Maryland Department of the Environment
Water Management Administration

Review of Maryland State Highway Administration's 2007 and 2008 National Pollutant Discharge Elimination System Stormwater Annual Reports

The Maryland State Highway Administration (SHA) was issued a National Pollutant Discharge Elimination System (NPDES) permit (99-DP-3313, MD0068276) on October 21, 2005. This permit requires SHA to prohibit non-stormwater discharges and reduce stormwater pollutants through its storm sewer system to the maximum extent practicable. For each year of SHA's permit an annual report is required for assessing the progress of stormwater management programs. This review by the Maryland Department of the Environment (MDE) provides SHA with NPDES permit compliance status and guidance toward completion of permit requirements.

Administration of Permit

SHA's permit is administered by an NPDES Coordinator in the Highway Hydraulics Division. Industrial NPDES stormwater permits are managed through the Office of Environmental Design. SHA provides detailed organizational charts describing staff roles in relation to NPDES stormwater tasks. The information submitted for this section is clear, concise, and complies with permit requirements.

Legal Authority

SHA identified numerous sections of the Code of Maryland Regulations (COMAR) as the basis for the legal authority to perform NPDES stormwater tasks. To date, this COMAR authority has proven sufficient for regulating stormwater. Should any legal powers prove inadequate for complying with the regulations found at 40 Code of Federal Regulations 122.26(d)(2)(i), SHA should make the necessary changes to maintain adequate legal authority.

Source Identification

SHA is required to map its storm drain system located in NPDES Phase I municipalities on a geographic information system (GIS) and identify and describe impervious surfaces, drainage areas, inlets, outfalls, stormwater best management practices (BMPs), and opportunities for retrofits. There are three main components to this work, which include the research of office documents, field verification of data, and GIS development. The collection of source identification data for all of Maryland's Phase I jurisdictions, including Howard, Montgomery, Anne Arundel, Prince George's, Baltimore, Harford, Frederick, Carroll, and Charles counties is complete.

SHA's source identification effort is now focused on periodically updating its GIS. Updates will occur every three years to coincide with the State's BMP maintenance inspection frequency requirements. Information generated from maintenance inspections, dry weather field screening, remediation activity, and new construction is added to SHA's geodatabases. Updates have been

completed for Howard and Montgomery counties and are in process for Anne Arundel and Prince George's counties. Baltimore and Harford counties are scheduled for 2009.

SHA's data are shared with local jurisdictions and MDE, often completing watershed drainage area maps and helping with cooperative stormwater management initiatives. Permit conditions required that a GIS source identification example be provided. SHA provided its entire geodatabase of impervious surfaces and storm drain system infrastructure in the 2008 annual report. Updates should be provided each year. Data from the SHA and NPDES jurisdictions across the State are integral for regional cooperation of watershed management programs.

The routine use of the highway data by SHA staff is being encouraged and facilitated by an *NPDES GIS Viewer Application* tool. This GIS interface will allow SHA personnel to view, analyze, and query stormwater data as well as manage updates. Specific modules are being developed for organizing common NPDES tasks such as outfall screening, BMP inspections, impervious surface accounting, and tracking remediation work. This web-based application tool will also allow other NPDES jurisdictions and outside users easy access to SHA's data. The effort to compile source identification data is huge and SHA is commended for its efficiency in the collection and use of this information.

Quality assurance of highway data is continually addressed through updates to SHA's *Standard Procedures Manual (Manual)*. Topics in this manual include source identification and data collection and management procedures; BMP inspection, maintenance, and remediation; and illicit discharge detection and elimination. Workshops are then developed based on the *Manual* that provide instruction to relevant SHA staff and contractors. Workshops were held December 11 and 12, 2007 for illicit discharge and elimination and stormwater BMP inspections, and on February 27 and 28, 2008 that included source identification and GIS data management. These quality control efforts ensure SHA's ability to maintain and improve the stormwater management of Maryland's highway system.

SHA has made significant progress in establishing an impervious surface account, which is required by October 2009. SHA generates an impervious GIS data layer through photogrammetry. Information on BMPs and drainage areas is overlaid to determine controlled and uncontrolled surfaces. After several successful pilot studies using this method, SHA has begun to generate an impervious surface account for its entire NPDES stormwater permit area. This account delineates where impervious surfaces are controlled and uncontrolled thus providing an assessment of restoration opportunities. Impervious surface data are complete for Charles, Howard, Harford, Baltimore, Frederick, Anne Arundel, Carroll, and Montgomery counties. Prince George's County is scheduled for completion in 2009. Examples of maps and data of impervious surfaces were provided by SHA in its annual reports and indicate the usefulness of these analyses for watershed assessments, interjurisdictional cooperation, and restoration.

SHA is required to submit information on Maryland's urban BMP database, which tracks structures statewide and is integral to the accounting of the Chesapeake Bay Program's cleanup effort. Numerous important database fields found in Attachment A of SHA's permit are blank including watershed identification, runoff curve number, land use, and as-built dates. Also, the

field for structure drainage area is not populated for each BMP in the database. These omissions should be priorities as SHA continues to update its geodatabase.

In summary, SHA continues to develop comprehensive mapping and database structures for identifying pollutants sources, conducting watershed assessments, proposing retrofits, and constructing restoration projects. These activities meet the requirements stipulated in SHA's stormwater permit. Additionally, SHA has developed user-friendly computer interfaces that allow source identification information to be used by employees for scheduling routine maintenance tasks as well as conducting more complex watershed assessments and proposing projects for restoration. As SHA works to inspect and maintain its BMPs on a triennial schedule, the data necessary for completing MDE's urban stormwater database should be gathered as well.

Management Program

SHA is required to implement numerous programs to control stormwater discharges to the maximum extent practicable. These programs include environmental site design, erosion and sediment control, post-construction stormwater management, industrial facility maintenance, illicit discharge detection and elimination, and personnel and citizen education. A summary of these management efforts in relation to NPDES permit conditions is included below.

Environmental site design of highway projects has been regulated by the National Environmental Policy Act (NEPA) since 1970. This process requires that highway projects receiving federal funds be investigated for environmental impacts. Assessments consider the project's effects on land use, water, air, plants, animals, and other socio-economic parameters. While SHA's compliance with NEPA ensures a certain level of environmental safeguard, environmental site design will be further advanced through Maryland's Stormwater Management Act of 2007 (Act).

The Act requires that SHA use environmental site design to the maximum extent practicable for all new construction and redevelopment. This includes conserving natural drainage patterns, minimizing the use of impervious surfaces, slowing down runoff to maintain discharge timing, and increasing infiltration and evapotranspiration. SHA has been pro-active in trying new stormwater practices and monitoring them for efficiency including grassed swales, urban sand filters, and thermal impact studies helping to inform the State's stormwater management programs.

For maintenance of stormwater management structures, SHA has developed an inspection manual to document BMP conditions, water quality performance, and structural stability. This manual is used to complete field inspections for SHA facilities every three years to comply with Maryland maintenance requirements. All BMP and maintenance information is organized in a comprehensive data management system, which greatly aids in the analysis of storm drain system conditions and for generating task lists.

Results from BMP maintenance inspections are used to develop a work plan for making both small and major repairs. In 2007 and 2008 SHA identified 284 BMPs in need of minor maintenance. Work has been completed for 155 of these costing $145,421. Two hundred and seven BMPs were found to need major repairs. Because engineering will be required, this work

will take longer to complete. To date, major repairs for 158 BMPs have been completed costing $626,814.

When inspecting facilities built before 2000, SHA documents opportunities for converting each to meet the requirements of the *2000 Maryland Stormwater Design Manual*. Fifty-one of these projects are in the midst of design and construction. Their estimated cost is $7,831,897. When SHA began to intensely inspect BMPs in 2002, 65% were determined to be functioning as designed with the remaining in need of some sort of maintenance or repair. In 2008, 81% of SHA's indentified BMPs were functioning as designed. The significant increase in the percent of functioning BMPs shows the commitment and success of SHA's BMP inspection, maintenance, and repair program.

SHA is required to have an erosion and sediment control program that complies with State Law. Additionally, SHA collaborates with MDE in developing standards for erosion and sediment control and is currently working with MDE to update the *1994 Standards and Specifications for Erosion and Sediment Control*. Several other initiatives by SHA specific to highway projects include limiting disturbance during construction, improving turf acceptance standards, and distributing an Erosion and Sediment Control Field Guide for staff and contractors.

SHA has established an incentive based program where contractors receive bonuses when erosion and sediment controls are in compliance with approved plans. Damages are imposed when erosion and sediment controls are failing. Continued failure is cause for revoking a contractor’s SHA certification, which is necessary for bidding and working on State highway projects. For the last three years, an average of 1,700 inspections have been conducted annually for approximately 100 construction projects. Inspection and enforcement has enabled SHA to achieve a 99% compliance rate on sites in 2007, up from 96% in 2006, and 92% in 2005.

During 2007 and 2008, SHA offered training to 1,663 employees and contractors under the State’s erosion and sediment control responsible personnel certification course. The names of those certified have been submitted to MDE and added to the statewide list of approved personnel for erosion and sediment control. SHA has also developed more intensive training for highway contractors and designers that is known as basic erosion and sediment control training (BEST). Level I is a day and a half training course that is required for obtaining state highway contracts. This course has been attended by 1,194 people. BEST, Level II is geared toward design professionals and was given to 104 participants.

Maintenance of highways and rights-of-way can have significant impact on stormwater runoff. Street sweeping and inlet cleaning removes sediment buildup and pollutants that would otherwise reach local streams and the Bay. SHA's sweeping standard is to ensure that 95% of the traveled roadway is clear of loose material and less than 1 inch of debris for curb and gutters and 1 1/2 inches of debris along road shoulders. Additionally, SHA owns and operates four vacuum pump trucks that routinely clean storm drain inlets in central Maryland. Sediment and trash make up the majority of the waste removed. SHA should begin to quantify swept and vacuumed material from its road and storm drain system. Current studies in the Chesapeake Bay region relating pollutant loads to road swept material can be used by SHA in determining pollutant load reductions associated with this activity.

For the control of pesticides, herbicides, and fertilizers, SHA has developed an *Integrated Vegetation Manual for Maryland Highways* (October 2003). One example from the manual requires soil testing before the application of fertilizer to ensure that excess use is averted. Another management initiative is to greatly reduce the amount of mowing along roadsides while increasing runoff buffers. Strategies to decrease the effects of Winter weather deicing activities while keeping motorists safe is an ongoing effort. A practice that shows promise is to actually increase applications of a salt and water slurry prior to Winter weather events. This approach prevents ice from bonding to road surfaces and ultimately leads to lower material used. Research continues to examine new practices and evaluate ecosystem response.

Many of SHA's garage facilities are considered industrial activity under the Clean Water Act (CWA) and require stormwater permits. Administration of the industrial permits is through SHA's Environmental Design Program. Routine observations of maintenance facilities were performed in 2001 and 2005 and serve as the basis of stormwater pollution prevention plan development. Additionally, these assessments led to management responses and capital improvement projects where there were opportunities for improving the quality of stormwater runoff. Across the State, SHA allocated $1,041,312 in 2007 and 2008 for capital improvement projects including wash bay treatment systems, salt containment and vegetation control, BMP retrofits for water quality, spill response kits, and maintenance of oil and grit separators. More recently, SHA has developed a Compliance Focused Environmental Management System (CFEMS), which has helped to increase inspection and supervision of maintenance facilities and to ensure NPDES stormwater compliance. Management initiatives, pollution prevention plan development, and capital improvement projects show SHA's commitment to controlling stormwater discharges from its maintenance facilities to the maximum extent practicable.

SHA has historically conducted outfall stability inspections and illicit discharge detection inspections simultaneously. Now SHA believes it may be more efficient to run these programs independently. The Storm Drain Outfall Inspection and Remediation Program (SOIRP) documents physical problems to the storm drain system and prioritizes them for repair. More than 11,747 outfalls have been inspected in NPDES Phase I jurisdictions. Twenty outfalls in Baltimore County and 52 in Harford County are under design for remediation. Funding will most likely be established through an SHA open-end construction contract or transportation enhancement funds. Based on this experience, protocols will be established for the repair of failing outfalls in the remaining NPDES stormwater jurisdictions.

SHA continues to implement a successful Illicit Discharge Detection and Elimination (IDDE) program. Manuals from the Center for Watershed Protection and the United States Environmental Protection Agency (EPA) have been to used as a basis for local agency implementation. Screening of outfalls is complete for Frederick, Harford, Howard, and Montgomery counties. In 2008, screening was also completed for Charles and Carroll counties. In all, 371 outfalls were identified with dry weather flow with 29 having illicit discharges. Most of these discharges emanated from surrounding jurisdictions and SHA provided detailed reports that include location, photographs, and monitoring summaries to local governments to help with subsequent investigation and elimination. This is very good investigative work and SHA should continue to expand this program to the remaining Phase I NPDES jurisdictions.

SHA administers numerous environmental outreach programs geared toward highway users. Some programs include Adopt-a-Highway, Sponsor-a-Highway, Partnership Tree Planting, Transportation Enhancement Program, and an Annual Earth Day celebration. Through these programs in 2007 and 2008, an average of more than 900 miles of highway have been adopted or sponsored for the reduction of litter. Additionally, 360 SHA employees and 100 students participated in Earth Day activities at SHA headquarters and more than 300 volunteers planted 355 trees state-wide. SHA also participates in the Maryland Bay Game, which provides environmental education for kids en route to Maryland's ocean resorts.

SHA has over a dozen environmental outreach programs geared toward personnel. These programs cover popular conservation topics including recycling, environmental permitting, environmental ethics training, integrated pest and vegetation management, and employee commuter reduction incentives. In 2008, 66 SHA employees received pesticide training, 70 new employees received environmental sensitivity training, and 306 employees from SHA Headquarters and the 7 regional districts participated in an environmental permitting tour. Many of these initiatives are supported by the Maryland Department of Transportation water quality clearing house web page at www.mdot.state.md.us. All toll, SHA has a comprehensive suite of educational programs for citizens and staff alike that promote stewardship of the environment and comply with NPDES permit provisions.

Watershed Restoration

Watershed restoration permit conditions require SHA to share GIS data with surrounding NPDES municipalities, complete an accounting of its impervious surface area by October 2009, and implement 25 significant stormwater retrofits in areas with poor or no stormwater management. Data gathered by SHA on its storm drain system are being shared with MDE and local governments and help to complete larger watershed assessments for improving water quality. Additionally, SHA is exploring ways to go beyond simply sharing data on its infrastructure to surrounding jurisdictions. Using a grant from the United States EPA, SHA is investigating how highway planning and design can be used as the nexus for holistic watershed management.

SHA has developed a GIS method for estimating its impervious surface cover. Using this method, SHA has completed an accounting of impervious surface area for all NPDES Phase I counties except Prince George's. In these NPDES jurisdictions, SHA owns and maintains 20,571 acres of impervious surfaces of which, 2,061 acres, or roughly 10%, are managed with structural stormwater controls. Further assessments are being conducted by SHA to determine the extent of its road system that is controlled by nonstructural stormwater practices (sheet flow to buffer, grass swales, etc.) and areas where off-site impervious surfaces may be controlled by an SHA structural practice. Current NPDES stormwater permits for Maryland municipalities require that 10% of a jurisdiction's impervious surface be restored each permit cycle and future permits for SHA may require a commensurate amount.

Finally, SHA is required to implement 25 significant stormwater retrofits by the end of the permit term. Currently, SHA has completed 10 of these projects and has another 28 projects

under construction. Another 14 projects are in the design phase. Typical retrofit projects being implemented by SHA include stream stabilization and BMP functional and visual enhancements. The watershed locations of the retrofit projects include the Susquehanna River, Bush River, Gunpowder River, Patapsco River, West Chesapeake Bay, Patuxent River, Lower Potomac River, Washington Metropolitan, and Middle Potomac River. These projects and schedules are on pace for meeting NPDES permit requirements for watershed restoration. SHA should complete MDE's database for restoration activity in future annual report submittals.

Assessment of Controls

SHA is required to contribute to Maryland's understanding of stormwater runoff and its effect on water resources. Currently, the Long Draught Branch in Gaithersburg is being monitored prior to an extensive dam removal and stream restoration project. Monitoring before, during, and after construction will add to SHA's knowledge of stream restoration projects and associated water quality benefits. Not only will these results help to inform SHA's restoration management decisions, but the data can be used to support State programs for regional and Chesapeake Bay restoration.

SHA is required to monitor the chemical, physical, and biological conditions of the Long Draught Branch. For chemical monitoring, a combination of 12 storm or base flow events per year are required at an upstream and a downstream location where stream restoration is proposed. SHA has monitored 7 storm events and 13 base flow events over the past 18 months and the chemical data were submitted on MDE's database structure. The chemical monitoring data indicate that concentrations for most parameters did not vary from upstream to downstream locations during base flow events, except for total Kjeldahl nitrogen, which was significantly higher at the upstream location. During storm events, the biological oxygen demand was much higher at the upstream location while total phosphorus, total lead, total suspended solids, and ammonia were elevated at the downstream monitoring location. Information on existing BMPs and drainage areas that describe stormwater management in the watershed was identified during MDE's and SHA's joint field review need to be recorded in the monitoring site land use database.

SHA is required to use its chemical monitoring data to calculate annual and seasonal pollutant loads from its storm drain system, which it did not. There are numerous ways to do this including the simple method or more complex modeling. SHA may fortify its limited monitoring data with additional data from surrounding jurisdictions, MDE's statewide NPDES database, Chesapeake Bay Program data, or national stormwater sources. Once pollutant loads are calculated, the goal for SHA will be to sum reductions attributable to management and watershed restoration programs. These exercises will become increasingly important as local governments and the State will be required to show progress toward meeting local and regional water quality goals.

Physical monitoring was completed to document the existing conditions of the Long Draught Branch and the stream's stability. Rosgen Level I and II assessments were performed to determine the channel geometry, profile, bed composition, stream classification, and bankful discharge. Results indicate that the stream channel is eroding both along its longitudinal profile

and laterally along its banks. These conditions cause excess sediment and associated nutrients to be transported downstream, which may become catastrophic if the existing dam structure fails.

Biological monitoring was performed using Maryland Biological Stream Survey (MBSS) protocols. Using the MBSS allows for the biological data from the Long Draught Branch to be compared directly with established State data for the region. Both macroinvertibrate and fish indices for the Long Draught Branch are well below the average scores for other piedmont Maryland streams.

In summary, SHA conducts a successful stormwater monitoring program. Background conditions for the Long Draught Branch have been thoroughly characterized using chemical, biological, and physical monitoring. Because this watershed is targeted for a significant stream restoration and buffer restoration over the next several years, these efforts can be monitored and compared to the well established characterization data. SHA must begin using its chemical monitoring data from the Long Draught Branch and other highway studies to calculate pollutant load estimates for its storm drain system and begin to include in future annual reports. Ultimately, SHA's monitoring program will help to improve the knowledge of pollutant removal efficiencies associated stream restoration projects, better understand pollutant load contributions from highways, and inform watershed restoration activities across the State.

Program Funding

SHA has maintained adequate funding for complying with its NPDES stormwater permit. In 2006, SHA procured $9 million in open-end consultant contracts. These open-end contracts allow SHA flexibility in prioritizing program tasks and for selecting the appropriate vendors for implementation. Other funding sources include the State Planning and Research funds, Transportation Enhancement Program funds, and SHA Operation and Maintenance funds. For 2007 and 2008, the average annual expenditures for all NPDES stormwater program tasks was $5,740,000. SHA is currently procuring open-end consultant contracts worth $18 million for the next five years in order to meet stepped-up restoration and program requirements. These funds are adequate for NPDES stormwater program implementation.

Summary

SHA's NPDES stormwater program continues to evolve and provide valuable information to local municipalities for completing watershed restoration assessments. SHA has established specific protocols for the collection and use of source identification information and has completed these tasks ahead of permit requirement dates. This information is readily used by MDE and local governments to complete watershed drainage maps and help to determine projects for restoration. SHA also helps in this regard by funding municipal stream restoration projects or structural BMP retrofits when urban drainage areas span jurisdictional boundaries. Another example of how this cooperative relationship exists is the IDDE program where SHA often finds illegal hook-ups to its storm drain system that emanate from beyond its rights-of-way. Detailed reports, photos, and monitoring are provided to the surrounding municipality detailing the violation for enforcement. These programs are indicative of SHA's pro-active approach to

addressing stormwater from its rights-of-way and arguably meet the maximum extent practicable yardstick.