties, MD	02140205 Anacostia River	Approved Mar. 14, 2007
Total Maximum Daily Loads of Nitrogen and Phosphorus for Mattawoman Creek in Charles County and Prince George's County, MD	02140111 Mattawoman Creek	Approved Jan. 5, 2005
TMDL of Biochemical Oxygen Demand (BOD) for the Western Branch of the Patuxent River, Prince George's County, MD	02131107 Western Branch	Approved June 6, 2000
Total Maximum Daily Loads For Polychlorinated Biphenyls (PCBs) Tidal Potomac & Anacostia River Watershed	02140205 Anacostia River	Approved Oct. 31, 2007
Anacostia River (nontidal) for PCBs	02140205 Anacostia River	Under Development 2009

To streamline the stormwater-related activities within the existing organizational structure, Prince George's County should consider stormwater work groups that meet routinely to share information and follow up on ongoing initiatives. These working groups are recommended to meet at least quarterly and do not replace normal daily staff interactions. Working groups may focus on topics such as water quality, watershed planning, stormwater operations and maintenance, and public education, communication, and engagement.

Stormwater Funding—The Chesapeake Bay is an important environmental, economic, and social resource of regional and national significance. The regulatory requirements both for local governments, such as Prince George's County, and the private development community may continue to increase. The increase in responsibilities may also lead to an increase in costs. For example, the increased requirements for ESD for new developments may increase initial costs for the development community at the time of design and construction; with a larger number of small stormwater facilities, it may also increase

the cost of plan review and long-term stormwater facility inspections by Prince George's County staff. Similarly, the increased attention on restoring impaired waters has a financial impact on Prince George's County. Watershed restoration activities such as BMP retrofits, stream restoration, and bank stabilization are very expensive to design and construct, placing additional burdens on tight budgets. Retrofits to address water quality challenges are often needed in the most urban areas, where land is very expensive, good sites are difficult to identify, stormwater management is inadequate or is nonexistent, and underground infrastructure can increase design and construction costs. This plan recommends implementing more aggressive stormwater management funding strategies beyond the current ad valorum tax that is currently in place in Prince George's County.

Stormwater Utility Fees—Like other public utilities, stormwater utilities charge property owners for services provided by the local government. Stormwater utilities provide a stable and dedicated revenue source for most stormwater and watershed-related projects. Fees provide an alternative to tax increases or impact fees for the support of local programs. Stormwater utilities are very similar in nature to enterprise funds established by more traditional water and wastewater utilities.

Specifically, stormwater utilities collect fees from property owners in relationship to their stormwater impact to fund provided services. Stormwater impacts for each property are calculated based on their relative burden on the stormwater system resulting from changes that they have made to the character (volume, rate, and pollutant content) of the stormwater that runs off their property. Most stormwater utilities relate this burden to the type of land use activity and the percentage of impervious ground surface for each property. Properties with a greater level of impervious surface pay more for their increased negative contribution to the system. Because a stormwater utility is a fee for service provided, if property owners provide a portion of the service, then a credit should be issued that relates to the benefit provided. Services may be calculated to include: tree canopy, infiltration, green roofs, and other ESD practices.

Stormwater utilities have existed for a number of years in several states. A stormwater utility can provide a vehicle for consolidating and coordinating activities and responsibilities; generate funding that is adequate, stable, equitable, and dedicated; and develop programs that are comprehensive, cohesive, and consistent. More detail on stormwater utilities as a funding source and the process for developing a stormwater utility are outlined later in this section.

In Prince George's County the responsibility for stormwater services was transferred from WSSC to the county government in July 1987. The county is authorized to issue bonds to provide funds for stormwater management facilities. A Stormwater Management District has been established that includes all the land in the county excluding the City of Bowie. A Stormwater Management Enterprise Fund is used to pay for stormwater management operations and activities within the district. The stormwater fund is supported by a stormwater management ad valorum tax on all property assessed for tax purposes within the district that receives stormwater management services. Many of the county's stormwater structures are ten or more years old. They need significant maintenance to clear tree growth from dams, remove sediment that has reduced peak runoff control storage volumes, and repair clogged or deteriorated outlets. Without regular and adequate maintenance, these structures gradually lose their water quality protection functions and, eventually, some structures can become serious public safety hazards.

The current stormwater tax/fee structure in Prince George's County has not adequately addressed existing stormwater issues and will continue to fall short of water quality and regulatory requirements, as structured, in the future.

Supplemental Funding Options—A comprehensive stormwater management program requires either dedicated revenues from the general fund or a stormwater fee to fund the bulk of the programmatic requirements. There are, however, several sources of supplemental funding that can augment the primary funding source, including several different types of loans, service fees, and grants.

- **Loans/Bonds**—Loans and bonds allow immediate expenditures on stormwater and watershed projects beyond readily available local funds. Funds are typically paid over a 15- to 20-year period with interest charges, similar to a home mortgage. Despite interest charges, loans and bonds are often a financially sound method for funding capital improvement projects. For some capital improvement projects, such as replacement of culverts to avoid collapse or flood mitigation projects to reduce property damage, the up-front expenditure may be less than the long-term expense of damage repair due to deferred maintenance. Typically loans and bonds are used for capital improvement projects that cannot wait until local funds are available; they are not recommended for routine operations. Repayment schedules for loans and bonds can be developed to smooth out peaks and valleys in revenue requirements and, thus, reduce the need for sporadic large rate increases. MDE offers water quality revolving loans to eligible communities that can be used for stormwater, green infrastructure, and water quality improvement projects. In 2009, the grant amount may be up to $6 million per community.
- **Service Fees**—Local governments have the authority to establish special taxes or service fees to address specific local challenges. Service fees include special purpose local-option sales tax (SPLOST) funds, impact fees, special assessments/tax districts, in-lieu of construction fees, and mitigation banks. Prince George's County currently assesses service fees for plan reviews and construction site inspections. The county also has a stormwater management enterprise fund that includes tax revenues as well as permit fees and fee-in-lieu for facility construction.
- **Grants**—A grant is a form of federal or state financial aid that does not need to be repaid and is typically based on demonstrated need. Grants typically require a local match but are a good way to leverage existing funds. Although grants are helpful to extend locally-available funds, they typically are awarded on a competitive basis and involve a long lead time to secure funds. Most grants will not fund completed projects. Prince George's County currently has several grants. MDE offers a number of grants that support stormwater and watershed projects including 319(h) grants, a stormwater pollution control cost-share program, a small creeks and estuaries restoration program, and a comprehensive flood management grant program.

Designated Use:
Each major stream segment in Maryland is assigned a use. The use is a goal for water quality and may or may not be served now, but should be attainable.

Bottle Bill:
Failed HB 839, sponsored by Del. Pete Hammen, D-46, would have required a $.05 deposit, and subsequently a refund, on beverage containers (glass, aluminum and plastic) sold in Maryland. Currently, 11 states across the U.S. have bottle bills. Although every bill differs, the common thread running through them is that a person pays an extra amount when purchasing a bottle and receives it back when returning the bottle for recycling.

NUTRIENTS, SEDIMENT, AND TRASH

Maryland's efforts to reduce stormwater pollution have focused on protecting and restoring water quality in the Chesapeake Bay. The biggest challenges that face the county include nutrients, sediment and trash according to the results from the Chesapeake Bay program as outlined below. The watersheds that drain to the bay have accomplished significant reductions in pollution levels from point sources; however, stormwater pollution remains a challenge. A baywide TMDL will be issued by EPA in 2010 that will provide nutrient load allocations that will continue the existing progress toward protecting and restoring the bay.

The county has performed detailed water quality monitoring in the Beaverdam Creek watershed and has completed an initial assessment of 41 watersheds through the countywide biological monitoring program. The county is still developing a formal protocol for source identification to link pollutants of concern with a specific water quality impact for the watershed. A comprehensive water quality monitoring program that covers the entire county and looks at chemical, habitat, and biological conditions in major waterbodies will provide the framework necessary for a comprehensive watershed management program. The county should develop a method for collecting and analyzing data that can be used to document water quality trends. Efforts are underway to develop a shared database that would allow multiple departments to view and use collected data and forecasted trends. The trends will show if water quality is declining based on new land development and also document improvements related to BMPs.

Nutrients—Nutrients include nitrogen and phosphorus that in excessive quantities can cause disproportionate algae growth and reduce the oxygen levels in waterbodies, which may negatively impact aquatic conditions. Nutrients are typically associated with point source pollution and nonpoint sources such as fertilizer, wastewater, and runoff from active agricultural operations, with the three latter sources being stormwater related. The EPA's Chesapeake Bay Program Office created standards for dissolved oxygen, chlorophyll a, and water clarity that were developed to protect the designated use of the tidal Anacostia River. There is a TMDL for nitrogen, phosphorus, and biological oxygen demand that addresses the exceedance of target levels for these parameters.

Within the Chesapeake Bay watershed, preliminary estimates indicated that 291 million pounds of nitrogen and 13.8 pounds of phosphorus reached the bay during 2008, which represents a 13 million pound decrease in nitrogen and a 7.5 million pound decrease in phosphorus from 2007 (Chesapeake Bay Program). Within Prince George's County, the nonpoint source nutrients are primarily associated with active agricultural and urban/suburban land uses according to the Water Resource Plan model in Appendix I.

Sediment—Sediment refers to organic and inorganic particles that result from stormwater runoff and instream processes that reduce the clarity of waterbodies and can negatively impact aquatic habitat. Sources of sediment in Prince George's County are primarily related to stormwater and include urban runoff, construction sites, agriculture, and instream/streambank erosion. Although Maryland does not have a numeric standard for sediment, MDE has estimated sediment loads and developed threshold sediment loads to determine streams with sediment impairment and subsequent TMDLs. The sediment impairment is based on comparing actual monitoring data results to a reference watershed that is not impacted. The Anacostia River is considered impaired for high sediment loads according to this methodology. A TMDL for the Anacostia River was published by MDE in 2007.

Within the Chesapeake Bay watershed, preliminary estimates indicate that 3.3 million tons of sediment reached the bay during 2008, a 700,000 ton increase from 2007 but an 800,000 ton decrease from the average load for 1990–2008 (Chesapeake Bay Program). Within Prince George's County, sediment loads are thought to be associated with instream erosion that results from increased stormwater flow velocities. Older developments within Prince George's County do not always meet contemporary stormwater management requirements and do not have BMPs to slow the flow of stormwater from the site.

Prince George's County, as part of the NPDES MS4 permit and WRAS, should identify development without proper stormwater management controls and seek to retrofit these conditions either with grant funding or through redevelopment activities. The county should also continue to enforce and upgrade existing regulations to prevent erosion and sedimentation from ongoing development activities.

Trash—Trash is a stormwater parameter of concern, mostly in urban areas, and includes debris that is picked up by stormwater flows and deposited in streams and stormwater treatment facilities. Trash is highly visible and, therefore, receives a great deal of public attention. Volunteer cleanup efforts can help remove trash from waterbodies. Proper maintenance of parking lots, dumpsters, and stormwater treatment facilities can reduce the volume of trash in urban waterways.

The Trash Free Potomac Watershed Treaty, which has been signed by the Governor of Maryland and Prince George's County, calls for a trash free Potomac by 2013.[6] The initiative encourages activities to reduce and remove trash from local waterbodies that impact the Potomac.

The D.C. Council unanimously approved legislation in June 2009 banning the use of disposable, nonrecyclable plastic bags and assessing consumers a five-cent fee per recyclable paper and plastic bag used to haul away purchases at places such as grocery and convenience stores.
—The Washington Times

In addition to municipal programs, Prince George's County enlists the support of the community to remove and reduce litter from roadways. DPW&T manages the Adopt-A-Road/Median Program that supports volunteers who routinely clean debris and trash from their adopted area. The DPW&T also provided logistical support to over 10,000 volunteers during Gorgeous Prince George's Day in FY 2009. According to the 2006 MS4 permit report, volunteers collected 52,900 tons of solid waste, 597 tires, and 72,700 gallons of hazardous waste through various cleanup activities.

State efforts to initiate a bottle bill in Maryland should be actively supported in Prince George's County to ensure recycling is sustained at the highest level possible in the county. A bag bill has been legislated in neighboring Washington, D.C., to remove nonrecyclable bags from the trash stream; it appears to be a governmental solution for a major pollution culprit in many waterways.

[6] http://www.fergusonfoundation.org/trash_initiative/trash_index.html

STORMWATER FACILITIES OPERATIONS AND MAINTENANCE

The Chesapeake Bay Tributary Strategies place emphasis on controlling nonpoint source pollution from urban runoff to help protect local streams and the bay. Since 1983, thousands of stormwater management facilities have been built throughout the state to slow the erosive effects of runoff and/or to capture and reduce pollutants from developed urban surfaces. In Prince George's County alone, over 170 private stormwater facilities were built between 2000 and 2006 for water quantity and/or quality controls. In addition, DPW&T inspects and maintains the 382 publicly owned and maintained stormwater management ponds in Prince George's County. Although DPW&T maintains the publicly owned stormwater system, DER assists with responding to drainage complaints.

Many of the county's stormwater structures are ten or more years old. They need significant maintenance to clear tree growth from dams, remove sediment that has reduced peak runoff control storage volumes, and repair clogged or deteriorated outlets. Without regular and adequate maintenance, these structures gradually lose their water quality protection functions and, eventually, some structures can become serious public safety hazards.

DPW&T maintains the stormwater facilities located within the right-of-way. Based on the 2006 MS4 permit report, Prince George's County performed preventative maintenance inspections on 297 county-owned stormwater facilities over a three-year period and collected 700 tons of leaves and cleaned 5,965 storm drain inlets. Some areas of Prince George's County were developed 20 to 30 years ago. The stormwater infrastructure in these areas is nearing the end of its useful life and materials used were occasionally substandard compared to modern materials and development requirements. Prince George's County will experience growing financial pressures to maintain and replace these portions of the aging infrastructure. In other portions of the county, there is new development that is extending the footprint of the existing municipal storm sewer system. The extension of the system should be carefully planned to ensure longevity and prevent future flooding.

There are seven county-owned and operated facilities that require NPDES industrial stormwater permits. According to the 2006 MS4 report, only three of the seven facilities have the required Stormwater Pollution Prevention Plan (SWPPP) that is required by their NPDES industrial stormwater permit. Prince George's County should consult the list of facilities that require industrial stormwater permits to ensure that all municipal facilities are covered and have SWPPPs to reduce impact to local water resources.

Private landowners are responsible for maintaining their stormwater facilities; however, Prince George's County, under the MS4 permit, is responsible for performing inspections of these facilities to ensure proper operations. Based on the 2006 MS4 permit comments from MDE, Prince George's County did not have a program for inspection of these private facilities. Many private landowners are not aware of their maintenance responsibility and/or are unaware of proper maintenance operations. Inspections of these stormwater facilities will help ensure they operate correctly to protect water resources.

Landscape and Road Maintenance—The DPW&T is responsible for road maintenance activities that include landscape maintenance in the right-of-way. One of the more recognizable road maintenance programs is street sweeping. According to the 2006

MS4 permit report, 434 tons of debris was removed from roadways through street sweeping. DPW&T sweeps all residential subdivisions annually and arterial and collector roadways twice a year.

DPW&T should strive to minimize the use of chemicals in the routine maintenance of roadways and rights-of-way to reduce water quality impacts. When designing new roadways or roadway maintenance projects, the county should use native landscaping where possible to reduce maintenance and increase survival rates. Stormwater runoff should be treated using green infrastructure and environmental site design techniques to the maximum extent practicable to reduce environmental impacts.

Erosion and Sediment Control—As discussed previously, excess sediment in local waterbodies reduces clarity and impacts the habitat of aquatic life. Understanding the erosion process is essential to the development and implementation of effective erosion control plans. The key to erosion control is preventing the detachment of soil particles and reducing the volume of runoff. This is achieved through the use of practices such as minimizing land disturbance activities and maintaining vegetative covers or substituting for lack of growing vegetation by mulching or applying a compost blanket or erosion control mat. Sediment control is trapping detached soil particles that are being transported and ensuring they are deposited on site to prevent damage to other properties or receiving waters. This is achieved by such practices as silt fence installation, and sediment control basins.

The initial construction of new developments can contribute substantial amounts of sediments to the stream systems and its tributaries. Construction sites can contribute, on a per-acre basis, 10 to 20 times as much sediment as agricultural lands. Excess suspended sediment is one of the largest contributors to the bay's impaired water quality. The culprits are the tiny clay- and silt-sized fractions of sediment. These particles are frequently suspended in the water because of their size and can be carried long distances during storms.[7] If properly designed, constructed, and maintained, erosion and sediment control measures can greatly reduce sediment from entering local waterbodies.

The Sediment and Erosion Control Program developed in 1970 is essentially the same that exists today with an approved plan being required for any earth disturbance of 5,000 square feet or more and 100 cubic yards or more; plan approval exemptions for agricultural uses; plan review and approval by local SCDs; grading ordinance adoption and project inspection by local jurisdictions; utility construction inspection by WSSC; and criminal penalties for sediment pollution. Agricultural pollution contribution is ultimately subject to MDE authority enforcement. Various programmatic improvements have included requiring sediment control plan approval prior to issuing grading and building permits (1973); requiring training and certification of responsible personnel (1980); shifting enforcement authority from local to state control and establishing delegation criteria (1984); limiting the exemption for single-family residential construction on two-acre lots (1988); requiring NPDES stormwater discharge permits for construction activity (1991).

The Maryland Department of the Environment (MDE) initiated a comprehensive review of the state's erosion and sediment control standards in early 2009 and has developed an initial draft of the "2010 Maryland Standards and Specifications for Soil Erosion and

Wetland:
An area inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (U.S. Army Corps of Engineers Regulation 33 CFR 328.3 (1988)).

Floodplain:
The generally flat area adjacent to rivers that is periodically flooded. Evolving over hundreds or thousands of years, the size of floodplains is related to the frequency of flooding, the energy of the flow of the river when in flood and the amount of sediment in the river system.

[7] http://www.chesapeakebay.net/sediments.aspx?menuitem=14691

Sediment Control"[8] as part of the May 30, 2010, schedule for incorporation into regulation. Maryland's Erosion Control Law and regulations specify the general provisions for program implementation; provisions for delegation of enforcement authority; requirements for erosion and sediment control ordinances; exemptions from plan approval requirements; requirements for training and certification programs; criteria for plan submittal, review, and approval; procedures for inspection and enforcement; and applicant responsibilities. Clearly defining minimum standards is essential to make erosion and sediment control work. The current 1994 standards and specifications for soil erosion and sediment control are incorporated by reference into state regulations and serve as the official guide for erosion and sediment control principles, methods, and practices.[9]

Contractors and other construction industry personnel knowledgeable about erosion and sediment control principles, implementation and maintenance techniques, and specifications associated with various BMPs are an essential component of Maryland's statewide sediment control program. Well-trained construction personnel help to ensure that quality implementation and maintenance occur. Since 1980, many construction industry personnel have attended the MDE's Responsible Personnel Training for Erosion and Sediment Control Program.[10] According to the 2006 MS4 annual report, 137 individuals were certified as part of the "green card" erosion and sediment control training program that helps to ensure professionals are designing, constructing, and maintaining measures properly.

Although training and enforcement are important and erosion and sediment control measures minimize soil movement on disturbed areas, reducing the area disturbed during construction, especially areas with steep slopes, reduces erosion and sediment challenges. Prince George's County may consider establishing limits for areas disturbed during development, which protects greenspace and limits erosion potential. These limits are most beneficial in suburban and rural areas and not necessarily appropriate for higher density land uses.

FLOODING

Flooding in Maryland is caused by both heavy rains and wind. In the upland areas, storms can cause streams and rivers to overflow their banks, inundating the surrounding floodplains. Along the tidal reaches of the Atlantic, the Chesapeake Bay coastline, and in tidal areas of streams and rivers, wind-driven waves on top of elevated tidal levels can severely damage coastal property and endanger the lives of residents.[11]

Rain, wind, and snow storms of all sizes can cause flooding, depending on the amount of precipitation and its intensity and/or the speed and direction of the wind. Summer

[8] http://www.mde.state.md.us/assets/document/sedimentstormwater/MD_ESC_Standards_10-15-09_DRAFT_III.pdf

[9] http://www.mde.state.md.us/programs/waterprograms/sedimentandstormwater/erosionsedimentcontrol/standards.asp

[10] http://www.mde.state.md.us/Programs/WaterPrograms/SedimentandStormwater/erosionsedimentcontrol/index.asp

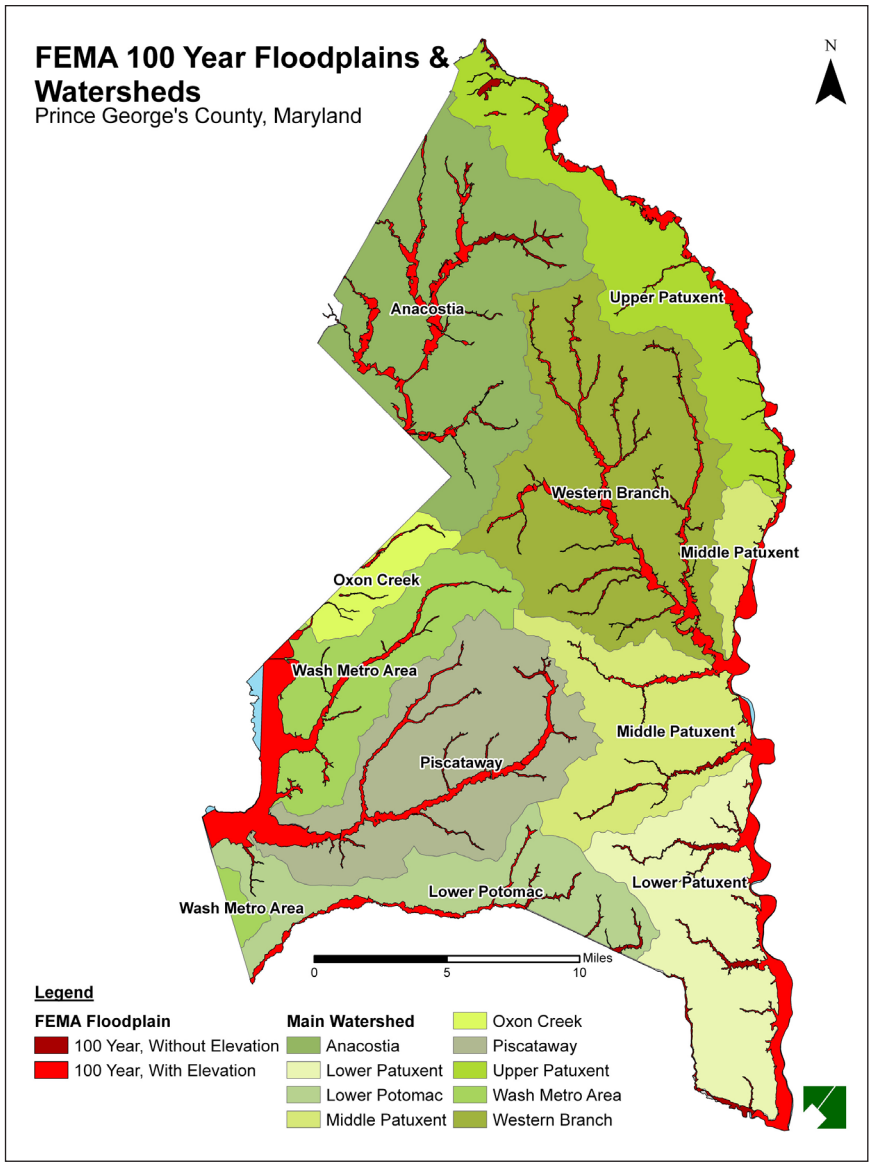
[11] http://www.mde.state.md.us/Programs/WaterPrograms/Flood_Hazard_Mitigation/reliefAssistance/index. asp

thunderstorms are generally very intense but short-duration events, which can cause flooding of major rivers. Hurricanes and "nor'easters" typically bring the sustained winds and rain necessary to cause significant flooding in large rivers and coastal areas.

Prince George's County has a history of modest storm-related flooding. Most flooding events have usually occurred during mid and late summer and are associated with tropical storms and hurricanes. Small sections of the county are also subject to occasional flooding due to the influence of tides.

Storms are typically measured in terms of the average frequency that a storm of that size occurs. Hurricane Fran (1996) was classified as a "40-year storm" meaning a storm the size of Fran has a one in forty chance of occurring in any given year. Larger storms such as Hurricane Agnes (1972) have a 1 in 100 chance of occurring in a year. Isabel was considered to be a 75- to 80-year storm based on the tidal surge. In a few places, the rainfall from Floyd was 20 inches and exceeded the 500-year storm.

Flooding in Prince George's County is also attributed to changes in topography and increases in impervious surfaces due to development that can result in perched groundwater. Groundwater that migrates to the surface often results in seepage into building basements. Where these conditions exist, or could likely exist, a no-basement policy for construction should be considered.



Map 17: 100-Year Floodplains and Watersheds

Floodplain Management—New developments must be carefully designed to ensure that flooding in Prince George's County is not aggravated. In some cases, historic development practices have aggravated downstream flooding and changed natural stream flow dynamics. Flood damage is mitigated by preserving and protecting floodplains as natural areas able to hold stormwater during and following storm events.

The National Flood Insurance Program regulates developments within mapped floodplains, typically the 100-year floodplain (or the area with a one percent annual chance of being flooded). Land development activities can alter a watershed's ability to handle storm events, thereby impacting the frequency of flood events. For example, the delineated 100-year floodplain may experience flooding more frequently than once every 100 years because upstream developments have changed the landscape and timing

Perched groundwater occurs above the main body of groundwater and is separated from it by unsaturated, impermeable sediments or rocks.

of flows into the stream. Floodplain maps are not updated regularly and, therefore, do not always indicate the true risk of flooding. In other words, an area delineated in the 100-year floodplain that has experienced recent upstream development activity may actually have a higher than one percent chance of being flooded. Prince George's County reviews stormwater plans as part of the land development process to ensure new developments preserve the floodplain and do not impact downstream landowners.

Flood Relief Assistance[12]—FEMA provides emergency financial assistance to individuals and communities following a flood if the damage threshold defining a federal disaster is exceeded in the area, or if federal flood insurance is in force. Flood insurance is offered by FEMA through participating commercial agents. For uninsured persons, the amount of the relief for a first time flood event is reduced by the amount of the premium that would have been required to insure the building and its contents. Relief for second and subsequent events may not be provided unless insurance has been purchased.

Under the state's Comprehensive Flood Management Grant Program (CFMGP), established in 1976 following hurricanes Agnes and Eloise, the legislature authorized MDE to request the sale of bonds to generate funds to purchase, relocate, and elevate houses. The program can also be used to establish warning systems and build flood control structures. State funds provided by this program are matched on a 50/50 basis with those from local governments.

ENVIRONMENTAL SITE DESIGN

ESD is defined by the Stormwater Management Act as "using small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources." ESD can also include conserving natural features, drainage patterns, and vegetation; minimizing impervious surfaces; slowing down runoff; and increasing infiltration. Prior to the Stormwater Management Act of 2007, ESD was encouraged through a series of credits within the Maryland Stormwater Design Manual. The Stormwater Management Act of 2007 requires that ESD be used to the MEP. MEP means designing stormwater management systems so that all reasonable opportunities for using ESD planning techniques and treatment practices are exhausted and, only where absolutely necessary, a structural BMP is implemented.

Figure 11: Schematic rendering on an on-lot bioretention area. Source: DER

The regulatory definition for MEP consists of two parts: definition and performance. The definition requires that all reasonable opportunities for using ESD planning techniques

[12] http://www.mde.state.md.us/Programs/WaterPrograms/Flood_Hazard_Mitigation/reliefAssistance/index.asp

and practices are exhausted. The threshold for meeting the MEP definition consists of performance criteria. MEP is met if channel stability and predevelopment groundwater recharge rates are maintained and nonpoint source pollution is minimized. In both the definition and performance threshold, the condition is the same; structural stormwater practices may be used only if determined to be absolutely necessary. Although some flexibility and best professional judgment will be needed to determine when these conditions are met, the performance threshold is straightforward. Local plan review and approval agencies should not approve structural BMPs if ESD options are available.

DER has developed a bioretention handbook that been prepared to replace and update the 1993 edition of the *Design Manual for Use of Bioretention in Stormwater Management*. This manual builds on that work and further identifies methodologies, practices, and examples of bioretention. Changes that were made focus primarily on four parameters: (1) functionality and application; (2) pollutant removal efficiency; (3) aesthetics and site integration; and (4) design simplification for cost containment.[13]

Updates to County Stormwater Ordinance—Prince George's County is currently updating the county's Stormwater Ordinance to comply with the Stormwater Management Act of 2007. Changes will include requiring developers to demonstrate ESD to the maximum extent practicable before structural practices are considered and requiring coordination with the planning and approval, implementation, and maintenance agencies prior to approval. Other changes may emphasize the need for impervious surface area reductions associated with the anticipated MS4 permit revision. Coordination is critical to the success of the new stormwater regulations and the Planning Department, the Department of Environmental Resources, and the Prince George's County Soil Conservation District shall all take an active and participatory role in assuring that all stormwater management practices contribute to the protection and improvement of water quality in the county. Prince George's County has plans to submit the proposed stormwater ordinance revisions for state review. Once reviewed by MDE it must be adopted by Prince George's County by May 2010. This ordinance applies to all new and redevelopment projects that have not received final approval for erosion and sediment control and stormwater management plans by May 4, 2010.

BASIS FOR REVISION OF COUNTY STORMWATER POLICIES

The recommendations for the revision of existing stormwater policies and programs are based on an evaluation of the Prince George's County existing stormwater related programs, consideration of both existing and future regulatory requirements, and a review of national stormwater management trends. The stormwater policy recommendations also considered future land use pollutant load modeling analysis discussed in the Growth Policies and Land Use Planning section of this report. As described throughout this section and the entire Water Resources Plan, numerous programs provide effective stormwater management throughout the county, which protects water quality. However, additional organization and access to information would strengthen the county's ability to provide effective watershed enhancement measures.

[13] http://www.co.pg.md.us/Government/AgencyIndex/DER/ESG/Bioretention/pdf/Bioretention%20Manual_2009%20Version.pdf

CHAPTER ISSUES SUMMARY

- Current stormwater regulations require the use of nonstructural BMPs that mimic natural systems, encourage infiltration, and manage stormwater on-site to the maximum extent practicable.
- Development that predates current stormwater regulations and aging infrastructure failures has lead to degraded stream systems and flooding.
- Funding for stormwater management, to achieve water quality protection and improvement, requires a dedicated funding source managed at a watershed scale.
- Trash remains a significant impairment in many of Prince George's County's urban waterways and undermines community investment, environmental health, and economic viability for redevelopment.
- Stormwater issues cross governmental and jurisdictional boundaries and require cooperative solutions and community engagement and participation.

POLICIES AND STRATEGIES

Stormwater Management Organization

POLICY:

Stormwater management decisions are made within a watershed-based system of analysis based on the best available scientific data, regulatory requirements, watershed and development needs, economic and environmental impacts, and local opportunities and constraints.

STRATEGIES:

- Create a watershed-based organization to administer water protection and remediation activities built on stormwater and ecosystem BMPs. The framework and responsibilities of this organization should be based on input from a variety of working groups.
  - Create a stormwater working group(s) that encourages interjurisdictional and intrajurisdictional collaboration on stormwater issues within a watershed management framework. This group should support education, training, outreach, communication, and community engagement.
  - Create a water quality working group(s) that meets to discuss water quality trends, shares collected data, provides status reports on ongoing corrective actions, and discusses inter-relationships between programs.
  - Create a watershed planning working group based on the 2008 DER report *Watershed Management Program: Supporting Clean Water and Livable Communities through Watershed Restoration and Protection* to link multiple departments and existing regulations under one watershed management program.
- Develop an iterative approach for assessing progress toward pollutant loading reduction benchmarks and for identifying additional projects and programs if benchmarks are not achieved.

POLICY:

The countywide stormwater management program complies with the intent of any and all environmental requirements of the EPA, the State of Maryland, and any regional regulations or programs.

STRATEGIES:

- Properly fund programs and activities required to meet all stormwater regulatory requirements through a stormwater utility or other equitable and sufficient funding source or sources.
  - Assess stormwater utility fees associated with commercial and high density residential as a percentage of imperviousness minus any mitigation strategies such as tree canopy.
  - Stormwater fees for each property should be calculated based on their relative burden on the stormwater system resulting from changes that landowners have made to the character (volume, rate, and pollutant content) of the stormwater that runs off their property.
- Continue to develop and implement WRAS for county watersheds and monitor the effectiveness of projects at reducing stormwater pollutant loads. The WRAS may include the following elements:
  - Development of stream restoration plans to include strategies to reduce flow velocity and stream scouring and incising.
  - Construction of grade controls in streams to prevent further incision of the stream channel and create a riffle-pool system for aquatic habitat.
  - Establishment and achievement of measurable goals by watershed for forest cover, tree canopy, and impervious surface by percentages.
  - Identification and mitigation of pollution sources in the Patuxent and Potomac watersheds through proven and innovative techniques to meet the Tributary Strategies agreed to as part of the Chesapeake Bay Agreement in 2000.
- Manage point and nonpoint pollution sources to comply with county, regional, and state load allocations established by the Chesapeake Bay TMDL and subsequent geographical refinements.
  - Develop a framework for the coordination of TMDL implementation plans with state and county agencies; municipalities; adjacent counties and jurisdictions; and watershed organizations that adhere to a comprehensive watershed approach.
  - Require additional and enhanced stormwater volume reduction and quality improvement requirements for all new development and redevelopment in areas draining to waters with existing TMDLs, of known water quality impairments, or Tier II water quality.
  - Develop subwatershed tree canopy goals in county master and sector plans to achieve the forest protection and expansion strategies as set forth in the *Anacostia Watershed Forest Management and Protection Strategy,* June 2005.

Water Quality

POLICY:

The county is committed to improve the quality of impaired water and protect healthy water in the county through short-term actions as well as a long-term commitment to effective stormwater management and water resources protection.

STRATEGIES:

- Maintain and fund a comprehensive water quality, habitat, and biological monitoring program that provides data needed to assess watershed health and track the benefits of restoration activities.
- Respond to changes in environmental regulatory requirements to produce TMDL implementation plans and institute pollution limits for nutrients, trash, and sediment in streams and their tributaries based on benchmarks for stream health.
- Fund implementation projects that achieve significant and measurable improvement in water quality.
  - Reducing polluted run-off from urban development and agriculture.
  - Implementing TMDLs to restore impaired waterbodies.
  - Protecting and restoring habitat including riparian corridors, floodplains, wetlands, and the bay.
- Encourage partnerships among agencies and organizations that have purview over water quality and land use decisions to protect and restore watershed functions and values.

POLICY:

The county is obligated to achieve the committed goals of a trash-free Potomac River by 2013 by developing trash reduction, recycling, and education programs that promote liter reductions in all streams and creeks in the county.

STRATEGIES:

- Support effective yard waste and other recycling programs, street sweeping, and trash removal strategies to reduce trash and waste that can impede stormwater flow and impact rivers and streams.
- Develop an outreach and education program to improve trash management, increase recycling rates, and reduce littering and illegal dumping.
- Develop a baseline of existing levels of trash in the Potomac and benchmark ongoing programs to determine if they will meet the trash-free Potomac goal by 2013. Add additional public and private programs as necessary to meet the goal.
- Educate local businesses on the importance of trash and waste prevention through routine cleaning of parking lot areas, dumpster areas, and structural stormwater management facilities.
- Support statewide efforts to increase recycling and reduce trash through the other legislative examples such as; the bag and bottle bills.

Stormwater Operations and Maintenance

POLICY:

Ensure the efficient and safe performance of all stormwater management facilities including county-owned and privately owned facilities.

STRATEGIES:

- Complete and maintain an accurate database of all privately and publicly owned and maintained stormwater facilities and storm drainage systems in the county.
- Conduct preventative maintenance and inspections of county stormwater management facilities on a regular basis. Document and provide corrective measures as needed.
- Provide documentation of inspection schedules, enforcement actions, and other relevant information to guarantee optimum functioning of stormwater management systems.
- Develop a program for routine inspections of private stormwater facilities in compliance with NPDES MS4 permit requirements.
- Develop a program for inspecting and cleaning stream corridors of debris, both manmade and natural, especially in known flooding areas.
- Ensure that all municipal facilities that require industrial stormwater permits are kept current and have SWPPPs to reduce impact to local water resources.

Landscape and Road Maintenance

POLICY:

Reduce pollutants associated with road maintenance from herbicides, fertilizers, pesticides, deicing, and vegetation maintenance. Require ten acres or greater of treated roadway to follow the University of Maryland's guidelines for documenting all maintenance practices and be subject to inspections by the Maryland Department of Agriculture.

STRATEGIES:

- Incorporate green infrastructure and ESD into roadway construction and maintenance activities.
- Consider reducing street width and parking lot requirements to reduce impervious area.
- Utilize conservation landscaping techniques that reduce water consumption and the need for fertilizers or chemical applications.
- Plant adapted native vegetation and use efficient irrigation, mulching, soil preparation, and appropriate planning, design, and maintenance standards and techniques.
- Continue to limit the use of herbicides and fertilizers in roadway maintenance activities and implement measures to ensure deicing materials are not over-applied. Ensure that street sweeping materials and other debris collected during routine road maintenance is properly disposed.

- Capture and reuse rain water to provide irrigation and maintenance of landscaped areas, where practicable; create demonstration projects on public properties.
- Design landscaped areas to intercept stormwater, thereby increasing pollutant removal and reducing the need for irrigation.

Erosion and Sedimentation

POLICY:

The county proactively acts to prevent erosion from active and completed construction sites that may result in sedimentation of streams and creeks.

STRATEGIES:

- Keep disturbed areas to a minimum during construction, especially areas with steep slopes.
- Specify the amount of time allowed to stabilize exposed soil when construction activities have temporarily or permanently ceased.
- Require erosion and sediment control inspections to be conducted at least every 7 to 14 days or following any rainfall event of 0.5 inches or more.
- Require the removal of accumulated sediment from control devices when sediment storage capacity has been reduced by 25 percent.
- Provide continued training and education to construction site operators and inspectors regarding erosion and sediment control compliance.
- Require inspection and enforcement of all publicly permitted erosion and sediment control devices by means of regular site visits and documentation of all infractions that shall require fines and/or cease-work orders.

Flooding

POLICY:

Protect the health, safety, and welfare of Prince George's County citizenry and properties by identifying flood hazards within the county, seeking funding to address flood hazards, and protecting future flooding from new developments.

STRATEGIES:

- Prohibit inappropriate and incompatible uses in floodplains to maintain water storage functions to the MEP and provide for expanded environmental preservation opportunities.
- Create a strategy to address repetitive property loss through FEMA's buyout program or other permanent corrective action.
- Document flooding events associated with nonexistent and/or poorly performing stormwater management facilities, floodplain encroachments, or perched water tables and/or groundwater seeps and transfer identified data into a GIS mapping format.
- Spatially analyze existing flooding data and patterns and develop policy and action strategies, legislation, and building standards to remedy existing conditions and avert future problems.

- Identify soils and geology in the county associated with perched groundwater and/or water seeps that may cause flooding, particularly in structures with below grade construction.

Stormwater Land Development Standards

POLICY:

Land development practices will support healthy hydrologic systems that maintain minimum stream flows, control flooding, support neighborhood, community and countywide health, and protect and preserve environmentally sensitive features and living resources.

STRATEGIES:

- The quantity of stormwater discharge must satisfy the Stormwater Act of 2007 for water quality, channel protection, and recharge volume using ESD practices.
- Capture and manage, through infiltration and evapotranspiration, the first inch of rainwater associated with over 90 percent of all storm events in the county for urban development and redevelopment projects.
- Minimize use of impervious surfaces.
  - Design to the minimum parking requirements during development.
  - Establish incentives for shared parking programs.
  - Concentrate development in order to provide economic incentives to develop parking structures in centers.
  - Break up large expanses of paved surfaces with landscaped/infiltration areas.
  - Set maximums on areas of paved surfaces in development plans.
- Establish maximums for impervious percentages within defined watershed, subwatershed, and catchment areas based on land use and watershed conditions.
- Optimize conservation of natural features, including drainage patterns, topography, and vegetation during development and redevelopment projects.
- Manage changes in topography during development and redevelopment to encourage sheet flow and maximize length of flow paths.
- Disconnect impervious areas such as pavement and roofs from the storm drain network, allowing runoff to be transported over pervious areas to support infiltration and groundwater recharge.
- Preserve and provide vegetation along stream banks, roadways, and within large paved areas to reduce stormwater run-off velocity and temperature, absorb pollutants, diminish green house gases, and support biodiversity.
- Tie preserved natural land areas to the Green Infrastructure Plan so that they are tracked and counted toward the countywide goals.
- Develop a county tree ordinance that supports the preservation and enhancement of the urban tree canopy that is compatible with ESD requirements, the county's Green Infrastructure Plan, and associated environmental legislation or code requirements.

Environmental Site Design

POLICY:

The county supports and implements the stormwater design policies, principles, methods, and practices as put forth in the 2000 Maryland Stormwater Design Manual and its updates, as well as the provisions of Maryland's Stormwater Management Act of 2007 requiring stormwater to be treated nonstructurally to the MEP.

STRATEGIES:

- Update the county stormwater ordinance to comply with the Stormwater Management Act of 2007 to require developers to demonstrate ESD to the maximum extent practical before structural practices are considered.
- Recognize that nonstructural techniques and ESD mimic natural hydrologic runoff and infiltration characteristics and provide a long-term cost effective, low-impact method to minimize the impacts of land development on water resources.
- Design, develop, implement, and maintain ESD demonstration projects to manage nonpoint source stormwater run-off on public properties to provide educational opportunities, increase public awareness, and hone a knowledge base for refining site design and ESD best practices application.
- Secure the sustained success of ESD facilities by establishing guidelines and standards for design, implementation, maintenance, and evaluation of nonstructural and/or innovative stormwater management practices and technologies to manage nonpoint source run-off.
- Identify legislative, physical, and economic impediments to the implementation of ESD.
- Modify the development and redevelopment plan review and approval process to require coordination of sediment control and stormwater management design, inspection and maintenance practices, and planning policies and recommendations as necessary in order to implement ESD to the MEP.

VIII: DRINKING WATER AND WASTEWATER

Maintain, inspect, protect, and manage drinking water sources and distribution methods and wastewater management facilities and infrastructure systems to sustain public, environmental, and economic health.

A safe and adequate drinking water supply and wastewater treatment facilities are necessary for the vitality of current communities and future residents of Prince George's County. Human life and public health, safety, and welfare depend on clean and potable drinking water and sufficient wastewater management. Wastewater treatment is also important to ensure the protection of receiving waterways for recreational purposes and the health requirements of living organisms. As the population and growth of the county continues to increase, it is necessary to ensure that the potable water sources and the proper treatment of wastewater can be accommodated.

Scientists estimate that each year up to seven million Americans become sick from contaminated tap water, which can also be lethal. Pollution, old pipes, and outdated treatment threaten tap water quality.
—The Natural Resources Defense Council

Water and sewer systems provide the basic building blocks for a modern, growing and environmentally healthy community. Water and sewer planning is critical to the staging and promotion of orderly growth of communities and the prevention of urban sprawl. Therefore, water and sewer planning must be based on consideration of geographical features and environmental factors, community needs as expressed in the county's land use and development policies, federal and state policy guidance, and public health requirements. The contextual framework for water and sewer planning includes the natural environment, community planning and development, and legal requirements.

Source Water Protection Areas are delineated by a state for a public water supply or including numerous such suppliers, whether the source is groundwater or surface water or both.

Turbidity:
A cloudy condition in water due to suspended silt or organic matter.

Protozoa:
One-celled animals that are larger and more complex than bacteria; may cause disease.

Disinfection By-Products:
Chemical, organic, and inorganic substances that can form during a reaction of a disinfectant with naturally present organic matter in the water.

The Washington Suburban Sanitary Commission (WSSC) is the eighth largest water and wastewater utility in the nation, with a network of more than 5,500 miles of fresh water pipeline and nearly 5,400 miles of sewer pipeline. WSSC has serviced customers in Prince George's and Montgomery counties since 1918 and WSSC's drinking water has always met or surpassed federal standards.

The Water Resources Plan contains policy and strategy recommendations to address inspection and maintenance of existing water and wastewater infrastructure and to plan for future growth in response to drinking water and wastewater management demands and capacities. The Water Resources Plan promotes source water protection strategies and use and demand management of water resources. Through conservation and efficiency recommendations, this plan strives to establish achievable sustainability goals for water resources in Prince George's County.

DRINKING WATER

Plan for potable water demands through efficiency and conservation standards; protection of potable water sources; and oversight, monitoring, and enforcement of water quantity and quality standards.

Prince George's County's public drinking water supply originates from the Patuxent and Potomac Rivers, which is treated and distributed by WSSC. The remainder of the county is served by groundwater supplies in areas outside the WSSC service area and water and sewer envelope as defined in the 2008 Water and Sewer Plan. The same land use practices which impact the water quality and quantity of streams and rivers can also impact the availability and quality of the county's drinking water sources. Because headwaters and reservoirs that ultimately provide potable drinking water are beyond the jurisdictional boundaries of the county and the groundwater sources are part of a shared regional system, it is imperative that source water protection and groundwater management policies are coordinated with neighboring counties.

Approximately two-thirds of Prince George's County is serviced by a public water supply from WSSC. WSSC is a bicounty agency, which provides water and sewer service to 1.8 million residents in Montgomery and Prince George's Counties and to small portions of Howard and Charles Counties. Water for Prince George's County is drawn from both the Potomac River and one of two reservoirs on the Patuxent River. It is treated at the Potomac and Patuxent water filtration plants, respectively. Current water demand forecasts are prepared by WSSC (see Technical Appendix III, 2006 Water Production Projections) and indicate that WSSC's average production is expected to increase approximately one percent per year, reaching 224 million gallons per day (mgd) in the year 2030. The Interstate Commission on the Potomac River Basin (acting for WSSC, Fairfax (VA) Water, and Washington Aqueduct), also periodically prepares water demand forecasts as well as future resource availability assessments (see Technical Appendix III, Water Supply Reliability Forecast for Washington Metropolitan Area, Year 2025). This study indicates that current water resources are able to meet demand forecast for the region; including the area of Prince George's County served by WSSC, to the year 2025, and as projected to 2045 under drought conditions similar to those experienced in the period of record (the past 80 years).

According to the terms of a long-standing agreement, WSSC has extended public water supply infrastructure to Charles County. Charles County will relieve their current demands on the Patapsco aquifer by 1.8 mgd in the community of Waldorf through extension of the WSSC surface water source public system. Additional public water

systems within the county include the City of Bowie, located in Prince George's County, a groundwater source distribution system that supplies up to 5.2 mgd of drinking water to the northern portions of the City of Bowie, and other smaller well water systems. The remaining county residents are served by private wells that are concentrated in the southwestern, southern and eastern areas of the county.

Prince George's County's Rural Tier, approximately one-third of the land area, relies on individual well water for domestic supplies and other uses. The 2008 Water and Sewer Plan delineates the water and sewer envelope boundaries that are reviewed by the Planning Department during updates to the plan and during tri-annual water and sewer review cycles when requests for water and sewer category changes are considered. Protection of the quality and quality of this water resource is becoming more critical as regional demands on the aquifer system continue to increase, and groundwater levels continue to decline in many areas.

Patuxent Water Supply Patuxent Water Supply—The Triadelphia and Rocky Gorge Reservoirs provide water to the Patuxent Water Filtration Plant (WFP) for treatment. These reservoirs, located in the upper reaches of the Patuxent River in Central Maryland between the cities of Baltimore and Washington, D.C., have a combined water storage capacity of 11 billion gallons and collect water from a 132-square-mile watershed; the vast majority of the watershed is located in Montgomery and Howard Counties, with only a small portion within Prince George's County. Much of the watershed is rural, although there are some areas of denser, mixed land use. WSSC owns and controls only 6.9 square miles of land immediately adjacent to the reservoirs. The primary purpose of this protected area is to provide a buffer zone to control sediment and pollutant runoff into the reservoirs. Prince George's County Code currently restricts impervious surfaces within the Rocky Gorge watershed to ten percent, while Code of Maryland Regulations prohibits the installation of a septic system within 300 feet of the spillway crest water level of a water supply reservoir. Potential sources of contamination for the reservoirs include a variety of point and nonpoint sources, such as roadways, a railroad, a petroleum product pipeline, agricultural activities, septic systems, surface water discharges, and stormwater runoff from developed areas. Based on water quality monitoring results and analyses conducted by WSSC, phosphorus is the primary contaminant of concern to the reservoirs. Additional contaminants of concern include turbidity, disinfection by-products, iron, manganese, and protozoa.

Cryptosporidium and Giardia are parasites that exist in rivers and lakes. These parasites can cause intestinal illnesses.

Fecal Coliform are bacteria, which are present in large numbers in the feces and intestinal tracts of humans and other warm-blooded animals, and can enter water bodies from human and animal waste.

Dieldrin is no longer produced or used. From the 1950s until 1970, aldrin and dieldrin were used extensively as insecticides on crops such as corn and cotton.

The Patuxent Reservoirs Watershed Protection Group was formed in 1998 to promote policies that would protect the long-term biological, physical and chemical integrity of the Patuxent reservoirs watersheds. The group engages participants from relevant programs in Howard County, Montgomery County, M-NCPPC, Prince George's County, Soil Conservation Services for Howard and Montgomery Counties, the State of Maryland, and WSSC. This group has historically supported initiatives targeted at reducing contaminant loading into the reservoirs, such as implementation of stormwater management BMPs along tributaries leading into the reservoirs. The group also is involved in public outreach activities and has sponsored workshops and Patuxent Reservoir Days every spring and fall. These outreach efforts have also promoted the

Patuxent Water Filtration Plant

establishment and recognition of several schools within Prince George's County as the Maryland Association for Environmental and Outdoor Education Green Schools.

The following recommendations were made in the Maryland Department of the Environment's 2004 Source Water Assessment for the WSSC Patuxent WFP to protect the reservoirs and ensure a safe and adequate water supply for WSSC customers:

- Strengthen the existing Patuxent Reservoirs Watershed Protection Agreement[1] (established in 1996).
- Expand protected property within the watershed and improve management of forested lands.
- Enhance WSSC's existing water quality sampling program.
- Reduce phosphorus loadings.
- Implement controls for spills at major highway crossings.
- Analyze traffic accident statistics and patterns to identify potential problem/spill locations.
- Establish notification and emergency response procedures for potential contaminant sources.

Potomac Water Supply—The Potomac River is the water source for the Potomac WFP, which is also owned and operated by WSSC. The Potomac River watershed is approximately 11,400 square miles and is primarily forested, with significant agricultural use and some urban land uses. The existing intake for the plant is located on the bank of the Potomac River and is opposite several islands in the river. The intake structure, near the C & O Canal above Swain's Lock, was built in 1982. The WDDC's Potomac WFP has a maximum treatment capacity of 300 mgd. There are numerous long-standing efforts to improve water quality in the Potomac River. In particular, efforts are currently underway in the Watts Branch watershed in Montgomery County to identify priority stream restoration and stormwater management projects to improve both the habitat and water quality of the watershed. According to the findings of the 2002 Source Water Assessment for the Potomac WFP, contaminants that cause major challenges and are of particular concern include: natural organic matter and disinfection by-product precursors, sediment, cryptosporidium and giardia, taste and odor causing compounds, ammonia, sediment/turbidity, algae, fecal coliform, ammonia, and dieldrin (a banned pesticide). Sources of these contaminants are present throughout the watershed. The Potomac WFP is also vulnerable to spills and overflows from various transportation and industrial sources in the watershed.

Source water at the intake can become largely isolated from the main flow of the river and be heavily influenced by local run off from Watts Branch, which flows into the Potomac River approximately 1,800 feet upstream of the intake. WSSC analysts believe that the Watts Branch is the cause of sudden negative changes in raw water quality and treatability at the Potomac WFP intake. Analyses conducted as part of the 2002 Source Water Assessment for the WSSC Potomac WFP indicate that a submerged channel intake (at a mid-channel location) would allow the plant to effectively avoid these impacts.

[1] http://www.montgomerycountymd.gov/deptmpl.asp?url=/content/dep/csps/Watersheds/csps/html/upperpat.asp

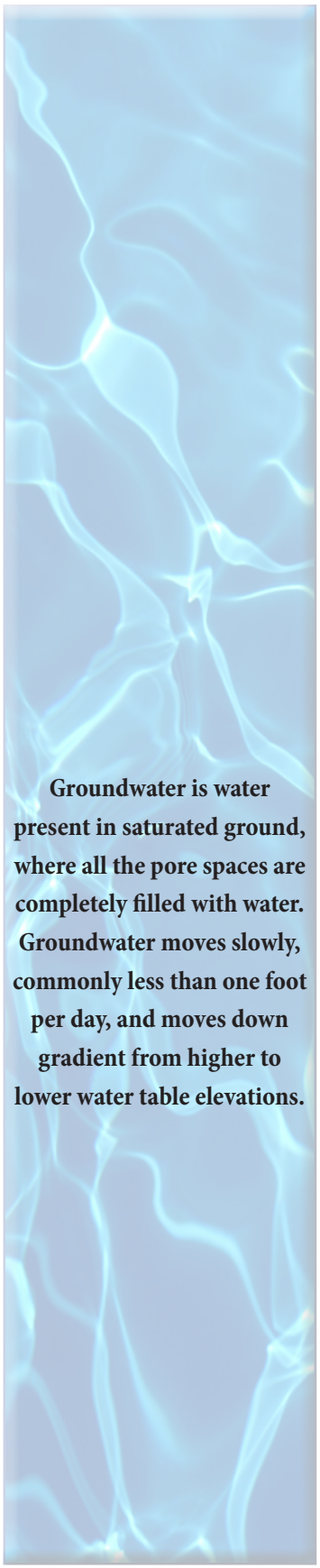
The following recommendations were made in the Maryland Department of the Environment's 2002 Source Water Assessment for the WSSC Potomac WFP to protect the watershed and river and ensure a safe and adequate water supply for WSSC customers:

- Formulation of a watershed protection group representing all stakeholders. Among other things, this group should have aggressive involvement in upstream agricultural and animal farming BMP implementation plans to address nutrient, bacteria, and pathogen loads.
- Serious consideration should be given to an upgraded intake structure with flexibility to withdraw water from a submerged mid-channel location. As previously noted, such a structure would help moderate changes to raw water quality at the Potomac WFP intake.
- Preparation of a proactive spill management and response plan to minimize the risk of contamination resulting from spills in the watershed.
- Consideration of appropriate source evaluation and management practices for fecal contamination to improve public health protection.

The Potomac River Basin Drinking Water Source Protection Partnership (DWSPP) is a unique regional organization formed to help ensure that the basin's public drinking water sources, serving more than five million people, are protected from contamination that could adversely affect the health of consumers. The partnership was formalized in 2004. At the present time, 20 drinking water utilities and government agencies from throughout the Potomac River basin are DWSPP members.

Groundwater and Aquifers—Groundwater is water found below the ground surface located in soil pore space and in rock fissures. Groundwater is recharged from, and can eventually flow to, the surface, discharging into streams and wetlands or as seeps and springs. An aquifer is an underground water layer within unconsolidated materials such as gravel sand or clay or fractured rock. Aquifers function as underground reservoirs that provide clean potable water via drilled wells that access the aquifer water and pump it to the surface. Coastal Plain aquifers composed primarily of sand and gravel with layers of silt and clay are productive groundwater sources of generally good quality domestic drinking water. Prince George's County groundwater levels from unconfined portions of the aquifers undergo seasonal fluctuation and are principally recharged by precipitation during the spring and winter months. Groundwater levels in the confined portions of the aquifers are subject to impacts from groundwater pumpage at a regional scale.

Increased water demands from a growing population place new and additional stresses on the aquifers, and additional analysis of the county's groundwater resources is needed to assess the long-term viability of the county's aquifers in the face of increasing demands. Except in some urban and industrial areas, county groundwater is generally of good quality and deeper, confined aquifers meet drinking water standards. The unconfined Coastal Plain aquifers are vulnerable to groundwater contamination associated with human activities on the land surface, but incidents of serious contamination are usually localized around specific sources. A historical source of contamination has resulted from abandoned sand and gravel mining operations that then became landfills or rubblefills. Certain heavy metals, pathogens, and other toxic elements easily combine and become activated by water resulting in contamination.



Groundwater is water present in saturated ground, where all the pore spaces are completely filled with water. Groundwater moves slowly, commonly less than one foot per day, and moves down gradient from higher to lower water table elevations.

Maryland Groundwater Rights—Water rights in Maryland run with the land and are considered inseparable from the property's "bundle of rights." Landowners are allowed reasonable use of groundwater in view of the similar rights of others (reasonable use=without unreasonable interference to others). Because Maryland adheres to the reasonable use (American rule) for water rights, allocation includes the following prioritization of allowances and restrictions. If a "water supply emergency" exists, then priority is:

- Domestic and municipal uses for sanitation, drinking water, and public health and safety;
- Agricultural uses, including the processing of agricultural products; and
- All other uses.

Maryland's "recharge rule" is an unwritten administrative policy that calculates water recharge very conservatively. If one wishes to withdraw 3,000 gallons of groundwater per day and assume a recharge calculation of 300 gallons/day/acre, one must own or have control over ten acres of land. This policy can prove very problematic for public water suppliers and commercial users, because sufficient land area must be controlled to assume recharge equal to or greater than withdrawals.

Source Water Protection—The U.S. Environmental Protection Agency (EPA) provides funding through Section 106 of the Clean Water Act to assist in the coordination of groundwater protection activities. Maryland's annual funding for this program is approximately $385,000. These funds are used to support the coordination of activities, as well as for groundwater assessment projects, wellhead protection efforts, and educational outreach activities.

Groundwater aquifers, where unconfined (geologically protected by a clay layer), similar to surface water, can be contaminated and compromised by activities employed on the land. Pollutants can seep through the ground surface or streambeds and access groundwater. The Maryland Department of the Environment (MDE) is responsible for the development and implementation of the state Comprehensive Groundwater Protection Strategy and to coordinate efforts by other state agencies to protect and manage groundwater.

Maryland's environmental, agricultural, and natural resources protection programs administered by MDE, the Maryland Department of Agriculture (MDA), and the Maryland Department of Natural Resources (MDNR) work to achieve groundwater protection through the implementation and administration of programs that educate the general public, businesses, and industries concerning the importance of water quality protection and water conservation. In addition, these departments promote land use practices that strive to minimize the impacts of development in environmentally sensitive areas and encourage the preservation of natural resources by promoting development in growth centers where transportation and infrastructure exists.

> ***The State of Maryland is committed to protect the physical, chemical, and biological integrity of the groundwater resource, in order to protect human health and the environment, to ensure that in the future an adequate supply of the resource is available, and in all situations, to manage that resource for the greatest beneficial use of the citizens of the state.***
> ***—The Maryland Groundwater Protection Strategy***

In order to protect important public water supply sources, Maryland has developed and implemented the Wellhead Protection Program (WHPP), a preventive program designed to protect public water supply wells from contamination by establishing a wellhead protection area (WHPA) around each well. Existing and potential contamination sources are identified and management plans are developed to identify the best means for protecting the sources. EPA approved Maryland's WHPP in June 1991. The program coordinates wellhead protection activities among State agencies, public water suppliers, local governments, and the public. The MDE's Water Supply Program (WSP) assists local governments in delineating WHPAs and in developing management programs to protect water supplies within the WHPAs. Participation at the local level is voluntary.

It is the responsibility of the WSP to ensure the safety of new public water supplies by reviewing and evaluating proposals for the siting of new wells. To ensure that wells are sited in the safest locations, staff review departmental databases to identify existing or potential contamination sources and use site investigations to verify this information and evaluate any additional factors that might influence the safety of the water supply. It is imperative that water withdrawal permitting consider the cumulative impacts of withdraws and ensure that residents and businesses in Prince George's County that currently rely on well water do not suffer adverse impacts to the quality and quantity of that resource due to over permitting to new customers.

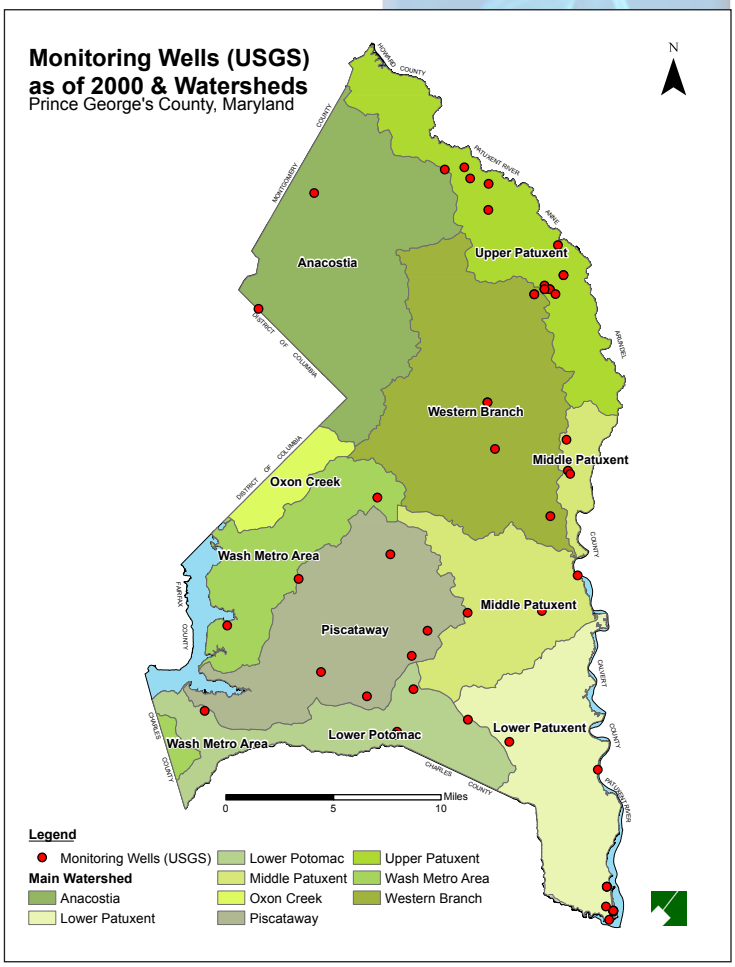
Cone of Depression:
A depression in the water table that develops around a pumped well.

Drawdown:
(1) The drop in the water table or level of water in the ground when water is being pumped from a well.
(2) The amount of water used from a tank or reservoir.
(3) The drop in the water level of a tank or reservoir.

Additionally, the use of surface and groundwater is controlled through the state water appropriation permits. These permits help to ensure that Maryland's water resources are conserved and protected while providing safe drinking water to the state. Specific proposed uses are reviewed to determine if the resource is adequate to sustain the requested allocation without adverse impacts and whether impacts are reasonable relative to the recharge rule requirements for surface water and unconfined groundwater and relative to the so-called 80 percent management (20 percent of pre-pumping drawdown) level reserve requirement for confined groundwater.

Aquifer and Groundwater Monitoring—Groundwater continues to be a plentiful natural resource serving as a significant source of drinking water in Prince George's County. About one third of the land area of the county and approximately 12 percent of its population depends on groundwater for its drinking water supply.

Groundwater also serves as a critical resource for agricultural communities and as a source of water base flow in county rivers and streams. As households and businesses increase in the county, demand for additional groundwater resources rises as well. As of 2008, the average daily well water demand in Prince George's



Map 18: Monitoring Wells

Hydrogeology:
The scientific study of the occurrence, distribution, and effects of groundwater.

Aquifer:
An underground geological formation, or group of formations, containing water. Aquifers are sources of groundwater for wells and springs.

County was estimated to be 0.2 million gallons a day (mgd). By 2030, development will create demand for approximately 0.36 mgd.[2]

Due to limited scientific study to this point, the amount of sustainable aquifer withdrawal in Prince George's County is unknown. The United States Geological Society (USGS) along with the Maryland Geologic Society (MGS) have been monitoring aquifer wells to verify the water levels over the past few decades. The general trend shows recharge is not keeping pace with withdrawals. This reality has created several large-scale cones of depression around both individual pumping well points and aquifer pumping centers throughout Maryland. These areas of groundwater-level depression have resulted in significant drops in water levels in several aquifers underlying Prince George's County, particularly in the southwestern areas of the county.

MDE is considering extension of the existing water management strategy areas in Indian Head and Waldorf in Charles County, into southwestern and southern Prince George's County. This designation would allow MDE to adopt specific use restrictions or criteria for permit approval in order to protect the water resource or existing water users. There is also the option of directing domestic residential well users to a deeper aquifer, but that option has associated elevated well construction and energy demand costs.

The 2003 Advisory Committee on the Management and Protection of the state's water resources identified the need for a comprehensive assessment of groundwater resources in the Maryland Coastal Plain, where population is expected to grow by 44 percent between the years 2002 and 2030. In 2007, USGS, MGS, and MDE continued their Phase I work (2006-2008) on the Regional Coastal Plain Assessment of the Maryland Coastal Plain, documenting the hydrogeologic characteristics of the aquifer system.

Future assessment activities will include conducting detailed studies of the regional groundwater flow system and water budget; improving documentation of patterns of water quality in the aquifers; enhancing groundwater level, streamflow, and water quality monitoring networks; and developing tools to facilitate scientifically sound management of the groundwater resources in the Maryland Coastal Plain. Phase I activities are being jointly supported by funds and services from MDE, MGS, and USGS. Phases II and III will require significant additional investment from current and new funding partners from 2008 to 2013.

MGS continues the study, begun in 2001, of the hydrogeologic characteristics and water supply potential of the Patapsco aquifer system in southern Maryland. The objectives of the project are to obtain additional hydrogeologic information regarding the upper, middle, and lower Patapsco aquifers in Charles, Calvert, and St. Mary's Counties, to integrate these data into a quantitative assessment of the aquifers' capacity to supply future water demands in the tri-county region, and to construct observation wells to monitor future changes in Patapsco water levels. Preliminary analysis indicates that even though the Patapsco aquifers are widely distributed, their water-producing properties are locally variable. The Patapsco aquifer is the primary source for private wells in southwestern Prince George's County and impacts to and influences of withdrawals in the county have been reflected, to some extent, in this study. MGS should expand the study into southern Prince George's County to account for the broad-based regional influences on the Patapsco aquifer.

[2] Wolman Report: http://wsscwater.com/AnnualReports/WSSC-AR2003.pdf

Water Supply Program[3]—The Water Supply Program (WSP) of the MDE is responsible for regulating public drinking water systems in Maryland and implementing development capacity standards. The WSP is a part of the Water Management Administration within the MDE. The mission of the WSP is to ensure that public drinking water systems provide safe and adequate water to all present and future users in Maryland, and that appropriate usage, planning, and conservation policies are implemented for Maryland's water resources. This mission is accomplished through proper planning for water withdrawal, protection of water sources that are used for public water supplies, oversight and enforcement of routine water quality monitoring at public water systems, regular on-site inspections of water systems, and prompt response to water supply emergencies. Capacity development is the process of water systems acquiring and maintaining adequate technical, managerial, and financial capabilities to enable them to consistently provide safe drinking water. Public drinking water systems fall into three categories. Community water systems serve year-round residents; non-transient non-community water systems serve regular consumers, such as in a school or day care setting; and transient non-community water systems serve different consumers each day, such as in a campground or restaurant. Historically, WSP has emphasized preventative measures to avert serious public health incidents instead of reactive enforcement actions. Preventative measures include activities such as sanitary surveys, training and technical assistance, comprehensive performance evaluations, monitoring, operator certification, financial assistance, consolidation, county water and sewer planning, source water assessments, and special initiatives. MDE's WSP recently initiated a statewide effort to evaluate watersheds by assessing the available water supply within a watershed as it relates to existing and future water demands. Although resources for this effort are limited, the goal is to provide regulators, planners, and water suppliers with information that can serve as a guide when planning for future water needs.

Water Management Administration, MDE Permitting Administration—The mission of the MDE's Water Management Administration (WMA) is to restore and maintain the quality of the state's ground and surface waters, and to plan for and supervise the development and conservation of the state's waters. WMA manages a broad range of activities, including regulating and financing municipal wastewater treatment systems; regulating the use and development of the state's water resources, public water supplies, and on-site residential sanitation systems; regulating well drilling and industrial pretreatment; providing technical assistance for water and wastewater utilities; financing small creek and estuary restoration; approving erosion/sediment control and stormwater management plans; issuing stormwater permits; inspecting and issuing dam permits; protecting and managing tidal and nontidal wetlands and waters; and regulating mining activities and mitigation problems associated with abandoned mines. These protections, financing, and regulatory activities help WMA ensure that state waters are safe for drinking, recreation, and wildlife.

[3] Safe Drinking Water Act Capacity Development Report, September 2002, Maryland Department of the Environment Water Supply Program

MDE programs that are administered by WMA are designed to:

- Create outreach and assistance activities that can address cross-functional issues involving water regulatory programs.
- Manage water, wastewater, and nonpoint source pollution control capital projects that are funded through grants and loans from the department.
- Permit and provide construction inspection for water and sewerage facilities.
- Develop and implement the new federally mandated stormwater permitting program.
- Review and approve erosion/sediment control and stormwater management plans for state and federal construction projects.
- Inspect dams for safety, issue new permits, and approve downstream warning plans for high-hazard dams.
- Issue water appropriation permits for use of surface and groundwaters.
- Issue permits for discharges to surface and groundwater from both industrial and municipal facilities as required by the federal Clean Water Act.
- Oversee programs delegated by the department to local health departments. Activities include MDE's regional consultants who provide technical assistance to local health departments for on-site water and wastewater systems and assistance in developing and testing new innovative or alternative septic system designs.
- Regulate activities conducted in nontidal wetlands and their buffers, nontidal waterways (including the 100-year floodplain) and tidal wetlands.
- Create, restore, and enhance nontidal wetlands and streams; provide training and technical assistance for the development of watershed management plans.
- Inspect industrial and municipal wastewater discharges, coal and surface mining operations, agricultural sites, and construction activities involving sediment control, stormwater management, wetlands, and waterways.
- Regulate active mines and mitigate environmental problems associated with abandoned mines. Also, regulate oil and gas exploration, production, and storage.
- Ensure safe drinking water in Maryland by administering the federal Safe Drinking Water Act, develop the state's comprehensive groundwater protection program, and respond to local water supply emergencies.
- Conduct performance evaluations of surface water filtration plants to assist systems in optimizing treatment and reducing the risk of passing cryptosporidium (a protozoan parasite that can infect humans) into the finished water.
- Train public water and wastewater treatment operators, and provide on-site technical assistance to support the state's operator certification program and achieve compliance and pollution prevention goals.
- Finance stormwater management practices and small creek and estuary restoration projects.[4]

[4] http://www.mde.state.md.us/Permits/WaterManagementPermits/index.asp#3.02

The Prince George's County Health Department has the responsibility to assure a safe and adequate water supply for every residence and business within the county. It is specifically mandated to evaluate well locations, permit the installation of wells, inspect wells during their construction and sample wells to assure the potability of the water supply. The department reviews monthly reporting from community water supply operators. The department also responds to calls from individual well users, along with complaints concerning illegal discharges of hazardous waste into streams or other water bodies, and requires environmental assessment as part of the county's subdivision review process if groundwater contamination is possible based on previous land use or evidence of illegal disposal of waste products. The Health Department is also responsible for assessing the necessity of water appropriation permits during subdivision review and to implement and enforce the State of Maryland's well construction regulations.

Senate Bill 970 was signed into law on May 8, 2007, and codified as Chapter 365 covering the environment, water appropriation permits, and penalties. This new law exempts most small water users (5,000 gallons per day or less) from the requirement to obtain a water appropriation permit and provides specified penalties for misappropriation or misuse of water. The new law will allow MDE to better allocate resources to address larger and more complex permits and to better enforce existing permit requirements. Public drinking water systems and withdrawals located in groundwater management strategy areas must still obtain a permit.

Other exemptions include temporary construction dewatering (up to 30 days and less than 10,000 gallons per day), creation of small subdivisions (5,000 gallons per day or less), individual domestic use, agricultural use under 10,000 gallons per day, and extinguishing a fire.

The most effective way for a water system to improve its water use efficiency is to develop and implement a water conservation plan. A water conservation plan is a written document developed for public and private drinking water systems that evaluates current and projected water use; assesses infrastructure, operations, and management practices; and describes actions to be taken to reduce water losses, waste, or consumption and increase the efficiency with which water is used, treated, stored, and transmitted.

As local governments, not-for-profits, and the private-sector industry look for cost-saving opportunities, we need to focus explicitly on water efficiency. The use of water-saving appliances, low-flush toilets (1.6 gallons) water-saving shower heads, and metered water faucets are examples of measures that individual households and businesses have used to reduce water consumption. The objective of conservation and efficiency is undermined by cracked and broken pipes, outdated metering systems, potable water used for inherently nonpotable uses, extensive public infrastructure extensions into exurban large lot residential communities, and water billing processes that fail to reward consumers for reducing water consumption.

WASTEWATER

Maintain a safe and efficient wastewater management system and sewage disposal to service Prince George's County's existing and future development needs and preserve human, environmental, and economic health.

Waste Load Allocation: The maximum load of pollutants each discharger of waste is allowed to release into a particular waterway. Discharge limits are usually required for each specific water quality criterion being, or expected to be, violated. Waste load allocation is based on the portion of a stream's total assimilative capacity assigned to an individual discharge.

Public Wastewater—During the 1940s, WSSC developed a sewage treatment plant in Bladensburg in Prince George's County to provide pollution control service to Maryland's portion of the bicounty Anacostia Basin. Shortly after the end of World War II, negotiations began with the District of Columbia for the joint Maryland and D.C. development of the Blue Plains Water Pollution Control Plant, which was designated as the regional facility for both Washington, D.C. and the Maryland suburbs. The cooperative arrangement permitted the abandonment of the WSSC's Bladensburg Plant in the early 1950s. The regional Blue Plains Wastewater Treatment Plant (WWTP) has a present day capacity of 370 mgd, of which just under 170 mgd has, by agreement, been allocated to the WSSC.

It was not until the late 1950s and the 1960s that WSSC began to develop some new permanent sewage treatment facilities of its own. These plants were located in Prince George's County to serve areas that were earmarked for growth and were financially and operationally out of reach of the regional Blue Plains WWTP. In the mid-1950s, WSSC designed and built the Parkway WWTP (opened in 1959), which has a current capacity of 7.5 mgd. The 1960s saw the opening of the Piscataway Plant in southwestern Prince George's County (now able to treat 30 mgd) and the Western Branch WWTP in eastern Prince George's County, where the nominal capacity is 30 mgd.

WSSC forecasts wastewater treatment demands based on population and employment figures compiled by Prince George's County and developed for the Metropolitan Washington Council of Governments. These projections are currently established in Prince George's County through the year 2040 as Round 7.2 and are reevaluated on a cyclical basis. WSSC develops wastewater flow projections (see Technical Appendix II) based on these figures to show existing and projected demands and capacity limits at their WWTP. WSSC forecasts indicate that current wastewater treatment capacity for Prince George's County is sufficient through the year 2030.

Additionally, several private and community systems are in place in Prince George's County to service areas of Bowie and Cedarville. A private system was originally installed in the Marlboro Meadows development but has been acquired by WSSC and effluents will be processed through the Western Branch facility by the year 2012.

Wastewater Treatment Plant Upgrades—The primary cause of the Chesapeake Bay's poor water quality and aquatic habitat loss is elevated levels of nitrogen and phosphorus. Excessive amounts of nitrogen and phosphorus create dense algae blooms that deplete oxygen and light, eventually killing grasses and aquatic species. Nutrients enter the bay through rivers and streams from point and nonpoint sources in Prince George's County and the entire bay watershed. The vast majority of point source discharges of nutrients are from sewage treatment plants, along with smaller contributions from industries. In recent years, all WSSC WWTPs have been equipped with some form of advanced treatment. The WSSC service area is generally ahead of the rest of the nation in the development of facilities that have taken a big step (tertiary treatment) beyond the conventional primary/secondary processing of wastewater. Consequently, it produces an exceptionally high quality of effluent (treated wastewater) at all of its

plants. Wastewater plant treatment upgrades over time have made significant progress toward restoring water quality in county tributaries and the bay at large. Although plant upgrades have lowered concentrations of nutrients in discharges, increases in treatment volumes have resulted in additional flow into receiving waters.

The WSSC WWTPs servicing Prince George's County include Western Branch, Parkway, and Piscataway. These plants are all funded and scheduled for enhanced nutrient removal (ENR) upgrades in the next several years. The Blue Plains WWTP (owned and operated by D.C. Water and Sewer Authority) and Mattawoman WWTP (owned and operated by Charles County) also treat sewage from Prince George's County and have ENR treatment upgrades underway. Additionally the City of Bowie, in Prince George's County, has scheduled an ENR upgrade to its wastewater facility within the next year and a half.

"The need for ever-changing technology in the wastewater industry stems from past biological systems that did a good job at removing particulate matter that we knew existed. But instrumentation just kept getting better and better at detecting more and more trace compounds that we didn't know existed or couldn't detect in earlier years,"
—Robert McMillon, former president of the Water Environment Federation

Activated Sludge Treatment Process—In the early 1960s, the Blue Plains WWTP incorporated an activated sludge treatment process to improve the quality of treated wastewater that it discharges into the Potomac River. This process passes wastewater through screens, which captures large items. This is followed by a grit removal tank, which slows down the wastewater flow enough to settle relatively heavy particles such as sand. The screens and grit tank represent the preliminary treatment system. The wastewater then flows into a primary clarifier, in which the velocity of wastewater flow is further reduced to allow for lighter particles to settle. After this physical treatment process, the wastewater is directed to the biological treatment process in the aeration basin.

In the aeration basin, bacteria take in organic matter, ammonia, and added oxygen to produce carbon dioxide and nitrates. This biological process removes more biochemical oxygen demand and suspended solids. Approximately 90 percent of the sludge is returned to the aeration basin from the final clarifier to allow for more bacteria growth. One of the by-products of this treatment was the collection of massive quantities of solids far greater than could be managed at or near the plant. In 1974, a regional agreement was signed requiring each major jurisdiction sending flows to the plant—Montgomery County, Prince George's County, and the District of Columbia—to manage its share of the sludge.

Biological Nutrient Removal (BNR)—Raw or untreated wastewater contains ammonia, which is toxic to fish. Ammonia degrades to nitrates, which removes the oxygen from the stream, therefore, killing animal and plant life. Nitrates also become fertilizers promoting algae growth. As algae die and decompose, a high oxygen demand is created, which leads to low dissolved oxygen in the water. The BNR denitrification process can convert some of the nitrate into nitrogen gas bubbles that are harmless and the wastewater effluent has no deleterious effects on receiving waters.

Maryland honored its commitment of the Chesapeake Bay Agreement by establishing the Biological Nutrient Removal Program (BNR)[5] to reduce nutrients in treated sewage.

[5] http://www.mde.state.md.us/ResearchCenter/Publications/General/eMDE/vol1no7/enr.asp

The goal of the BNR Program, established in 1984, is to reduce nitrogen levels in the treated wastewater (effluent) down to 8 milligrams per liter (mg/l). Without BNR, a typical WWTP discharges nitrogen at a level of about 18 mg/l. To date, Maryland has provided funding for this program to upgrade 45 of the 66 targeted facilities with the BNR process. An additional estimated $100 million in state grant funding is needed to complete the remaining BNR upgrades, and the state has committed to provide the funding through annual capital appropriations.

Enhanced Nutrient Removal—Maryland's Enhanced Nutrient Removal (ENR) Program takes the next step beyond BNR and controls point source nutrient discharge by upgrading wastewater treatment plants to the limit of technology for nutrient removal. ENR reduces nitrogen discharge from BNR treatment level of 8 milligrams per liter to 3 mg/l and phosphorus from 3 to 0.3 mg/l. The Bay Restoration Fund provides grants to local governments for up to 100 percent of the cost of upgrading a BNR plant to ENR. As a common method to achieve ENR, filters are added to the BNR process for additional nitrogen and phosphorus removal. An external carbon source, such as methanol, is added to the filter to increase bacteria growth and further improve treatment. This process allows wastewater treatment facilities to achieve maximum nutrient removal with current technologies.

Point Source Load Data Input—An evaluation of the six major WWTPs located within Prince George's County was conducted to reflect point source loads for total nitrogen and total phosphorus for the initial and future scenarios. These WWTPs are identified in Table 17.

Table 17: Approximate Population Forecasts by Sewershed in Prince George's County

BASIN	2005	2010	2015	2020	2025	2030
Blue Plains	407,110	425,381	440,766	450,204	456,129	458,289
Mattawoman	3,516	5,348	6,707	7,691	9,339	10,989
Parkway	54,125	55,649	55,725	55,585	55,375	55,091
Piscataway	158,835	165,315	171,417	175,374	178,771	181,490
Western Branch	167,601	185,641	196,857	204,723	210,963	216,883
Unsewered	20,212	21,924	22,775	23,414	24,197	24,702
TOTAL	811,399	859,258	894,247	916,991	934,774	947,444

Source: Prince George's County Planning Department (M-NCPPC) Round 7.1 Cooperative Forecasts, 2008.

Initial (year 2005) and future (year 2030) nitrogen and phosphorus loads were determined based on review of several resources including:

- Demand and capacity projections prepared by WSSC for WSSC-owned WWTPs.
- 2005 National Pollutant Discharge Elimination System permit discharge limits for the WWTPs.
- Monthly discharge monitoring reports for WSSC-owned WWTPs.

- ENR preliminary engineering reports for WSSC-owned WWTPs.
- Maryland's Tributary Strategy Statewide Implementation Plan.

Year 2005 loads were determined based on historic information contained in the above-mentioned resources, year 2030 projected loads, and the ultimate ENR total nitrogen and total phosphorus load caps identified in the Statewide Implementation Plan as shown in Table 17. This information shows that for the year 2030, the larger WWTPs will be near their ultimate nutrient load capacities.

Maryland's numerical limit is a maximum of 37 million pounds per year nitrogen and 2.9 million pounds per year phosphorus. To achieve this, Maryland still needs to reduce nitrogen loading by an additional 20 million pounds per year and phosphorus by 1.1 million pounds per year. Nutrient reduction from both point and nonpoint sources is necessary to accomplish this goal. The goal is to remove the bay and the tidal portions of its tributaries from the impaired waters list, Section 303d of the Clean Water Act, by 2010.

Alternative Distribution wastewater management can rely on land distribution and treatment methods in order to reduce direct discharges into streams. Land treatment systems are permitted in some states, but are not widely used because of their large land area requirements. For example, a spray irrigation system requires about four times the area of an individual home lagoon. When these systems are used, large buffer areas and fencing may be required to ensure minimal human exposure. Also, requirements include disinfection and significant pretreatment before application. Spray irrigation systems distribute wastewater evenly on a vegetated plot for final treatment and discharge. Spray irrigation can be useful in areas where conventional on-site wastewater systems are unsuitable due to low soil permeability, shallow water depth table or impermeable layer, or complex site topography. Treatment occurs within the soil before the wastewater reaches the groundwater.

The evapotranspiration/infiltration process is a subsurface system designed to dispose of effluent by both evapotranspiration and infiltration into the soil. In evapotranspiration/infiltration systems, effluent is allowed to percolate into the underlying soil. Modifications to evapotranspiration/infiltration systems include mechanical evaporating devices and a broad array of different designs and means of distribution, storage of excess influent, wicking, and containment or infiltration prevention. Some newer studies are using drip irrigation with distribution to forested areas with purported success.[6]

Rapid infiltration is a soil-based treatment method in which pretreated wastewater is applied intermittently to a shallow earthen basin with exposed soil surfaces. It is only used where permeable soils are available. Because loading rates are high, most wastewater infiltrates the subsoil with minimal losses to evaporation. Treatment occurs within the soil before the wastewater reaches the groundwater. The rapid infiltration alternative is rarely used for on-site wastewater management. It is more widely used as a small-community wastewater treatment system in the United States and around the world.

In an overland flow system, pretreated wastewater is spread along a contour at the top of a gently sloping site that has minimum permeability. The wastewater then flows down the slope and is treated by microorganisms attached to vegetation as it travels by sheet flow over very impermeable soils until it is collected at the bottom of the slope for discharge.

Infiltration or Percolation: The technique of applying large volumes of waste water to land to penetrate the surface and percolate through the underlying soil.

Evapotranspiration: The combined effect of water removal from a medium by direct evaporation and by plant transpiration.

[6] http://www.epa.gov/nrmrl/pubs/625r00008/html/html/tfs6.htm

Today's wastewater treatment challenges are to improve or develop technologies that address the changing issues of society, while keeping an eye on the advances these technologies may provide in the future. Some technology advances will lead away from chemical additives and back to using naturally occurring bacteria as well as recycling what is produced naturally in the process, such as oxygen and methane. Such technologies must continue to advance and provide additional nutrient removal services to best manage effluents and wastewater discharges.

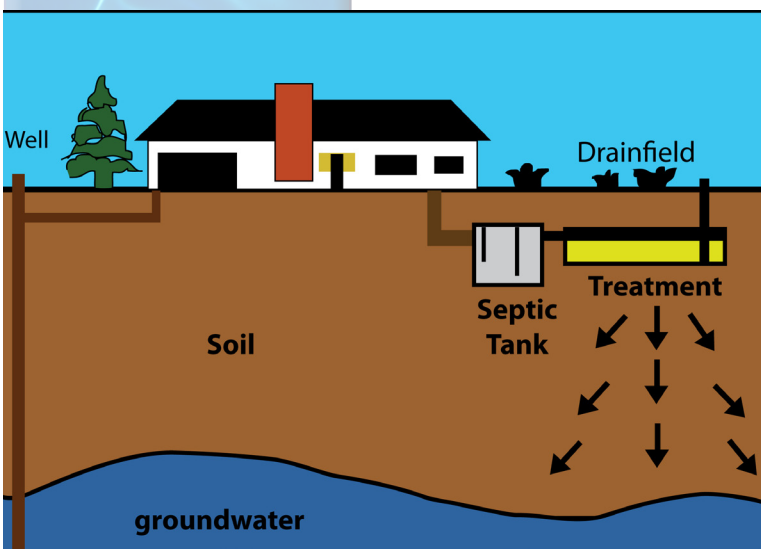


Figure 12: Septic System Diagram

Septic Systems—Ten to 12 percent of property owners in Prince George's County rely on on-site sewage disposal systems (OSDS), for wastewater treatment. The average person using a septic system delivers about 9.5 pounds of nitrogen per year to the groundwater. If you live on one of the over 51,000 properties in the county within the Chesapeake Bay critical area (the land within 1,000 feet of tidal waters) and are served by a septic system, approximately 80 percent of the nitrogen from your septic system will reach surface waters.

The standard on-site wastewater treatment system for homes and small businesses consists of a basic septic tank connected to a septic drainfield. Effluent from homes and businesses flows into the septic tank. Flows leave the tank through one solid-walled pipe that carries the effluent to a distribution box from whence the flow is distributed into a connected series of drainfields. The pipes within the drainfield are laid out parallel to the contour of the ground in regular spacing intervals to form a subsurface dispersal system. Perforations within the pipe walls allow effluent to leave the pipes at random rates of flow. Many modern septic systems are designed to use a pump chamber that allows the effluent to be pressure dosed, resulting in a more uniform rate of flow throughout the drainfield system. The use of small diameter pipes within the conveyance system associated with low pressure distribution and drip systems allow for the system to be located closer to the surface where evapotranspiration may more effectively remove nitrogen in the form of nitrates and phosphorus.

Of critical importance to the functioning of the septic system is the size of the central receiving tank. The volume of the central tank is directly proportional to the expected flow rate of the effluent. As a rule of thumb, the volume of the tank will be at least 50 percent more than the expected daily effluent flow. The tank serves as a settling basin that separates out the various components of the effluent. Fortunately, septic tanks within Prince George's County are sized 30 percent larger than in other jurisdictions. The use of two compartment tanks and outlet filters are options that result in improved septic tank effluent quality.

Most of the nitrogen in traditional septic tank effluent, where denitrification has not occurred, is discharged primarily as highly diluted nitrates into groundwater. Although shallow groundwater is still utilized as a drinking water source by some county residents, groundwater is predominantly discharged to surface waters. Septic systems have been designed to remediate most public health threats, but no matter how well

the septic systems may have been constructed, they are not designed to significantly reduce discharged nitrogen. All septic systems are contributors of nitrogen to our local watersheds at varying degrees. This excess loading of nutrients, like nitrogen and phosphorus, from septic systems contribute to degraded water quality and negatively impact the ecology of the bay and its tributaries.

The Prince George's County Health Department plays an important part in the subdivision review and single-lot development process. During the process, the Health Department works with the applicant to determine the best type of sewage disposal as well as the best possible location of the sewage disposal system to maximize buffers to groundwater and distances to streams and other bodies of water. Through its testing procedures, the Health Department assures that the land has the capacity to assimilate sewage effluent as necessary to prevent health consequences. After testing, the applicant is required to provide the Health Department a site plan delineating the proposed sewage disposal areas and well locations for on-site systems. The department is also responsible for the review of site plans that designate the septic system design, the permitting of the construction of that system, and the inspection and documentation of the installation of the system. At a larger scale, the Health Department also plays an active role in the development of water and sewer plans for the county and provides comments and testimony for proposal and amendments to the plan. The local Health Department and environmental protection programs are in place to ensure the citizens of Prince George's County have safe drinking water, adequate septic systems, and clean streams.

Septic System Upgrades[7]—Nitrate contamination in groundwater has become an increasingly serious problem, especially in agriculture-oriented communities. Septic tank systems are the most common form of on-site wastewater management systems in the rural communities of Prince George's County. However, traditional septic systems fail to significantly treat nitrate and other contaminants, which make septic tank systems a minor source of nitrate contamination to surface waters within Prince George's County. Even though septic systems within the county likely contribute little to total nitrogen water resource loads, it has become imperative to remove nitrate from septic tank effluent in order to reduce the cumulative impacts from nitrogen in groundwater and in surface waters within the Chesapeake Bay critical areas and properties in the vicinity of the Patuxent reservoirs.

One of the most efficient methods to treat nitrate is the biological denitrification process. Biological denitrification is effective in nitrate removal as long as there is sufficient external organic carbon to support bacteria growth, something that is typically available in the discharge of household waste. Currently there are several approved aeration treatment units that utilize biological denitrification to effectively remove approximately 40 percent of the nitrogen within a septic system. Through the Bay Restoration Fund the MDE has awarded grants totaling approximately $9 million to ten jurisdictions statewide to provide money for septic system upgrades. The grants will finance the implementation of approximately 700 septic system upgrades annually in Maryland. Recently, funding has been limited to the installation of these systems as part of a replacement system for failing septic systems located in the critical area. Several property owners within Prince George's County are taking advantage of these

Denitrification: The biological reduction of nitrate to nitrogen gas by denitrifying bacteria in soil.

[7] http://www.mde.state.md.us/ResearchCenter/Publications/General/eMDE/vol3no6/septic_upgrades.asp

Infiltration:

The penetration of water from the soil into sewer or other pipes through defective joints, connections, or manhole walls.

monies in the remodeling of their disposal systems. A law enacted by Senate Bill 554 requires that all residences built within the Chesapeake Bay critical area after October 1, 2009, incorporate bay restoration systems into their septic system design.

The Bay Restoration Fund is also being used to support the upgrading of the 66 largest wastewater treatment plants in Maryland to ENR technology and to expand planting of nitrogen deposition reducing cover crops on agricultural land.

By 2030, based on the normal lifetime of a septic system, it can be assumed that all existing septic systems will need to be repaired due to the system failures that will likely occur during the next 20 years. This will be a daunting task since there is no mandated law enforcement for upgrades and self-reporting or a house by house inspection cannot be expected. With this assumption, a 100 percent implementation of septic system upgrade is unlikely. Therefore, the default implementation rate of 50 percent for nonpoint sources is used in the nutrient model exercise of this plan for the existing septic system upgrade, 100 percent for any new septic system, and somewhere near five percent is assumed to be connected to public systems by 2030.

Sanitary Sewer Overflows (SSO is an unintentional discharge of untreated, raw sewage into local waterways. Overflows occur when there are too much infiltration and inflow into the sanitary system from surface water or groundwater infiltrating through cracks in the pipe infrastructure, particularly during significant rain events; rain water, snow-melt, or groundwater flowing into the sanitary system through roof drains or house leads connected to sewers; undersized sanitary systems with sewers and pumps that are too small to carry the sewage; system failures due to tree roots growing into the sewer; sections of sewer pipe settling or shifting so that pipe joints no longer match; stream incising below sewer pipes in streambeds, undermining their support causing the pipes to rupture; sediments, fats, oils, grease and/or other material building-up and causing blockages; equipment and pump failures; power failures; and human error.

Sewer overflows have taken place at the Broad Creek pumping station and Piscataway and Western Branch WWTPs. These overflows, as well as sewer line breaks, have discharged untreated wastewater into county waterways. WSSC has begun planning and design of a sewer from the Broad Creek pumping station to Piscataway WWTP and a wastewater storage tank at the WWTP. This tank is expected to serve as a back-up in event of failures at Broad Creek and to prevent sewage discharges there. In 2005 WSSC entered into a consent decree with MDE and the U.S. EPA for Prince George's and Montgomery Counties to implement reporting, monitoring, inspection, maintenance, repair and replacement remedial measures for its sewage collection system as part of a comprehensive 12-year plan. In the area specific to the Piscataway WWTP, WSSC must conduct sewer system evaluation surveys, develop a water quality monitoring plan, determine bacteria sources, and test for fecal coliform. State and federal regulations require WSSC to reduce overflows and meet Clean Water Act requirements.

Sanitary sewers are designed and installed with sufficient diameter to carry the normal waste discharges from a residence or business. When fats, oils, and grease (FOG) are discharged to the sewer, it cools and accumulates on the sidewalls of the sewer pipes. Over time, this accumulation of grease restricts the flow and causes blockages in the sewer that may result in overflowing manholes or basement backups. SSOs can discharge to storm drains and creeks that ultimately flow to the Chesapeake Bay. All food service establishments (FSE) having the potential to discharge FOG must apply

for a FSE wastewater discharge permit. The establishments may include restaurants, cafeterias, grocery stores, hotel kitchens, church kitchens, school kitchens, bars, or any other commercial or industrial operation that discharges grease-laden wastewater.[8]

Upon the issuance of a FSE wastewater discharge permit, WSSC provides inspection services to address compliance. WSSC is currently partnering with the Restaurant Association of Maryland to help the food service industry understand the problems associated with FOG discharges and to provide business owners assistance managing FOG correctly through the use of BMPs.

Waste vegetable oil ("yellow grease") from restaurants is becoming a resource for the agricultural industry because it can be converted to bio-fuel and run much of its farm equipment and trucks on converted diesel engines. Currently restaurants must pay a hauler to carry away the cooking oil waste. Pennsylvania implemented a program to swap cooking oil for fresh produce when the farmers came into the city with goods. This program not only ensures that cooking oil doesn't reach the sewer systems but supports local farmers and food production. Montgomery and Prince George's County's parks are also possible users for recycled cooking oil in converted diesel equipment.

Reclaimed Water Reuse is wastewater, graywater, or rainwater that has been treated to such a high level it can be used safely and effectively for nondrinking purposes such as landscape and agricultural irrigation, heating and cooling, and industrial processing. Reclaimed water is available year-round, even during dry summer months or when a drought strains other water resources. Reclaimed water is highly filtered and disinfected and is tested often. It contains only trace amounts of some nutrients and dissolved chemicals. Although reclaimed water is not drinking water, it is safe for human contact, even unintentional swallowing or exposure to open cuts. Reclaimed water is distributed through a separate set of purple pipes. Purple is the nationally designated color marking reclaimed water pipes, hoses, pumps, and other equipment. Development of a plan to study opportunities for reclaimed water will require an open regional participation process to provide input and advice throughout the planning process. The participation process should provide a broad range of opportunities to engage community leaders, environmental groups, regulatory agencies, water/wastewater utilities, business and civic organizations, the general public, and potential agricultural, recreational, commercial, and industrial user groups.

Panda Energy,[9] a gas-fired power plant in Brandywine, developed a reclaimed water system to support the plant's cooling operation. Panda worked closely with the Power Plant Research Program[10] to study the feasibility of bringing treated effluent water into the facility for cooling. Ultimately the plant devised a combination permit for water access: one permit for an average of 64,000 gallons per day of groundwater for the boiler structure and other auxiliary uses and a second for effluent from the Mattawoman WWTP in Charles County for the five unit mechanical draft cooling towers. All effluents are then returned to Mattawoman WWTP. Panda constructed a 17-mile pipeline to bring tertiary treated effluent to the plant for the cooling tower that entered commercial operation on October 31, 1996.

Greywater is nonindustrial wastewater generated from domestic processes such as dish washing, laundry and bathing. Greywater comprises 50-80% of residential wastewater. Greywater comprises wastewater generated from all of the house's sanitation equipment except for the toilets (water from toilets is blackwater, or sewage).

[8] http://www.wsscwater.com/rsg/FOGProgram/index.cfm#overview

[9] http://esm.versar.com/PPRP/powerplants-new/pandainfo.htm#aspects

[10] http://www.dnr.state.md.us/Bay/pprp/

Fly Ash
is produced from the burning of pulverized coal in a coal-fired boiler is a fine-grained, powdery particulate material that is carried off in the flue gas and usually collected from the flue gas by means of electrostatic precipitators, baghouses, or mechanical collection devices such as cyclones.

Mirant's Chalk Point Generating Plant, the largest power plant in Maryland, helps support the D.C. area's thriving economic hub. Chalk Point, located in Aquasco, is predominately a coal-fired steam generating power plant. Steam generating plants use large volumes of water for cooling and Chalk Point uses the nearby Patuxent River as its water source. The surface water appropriation is based on a forecast of the plant's water needs over several years. The surface waters also receive the effluent and wastewater discharges from the power plant. Both withdrawal and discharge of water at power plants can adversely affect surface water quality. MDNR's Power Plant Research Program is working in partnership with electric utilities to avoid, minimize, and mitigate adverse impacts on both local and regional scales. Recent research on the regional level undertaken by MDNR includes a statewide biological stream survey to provide comprehensive baseline information on the health of freshwater systems in Maryland and to reference-based ecological indicators. These indicators are critical for assessing the effects of different degrading activities and measuring progress toward environmental goals. A related cumulative impact model, currently under development, will couple indicators of biological integrity with spatial data on land uses, power-related impacts, and other anthropogenic stressors to evaluate watershed impacts on aquatic systems.[11]

Chalk Point has recently applied for permits to drill to the Patuxent aquifer, in order to withdraw water for the plant's air scrubbers as a part of its compliance with updates to the Clean Air Act. This additional consumption of potable water for nonpotable use should be carefully scrutinized in light of the statewide decline in aquifer water levels. Alternative recycled wastewater options should be analyzed for feasibility and cost.

Although ample water is available to provide cooling for Chalk Point, adverse environmental impacts can result from withdrawing, heating, and discharging such large volumes of water. The aquatic organisms are impacted through entrapment, impingement, entrainment, and discharge effects. Alternative recycled graywater options should be analyzed for feasibility and cost. A partnership with WSSC could alleviate the need for drilling, aquifer water withdrawal, and further decline of water resources in the county. Considerations should include:

- Technical feasibility and cost effectiveness of various pollution control alternatives.
- Air emissions of acid rain precursors and particulate matter, including heavy metals.
- Aquatic impacts of cooling water withdrawals and discharges.
- Beneficial use of combustion by-products.
- Unique approaches to minimize resource consumption.

Mirant is in the process of a $1.6 billion upgrade to the coal-burning plant to install scrubbers that will filter out sulfur, nitrogen, and mercury before they leave the smoke stacks. The measures are expected to be complete by early 2010. Currently Mirant has received permit approval from MDE to remove potable water from the Patuxent aquifer for this process. WSSC and Mirant discussed using recycled graywater from

[11] http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V78-3XK0PBH-22&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&view=c&_searchStrId=980667681&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=3e3102fa59548aec29fa8edfae14fa53

the Western Branch WWTP for the air scrubbers. The study indicated that Mirant was unable to use wastewater from the western branch facility until the plant had completed its ERN upgrade.

During the combustion of coal, bottom ash, fly ash, flue gas desulfurization waste, and fluidized bed boiler waste may be produced.

Although some of these wastes are used in building materials and as structural fill material, the majority is disposed in landfills and surface impoundments. The potential for groundwater contamination from leachate originating from these landfills and surface impoundments represents the greatest environmental concern for disposal of coal combustion by-products. Leachate from coal combustion by-products can contain elevated concentrations of boron, sulfate, trace metals, and other inorganic constituents. To properly evaluate the potential impact of coal combustion by-products disposal on groundwater quality, the physical and chemical properties of coal combustion by products, transport processes in groundwater, and the solution techniques of mathematical models must be understood.[12]

Rainwater Harvesting—On-site rainwater collection is one means to augment fresh water needs and help prevent rapid stormwater accumulation and runoff from roof areas. Harvested rainwater is rainwater that is captured from the roofs of buildings and can be used indoors or for irrigation depending on its processing and intended use. Rainwater harvesting techniques can provide a free, high-quality water source once the initial investment in collection and storage systems is recouped. Systems as simple as rain barrels, or more complex with filters and purifiers, are becoming increasingly more mainstream and commercially available. The U.S. Green Building Council supports rainwater harvesting and applies certification credits for implementation of a rainwater collection and reuse system[13].

Rainwater Harvesting Rooftop Collection Estimation: One inch of rainfall on a 1,000-square-foot roof could collect 600 gallons of water. —Tucson Water; Rain Water Harvesting and Gray Water Reuse Resources

[12] http://www.mcrcc.osmre.gov/PDF/Forums/CCB/6-1.pdf

[13] http://www.greenhomeguide.org/documents/leed_for_homes_rating_system.pdf

CHAPTER ISSUES SUMMARY

- Plans for future growth must take into account protection of the county's water supplies for drinking water and assimilative capacity of streams for wastewater treatment.
- Aquifers cross jurisdictional boundaries and are utilized by many counties and municipalities, necessitating the need for regional planning for conservation of these resources.
- Conservation and efficiency standards for potable water should be defined and incentivized.

POLICIES AND STRATEGIES

POLICY:

Water and sewer service area boundaries are consistent with county growth policies recognizing that public water and sewer should service high-density development that is greater than one dwelling unit per acre except in cases involving public health and welfare risks.

STRATEGIES:

- Modify the 2008 Water and Sewer Plan to prohibit public water and sewer extensions to the Open-Space (O-S), Rural-Agricultural (R-A), and Rural-Estate (RE) zones with the exception of cases with documented septic and/or well health or adequacy issues that cannot be met on-site.
- Continue to review water and sewer category changes during scheduled review cycles (three times per year) to address policy inconsistencies, new environmental regulations or conditions, and/or public health and welfare concerns.
- Create and maintain adequate funding mechanisms to finance perpetual maintenance and replacement of public water and sewer infrastructure.
    - Infrastructure renewal fees.
    - Phased implementation of additional fees.
- Public education to increase understanding of additional fees and why they are necessary, how they work, and the direct and indirect benefits they provide.
- Adopt a stewardship education and outreach program that promotes and supports standards for residential, commercial, and institutional practices that reduce water use, and support water reuse and wastewater recycling for nonpotable uses.

POLICY:

The reuse of reclaimed water including wastewater; grey water; and rainwater for nonpotable purposes offers the potential to reduce the existing and future demands for potable water and support of our natural hydrologic cycle.

STRATEGIES:

- Capture, treat, and reuse wastewater for nonpotable uses including industry, commerce, agriculture, and irrigation.
- Develop a water reuse program that establishes standards for regional participation.
  - Consolidate issue analysis and coordinate with community leaders, environmental groups, regulatory agencies, water/wastewater utilities, business and civic organizations, the general public, and potential agricultural, recreational, commercial, and industrial user groups.
- Evaluate elements of a future reclaimed water program within Prince George's County to include:
  - Identification of regional issues related to developing a reclaimed water program including environmental, public health, financial, regulatory, community, and wastewater system operational issues.
  - Consideration of treatment, transport and reuse standards as part of future reuse strategies.
  - Description of costs, challenges, and benefits associated with reclaimed water including financial, operational, social, and environmental considerations. Evaluation of the county's building code for regulatory impediments to the reuse of wastewater, graywater or rainwater for residential, commercial, institutional, and commercial uses.
  - Coordination with WSSC to establish advantages, disadvantages, feasibility, and actions needed to develop a reclaimed water program.
- Identify opportunities for using reclaimed water including:
  - Nonpotable domestic uses
  - Commercial uses
  - Industrial uses
  - Steam flow augmentation
  - Wetlands enhancement
  - Groundwater recharge
  - Irrigation
  - Fire suppression
- Develop policies that facilitate implementation of feasible, beneficial, and economical applications of reclaimed water.

POLICY:

Adequate public and private drinking water and sewerage disposal are sufficiently addressed in the planning, development, and subdivision process, and the role of water and sewer service categories as an implementation tool for county growth policies is comprehensively addressed in the Ten-Year Water and Sewer Plan.

STRATEGIES:

- Evaluate the current planning, review, and approval process for water and sewer permitting to assure consistency with General Plan policies.
- Bring WSSC into the master planning and development review process earlier in order to assure capacity management plans and water demand forecasts are current with ongoing and planned development in the county.
- Proactively pursue state and other grants for installing innovative and alternative nitrogen removal septic systems and connecting failing systems to community systems if appropriate.

Drinking Water

A safe and adequate drinking water supply is critical to the sustainability of existing communities and to the viability of future planned growth.

POLICY:

The county provides a safe and ample supply of drinking water from both surface and groundwater sources to county residents, workers, and visitors.

STRATEGIES:

- Provide regulatory protection for source water resources including reservoirs, rivers, streams, wetlands, and aquifers to assure high quality and an adequate quantity of drinking water.
- Preserve and enhance the green infrastructure network to provide pollutant removal benefits, provide some protection for both groundwater and surface sources of drinking water, and provide groundwater recharge opportunities.
- Establish and maintain quality standards and controls for local drinking water, and routinely maintain and improve drinking water infrastructure systems to sustain public, environmental, and economic health.
- When reviewing land development proposals, emphasize the protection and preservation of source water resources including wetlands and headwater areas of streams and the preservation and maintenance of natural hydrology and topography. Encourage groundwater recharge through techniques such as rain gardens, existing wetland area enhancements, and riparian buffer preservation and creation to the maximum extent practicable.
- Evaluate the existing aquifer draw downs, provide future use projections, establish conservation and efficiency strategies and locate, put into operation, and maintain monitoring wells to verify assumptions and realities.
- Conduct a comprehensive aquifer study in coordination with neighboring jurisdictions to evaluate future growth scenarios and watershed environments considering water supply conditions and demands.
- Utilize source water assessment reports, water quality assessments conducted by the U.S. Geological Survey (USGS) or the Maryland Geological Survey (MGS) and other available county or region-specific assessments to provide information for assessing areas served by residential wells.

- Develop source water assessment reports to provide recommendations for public and private water systems and develop area-specific, countywide or regional water management solutions, for example, interjurisdictional agreements for protecting regional reservoirs.
- Develop a water conservation plan for public and private drinking water systems that evaluates current and projected water use, assesses infrastructure, operations, and management practices, and describes cost effective actions to be taken to reduce water losses, waste, or consumption and increase the efficiency with which water is used, treated, stored, and transmitted.
- Upgrade the Potomac River WFP intake structure with flexibility to withdraw water from a submerged mid-channel location if deemed feasible.
- Establish county and localized strategies for efficiency regarding demand and supply for drinking water.

  Supply Side

  - Ensure source water protection
  - Implement improvements in metering and billing
  - Locate illegal or unregistered connections
  - Inspect, clean, and perform maintenance on pipes to prevent leaks
  - Manage pressure to reduce volume and frequency of water loss
  - Control water levels to reduce storage overflow

  Demand Side

  - Eliminate downsizing, or postponing the need for capital projects
  - Extend the life of existing facilities
  - Lower variable operating costs
  - Avoid new source development costs
  - Improve drought or emergency preparedness
  - Educate customers about the value of water
  - Improve reliability of safe and dependable yields
  - Protect and preserve environmental resources[14]

POLICY:

The county recognizes the limitations of groundwater resources in the county and establishes priority uses as well as conservation and efficiency standards.

[14] Developing and Implementing a Water Conservation Plan Guidance For Maryland Public Water Systems On Best Management Practices For Improving Water Conservation And Water Use Efficiency, 2003, Maryland Department of the Environment Water Supply Program

STRATEGIES:

- Consider water withdrawals and availability on a watershed basis to allow for evaluation of demands being placed on groundwater resources by others and evaluate recharge opportunities within the watershed.
- Evaluate the existing aquifer draw downs, provide future use projections, establish conservation and efficiency strategies and locate, put into operation, and maintain monitoring wells to verify assumptions and realities.
- Work with USGS and MGS to continue to update aquifer draw down and stream flow data and coordinate data collection and findings with neighboring jurisdictions that rely on, and contribute impacts to, shared water resources to account for the broad-based regional influences on the Patapsco aquifer.

Wastewater

Safe, functional, and efficient wastewater management and sewage disposal systems are critical to the preservation of human, environmental, and economic health.

POLICY:

Wastewater management treatment technologies are consistently becoming more efficient and versatile. Incorporate the most effectual and ecologically sustainable technologies to countywide wastewater systems.

STRATEGIES:

- Reduce or eliminate septic system failure and compromised functions that contribute significant nitrogen loads to waterways particularly relative to soil conditions and in relationship to physical proximity of surface waters.
- Require nitrogen removal septic systems for all new development and retrofit existing septic systems within 1,000 feet of surface waters and tributaries.
- Require all new or failing septic systems countywide to be replaced with the best available technology.
- Develop an inspection and maintenance program for traditional and denitrification septic systems.
- Continue to support wastewater treatment facility upgrades to achieve ENR standards.
- Support funding and implementation of advanced treatment technologies and other future capital upgrades required for wastewater treatment facilities to meet wasteload allocations.
- Establish growth and development planning policies and programs requiring assessment of impacts to wastewater conveyance capacity, treatment capacity, wasteload allocations, and other factors impacting water resource management.

POLICY:

Wastewater treatment plant and infrastructure failures result in untreated effluent being directly discharged onto surface water and groundwater. Coordinate with WSSC to promote strategies, programs, and funding required to minimize these events. Develop strategies to eliminate, or at a minimum, mitigate these events.

STRATEGIES:

- Coordinate with WSSC to support implementation of programs, funding, and outreach for wastewater collection system upgrades that will reduce sewage overflows and flooding due to pipe failure, capacity constraints, infiltration, blockages, and power, process, and pump station failure.
- Develop stream bank restoration and protection programs to reduce erosion that can contribute to pipe failure.
- Support development of a "yellow grease" recapture program at bicounty restaurants to eliminate grease that can cause sewer overflows and provide a reusable resource for agricultural and parks departments' needs utilizing diesel-powered equipment converted to bio-fuel derived from cooking oil.
- Support programs and funding that prioritize infrastructure repair in developed communities and designated centers and corridors, particularly in areas designated for redevelopment through other county plans.
- Inspect all oil/water separators, grease interceptors, and grit traps on an annual basis to ensure they are operating properly and that oil and accumulated sediments are removed before they exceed the capacity of the vessel.
- Support implementation of programs and funding needed to provide any necessary investments in infrastructure such as holding tanks and back-up generators at wastewater treatment plants that assist with flow management during power loss, human error, or excess capacity contributing to unintended raw sewage discharges.

IX: STEWARDSHIP AND IMPLEMENTATION

Achieve water resource protection and restoration through implementation strategies that incorporate scientific research; data collection and dissemination; funding opportunities; regulatory revision; conservation programs and strategies; community engagement; outreach and education; and interagency and interjurisdictional communication, coordination and cooperation to achieve measurable goals and successes for water quality improvement.

A viable water resource protection and restoration plan will require a more expansive planning strategy than is currently in practice in Prince George's County. New planning methodologies, coupled with expanded data resources and modeling technologies, allow local planning departments to examine existing conditions and projected impacts from proposed development and growth scenarios more thoroughly using systems-based analysis. To implement water resource protection, mitigation, and remediation strategies, Prince George's County will need to assess existing and future development patterns while considering the cost of infrastructure, environmental protection and land conservation, and the integration of data and technological resources. It is the responsibility of the county's agencies, departments, and political electorate to establish a clear communication of *consensual* intent to the citizenry regarding the policies and priorities for the existing and future protection of the county's natural environment, social well-being, and economic stability. Smart growth principles offer a range of implementation strategies for ensuring a sustainable quality of life:

Intergovernmental Cooperation and Communication

- Education and Outreach
- Community Engagement and Funding
- Data Collection, Management, Distribution, and Incorporation
- Conservation, Preservation, and Restoration Programs
- Regulatory Revision
- Systems-Based Management

INTERGOVERNMENTAL AND INTERJURISDICTIONAL COMMUNICATION, COOPERATION, AND COORDINATION

Collaborate with, and develop planning initiatives and actions between, governmental agencies and political representatives, neighboring jurisdictions, and county municipalities that share responsibility for water resource protection and management.

Diminishing water availability and quality and the loss of critical habitat for fish and wildlife are key issues facing Prince George's County. The county depends on reliable supplies of clean water to support growing communities, restore our natural resources, and provide for agricultural production. In order to move forward on increasingly critical water issues, citizens, interest groups, and government agencies will need to develop new, more collaborative ways of solving problems.

Land use decisions in Maryland are overwhelmingly made by municipal and county governments, whereas many environmental regulations, such as water withdrawal and allowable quantities of wastewater delivered to the receiving waters, are made and enforced by the federal and state governments through the U.S. Environmental Protection Agency (EPA) and the Maryland Department of the Environment (MDE). These regulations have direct and indirect incentives and impacts that affect land use decisions.

Lack of coordination sometimes poses a conflict between local government growth plans and the influences and limitations that are placed upon those plans by the state. In fact, there are a few examples in which MDE has asserted its authority in ways that resulted in development moratoria that frustrated growth plans. MDE asserted its authority due to limited water supplies or because wastewater treatment plans were over their capacity and unable to meet permit limits.[1]

Bringing together the county's agencies, utilities, and the municipalities' planning objectives into one process allows planners, regulators, and the electorate to work as partners to evaluate more specifically the resource protection needs in watersheds and identify strategies to provide water and wastewater service to support future planned growth. Water supply and wastewater planning must be done in concert with local planning objectives, interests, and needs and must be accomplished at the county level in close coordination with the agencies that have water resource responsibility within the county. Thus, water resource planning must be performed as a multiagency effort for water resource management of shared watersheds and sewersheds for water supply and/or wastewater disposal.

The Water Resources Element (WRE) of the Prince George's County's General Plan has been developed as an integrated countywide Water Resources Functional Master Plan (Water Resources Plan) in order to establish a framework for, and provide guidance to, water resource protection and restoration, and to provide support for, and information to, similar planning efforts at various agencies and at various planning jurisdictional levels.

[1] Challenges of a Growing Maryland Balancing Land Use and Environmental Decisions, A Series of Workshops Sponsored by: Maryland Department of the Environment and Maryland Department of Planning.

EDUCATION AND OUTREACH

Provide environmental educational resources, training, and activities to the residents, businesses, institutions, industries, and other county land users through an open and transparent platform that serves to inform and engage the community in shared goals, policies, and strategies for water resource preservation, protection, and restoration.

Stormwater runoff results from our daily activities; therefore, public education is an important component of a stormwater management program. Stormwater education efforts should include traditional educational efforts and activities for the public to become involved and engaged in stormwater management. Messages should focus on the daily activities of residents and businesses that contribute to stormwater pollution. Stormwater education is considered one of the most cost-effective best management practices (BMPs).

Anne Arundel County, Maryland, offers a great example— **The Watershed Stewards Academy**[2]—of community education coupled with active project engagement. This program, created by the Anne Arundel County Department of Public Works (DPW) and Anne Arundel County Public Schools, trains county residents to work in their communities to reduce the pollution that flows into the county's storm drains, local rivers and, eventually, the bay.

The idea for the Watershed Stewards Academy formed when DPW partnered with **Arlington Echo**[3], which is part of the Anne Arundel County Public School system, to find a way to teach citizens about reducing pollution in order to meet federal pollution reduction regulations. The long-term goal of the Watershed Stewards Academy is to reduce polluted runoff to the bay and empower citizens through improving their understanding of the actions they can take to rainscape, reduce nitrogen and phosphorus, properly dispose of pet waste, and plant more trees and native species. The Watershed Stewards Academy goal is:

To give Master Watershed Stewards the tools to educate, engage, and empower citizens, businesses, and communities to restore subwatersheds in Anne Arundel County. Restoration efforts will emphasize stormwater infiltration to restore watershed function.
—The Master Watershed Stewards

The **Surf Your Watershed** project is a cooperative effort involving the Maryland Departments of the Environment and Natural Resources to catalog important environmental, socioeconomic, and programmatic information on a watershed basis. The project provides a database in which natural resources and biological information (including hydrologic, hydraulic, and water quality); bibliographic references; contacts, programs and activity descriptions; and other data can coexist and be easily obtained for watershed management, planning, and natural resource conservation programs and projects.[4] This project affords all interested parties in Prince George's County access to watershed information. The county should actively support this project and help educate citizens regarding its use and its applicability.

[2] http://www.arlingtonecho.net/Restoration-Projects/Watershed-Stewards-Academy.html.

[3] http://www.arlingtonecho.net/

[4] http://www.dnr.state.md.us/watersheds/surf/

Green industries and environmental technologies offer multiple opportunities to provide economic, social, and environmental benefits to the county and its residents. Partnerships with schools, nonprofits, environmental education centers, and green businesses can facilitate countywide participation in programs, funding opportunities, and accessing informational resources in order to proactively engage in personal and community management of water resources. By maximizing an array of education and participation opportunities, we optimize the chance to connect with people in the context of their interest and values, and augment their current level of understanding or motivation.

Community and citizen participation in water resources protection and preservation is critical to the long-term success of implementation strategies. Educational training, workshops, conferences, tours, and other events for the general public, as well as environmental professionals, community groups, and the business and industrial community should provide:

- Technical environmental training
- Home and building efficiency education
- Personal sustainability education and events
- Civic leadership training

COMMUNITY ENGAGEMENT AND FUNDING

The Prince George's County citizenry and business community should be informed, engaged, supported, and included in decision-making that establishes and achieves shared community visions and objectives to protect, restore, and manage water resources.

Community support for resource protection by planning and regulatory agencies increases a community's capacity to respond to change and opportunity, thereby increasing community resilience. Providing the opportunity for communities to actively participate in evaluating their existing conditions and development experiences enables them to avoid errors and replicate successes. Resilient communities can actively influence and prepare for economic, social, and environmental change. Communities that utilize social capital maintain access to good information and communication networks and can call upon a wide range of external as well as internal resources. Although community members cannot control all the changes that impact their community, they can respond effectively to those changes and can continue to improve their community's ability to thrive and change. Such a strategy will need to engage stakeholders, identify and set priorities for action, assign responsibility, monitor implementation, and keep strategies under regular review.

The **Alliance for the Chesapeake Bay** is a regional nonprofit organization that builds and fosters partnerships to protect and restore the bay and its rivers. The alliance does not lobby or litigate. Instead, they bridge dialogue between groups that do not see eye-to-eye, forming strategies for joint solutions, and build the capacity of communities for local-level action. To this end, the alliance:

- Develops methods and tools for restoration activities and trains citizens to use them.
- Mobilizes decision-makers, stakeholders, and other citizens to learn about bay issues and participate in resolving them.

- Provides analysis, information, and evaluation of bay policies, proposals, and institutions.

The Alliance for the Chesapeake Bay builds partnerships and consensus to protect and restore the bay. Their activities are organized within four major program areas:

- **Watershed Protection and Partnerships**—Projects that teach or promote sustainable practices for how to live, work, and play in the bay watershed. Projects often involve: (1) training of individuals, organizations, local governments, and businesses on watershed protection techniques; (2) involvement of citizen volunteers in the planning and implementation of local activities; and (3) a strong partnership component. Projects include RestoreCorps, BayScapes, Businesses for the Bay, and River Sojourns.
- **Restoration and Monitoring**—Projects involve on-the-ground restoration and monitoring activities, often for the purpose of demonstrating innovative restoration or monitoring techniques. Projects usually involve citizen participation. Projects include submerged aquatic grass restoration and monitoring.
- **Communication and Information**—Projects that present balanced, objective, and in-depth information on issues central to the restoration of the Chesapeake Bay watershed. Projects include Bay Journal, Ask the Bay Experts, and Alliance fact sheets and white papers, as well as the annual Taste of the Chesapeake and the Frances Flanigan Environmental Leadership Award.
- **Public Policy**—Projects and roles that facilitate the balanced analysis of Chesapeake Bay policy issues, fosters citizen participation in the establishment of sound policy, and builds consensus where constructive dialogue is lacking. Projects include Citizens Advisory Committee to the Chesapeake Bay Program and Builders for the Bay roundtables.

Many communities in Prince George's County are actively engaged and participate in the planning process. During the development of sector, master, and subregion plans, the planning process must include a significant outreach and public participation program. Many residents go beyond the scope of participation in community planning and have organized groups, committees, and nonprofits that address complex environmental, social, and economic issues. As part of a countywide effort to remediate, protect, and manage water resources, it is clear that these groups, and the engaged and concerned citizenry of Prince George's County, represent an invaluable human resource that is critical to the success of the implementation, oversight, monitoring, and regulatory enforcement of the Water Resources Plan's goals.

It is imperative that the county recognize and empower its citizenry to actively engage in water resources protection. The residents are the eyes and ears of the county. Citizens have on-the-ground, real-time connections to their neighborhoods and communities and offer a de facto monitoring service that should be recognized, acknowledged, and supported through transparent documentation and follow-up actions. All reported incidents of environmental infractions should be taken seriously and, on DER's county web site, accepted, documented, and made available for review by neighbors and other citizens.

Funding sources from federal, state, and regional programs encourage cooperative partnerships that are established with clear intents and incentives for continued community and stakeholder investment. The county should support, encourage, and

help facilitate communities to access financial resources and utilize human capital to achieve shared environmental goals to protect and enhance water resources. The Department of Natural Resources (DNR) provides a number of direct grant and project grant programs, as well as reimbursement programs and low interest and no interest loans.[5]

The Town of Edmonston has recently proven, by example, that a directed partnership with clear intent and will, can in fact achieve positive and impactful results. Edmonston constructed several bioretention facilities to reduce runoff and pollutants entering the northeast branch of the Anacostia River in Edmonston. The work was done by the University of Maryland, College Park's chapter of Engineers Without Borders, the Anacostia Watershed Restoration Partnership, and the City of Edmonston. The project team, consisting of students, faculty advisers and various professionals, designed a bioretention system and implemented it in a park owned by The Maryland-National Capital Park and Planning Commission near Edmonston's Decatur Street.

Forest Heights, a community along Oxon Run in Prince George's County, is preparing for construction of an eco-friendly roof for its administration building. Unlike traditional flat rooftops, a green roof has multiple membrane layers to absorb and drain water. The roof would better insulate the building and reduce energy costs. The renovations are expected to cut the town's energy bill by up to 50 percent. Councilwoman Jacqueline Goodall said the town hopes to become a "green" model for other municipalities. The goal, she said, is for the town to produce zero stormwater runoff into the Chesapeake Bay watershed because stormwater often carries pollutants.[6]

The U.S. Department of Agriculture provides many support programs that family and individual landowners can use to conserve their working land. The programs provide expert technical advice and often include financial assistance for landowners who use specific management practices. Some programs also offer rental payments to offset income losses due to changes in land use.

These are voluntary programs—property owners choose the program that most closely matches their management goals, such as improving wildlife habitat or restoring a wetland. The Natural Resources Conservation Service administers many of the programs and the U.S. Forest Service and Farm Service Agency manage other programs.

Stormwater task forces could provide opportunities to engage the public in identifying stormwater solutions that benefit their community and the county. The county currently includes citizens in a number of stormwater-related programs including Adopt-A-Road/Median, Livable Communities Initiative, and Gorgeous Prince George's Day. Concepts for new opportunities to engage the public in stormwater task forces are outlined below.

- **Stormwater Program Funding Task Force**—Funding ongoing stormwater management programs is a continuing challenge for Prince George's County as revenue streams decrease and regulatory requirements increase. Many communities across the United States have sought the advice of citizens through a task force to evaluate funding opportunities that address the community expectations for stormwater services and quality of life. Typically, the task force will look at

[5] http://www.dnr.state.md.us/land/grantsandloans/grants.asp

[6] http://www.gazette.net/stories/10012009/clinnew190523_32529.shtml

existing funding levels and the cost of meeting regulatory requirements. The task force will also evaluate how the cost increases as additional services are provided to the community. The committee will then analyze existing and potential future revenue sources, such as stormwater fees, and make a recommendation for moving forward. A stormwater program funding task force can be a very powerful tool for developing a sound funding strategy that provides for compliance with regulatory requirements and meets the community's expectations for service.

- **Commercial and Industrial Stormwater Task Force**—A task force could be created to educate and share success stories from local commercial and industrial facilities within Prince George's County and beyond. This task force could develop in a few different directions; the task force could be a voluntary group of commercial and industrial business who seek to learn and share, it could become an avenue for public recognition where participating commercial and industrial businesses receive "green" recognition, or it could have a learning focus and involve entities with recent stormwater violations and/or commercial and industrial businesses new to Prince George's County who may need stormwater pollution education. The nature of the task force and the emphasis may change over time or the Prince George's County government may determine that more than one of the options would be beneficial. This task force may also travel throughout Prince George's County to increase participation from commercial and industrial businesses. One area of emphasis for the commercial and industrial stormwater task force should be the maintenance of private stormwater infrastructure, to clarify responsibility for maintenance as well as provide an overview of proper maintenance practices, as required by the municipal separate storm sewer systems (MS4) permit. This task force may be coordinated with ongoing activities by the county business license office, water conservation education efforts, or commercial sanitary waste education efforts.

DATA COLLECTION, MANAGEMENT, AND DISTRIBUTION

Provide all countywide stakeholders a base of information to inform county policies and support specific actions for water resource protection, preservation, and restoration.

Data provides baseline information to inform planning and development decisions. Data quality and quantity must be managed within a structured and transparent process and with defined management protocols to ensure its incorporation into decision-making is clear and comprehensive.

Natural systems are dynamic and evolving. Data collection and interpretation must remain timely and continued updates must be prepared to ensure planning decisions are relevant to the most current conditions. Data alone cannot provide the guidance necessary to make informed decisions regarding our natural environment and our county's water resources. It is important to develop data collection protocols with a clear understanding of its intended use. Data alone serves no function; it is the application of data for decision-making that is the true purpose.

Data, management, interpretation, and application combine to form the basis of scientifically informed decision-making.

The Water Resources Plan has provided a starting point and a tool for ongoing and future water quality impact assessments of the county's watersheds. Assessment of nutrient loads from different types of land uses can be best achieved through small-scale analysis using locally tested loading rates, measured impervious percentages, topographic and soil conditions, and hydraulic, hydrologic, and other data relative to the watersheds being modeled. In addition to estimation of loads from primary land uses, these analyses should include assessment of the specific treatment techniques or BMPs known to exist within the modeled area using local effectiveness data for those specific treatment techniques. As described previously, the water treatment model (WTM) provided by the Center for Watershed Protection contains the functionality to analyze small areas, and so was incorporated into the pollutant load analysis model (PLAM) to provide the county with the ability to conduct and compile analyses of individual subwatershed areas over time. The PLAM model developed for the Water Resources Plan provides a tool for the county's future assessment of policy and watershed management impacts within individual development sites, small subwatersheds, or larger hydrologic units, as more local information and data become available.

LAND CONSERVATION, PRESERVATION, AND RESTORATION PROGRAMS

Continue to support land preservation programs and activities, such as the Maryland Agricultural Land Preservation Foundation (MALPF), Conservation Reserve Enhancement Program (CREP), the Historic Agricultural Resource Preservation Program (HARPP), and Rural Legacy, and the woodland conservation program. Encourage the purchase of land by public agencies and private organizations as conservation easements, stream buffers, and wetland protection on land that drains to Tier II waters, waters with established total maximum daily loads (TMDLs) or water quality impairments, or in priority protection watersheds where impervious cover approaches or exceeds ten percent.

Conservation, preservation, and restoration of our natural environmental and associated ecosystems are critical to water resource protection. Clear criteria for, and identification of, high priority preservation areas are the initial requirements for the establishment of a preservation strategy that responds to natural and developed conditions within watersheds. The state, the Chesapeake Bay Program, and EPA have all developed guidelines relative to percentages of developed and open lands within watersheds to maximize protection of water quality and minimize impacts due to development and development patterns.

Prince George's County farmers, under pressure from rising costs of living and farming, have been subdividing their land to make ends meet or to cover their retirements. This dynamic is altering the land use patterns in the more rural portions of the county. Strategies, programs, and policies are in place to stem this trend, but the needed support for the continued economic viability of agriculture in Prince George's County should continue to be strengthened.

The Prince George's County Soil Conservation District provides agricultural land use support by bringing various agencies together to provide a multipurpose service center for the local farm community. Currently there are over 63,000 acres of agricultural land in the county, with 917 parcels over ten acres in size and 712 parcels less than

ten acres in size. There are over 29,000 acres of active cropland in the county. The Soil Conservation District currently maintains over 500 soil and water quality conservation plans on file. These plans inventory the natural resources on a specific property and offer technical advice based on sound engineering and agronomic principles that address soil erosion and water quality issues.

As the face of agriculture has changed, so has the farming community. The horse industry In Prince George's County has become the fastest growing sector within the agricultural landscape. According to the 2002 Maryland Equine Census,[7] Prince George's County has the fourth largest number of horses in Maryland. This industry uses almost 20 percent of the agricultural land in the county and requires special needs as related to soil erosion, soil compaction, waste management, and water quality.

Agriculture is a significant landscape of Prince George's County, both as an industry and as a contributor to the county's character. That economy adds millions of dollars of income to the citizens of Prince George's County. Therefore serious efforts are underway to protect our agricultural lands and rural character.

The Prince George's Soil Conservation District also administers the county's agricultural preservation programs. From 2006 to 2008 a total of 565 acres of prime farm land has been perpetually protected from development and an additional 3,500 acres have applied to be protected. The land will be preserved forever as productive farmland, woodland, wildlife habitat, and open space that will keep a part of the county's rural heritage alive. In the future many more farms will be preserved with help from these programs.[8] The Green Infrastructure Plan established a land preservation objective:

> Protect a countywide average of 1,500 acres per year of agricultural, strategic forest, or other sensitive lands through the use of the Rural Legacy Program, county-funded acquisitions, and other conservation programs.

According to the 2008 General Plan Policy Update, this objective has not been met to date. A total of 3,233 acres were protected from January 2002 through December 2006 under various programs, for an average of 646.6 acres per year. Since the beginning of 2002, over 100 woodland conservation easements have been established that protect over 1,493 acres. The trends are different for the different programs as noted in Table 18 below. Overall, there is an increase in the total amount of preserved land in the last two years. The Prince George's County Historic Agricultural Resource Preservation Program (HARPP) is in the process of identifying and preserving properties totaling over 1500 acres.

The trends track closely with the amount of state funds available for easement and land acquisition. Various programs are in place to protect sensitive lands through the establishment of easements or through acquisition. Except for woodland conservation, which is achieved through the implementation of the Woodland Conservation Ordinance, the programs rely on state funding. Some years there has been little or no funding available for preservation programs.

Various federal and state conservation programs, along with those of Prince George's County, have been summarized in Appendix IV, Land Conservation Programs.

[7] http://www.equinestudies.umd.edu/extension/Bennett.pdf

[8] http://www.pgscd.org/

Table 18: Preservation Acres by Year					
Year	**2002**	**2003**	**2004**	**2005**	**2006**
Woodland conservation easements	315	203	522	163	290
Maryland Environmental Trust easements	115	172	0	74	71
Rural Legacy Program acquisitions/easements	61	188	0	240	0
Program Open Space acquisitions	83	2	0	119	360
Maryland Agricultural Land Preservation Foundation easement	0	123	0	132	0
Total 3,233 acres	574	688	522	728	721
Average 646.6 acres per year					

Conservation Corps—The Maryland Conservation Corps (MCC) is an award-winning AmeriCorps program that engages young adults in extensive natural resource management and park conservation projects. Managed by the Maryland Park Service since 1984, MCC provides members with opportunities for skill development and personal growth through a supportive, team-based environment, emphasizing the satisfaction of completing projects that benefit Maryland's natural resources. Under the supervision of experienced Maryland DNR staff, MCC members work in crews consisting of five to seven persons. From state parks and forests to the Chesapeake Bay, they are engaged in projects in Maryland's most beautiful places.[9]

At the Merkle Wildlife Sanctuary, positioned on the Upper Patuxent River in Prince George's County, the conservation service activities include: trail maintenance, environmental education, stream and wetland restoration, park facility improvements, invasive species removal, and bay grass planting. The sanctuary's nature center is operated by the crew and includes interpretive exhibit development, programming, special events, and the care of live animals. The wildlife sanctuary is a beautiful natural area renowned for providing critical resting habitat for wintering Canada geese.

The Bay Crew is based out of Mitchellville, Maryland, located in Prince George's County. The team's service focuses on various facets of the protection and restoration of the Chesapeake Bay. Bay Crew members conduct stream corridor assessments for the Maryland DNR, identifying physical problems in the watershed for potential mitigation by the state or county. Members participate in scientific studies such as inventorying migrating waterfowl and assessing the health of the oyster populations at the Academy of Natural Sciences. The Bay Crew also assists in shoreline and wetland restoration projects, removal of invasive, nonnative species, and the replanting of native bay vegetation. Like the other crews, this team performs hazardous tree removal, trail construction, and trail maintenance at various parks.

Cedarville State Forest was purchased In the 1930s in an effort to create a forest demonstration area. The Civilian Conservation Corps (CCC) developed Cedarville's roads and trails for fire protection and future recreation development. From 1933 to 1935, approximately 160 men of the CCC, mostly African-Americans from Baltimore and Washington, D.C., worked at Cedarville.

[9] http://www.dnr.state.md.us/mcc/

Conservation corps provide the implementation arm critical to the success of any and all environmental restoration projects. Conservation corps and other training and educational organizations provide the county with opportunities to implement projects, engage and educate youth about natural process, and reinvest in local communities.

REGULATORY REVISION

Adopt and implement policies through legislation, ordinances, codes, standards, and programs to guide both development and conservation in order to establish a suitable balance between meaningful regulation and permanent protection to improve water quality and proactively sustain water resources.

An important consideration in the assessment of land use impacts is the capability of local government agencies to administer land and water management policies and programs. These should provide sufficient regulatory controls and planning tools to improve current environmental conditions and mitigate environmental impacts from land use change.

Evaluations of current regulations occur in the county with review of zoning, subdivision, and environmental ordinances and comprehensive plans for policy consistency in order to achieve countywide smart growth and sustainability. Evaluation and review make it possible to identify regulations that are not meeting the stated goals and to note resource protection that has been overlooked or inadequately monitored by local or state government agencies. Natural resource inventories , tree conservation plans (TCP), site plan, subdivision, and development review provide an excellent regulatory process to ensure that development does not negatively impact the environment.

Green building techniques, urban landscape, wetland protection, biodiversity, transportation systems, plumbing, environmental site design watershed planning, wastewater and water system maintenance, and neighborhood development standards should be codified to incorporate the most current understandings and technologies to achieve water resources sustainability.

Our current zoning, development standards, and building codes should reflect the county's desire to maximize opportunities for smart growth in the county. Many communities nationally are devising incentive programs along with mandates to foster change in their building and development paradigms to achieve long-term sustainability of the built and natural environment. Prince George's County should develop consistency between county growth policies and building and development standards to sustain and protect water resources in the county.

Accomplishing a comprehensive restoration plan for an ecosystem as complex as the Chesapeake Bay requires the full engagement of restoration leaders, citizens, and all stakeholder groups throughout the watershed. All of the bay's stakeholders require a base of information and motivation to take action. By providing an array of opportunities we optimize our chance to connect with people in the context of their interests, values, and current level of understanding or motivation —The Chesapeake Bay Program.

SYSTEMS-BASED MANAGEMENT

Employ systems-based management by integrating multiple disciplines and stakeholders, adapting management decisions based on scientifically collected data, taking precaution in decision-making, and incorporating sustainable management decisions to most effectively and efficiently address the impacts to water resources from land use practices.

The systems-based management approach assimilates four principles—integrating multiple users and uses of resources, providing for a sustainable use of resources, taking precaution against making deleterious actions, and adapting management decisions based on past-experiences.[10] Although systems-based management is not new, it is difficult to implement comprehensively and requires a proactive effort on the part of many stakeholders, including the public, scientific groups, and governmental regulators, along with the political will to prioritize water resource protection and sustainable management. The Water Resources Plan is an excellent example of when the adoption of a systems-based management approach may be necessary and can result in significant success due to the considerable overlap among many groups responsible for current water resource management and for its sustainability to accommodate future growth.[11]

To ensure a true systems-based approach to managing water resources, it is vital that scientific data along with other information is integrated into the management decisions regarding water resources. Many different agencies in Prince George's County have various roles in water resource management, and it is imperative that integration of scientific findings are incorporated into the management decisions and resulting policies.

Adaptive Management—Promising advances for natural resource management can be seen in the area of adaptive management (or adaptive environmental assessment and management), through the integration of ecological and participatory research advancements.

Many current research efforts concentrate on establishing approaches that more closely link science, management, and policy at an ecosystem level. These efforts represent a desire for research and implementation standards that combine:

- Resource management testing, evaluation, innovation, and flexibility.
- Natural resource system management at a watershed scale.
- Methods for bringing about action strategies among multiple agencies.
- Facilitation of the social and political processes and organizational capacity to realize adaptive management goals.

Adaptive management focuses on learning and adapting, through partnerships among managers, scientists, and other stakeholders who together devise strategies and action plans to create and maintain sustainable ecosystems. Managers must maintain flexibility in their decisions, knowing that uncertainties exist, and provide the latitude to adjust direction to improve progress toward desired outcomes. This management technique is based on learning from past experiences that influence the future of current decision-making regarding the health and sustainability of water resources. Management decisions are best influenced through comprehensive and long-term data collection.

[10] Boesch, D.F. 2006. "Scientific requirements for ecosystem-based management in the restoration of the Chesapeake Bay and Coastal Louisiana." Ecological Engineering 26: 6-26.

[11] http://www.dnr.state.md.us/met/ce.html

Precautionary Principle—Admittedly, uncertainty exists regarding planning decisions and management practices for natural resource protection, yet risks of serious and irreversible damage to environmental, human, and economic health exist. The precautionary principle underlies the execution of conservation efforts and promotes actions to avoid serious or irreversible environmental harm, despite lack of scientific certainty as to the likelihood, magnitude, or cause of the harm.

The release and use of toxic substances, resource exploitation, and physical alterations of the environment have had substantial unintended consequences on human health and the environment. Although human activities may involve hazards, people must proceed more carefully than has been the case in recent history. Corporations, government entities, organizations, communities, scientists, and other individuals must adopt a precautionary approach to all human endeavors. Where an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.[12]

Sustainability—In order to apply sustainability principles to decision-making for water resource protection, a holistic evaluation of costs is necessary. Typically, financial decisions have been made in response to short-term/up-front financial cost, but time has shown that the long-term costs of decisions have far-reaching impacts and a new and broader understanding of cost over time and for various impacts is essential to establish sustainable solutions.

The triple bottom line (or "TBL," "3BL," or "people, planet, profit") captures an expanded spectrum of values and criteria for measuring organizational (and societal) success: economic, ecological, and social.[13] This new paradigm of measure has been incorporated into true cost analysis of projects, particularly infrastructure projects. With an eye to sustainability, it has become increasingly clear that our current standards of measure for project costs are patently remiss in addressing long-term sustainability. The triple bottom line is a form of reporting that takes into account the impact a business has in terms of social and environmental values along with financial returns. TBL reporting is becoming an increasingly recognized concept and accepted way for businesses to demonstrate they have strategies for sustainable growth. Traditional economic models are about profit, profit, and more profit; triple bottom line accounting recognizes that without happy, healthy people to staff businesses and a healthy natural environment to sustain people and supply resources for trade, business is fundamentally unsustainable in the long run.

People: This is also known as human capital. It means treating employees right, but also the community where the business operates. In this part of the TBL model, business not only ensures a fair pay for fair work but also ensures some of the business gains return to the community through sponsorships, donation, or projects that go toward the common good.

Planet: This is also known as natural capital. Business should strive to minimize ecological impact in all aspects of its work from sourcing raw materials, to production processes, to shipping and administration. It is a "cradle to grave" approach or "cradle to cradle" including taking responsibility for goods after they have been sold through offering a recycling or take-back program. A TBL business refrains from the production of toxic items.

[12] Wingspan Statement on the Precautionary Principle

[13] http://en.wikipedia.org/wiki/Triple_bottom_line

Profit: This is about making an honest profit, not profit at any cost—profit that comes in accord with the other two principles of people and planet. Some big box stores have begun "greening" up their image and in doing so, demanding that their suppliers use less packaging or banning certain ingredients from products. The public response has been positive and in the process people have gained a greater understanding of sustainability and community responsibility.

TBL is not an award, accreditation, or a certification but an ongoing process that helps businesses keep on track in an effort to run greener and demonstrate to the community at large they are working not just toward riches, but the greater common good.

Resiliency—In the emerging field of ecosystem restoration, the term resiliency is being used under the larger sustainability heading. Resiliency is the ability of an ecosystem or community to handle disturbances, like storms, fire, or pollution, without shifting into a qualitatively different state. A resilient system is able to withstand these disturbances and shocks, and if damaged, is able to self-correct and rebuild itself. When designing restored ecosystems, this principle sets out to mimic natural systems that are self-correcting and, therefore, sustainable. Restoring ecosystems in a well-rounded, comprehensive, and resilient manner will lead to sustainable resources that will provide free ecosystem services like clean water well into the future.

Climate Change—Because of its vulnerability to climate change, the Chesapeake Bay estuary may be an omen for the rest of the country regarding potential impacts from sea level rise, increasing storm intensities, and other effects. Although the magnitude of anticipated impacts from climate change are unknown, enough information is available to suggest that adaptive estuary management, assessments of the ecosystems' vulnerabilities, development of adaptation plans, and implementation of adaptation measures will be required to protect water resources as much as possible from direct and indirect impacts. Due to the tidal coast line along the Potomac and Patuxent Rivers in Prince George's County, it is imperative that management decisions start to integrate data and information with an eye toward precaution against the unpredictable nature of the estimated sea level rise changes.

The Maryland Commission on Climate Change issued a technical report entitled "Global Warming and the Free State: Comprehensive Assessment of Climate Change Impacts in Maryland" in July 2008 based on modeled predictions of climate change effects across Maryland. With a chapter devoted to "Water Resources and Aquatic Ecosystems," the report assesses the following threats and challenges in regards to the predicted impacts of climate change:

- Reliability of freshwater supply, including both surface water and groundwater.
- Changes in flood hazards.
- Effects of changes in runoff and water temperature on aquatic habitats and populations.
- Impacts on water quality with implications for management and regulation of sediments and nutrients.
- Potential salt contamination of aquifers and freshwater intakes as the boundary between fresh and brackish water shifts with rising sea level.

The study also incorporates projections of impacts of both climate change and development on water resources. The key take-home points from this study regarding the impacts of climate change on water resources and aquatic ecosystems include:

- Increased precipitation would supply reservoirs but not alleviate overdraft of aquifers.
- Urban flooding will likely worsen because of intensification of rainfall events.
- Aquatic ecosystems will likely be degraded by increased temperatures and flashy runoff.

Although no formal study has been conducted in Prince George's County regarding the predicted effects of climate change specific to this area, it is recommended that the county engage in a study in cooperation with all agencies that would have a role in implementing management decisions based on this report. A greenhouse gas (GHG) emissions inventory should be conducted as soon as possible for the county to establish a baseline against which it can measure the effectiveness of needed GHG reduction strategies.

As a member of the Metropolitan Washington Council of Governments (MWCOG), the county endorsed the National Capital Region Climate Change Report[14] in November 2008 and agreed to collaborate in meeting the following reduction targets:

- 10 percent below business as usual levels by 2012.
- 20 percent below 2005 levels by 2020.
- 80 percent below 2005 levels by 2050.

The National Estuarine Research Reserve System[15] is developing a habitat restoration strategy to provide the scientific basis and technical expertise to restore, enhance and maintain estuarine ecosystems. The plan will develop and transfer effective approaches to identify, prioritize, restore, and monitor degraded or lost coastal habitat. The strategy uses a partnership approach coupled with education and community involvement. The restoration areas in which the reserve system hopes to play a national role include:

- Planning project.
- Developing effective approaches to test and evaluate innovative technology for restoration.
- Monitoring restoration response.
- Serving as local reference or control sites.
- Translating/transferring restoration information.
- Providing scientific and technological advice to support policy and regulatory decisions.
- Building awareness for the value of restoration science.
- Coordinating regional science.[16]

[14] http://www.mwcog.org/store/item.asp?PUBLICATION_ID=334 National Capital Region Climate Change Report, 11/12/2008.

[15] http://nerrs.noaa.gov/

[16] http://nerrs.noaa.gov/Restoration/Strategy.html

CHAPTER ISSUES SUMMARY

- Data sharing and communication between partners responsible for water resources protection, preservation, and restoration is needed to achieve the goals of this Water Resources Plan.
- Outreach, education, and stewardship awareness give citizens better opportunities and responsibility for water resource protection and management.
- Current regulations, ordinances, and codes can be a barrier to progressive and innovative ideas and solutions for water resource management and should be reviewed and updated.
- Systems-based thinking will help integrate work programs and galvanize efforts to improve the quality of water and water resources in Prince George's County.

POLICIES AND STRATEGIES

Implementation of water resource protection, preservation, and remediation strategies unites making choices concerning existing and future development patterns with consideration of the cost of infrastructure, environmental protection, a clear communication of intent, and the integration of data and technological resources.

Intergovernmental Cooperation and Communication

POLICY:

Shared data and resources between agencies provide for better assessment of existing conditions, prevent additional negative environmental impacts, and help foster plans for remediation and long-term protection of water resources.

STRATEGIES:

- Set protocols for data and resource sharing between agencies, communities, and organizations that have an interest and responsibility for water protection and conservation.
- Develop a web-based communication platform that will enable county agencies as well as county residents to coordinate the mission and information needed to protect water resources.

POLICY:

Water supply and wastewater planning and stormwater management is performed in concert with local planning objectives, interests, and needs and is accomplished at the county level through close coordination with the agencies that have water resource responsibility within the county.

STRATEGIES:

- Evaluate plans, policies, and strategies developed for the Patuxent and Potomac watersheds by various agencies and jurisdictions, and incorporate appropriate policies and strategies into county plans.

- Incorporate existing studies developed by various governmental and nonprofit organizations into county plans and regulations to help mitigate water quality degradation, improve existing conditions, and preserve and avert future harmful impacts to water resources in county watersheds.

POLICY:

Coordination with federal, state, county, local agencies, and municipalities to develop land use, zoning, redevelopment, urban design, forest conservation, wetland preservation, and green infrastructure policies is necessary to achieve implementation of the Water Resources Plan.

STRATEGIES:

- Create an interagency water resource policy board at the department head level to recognize the need for broad-based interagency coordination to address the ongoing and developing water resources and water quality-related regulatory and sustainability issues and needs the county is facing.
- Continue and expand M-NCPPC's participation in local and regional advisory committees and workgroups that focus on and support environmental, watershed, and water quality protection and improvement planning.

Community Engagement

POLICY:

The county supports communication and cooperation among residents, communities, environmental groups, and county agencies promoting activities such as stream monitoring, streamside tree plantings, trash removal, and storm drain inlet stenciling.

STRATEGIES:

- Engage county communities and municipalities to plant and conserve trees on private properties.
- Create landscape incentives and technical support in urban areas to increase number, quality, and survivability of trees planted in the public right-of-way and on private property.
- Build and maintain an information network service that provides on-line water resource updates on county programs and regular specific suggestions such as "green tips" to inform and encourage residents to take action to conserve and protect water resources.
- Establish and coordinate a coalition with representation from a broad range of community organizations to support outreach, raise awareness of the water resources protection strategies, and to provide opportunities and support for education programs.
- Create a water resource task group that includes a diversity of interest groups, organizations, and citizens to forward the water resource goals and policies as established in the Water Resource Plan.
- Establish a citizen's advisory committee to evaluate impacts to, and provide mitigation recommendations for, water resources from land use changes and development projects.

POLICY:

The county strives to provide scientific basis and technical expertise to restore, enhance, and maintain estuarine ecosystems.

STRATEGIES:

- Promote individual stewardship and assist individuals, community-based organizations, businesses, local governments and schools to undertake initiatives to achieve the goals and commitments of this plan.
- Support municipalities to work with local governments to identify small watersheds where community-based actions are essential to meeting bay restoration goals—in particular wetlands, forested buffers, stream corridors, and public access, and work with local governments and community organizations to bring an appropriate range of bay program resources to these communities.
- Enhance funding for locally based programs that pursue restoration and protection projects that will assist in the achievement of the goals of this and past agreements.
- Develop and maintain a clearinghouse for information on local watershed restoration efforts, including financial and technical assistance.
- Develop easily-accessible information suitable for analyzing environmental conditions at a small watershed scale and work with planning and other county agencies to apply this information to growth and land use decision-making.

Education and Outreach

POLICY:

Information is made publicly available regarding the impacts of stormwater discharges on receiving waters, why controlling these discharges is important, and what the individual citizens as well as business and industry can do to reduce pollutants in stormwater runoff.

STRATEGIES:

- Establish, coordinate, and maintain a county interdepartmental education and outreach program to address water conservation and water quality protection goals.
- Implement and maintain an education and outreach program to help reduce the discharge of pollutants caused by stormwater runoff.
- Maintain and monitor a publicly accessible database of all reported incidents of environmental infractions including location and nature of the reported situation, date of the report, and follow-up actions taken to remedy the condition.
- Provide training and education to construction site operators and inspectors regarding erosion and sediment control compliance.
- Adopt a stewardship education and outreach program that promotes and supports standards for residential, commercial, and institutional practices that reduce fertilizer, herbicide, pesticide, and water use.
- Provide county support for education and training programs that prepare citizens, especially youth, for environmental jobs and provide environmental services to communities and the county.

- Conservation Corps
- AmeriCorps
- Environmental Education Centers
- Internships

POLICY:

The county maintains an interdepartmental education and outreach program to explain stormwater management challenges, reduce the discharge of pollutants caused by stormwater runoff, and provide technical assistance to the regulated community.

STRATEGIES:

- Provide informational, technical, and research assistance to communities proactively pursuing environmental and ecological restoration projects.
- Develop a publicly accessible database of reported and identified environmental infractions and follow-up actions.
- Encourage and foster school programs, integral to curricula, that promote increased student involvement and engagement in forest and tree planting, water conservation, and stormwater prevention programs within their communities.
- Support and publicize opportunities for interaction between residents, community and environmental groups, and county agencies promoting annual activities such as stream monitoring, streamside tree plantings, trash removal, and storm drain inlet stenciling.
- Consider creating stormwater task forces to engage citizen representatives in stormwater decision-making. These task forces could address stormwater program funding and/or commercial and industrial stormwater.
- Develop educational materials on maintenance of private stormwater infrastructure and to respond to common commercial/industrial stormwater pollution sources identified through NPDES MS4 permit inspections.

Data Collection, Management, and Distribution

POLICY:

Provide accessibility to and incorporation of the best available science, technology, and data for planning recommendations that support the protection, preservation, and restoration of water resources.

STRATEGIES:

- Work with Maryland Geological Society and U.S. Geological Society to evaluate the existing aquifer drawdowns, incorporate future land use projections, establish conservation and efficiency strategies, and locate, put into operation, and maintain monitoring wells to verify assumptions and realities.
- Work with DER to develop ecosystem and science-based watershed management plans that provide a clear identification of the sources, impacts, and consequences of existing pollution problems.

- Identify information gaps in the scientific, technological, and ecological systems data necessary to make informed decisions to restore and protect watershed system functions, water quality, and stream health.
- Continue to develop and expand existing Geographic Information Systems (GIS), support the development of watershed management plans, and continue to evaluate and update water quality and stream morphology conditions to provide the best possible data to assist in decision-making and planning efforts.
- Build and maintain an information network service that provides on-line updates on county programs and legislation and specific suggestions to inform and encourage residents to take action to protect and improve stream and groundwater quality.
- Build and maintain an informational web-based network service that provides transparent online documentation of, updates to, and actions taken on environmental violations as reported by the public, noted by permitting and inspection agencies, or otherwise observed.
- Work with DER to develop a web-based communication platform that will enable county residents, as well as county agencies, to coordinate the mission and information needed to protect water resources.
- Build and maintain an information network service that provides on-line updates on county programs and legislation and provides specific suggestions to inform and encourage residents to take action to protect and improve stream and groundwater quality.
- Minimize the timeline interface between data collection, interpretation, development of remediation strategies, and implementation of BMPs.

Conservation, Preservation, and Restoration Programs

POLICY:

Land conservation programs are a focused preservation method to achieve woodland, forest, and tree cover; stream and wetland buffers; and open space goals for water resource protection.

STRATEGIES:

- Develop simplified processes and economic incentives to enable landowners to establish conservation easements and/or protection areas.
- Provide adequate funding, technical assistance, and enforcement to ensure that the agricultural community implements nutrient management plans on farmland utilizing natural system protection and enhancement to protect water quality.
- Continue to acquire targeted parcels and sites along stream corridors to create contiguous stream buffers.
- Support agricultural certification efforts in the county in order to acquire additional funding for MALFP easements, purchase of development rights, and HARPP through the identification and protection of countywide priority preservation areas (PPA).

Regulatory Revision

POLICY:

Prince George's County regulates consumption of, and impacts to, water resources through the activities employed on the land acknowledging that resource depletion must be relative to the rate at which that resource can be replenished.

STRATEGIES:

- Ensure county regulations prevent the loss of open space, tree canopy, and rural character, which is important to quality of life, environmental health, and economic stability in the county.
- Provide for coordinated planning and communication among agencies and the community to avoid controversial development patterns that may impact communities in an indirect and cumulative manner.
- Seek and leverage federal, state, and local funding to acquire or permanently protect sensitive and ecologically valuable lands through conservation programs and easements.

POLICY:

The county reviews and updates methods to achieve stronger policy support for water resource protection through the county's development and site plan review, environmental analysis, regulation, and preservation requirements.

STRATEGIES:

- Develop land use and zoning principles, standards, and guidelines that champion compact growth outside of environmentally sensitive and valuable resource land areas, and within transit serviceable centers and corridors.
- Identify existing legislation, regulation, and code standards that create barriers to effective and innovative implementation of water resources and water quality protection goals.
- Identify and modify current zoning classifications that are not tied to existing environmental legislation and constraints.
- Clearly show that development proposals have identified existing water resource conditions and have developed appropriate preservation, mitigation, and restoration strategies through the development proposal and approval process.
- Establish adequate public drinking water and public wastewater treatment capacities, appropriate septic treatment areas and methods, and well water withdrawal capacity and availability prior to approval of development plans.
- Based on existing land use information, estimate the current level of impervious surface in watersheds.
- Based on water quality characteristics of the receiving waterways of the watershed, establish a target level of impervious area.
- Calculate the potential capacity for additional impervious surface in the watershed based on current zoning categories and on an assumed full build-out of existing allowable zoning.

- Require surface water quality and stream morphology analysis as part of the natural resource inventory requirements.

POLICY:

Prince George's County reviews, and changes as necessary, county regulations, ordinances, permitting, and enforcement requirements to support green infrastructure, environmental site design (ESD), stormwater management, Leadership in Energy Environmental Design (LEED) building and development standards (or other similar or equivalent standards), water conservation and efficiency, and effective wastewater treatment.

STRATEGIES:

- Modify codes and regulations to remove impediments for existing development, new development, and redevelopment to implement water conservation and reuse practices and technology.
- Support and incorporate innovative planning tools including: watershed planning; environmental-based and agricultural zoning; conservation, and low-density rural subdivision; and ESD and low-impact building design standards to protect water resources and rural character.[17]
- Evaluate existing residential zoning and associated density regulations, specifically as defined by one- to three-acre minimum lot sizes, which do not adequately protect natural systems and has resulted in rural sprawl.
- Develop a zoning category to protect land identified as agricultural and/or forest resource through the PPA process.
- Evaluate the intent and success of the current Conservation Subdivision Ordinance to achieve open space, natural resource protection, and rural landscape preservation.
- Provide incentives for constructing new green buildings and green retrofitting of existing buildings, green development, and redevelopment.
    - Expedited Permitting
    - Tax Incentives
    - Floor Area Ratio Bonuses
    - Stormwater Billing Credits
    - Cost Sharing
    - Low-Income Assistance
    - Grant Programs
    - Rate Incentives

[17] http://www.dnr.state.md.us/met/ce.html

POLICY:

Local regulations are developed in concert with established federal and state regulatory requirements.

STRATEGIES:

- Improve the permit review and oversight procedures for wastewater discharge, National Pollution Discharge Elimination System permits, and well water withdrawals to achieve point source pollution control and support conservation management of aquifers.
- Aggressively enforce laws regarding erosion control, critical area encroachment, wetland and source water protection, stormwater management, and woodland conservation.
- Revise the environmental guidelines, Landscape Technical Manual, and woodland and wildlife conservation laws and regulations to enhance and add measures and requirements that will increase the success of tree planting efforts to establish healthy new forests and protect and improve water quality.
- Tie future changes in environmental regulatory requirements to total maximum daily loads (TMDLs) implementation needs. If higher stormwater management standards are needed to meet TMDLs, then assume additional regulatory requirements may be necessary.

Systems-Based Management

POLICY:

Objectives, measurables, testing, and flexibility standards are developed to achieve water resources protection and restoration goals.

STRATEGIES:

- Establish, monitor, and evaluate measurable goals to comply with watershed and/or subwatershed forest cover and impervious percentages.
- Plans, programs, projects, and policies should be monitored and evaluated to determine whether the expected land conservation and protection results are achieved and to improve future programs and practices.
- Develop modeling and scientifically sound approaches to integrate land use change findings and forecasts with respect to impacts to water quality, quantity, and environmentally sensitive habitats and resources.
- Synthesize research and modeling findings and develop support for strategies to conserve lands that provide water quality and ecological benefits.

POLICY:

Prince George's County's waterways and water-related resources are protected from potential impacts from sea level rise, increasing storm intensities, and other climate change related effects.

STRATEGIES:

- Incorporate natural design features, through best practices, with an emphasis on creating a resilient system, and protect and restore natural shorelines, tidal wetlands, and vegetated stream buffers that inherently shield shoreline development and resources from the impacts of sea level rise and coastal storm events.
- In cooperation and consultation with all relevant stakeholders, engage in a climate change impact study for Prince George's County and its water resources.
- Promote programs and policies aimed at the avoidance and/or reduction of impact to existing development, as well as future development, in areas vulnerable to sea level rise and ensuing coastal hazards.
- Evaluate sea level rise impacts to wastewater treatment facilities, power plants, and other vulnerable industrial services.
- Avoid the financial risk of development and redevelopment in highly hazardous flood-prone areas.