

**Maryland Department of the Environment
Water Management Administration
National Pollutant Discharge Elimination System
Municipal Separate Storm Sewer System Discharge Permit
99-DP-3317 (MD0068314)**

Audit of Baltimore County's 2011 Annual Report

Baltimore County was issued a National Pollutant Discharge Elimination System (NPDES) permit 99-DP-3317 (MD0068314) on June 15, 2005. This permit requires the County to prohibit non-stormwater discharges and reduce stormwater pollutants through its storm sewer system to the maximum extent practicable. While the Maryland Department of the Environment (MDE) is in the process of reissuing this permit, the existing permit is administratively continued. Each year, Baltimore County produces a report for documenting progress regarding its NPDES stormwater management programs. This audit by MDE provides the County with permit compliance status and general guidance for its next generation permit.

Permit Administration

Baltimore County has recently reorganized the Department of Environmental Protection and Resource Management (DEPRM) into the Department of Environmental Protection and Sustainability (EPS), which is the lead agency for administering the NPDES stormwater program. Revised organizational charts were provided in the County's annual report depicting this reorganization and how the primary NPDES roles and responsibilities are administered. This documentation meets NPDES permit administration requirements.

Legal Authority

Baltimore County is required to maintain adequate legal authority for implementing its NPDES stormwater permit. Several regulatory changes, initiated by the State have been addressed recently by Baltimore County. The Stormwater Management Act of 2007 (Act) required each jurisdiction to change its local ordinance and any associated design guidance. These revisions were initiated in 2009 by Baltimore County and completed in May 2010. Bill 25 -10 was passed by the County Council on May 27, 2010 and the Act's requirements are now being implemented. The County continues to maintain the necessary legal authority to control pollutants discharged from its municipal separate storm sewer system in compliance with the NPDES stormwater discharge program. If any legal powers prove inadequate for complying with the regulations in 40 Code of Federal Regulations 122.26(d)(2)(i), the County should make those changes necessary to maintain adequate legal authority and update MDE in subsequent annual reports.

Source Identification

Identifying sources of pollution by Baltimore County has evolved since the inception of the NPDES stormwater program in the early 1990's from a set of hand-drawn keysheets to today's geographic information system (GIS) mapping. EPS has compiled extensive data on the County's storm sewer system including storm drain outfalls, urban best management practices,

impervious surfaces, monitoring locations, and watershed restoration projects. Following is a brief summary of the County's current storm drain system data layers and status.

Baltimore County has mapped the location of both minor and major storm drain outfalls, along with the drainage area for each major outfall. Urban best management practices (BMPs) are represented by two data layers, one displaying the location of the facility as a point, and the other displaying polygon shape files of the drainage areas. The impervious surfaces in the County are represented by two separate data layers. The building data layer includes all residential, commercial, and industrial buildings, and farm sheds, barns and other accessory structures. The roads data layer includes all roads and parking lots. Sidewalks and driveways are not depicted, except in rural areas. These data layers are based on 2005 aerial photos and represent an update to previously submitted impervious data that were based on aerials flown in 1995-1997. Monitoring locations are presented in three separate layers, one for chemical monitoring, one for biological monitoring, and one for geomorphological monitoring. Finally, two data layers display the location of the County's capital restoration projects and the associated drainage areas. These layers are used to calculate the pollutant load reductions resulting from restoration efforts and to determine the amount of impervious area addressed by restoration activities.

Evolving mapping techniques, converting data from various coordinate systems, and missing data have led to some errors in the depiction of the County's storm drain system. The County is currently updating its GIS data in an effort to ensure better accuracy. A pilot project is underway to develop these improved data layers in the Jones Falls watershed. MDE believes that storm drain system mapping will continue to evolve and that the County has made significant progress in recent years. The value of this work is evident in the County's use of this information for both the routine maintenance of storm drain system infrastructure and the more complex planning tasks demanded by the permit's watershed restoration requirements and Chesapeake Bay total maximum daily loads (TMDLs). The County's source identification work is in compliance with NPDES permit requirements.

Management Program

Baltimore County is required to implement a management program designed to control stormwater discharges to the maximum extent practicable. The County's stormwater management program encompasses numerous elements including erosion and sediment control, post-construction runoff management, controlling pollutants associated with road maintenance activities, public education and outreach, and illicit discharge detection and elimination. Additionally, Baltimore County is required to implement watershed restoration for 10% of the County's total impervious surface cover that currently has little or no stormwater management. A summary of these program elements is provided below.

Baltimore County's erosion and sediment control program is administered by EPS's Inspection and Enforcement Section. In 2010, 188 grading plans were approved for 447 acres of earth disturbance. The County conducted 11,354 inspections that resulted in 711 enforcement actions. Additionally, the County continues to submit quarterly records of grading permits to MDE for

aiding in the enforcement of the NPDES construction general permit.

Baltimore County continues to offer erosion and sediment control responsible personnel training classes. In 2010, classes were held on February 24 and March 3 for a total of 25 participants. The names of participants are kept on a database and submitted to MDE regularly. The County has a strong erosion and sediment control program, has received full delegation of enforcement authority from the State during its most recent program review, and continues to meet all NPDES sediment control permit requirements.

For post-construction runoff management, Baltimore County must maintain a stormwater management program in accordance with State regulations, and track progress toward implementing the *2000 Maryland Stormwater Design Manual* and subsequent revisions required to address the Act. MDE approved the County's revised Stormwater Management Ordinance and it was officially adopted in May 2010. Future annual reports need to provide more information on the status of implementing environmental site design (ESD) according to the County's updated ordinance.

In 2010, 1,317 stormwater management plans were reviewed. Of these, 381 were approved, 936 were denied and 51 were pending. Most plans are not approved on the first submittal, and these numbers reflect multiple plan submittals for the same project. Variances in Baltimore County are only allowed when site conditions make it infeasible to provide stormwater management. A fee-in-lieu and a suitable mitigation site are required when variances are allowed. In 2010, \$290,324 were accepted for 78 fee-in-lieu projects.

Historically, the pace of BMP inspections in Baltimore County has not always kept up with the number of facilities being built. Therefore, the County's 2005 stormwater permit required specific BMP inspection and staffing conditions in order for the County to meet the State's requirement that all structures be inspected on a triennial basis. For publicly-owned facilities, the County created an Operations Crew, which includes six environmental maintenance specialists and one supervisor. Additionally, for privately-owned systems, EPS assigned three engineering associates for conducting the triennial inspections. The staff has compiled an extensive database of inspections and maintenance operations for the publicly and privately owned stormwater facilities. The County is commended for making these improvements and ensuring that the BMPs constructed for protecting water quality continue to function properly.

In 2010, EPS staff conducted 199 as-built inspections, 214 one year inspections, and 650 triennial maintenance inspections, for a total of 1,063 inspections of the 2,881 BMPs that have been built (1,153 public and 1,728 private). These inspections have resulted in 245 maintenance actions in the last year for public facilities. MDE believes that Baltimore County has fulfilled its obligations under its NPDES stormwater permit for the inspection and maintenance of stormwater BMPs. These efforts need to be sustained.

Baltimore County's permit requires that pollutants associated with road maintenance activities be reduced. An integral component of this effort is the Vac-Con Program where 313 storm drain

inlets and 13,310 linear feet of storm drain pipe were vacuumed resulting in the removal of 584 cubic yards of debris in 2010. Around 82% of this debris was removed from the heavily urbanized Patapsco/Back River Basin. In 17 years, the storm drain cleaning program has removed approximately 30,000 cubic yards of material from the storm drain system, which the County calculates as approximately 10 million pounds of material that would have eventually entered local waterways.

In 2010, 3,937 miles of street were swept in Baltimore County that removed 1,181 tons of debris, averaging 0.3 tons of material per mile. Since the inception of the street sweeping program in 1991, the County has swept 186,443 miles of roadway that has removed 49,693 tons of debris, for an average of 0.33 ton of debris per mile over that span. Initially, there were large swings in the amount of material swept from year to year, but in 8 of the last 9 years the average material removed per mile has remained constant at 0.3 tons. The County believes that optimizing the program's performance in the future may depend on fine-tuning activities, prioritizing sweeping routes, and possibly concentrating efforts more in commercial areas.

Baltimore County initiated a street sweeping study in 2005 in coordination with Baltimore City, the Center for Watershed Protection, and the University of Maryland Baltimore County to determine the amount of pollutants associated with the material removed. This study was entitled "Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin." The results from this study are used to estimate pollutant load reductions from the storm drain cleaning and street sweeping programs. In 2010, the County estimated that 348 lbs of nitrogen and 135 lbs of phosphorus were removed by the Vac-Con program and 4,313 lbs of nitrogen and 1,672 lbs of phosphorus were removed from the street sweeping program. Using data from the Chesapeake Bay Program on land use and pollutant runoff, the County estimated that these programs combined treated between 331 and 800 acres of impervious surfaces. MDE has used similar methodologies to estimate equivalent impervious acres in its guidance document, "Accounting For Stormwater Wasteload Allocations and Impervious Acres Treated," that should be used by the County in future annual reports.

Baltimore County is required to implement a public education and outreach program to raise awareness and reduce stormwater pollutants. The County's stormwater education program is multi-faceted and developed so that the message can be easily adapted to a variety of educational settings involving homeowners, community groups, schools, facility managers, watershed organizations, faith communities, and businesses. Volunteer citizen participation in pollution prevention and environmental stewardship is promoted. For example, pet waste, grass clippings, improper application of fertilizer, and other sources of nutrients in urban and suburban neighborhoods are highlighted at community and school events. Supporting materials developed by EPS and participating organizations are made available online.

For programs under direct EPS administration, standard operating protocols have been implemented that engage employees in the workplace and promote "green government." Some activities include preparing pollution prevention plans for vehicle maintenance operations,

implementing conservation landscaping and integrated pest management, and removing impervious surfaces on publicly owned properties. For the County's green schools initiative, the emphasis has shifted from hosting individual classroom events to increased teacher training and outreach to supervisors to influence curriculum review and revision. Finally, partnerships with other County offices and agencies are being forged to enhance the level of communication, avoid duplication of services, and increase overall outreach effectiveness.

Baltimore County keeps its citizens well informed regarding recycling through an internet web page, electronic newsletter, cable television broadcast, and lobby display. Liquid household hazardous waste (paint, antifreeze, motor oil, PCBs, corrosives, ammonia, and flammables) recycling has gone from 108,859 gallons in 1999 to more than 137,997 in 2010. Total solid household hazardous waste (asbestos, electronics, freon, oxidizers, toxics, mercury, propane, batteries, auto, and pesticides) recycling has gone from 354,435 pounds in 2004 to 4,762,908 pounds in 2010.

A substantial part of this growth is due to opening more facilities that accept household hazardous waste to the public and expanding the types of materials that are accepted. For example, in 2007 the County opened new drop off centers in Cockeysville and in Halethorpe. In October 2009, it became illegal in Baltimore County for residents to dispose of household electronics as trash. Collection of unwanted electronics for recycling quickly became a major source of material diverted from the waste stream. The County is commended for its promotion of effective environmental education and recycling programs that exceed NPDES permit requirements.

Baltimore County continues to keep statistics on fertilizer, pesticide, and deicing materials used for managing public golf courses, roads, utilities, colleges, and parks. As expected, the greatest use of fertilizers and pesticides in the County is for the maintenance of golf courses. Other large contributors include the County's Recreation and Parks division, schools, and the Bureau of Highways. Virtually all of the County's deicing material (99.2%) was used by the Bureau of Highways for clearing roads during winter storms. In 2010, the County used 181,573 pounds of fertilizer, 38,587 pounds of pesticides, and 162,724,620 pounds of deicing material. Over the past decade, fertilizer use has been reduced by 33%, while the use of pesticides and deicing materials has remained constant. The establishment of an NPDES stormwater committee of County property administrators supports the ongoing efforts to reduce these chemicals. These efforts are in compliance with NPDES permit requirements.

Baltimore County is required to implement an illicit discharge detection and elimination program. The County's protocols for outfall screening involve visual observations (qualitative) and chemical monitoring analysis (quantitative) using a field test kit that measures phenol, chlorine, copper, pH, and temperature. In 2010, EPS Water Monitoring Section conducted 149 routine outfall screenings. While 121 outfalls screened exhibited no quantitative problems, the remaining 28 outfalls had a total of 44 instances of elevated pollutants.

Qualitative, or visual problems, are more commonly observed in Baltimore County than

quantitative problems. These may include unusual water color or clarity, odor, trash, sediment, or erosion occurring immediately below each outfall. For the 149 outfalls screened by the County, 17 outfalls exhibited no problems and the remaining 132 had 259 qualitative problems. The County prioritizes major and minor stormwater outfalls for further screening based on the quantitative and qualitative results and citizen complaints.

The County has found that both routine outfall screenings and citizen complaints can be effective for discovering illicit connections. Routine outfall screenings are capable of catching chronic problems that may be missed by the public, such as chlorine leaks from the municipal water supply. Citizens, on the other hand, can provide a level of surveillance beyond that of the County monitoring staff. Citizens usually call while they are observing a problem and can provide immediate location information, increasing the chance of finding and eliminating an illicit connection. During the calendar year 2010, the Watershed Monitoring Section received 61 complaints from citizens and County staff.

Routine outfall screening and citizen complaints resulted in 73 outfalls that were suspected of having an illicit discharge. Approximately half of these were investigated further and enforced by EPS. The rest were referred to other responsible agencies (i.e., the County Health Department, the Department of Public Works, or MDE) for further investigation. Of the 73 suspected illicit discharges, 61 have been resolved in 2010 and 12 investigations are still ongoing.

In 2011, EPS began calculating pollutant load estimates associated with illicit discharges found in Baltimore County. The focus is on constituents that have TMDLs. When an illicit connection is discovered, flow and chemical analysis are conducted and when the illicit connection is corrected, another sample is taken and the two are then compared. Currently there are no TMDL or impervious area treatment credits for illicit discharge detection and elimination. MDE believes that quantifying this NPDES program component in relation to pollutant loading targets is extremely valuable. Overall, the County's program has been successful in identifying illicit connections by resolving 84% of them within the same calendar year. These efforts meet NPDES stormwater permit requirements.

Comprehensive management plans are now complete for the Bird River, Back River, Jones Falls, Loch Raven, Lower Gunpowder Falls, Patapsco River, Middle River, Baltimore Harbor, Little Gunpowder Falls, and the Gwynns Falls watersheds. The County's four remaining watersheds do not require management plans due to predominantly rural land use. However, recognizing the benefits of a watershed management plan, Baltimore County has completed the development of a Prettyboy Watershed Plan and, in conjunction with Harford County, a watershed plan for Deer Creek under the State's Watershed Restoration Action Strategy (WRAS) process. Each watershed plan is developed using a similar framework. This framework includes stormwater modeling, stream stability assessments, identification and ranking of water quality problems, development of management strategies, and the prioritization of projects for action.

The implementation of watershed management plans is summarized in Baltimore County's

annual report. For each watershed management plan a tally of “Completed Projects,” “Projects Under Design,” and “Proposed Projects” are recorded with other important information such as facility type, drainage area, cost, date of completion, and annual pollutant removal rates. These spreadsheets are a convenient way to keep track of how Baltimore County is meeting its impervious cover restoration requirements.

Analysis indicates that there are 33,170 acres of imperviousness with little or no stormwater management that drain through Baltimore County's storm drain system. The last two permit cycles have required the County to address 10% of this area with restoration projects. Typically the drainage area to restoration projects can be determined and subtracted from the total area in need of restoration. To account for impervious cover addressed by certain types of restoration activities where the drainage area is typically not applicable (street sweeping, storm drain cleaning, reforestation, tree planting, and shoreline erosion control projects), a formula based on pounds of phosphorus removed is used to calculate equivalent impervious acres. All together, through stormwater management, storm drain cleaning, street sweeping, capital improvement, community reforestation, growing home campaign, and watershed association restoration actions, the County has restored 5,344 acres of imperviousness, or 16% of its impervious surface area in need of control.

In summary, Baltimore County continues to implement effective countywide stormwater management programs and targeted watershed restoration efforts to meet NPDES requirements. Of particular quality are the County's watershed assessment reports, restoration projects, and comprehensive environmental outreach programs. Future annual reports should use MDE's recently released "Accounting For Stormwater Wasteload Allocations and Impervious Acres Treated" to document progress toward meeting permit requirements. Implementing restoration work takes years of planning, financial support, and follow-through. Baltimore County is commended for its commitment to meeting these goals and significantly improving water quality for the citizens of Baltimore County, Maryland, and the Chesapeake Bay.

Assessment of Controls

Baltimore County performs a comprehensive suite of monitoring programs that are designed to assess the condition of its water resources and the effectiveness of stormwater management programs. Significant monitoring elements implemented by the County include long-term chemical, biological, and physical characterization monitoring of the Scotts Level Branch; *2000 Maryland Stormwater Design Manual* monitoring in the Windlass Run; watershed management plan monitoring; and specific BMP monitoring. The current status of these program components are discussed below.

For Baltimore County's third NPDES permit term the long-term monitoring site was moved from Spring Branch in the Loch Raven watershed to Scotts Level Branch in the Gwynns Falls watershed. While the Spring Branch study monitored the effectiveness of one large restoration project, the Scotts Level Branch monitoring is designed to assess a number of restoration projects that will be implemented within the subwatershed over a period of time. Two additional

nearby subwatersheds, the Powder Mill Run and Upper Gwynns Falls, will be monitored as "control" sites to effectively assess the restoration activity occurring only in the Scotts Level Branch.

Baltimore County's permit requires that 12 storm events be monitored annually at the outfall and in-stream monitoring locations. When drought occurs, dry weather baseflow may be substituted for the required number of storm events. A 36" outfall near the headwater of Scotts Level Branch is being monitored for discharge flow and chemistry. This outfall has a drainage area of 15 acres with approximately 35% impervious cover. The land use is approximately 88% medium density residential and is representative of the major land use in the subwatershed. Analyses by the County shows reduced pollutant loads during the summer months attributable to extensive vegetation, which aids in the filtering and uptake of stormwater pollutants.

In the past year, the County has monitored 11 storm events and 3 baseflow conditions. While precipitation data was included on MDE's chemical monitoring database for all of the storm events, only 4 of them included chemical monitoring analyses. For the storms where chemical results were recorded, data regarding water temperature, pH, total petroleum hydrocarbons (TPH) and bacteria were mostly omitted indicating that they were probably not analyzed. Finally, data on metals were recorded in milligrams per liter (mg/l) and not micrograms per liter (ug/l). Baltimore County should make every effort to complete these NPDES chemical monitoring data requirements in future submittals to MDE.

For geomorphological monitoring, Baltimore County conducts cross-section measurements at 18 locations. Stream bank and bed core samples are collected in the vicinity of the permanent cross-sections for laboratory analysis of bulk density, particle size distribution, total nitrogen, and total phosphorus. Observed changes in stream channel morphology are most likely part of the process of the stream reworking its surrounding legacy flood plain sediments in response to increased impervious land cover. Baseline physical data collected will be useful in evaluating the impact of urbanization on stream channel stability and proposed stream restoration projects to alleviate these conditions.

Benthic macroinvertebrate and fish sampling is conducted annually at 5 fixed stations on the Scotts Level Branch using Maryland Biological Stream Survey (MBSS) methods. The benthic and fish communities of Scotts Level Branch show the effects of environmental stress, are low in diversity, and primarily composed of pollution tolerant organisms. Stream habitat is degraded and provides poor living space for both benthos and fish. Results have been consistent since biological monitoring began in 2005 suggesting that the baseline biological condition has been characterized.

Baltimore County has been monitoring the Windlass Run to assess the effectiveness of the *2000 Maryland Stormwater Design Manual*. The Windlass Run is a 2,000 acre watershed and only 3% impervious. Existing conditions show that the stream channel is low gradient and well connected with the flood plain at bankfull flows. The stream also has good riparian vegetation coverage because it is almost entirely within a well-forested setting. Industrial zoning and the

construction of MD Route 43 will eventually cause more than 20% of the watershed to become impervious. Annual monitoring efforts include 6 stream cross-sections, a slope/profile measurement, and a Wolman pebble count.

The effectiveness of new stormwater management regulations should be easy to document through continual monitoring of the Windlass Run. However, the timing of the ultimate build-out condition of the watershed needs to be considered in the context of the overall monitoring strategy. For example, as of 2008, some pockets of new development have occurred within the watershed, however, the current level of watershed imperviousness is not clear. In addition, the time to reach the ultimate build-out condition is unknown. If the 20% impervious area limit will not be achieved for several years, MDE recommends that the County consider different options to the current monitoring strategy. This might include focusing on smaller sections of development to gain more information on BMP implementation in those areas. As the watershed becomes further developed and new stormwater requirements are implemented, it may be possible to compare BMP effectiveness for different stormwater management strategies. MDE will continue to provide suggestions and guidance on this monitoring plan as more information on the timing of watershed build-out becomes available.

Countywide biological, physical, and chemical monitoring are being conducted to track the implementation of watershed restoration plans. Where sufficient monitoring data exist for stormwater BMP facilities and capital improvement projects, the County has estimated pollutant loads and reductions. Using monitoring data estimates and GIS map delineations, mass pollutant loading amounts have been developed. Most watersheds within the County show that nutrients are being reduced by 5% to 20%. These estimates include recent monitoring data and research on nutrient reductions attributable to street sweeping and storm drain infrastructure clean outs, shoreline erosion protection, and tree planting. Nutrient reductions still tend to be conservative because not all management efforts are being included. For example, no credit is currently being claimed for eliminating illicit connections nor for the County's education and outreach programs.

In summary, monitoring in the Scotts Level Branch is being used effectively to determine the pollutant loads generated from urban runoff versus stream channel erosion. This is helping Baltimore County to determine the best methods for restoring the Scotts Level Branch and other degraded urban streams within the County. Physical monitoring to assess the effectiveness of the *2000 Maryland Stormwater Design Manual*, shows that despite new road and manufacturing development in the Windlass Run watershed, the stream remains in good condition. Additionally, Baltimore County is committed to determining new methods for determining pollutant load reductions associated with illicit discharge elimination and education so that these worthwhile programs can be credited toward NPDES compliance as well. Baltimore County's comprehensive monitoring approach not only complies with NPDES stormwater permit requirements, but aids Maryland and the region with water quality monitoring data that can be used to show progress toward meeting TMDLs and restoring Chesapeake Bay.

Program Funding

Baltimore County's fiscal analyses show how NPDES stormwater permit conditions are being met. The annual operating budget for NPDES programs will grow from \$6,440,332 in 2012 to a projected \$7,466,110 in 2017. Several new positions are being added to increase stormwater management BMP inspections, plan review, pollution prevention activities, and provide GIS support, which accounts for the growth in the operational budget. Baltimore County's capital budget is allotted in two-year cycles and averages \$7,066,500 for 2011 and 2012. A total of \$18,200,000 is budgeted for 2014 and 2016. Future budget years do not necessarily account for grants and loans that the County may receive for capital projects, so final budget numbers are likely to be greater than indicated.

Summary

Baltimore County continues to comply with all NPDES stormwater permit conditions. Through the coordination of numerous permit requirements for pollutant source identification, monitoring, and watershed assessments, the County has established a sound framework for the successful implementation of stormwater management programs and capital improvement projects. These activities are improving local waterways, aiding regional efforts to restore Chesapeake Bay, and fulfilling Baltimore County's NPDES municipal separate storm sewer system permit obligations.