Crosswalk Comparison of Monitoring Needs and Existing Monitoring Components To Support the Development of the Revised Monitoring Program Required by the District of Columbia's NPDES MS4 Permit

Prepared for:
District Department of the Environment

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DISTRICT DEPARTMENT OF THE ENVIRONMENT

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Contents

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Executive Summary

The District Department of Environment (DDOE) is required to develop a Revised Monitoring Program as established in the District of Columbia's (District's) Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) permit. DDOE's ultimate goal for the development of the Revised Monitoring Program is a more effective, integrated, and efficient monitoring framework that will comply with MS4 permit requirements.

This Crosswalk Comparison of Monitoring Needs and Existing Monitoring Components is the third step in the process to develop the Revised Monitoring Program. It serves as a gap analysis between the monitoring needs and requirements outlined in the MS4 permit and monitoring efforts currently being implemented through MS4-related programs as well as other monitoring programs not driven by the MS4 permit. Recommendations for next steps are provided as well.

The results of the Crosswalk Comparison show that the overarching framework for the Revised Monitoring Program is in place; however, there are a number of gaps with regard to specific programmatic elements. Some of these gaps include the following:

- The permit's requirement for data to be "statistically significant and interpretable" is not considered in the current program.
- The permit's requirement to assess "quality of the stormwater program" is not explicitly addressed in association with data assessment or program evaluation (e.g., Annual Report development).
- Current monitoring efforts are not yet adequate to support permit requirements associated with source identification and tracking of progress toward meeting Total Maximum Daily Load (TMDL) wasteload allocations (WLAs).
- MS4 monitoring efforts need to include additional analysis of ambient data to evaluate water quality exceedances and stream impairments due to stormwater discharges.
- MS4 monitoring program does not currently evaluate water quality improvements or degradation identification (trends analysis) as the result of impacts from stormwater discharges.
- Dry weather discharge frequency/volume and environmental impact is not currently a part of the dry weather screening program.
- The Illicit Discharge and Detection Elimination (IDDE) Program does not currently have an enforcement program adequate for locating and ensuring elimination of illicit connections/improper disposal identified during dry weather screening.

Some of the key recommendations identified to help fill these gaps and meet the requirements of the Revised Monitoring Program include:

- Develop/revise program objectives
- Develop data sharing and management plan
- Identify opportunities for internal coordination and develop Interdepartmental Task Force
- Coordinate monitoring program with TMDL Implementation Plan (IP)
- Discontinue dry weather discharge monitoring
- Evaluate current MS4 monitoring locations

Crosswalk Comparison of Monitoring Needs and Existing Monitoring Components

While recommendations associated with monitoring program elements are summarized in this Crosswalk Comparison, additional detail on some recommendations and other supplemental materials are provided in Appendix 1.

1. Introduction

DDOE is required to develop a Revised Monitoring Program by the District's MS4 NPDES permit. The revised monitoring program supports implementation of the MS4 program. The aim of monitoring is to:

- Provide defensible data to allow estimates of wet weather pollutant loading from MS4 outfalls.
- Evaluate the health of District receiving waters.
- Support source identification and WLA tracking.
- Analyze chemicals in accordance with approved analytical methods.

DDOE's ultimate goal for the development of the Revised Monitoring Program is a more effective, integrated, and efficient monitoring framework that will comply with MS4 permit requirements as well as those of DDOE's other non-MS4 monitoring efforts.

The MS4 permit also requires DDOE to develop a Consolidated TMDL IP, which will define and organize a multi-year process centered on reducing pollutant loads originating within the District MS4. While the TMDL IP is a separate effort, it is being developed in close coordination with the revised monitoring program.

The District has implemented monitoring programs in association with its MS4 permit since 2000 when its first permit was issued. From 2004-2011, the program included monitoring of several representative outfalls in each watershed (Rock Creek, Potomac River, and Anacostia River). Monitoring occurred during three wet weather events per year on a rotating basis (i.e., each watershed was monitored every three years). Time-composited samples were collected by automatic samplers where appropriate starting in 2008, and otherwise, by grab method. Some parameters were also analyzed in the field.

Starting in 2012, the wet weather discharge monitoring was implemented in a slightly modified format (the Interim Program) based on the revised MS4 permit. The sampling protocols used for the Interim Program were changed to reduce the number of parameters. In addition, the number of stations monitored was reduced to two per watershed and were monitored each year. This program remains in place while the Revised Monitoring Program is under development (per Section 5.1 of the MS4 permit).

Although the MS4 permit is driving the development of the Revised Monitoring Program, DDOE also conducts monitoring in association with other non-MS4 programs (e.g., to provide data for the Integrated Report to EPA and US Congress regarding DC's Water Quality (DDOE 2012a)). These non-MS4 monitoring programs have also been evaluated in association with the development of the Revised Monitoring Program in an effort to most effectively streamline the District's monitoring efforts and to realize efficiencies across programs.

Development of the Revised Monitoring Program includes the following steps:

1. Evaluating MS4 Permit monitoring needs and requirements,
2. Evaluating current monitoring efforts,
3. Developing a crosswalk comparison of areas of overlap or where monitoring needs and requirements are not yet addressed by current monitoring efforts, and
4. Developing a revised MS4 monitoring framework.

This document details the third step of this process: a crosswalk comparison, or gap analysis, between DDOE's monitoring needs and requirements and the monitoring efforts currently being performed in association with both DDOE's MS4 permit and other non-MS4 permit-related monitoring programs.

This Crosswalk Comparison also identifies any gaps that exist between current efforts and requirements and any recommendations for next steps. Where necessary, additional discussion on the interpretation of permit terminology is also included.

The Crosswalk Comparison is organized as follows:

Section 2 compares the permit elements that pertain to the required overall design and utilization of the Revised Monitoring Program with existing monitoring program activities.

Sections 3 compares existing wet weather discharge monitoring activities with those required of the MS4 permit.

Section 4 compares the existing dry weather screening program with those required of the MS4 permit.

Finally, Section 5 summarizes the recommendations provided in this document and next steps planned in developing the revised monitoring program.

2. Revised Monitoring Program Elements

Section 5.1 of the District's MS4 permit addresses the Revised Monitoring Program. It includes elements that must be incorporated into the revised program's design, the objectives that must be met, (Section 5.1.1), and also specifies how the District must utilize the data and information collected through this revised program (Section 5.1.2).

Table 1 summarizes the crosswalk comparison conducted on the Revised Monitoring Program objectives, how the Program is to be utilized, and how DDOE's current efforts fulfill these requirements. Each individual element within these sections of the permit is discussed in additional detail in Sections 2.1 through 2.9, below. A brief description of recommendations to fill any "gaps" is included with additional detailed discussion provided in Appendix 1 as indicated.

Table 1. Crosswalk Comparison of the Existing MS4 program and the New Permit Design and Utilization Requirements

	Monitoring Needs & Requirements	Existing Monitoring Programs & Components
General Objectives and Program Utilization	Make wet weather loading estimates of *E. Coli*, TN, TP, TSS, Cd, Cu, Pb, Zn, Trash (from MS4 to receiving waters) and event mean concentrations	The geometric mean of all wet weather samples collected for a given year for each parameter listed here is calculated to represent the event mean concentration (EMC) for all six interim MS4 monitoring stations and reported in the DMR. A cumulative loading estimate is made for each station's drainage area, and for each of the three major watersheds using the two stations in each watershed.
	Number of samples, sampling frequencies and number, and locations of sampling stations adequate to ensure data are "statistically significant and interpretable"	Not addressed in current program.
	Evaluate the health of receiving waters	Not addressed in current MS4 program. Addressed through the District's Integrated Report development.
	Evaluate the quality of the stormwater program	Not addressed in current program.
	Use of any additional monitoring for source identification and WLA tracking	More evaluation is needed to see if this was achieved in monitoring before the interim program was implemented, and how it can be achieved moving forward.
	Identify and prioritize additional efforts to address WQ exceedances and receiving stream impairments (at least once per year)	Not addressed under current program.
	Identify WQ improvements or degradation (at least once a year)	Very basic trends in MS4 monitoring results are evaluated in the Discharge Monitoring Reports (DMRs) each year.
	Perform all chemical analyses in accordance with approved analytical methods	Currently being achieved in interim program.

2.1 Program Objectives

Section 5.1.1 of the MS4 permit identifies a number of objectives for the Revised Monitoring Program that include:

- Estimate wet weather pollutant loading for the parameters identified in the permit (e.g., E. coli, total nitrogen, total phosphorus, TSS, select metals, and trash);
- Evaluate health of receiving waters (as related to the impact of MS4 discharges);
- Identify pollution sources; and
- Track performance toward compliance with TMDL wasteload allocations.

DDOE previously identified objectives for the MS4 monitoring program, which are:

- To identify the characteristic discharges of the outfalls of the MS4 system through dry and wet weather screening.
- To evaluate the performance of source controls, such as retrofits and BMPs as they are developed and implemented.
- To continue to evaluate the discharge with respect to specific pollutants and their impacts on the full range of chemical, physical, and biological water quality (DDOE 2009).

> **MS4 Permit Section 5.1.1 - Design of the Revised Monitoring Program**
>
> …The revised monitoring program shall meet the following objectives:
>
> 1. Make wet weather loading estimates of the parameters in Table 4 from the MS4 to receiving waters. Number of samples, sampling frequencies and number and locations of sampling stations must be adequate to ensure data are statistically significant and interpretable.
>
> 2. Evaluate the health of the receiving waters, to include biological and physical indicators such as macroinvertebrates and geomorphologic factors. Number of samples, frequencies and locations must be adequate to ensure data are statistically significant and interpretable for long-term trend purposes (not variation among individual years or seasons).
>
> 3. Include any additional necessary monitoring for purposes of source identification and wasteload allocation tracking. The strategy must align with the Consolidated TMDL Implementation Plan….

Recommendations on MS4 Program objectives

It is recommended that DDOE evaluate the objectives required of the MS4 permit to ensure consistency with any other objectives DDOE has identified for its MS4 monitoring program, the MS4 program in general (including related efforts such as the TMDL IP), as well as objectives of non-MS4 programs, such as the Ambient Monitoring Program. It is recommended that part of this evaluation include the identification of additional objectives to guide the development, implementation, and any future modifications of the Revised Monitoring Program. Suggested additional objectives to consider are included in Appendix 1.

2.2 Make Wet Weather Loading Estimates

DDOE is required to make wet weather MS4 loading estimates to receiving waters for the nine parameters referenced in Table 1. Historically, DDOE calculates annual pollutant loads for each sewershed by the Simple Method (USEPA 1992) utilizing the wet weather event mean concentrations, the total drainage area, and land use distribution within each area that drains to a monitored outfall. A cumulative load for the portion of a watershed (e.g., Anacostia River) within the District of Columbia

boundary is estimated based upon the pollutant loadings calculated for each of the monitoring sites within that watershed. This cumulative load assumes that monitoring stations are representative of the watershed. These loading estimates are reported in both the DMR and Annual Report each year (DDOE 2012b).

Recommendations on wet weather loading estimates

- Recommendations associated with this permit requirement are discussed further in Section 3, Wet Weather Discharge Monitoring.

2.3 Ensure Data are Statistically Significant and Interpretable

DDOE has conducted MS4-related wet and dry weather monitoring since the early 2000's. "The selection of the sampling sites was driven in large part, by the DC Total Maximum Daily Load (TMDL) Consent Decree negotiated in June 2000" and to "enable DC to meet the TMDL deadlines and comply with the DC MS4 permit" (Bekele 2012[1]). The sampling locations were selected to be "representative" of the watershed on the basis of information on the watershed characteristics available at the time.

The current MS4 permit now requires that data collected from the MS4 be "statistically significant and interpretable." This term is found in several sections of the permit. In Section 5.1.1.1, the term refers to the requirement for the wet weather loading estimates to be based on sample number, frequency, and number of stations adequate to meet this permit requirement. The permit goes on to say that the data are to be statistically significant so as not to simply identify variation among individual years or seasons, but to allow DDOE to determine long-term trends.

Additionally, the evaluation of the health of the receiving waters (including biological and physical sampling, such as macroinvertebrate and geomorphic monitoring) must also be based on these sample number, frequency, and number of station requirements (MS4 Permit Section 5.1.1.2).

The MS4 permit fact sheet provides minimal guidance as to what this requirement means. The fact sheet references the National Research Council (NRC) Report (2009) and its recommendation for:

> "…MS4 programs [to] modify their evaluation metrics and methods to include biological and physical monitoring, better evaluations of the performance/effectiveness of controls and overall programs, and an increased emphasis on watershed scale analyses to ascertain what is actually going on in receiving waters. The report also ***emphasizes the link between study design and the ability to interpret data, e.g., having enough samples to ensure that conclusions are statistically significant***." (emphasis added)

Consequently, this term is interpreted to mean that the dataset collected must be robust enough to test for statistical significance in trends over time and among stations. There must be enough data collected to say with some level of confidence that these data are actually representative of the water body being monitored.

Recommendations on ensuring that data are statistically significant and interpretable

- Select the number of monitoring locations and frequency of sampling based on desired confidence level and trend detection

[1] Reference document cites correspondence to EPA dated November 27, 2000 and the EPA response dated January 17, 2001 in the DC MS4 Discharge Monitoring Report dated April 19, 2002.

- Eliminate rotating basin monitoring schedule for any future monitoring

Additional discussion is included in Appendix 1.

2.4 Evaluate the Health of Receiving Waters

The MS4 permit requires DDOE to "evaluate the health of the receiving waters" using methods such as macroinvertebrate and geomorphological monitoring (Section 5.1.1.2).

This requirement emerged from a recommendation in the NRC report (2009) to adapt current stormwater monitoring programs in order to include a more balanced approach that assesses chemical, biological, and physical parameters from the MS4 to receiving bodies, as explained in the MS4 permit fact sheet (USEPA 2011).

While Appendix 1 includes additional discussion of this term, for the purpose of this Crosswalk Comparison, "health" is defined as the ecological integrity of a water body as determined by the waters chemical, physical, and biological conditions.

The Monitoring and Assessment Branch of DDOE's Water Quality Division conducts ambient monitoring (including collection of water quality, fish, and macroinvertebrates) of the District's receiving streams. This data collection effort is the basis of the water quality assessment contained in the bi-annual Integrated Report to EPA and US Congress regarding DC's Water Quality (e.g., DDOE 2012a).

Given the overlap of the data needs and associated resources, DDOE's intent is to rely on existing monitoring programs to fulfill the elements of the MS4 permit requirements where possible. This overlap emphasizes the importance of ensuring interdepartmental communication is sufficient so that staff understand why these programs are in place and how they impact DDOE's compliance with the MS4 permit as well as facilitating the transfer of applicable data between Branches. Development of an internal Monitoring Task Force is recommended to provide the structure for DDOE staff to work through these issues.

The ambient water quality and biological monitoring data received from the Monitoring and Assessment Branch of DDOE's Water Quality Division were reviewed in the context of its potential for use in evaluating the health of the receiving waters for the MS4 permit. The current ambient water quality monitoring program uses the Maryland Biological Stream Survey (MBSS) method to collect and assess macroinvertebrate and fish assemblages, and habitat in District streams. The MBSS is a well-tested and respected methodology for the region. Its continued use is highly recommended for biological monitoring.

While the current ambient monitoring program may help satisfy the biological requirement to assess the health of receiving waters, it does not include the use of geomorphological indicators which are required under the MS4 permit. Geomorphological monitoring is currently only performed on a short-term basis for pre- and post-implementation monitoring on a small number of restoration projects. More discussion of the use of the ambient program to satisfy MS4 permit requirements is included in Appendix 1.

Recommendations on evaluation of the health of receiving waters

- Fill data gaps with respect to the ambient monitoring program biological and geomorphic indicators needed to assess the health of receiving waters
- Consider evaluating additional stream condition indices to incorporate additional indicators or approaches (several examples are discussed in Appendix 1)

- Incorporate receiving water data information gathered through other efforts (e.g., illicit discharge inspection data, information developed for TMDL Implementation Plan, etc.) into an adaptive plan for prioritizing efforts for additional receiving water monitoring
- Establish a Monitoring Task Force to facilitate communication on the Stormwater Program between the various Branches and Divisions of DDOE

2.5 Evaluate the Quality of Stormwater Program

Section 5.1.2 of the MS4 permit (Utilization of the Revised Monitoring Program) includes the requirement to evaluate the quality of DDOE's Stormwater Program. This requirement comes from a recommendation in the 2009 NRC report to switch objectives from overall stormwater characterization to long-term trend evaluation (USEPA 2011).

The term "quality" is not explicitly defined in the permit nor in the fact sheet. For the purposes of this Crosswalk Comparison, it is interpreted to mean the ability of DDOE to meet the water quality and programmatic goals (e.g., benchmarks and milestones) that may be set forth for stormwater program, TMDL IP, etc. While this program evaluation requirement is included within the monitoring section of the MS4 permit, DDOE recognizes the use of monitoring data alone is not sufficient, nor appropriate, to effectively evaluate stormwater program "quality".

DDOE currently includes an evaluation of various components of the stormwater program and actions required of the MS4 permit in the MS4 Annual Report, but the approach is piecemeal and does not include an overarching analysis or assessment of the "quality" of the program as a whole. Specifically, DDOE tracks progress towards established goals for stormwater control implementation (e.g., acres of land retrofitted, trees planted), but a comprehensive evaluation/assessment specific to MS4 monitoring (e.g., if the current program is effective at meeting water quality guidelines or other objectives) has never been completed.

MS4 Permit Section 5.1.2 – Utilization of the Revised Monitoring Program

… The permittee must use the information to evaluate the quality of the stormwater program and the health of the receiving waters at a minimum to include:

1. The permittee shall estimate annual cumulative pollutant loadings for pollutants listed in Table 4. Pollutant loadings and, as appropriate, event mean concentrations, will be reported in DMRs and annual reports on TMDL implementation for pollutants listed in Table 4 in discharges from the monitoring stations in Table 5.

2. The permittee shall perform the following activities at least once during the permit term, but no later than the fourth year of this permit:

   a. Identify and prioritize additional efforts needed to address water quality exceedances, and receiving stream impairments and threats;

   b. Identify water quality improvements or degradation.

Recommendations on evaluation of the quality of the stormwater program

- Develop a "Report Card" or "Score Card" to evaluate the quality of the stormwater program. The information compiled to develop the MS4 Annual Report could be modified to serve as a basis for evaluating and conveying stormwater program "quality" to the general public and stakeholders. This could include a comparison of what has been done in the past year vs. the benchmarks/milestones identified for that time period. Examples and more discussion are provided in Appendix 1.

2.6 Use Additional Monitoring for Source Identification and WLA Tracking

Section 5.1.1 of the MS4 permit requires DDOE to "include any additional necessary monitoring for purposes of source identification and wasteload allocation tracking" in coordination with the TMDL IP. This requirement applies to the same nine parameters (*E. Coli*, TN, TP, TSS, Cd, Cu, Pb, Zn, Trash) required to be monitored for wet weather events. Based on information reviewed to date, DDOE does not proactively incorporate additional monitoring efforts when/where it is determined additional data are needed for source identification and WLA tracking. To date, the primary driver for outfall monitoring has been discharge characterization with source identification/WLA tracking as a secondary, though minor, objective.

It should be noted that Section 5.8 of the MS4 permit requires that if a parameter is monitored more frequently than required by the permit, these data must be included in DDOE's calculations and DMRs.

Recommendations on the use of additional monitoring for source identification and WLA tracking

- Increase the utility of outfall and facility inspections under the Illicit Discharge Program to enable source identification (e.g., more extensive chemical analysis in follow-up monitoring when screening efforts result in a "hit").
- Coordinate with ambient monitoring program in order to use data for WLA tracking
- Align outfall monitoring stations with TMDL watersheds to aid in WLA tracking
- Target illicit discharge inspections/screening efforts in certain subwatersheds based on outfall monitoring results

2.7 Identify and Prioritize Additional Efforts to Address WQ Exceedances and Receiving Stream Impairments

Section 5.1.2.2 of DDOE's MS4 permit requires the District to use the information collected from the Revised Monitoring Program to identify and prioritize additional efforts needed to address water quality exceedances, and receiving stream impairments and threats. In this instance, "water quality exceedances" is interpreted to mean exceedances of water quality standards. All of the impaired water bodies within the District are impacted by multiple sources of pollution, and many are also impacted by upstream sources. Because of this, the achievement of MS4 WLA loading reduction on its own will not guarantee the achievement of TMDLs or exceedances of water quality standards.

Data collected through the efforts of the Monitoring and Assessment Branch will inform the biennial City-wide water quality assessment accomplished within the Integrated Report to EPA and US Congress regarding DC's Water Quality as well as may be used to identify water quality improvements and

degradation. This MS4 permit requirement again emphasizes the need for inter-program integration as well as confidence in the data collected through other Branches within DDOE.

Recommendations on identifying and prioritizing additional efforts

- Improve coordination with Water Quality Division to identify additional data collection needs that may meet shared objectives
- Use MS4 outfall monitoring data to prioritize areas of the District for increased BMP implementation
- Coordinate efforts with TMDL IP approach in addressing impaired waterbodies and those with TMDLs
- Incorporate additional recommendations from approved Watershed Implementation Plans, included in Appendix 1.

2.8 Identify Water Quality Improvements or Degradation

Section 5.1.2.2.b of DDOE's MS4 permit requires the District to use the information collected from the Revised Monitoring Program to identify water quality improvements or degradation to the District's receiving waters. This activity is required at least once during the permit term but not later than year four of the permit. While basic MS4 monitoring trend analysis is included each year in DDOE's DMRs, a more in-depth evaluation may be warranted going forward in order to facilitate develop statistically significant trends. Similarly, basic trend analysis of the District's ambient monitoring data is referenced in DDOE's Integrated Report (DDOE 2012a).

While broad generalizations can be made regarding these data, the MS4 permit requires that water quality trends are "statistically significant and interpretable." This requirement again underscores the importance of designing the Revised Monitoring Program so that findings, including trend analyses, are statistically sound.

This also underscores the importance for sharing data between the Water Quality Division (who collects outfall monitoring data) and Stormwater Management Division, and highlights the need to ensure any program or data gaps identified in association with monitoring efforts conducted by other DDOE Branches are addressed.

Recommendations on identifying water quality improvements or degradation

- Evaluate monitoring protocols (number of sites, number of sampling events, etc.) to ensure they form the basis for a "statistically significant" approach to data collection that facilitates trend analysis
- Facilitate inter-departmental data sharing (including QA/QC)

2.9 Use of Approved Analytical Methods

The District's monitoring programs all implement approved analytical methods.

Recommendations on use of approved analytical methods

- Evaluate alternative methods where necessary - while approved analytical methods are used in association with the data collected through the MS4 program and the ambient program, in some cases large numbers of non-detects using those methods can inhibit the use of these data. Additional evaluation alternative analytical methods should occur during the development of the Revised Monitoring Program.

3. Wet Weather Discharge Monitoring

DDOE has conducted wet weather discharge monitoring from MS4 outfalls since 2001. Starting in 2012, the wet weather discharge monitoring was implemented in a slightly modified format (the Interim Program), which is outlined in the MS4 permit (finalized in 2012). The following Section compares the MS4 permit requirements with the monitoring components associated with the currently ongoing Interim Wet Weather Discharge Monitoring Program.

Note that while implementation of an Interim Monitoring Program has been the initial requirement of the MS4 permit, the subsequent Revised Monitoring Program will necessitate incorporation of additional elements not required of the Interim Program. Because the Interim program is what has been implemented most recently, it is evaluated here in this Crosswalk Comparison. The crosswalk findings are summarized in Table 4 and demonstrate that wet weather discharge monitoring elements, required in Section 5.2.1 of the permit, are currently being met.

Table4. Crosswalk Comparison of Wet Weather Discharge Monitoring Requirements and Existing Program Elements

	MS4 Permit Requirements	Existing Monitoring Components
Wet weather discharge monitoring	Interim Monitoring Program: Monitor three times a year Monitor for *E. Coli*, TN, TP, TSS, Cd, Cu, Pb, Zn, Trash Monitor at the six interim sites Monitoring data submitted in DMR	Interim program is meeting all of these requirements.
	Storm event data Date and duration Measurement or estimate of rainfall (inches) with the event Duration (hours) between storm event sampled and the end of previous measurable storm event (greater than 0.1 inches of rain) Calculated flow estimate of the total volume associated with the event (gallons) Nature of the discharge sampled	Addressed under current monitoring program.
	Samples must be from discharges resulting from a storm event greater than 0.1 inches and at least 72 hours from the previously measurable event (greater than 0.1 inches of rain)	Addressed under current monitoring program.
	Samples may be taken with a continuous sampler or a combination of a minimum of three samples taken in each hour of discharge for the entire discharge with each sample separated by a minimum period of fifteen minutes	Addressed under current monitoring program.
	Specific monitoring requirements for discharges from holding ponds or impoundments with a retention period greater than 24 hours	Monitoring requirements specific to holding ponds and impoundments is not currently a component of the monitoring program as there

		are no applicable water bodies.
	Sampling waiver submitted in lieu of sampling data if samples are not collected due to weather or safety issues	Addressed under current monitoring program.

DDOE also monitors dry weather discharge from outfalls using a similar methodology (in terms of sampling sites and parameters analyzed) as that used for wet weather discharge monitoring. The frequency and volume of dry weather discharges are estimated if there is flow, but samples are not collected for analysis if there is insufficient flow. This dry weather outfall monitoring is not a permit requirement, but was implemented with the first MS4 program in 2001 in order to more fully characterize annual discharge in general (instead of just wet weather) from the MS4 to receiving waterbodies in the District (Jerusalem Bekele, personal communication).

Recommendations on wet weather discharge monitoring

- Collect additional data during wet weather events
- Evaluate monitoring locations
- Discontinue dry weather outfall discharge monitoring at the current, fixed sites and rely on dry weather screening efforts to assess dry weather discharges.

Additional discussion is included in Appendix 1.

4. Dry Weather Screening

Section 5.3 of the MS4 permit requires the development of a dry weather screening program to detect the presence of illicit connections and improper discharges to the MS4. Section 5.4 addresses area and/or source identification. Section 4.7.1 of the MS4 permit establishes the requirement to develop a program to address illicit discharges and improper disposal.

While the elements of these permit requirements have significant redundancies, they are addressed through the Illicit Discharge Program implemented by the DDOE Water Quality Division's Inspection and Enforcement Branch. Table 5 identifies the overlap between these permit elements and summarizes the requirements compared to existing efforts performed through the Illicit Discharge Program.

Table 5. Crosswalk Comparison of MS4 Permit Dry Weather Screening Requirements and Existing Efforts

MS4 Permit Dry Weather Screening Requirements			Existing Monitoring Components
4.7.1 Illicit Discharges and Improper Disposal: to detect illicit discharges and prevent improper disposal into the storm drain system	**5.3 Dry Weather Screening Program: to detect presence of illicit connections and improper discharges to the MS4**	**5.4 Area and/or Source Identification Program**	
Include all necessary inspection, surveillance, and monitoring procedures to remedy and prevent illicit discharges. Conduct chemical testing immediately after discovery of an illicit discharge when appropriate.	Develop/modify screening procedures based on experience gained during past field screening activities. Establish a protocol which requires screening to ensure that procedures are occurring.		An Illicit Discharge Program is in place that includes screening level inspections. Surveillance doesn't currently occur[2]. Chemical testing after discovery of illicit discharges doesn't occur unless done so by another interested party (e.g., PRP, the Coast Guard monitoring discharges that ultimately find their way to a water under their jurisdiction).
Include an updated schedule of procedures and practices to prevent, detect, and remove illicit discharges.	Inspect all outfalls by the end of the permit term.		A subset of outfalls is inspected each year; all are inspected once in five year period (within the permit term).
Include updated inventory (by watershed) of all outfalls that discharge through the MS4 (include the name and address, description [e.g., SIC code]) of the services/products of the facility.	Inventory all MS4 outfalls within the District.		Inventorying all MS4 outfalls has occurred and additional outfalls are added as they are identified.

[2] The term "surveillance" is interpreted here to mean visual observations to detect or prevent illicit discharges.

Crosswalk Comparison of Monitoring Needs and Existing Monitoring Components

MS4 Permit Dry Weather Screening Requirements			Existing Monitoring Components
4.7.1 Illicit Discharges and Improper Disposal: to detect illicit discharges and prevent improper disposal into the storm drain system	**5.3 Dry Weather Screening Program: to detect presence of illicit connections and improper discharges to the MS4**	**5.4 Area and/or Source Identification Program**	
Implement illicit connection detection and enforcement program to perform dry weather flow inspections in target areas. Conduct visual inspections of targeted areas.	Screen known problem sewersheds based on past screening activities. Ensure dry weather screening has addressed all watersheds within the permit term.	Identify, investigate, and address areas/sources… that may be contributing excessive levels of pollutants to the MS4/ receiving waters – including, but not limited to those pollutants identified in Table 4 of the permit (listed in Table 1 of this document).	Some outfalls are given priority status--whether the outfall is a common "problem area", whether there is continual flow, etc. and are inspected every six months. Businesses on the "critical source" list (based on business type that could potentially release illicit discharges) are inspected twice a year by a site walk through and interview only. Monitoring for parameters identified in Table 4 of the permit only occurs when required to be monitored by a particular NPDES discharger (e.g., an industrial facility, Amtrak, etc.) per its permit requirements.
	Conduct screening sufficient to estimate the frequency and volume of dry weather discharges and their environmental impact.		Only the presence/absence of flow is documented during outfall inspections. Estimation of volume does not occur. Frequency depends on number of inspections; there is not a set number of follow up visits.
Issue fines, tracking, and reporting illicit discharges and reporting progress on stopped targeted illicit discharges. Include enforcement procedures for illicit discharges.	Implement enforcement program for locating and ensuring elimination of all suspected sources of illicit connections and improper disposal identified during dry weather screening. Report results of enforcement program implementation in each Annual Report.		The Enforcement Branch is currently working on strategic enforcement plan based on EPA identifying this as a deficiency in the 2008 MS4 audit.

Crosswalk Comparison of Monitoring Needs and Existing Monitoring Components

MS4 Permit Dry Weather Screening Requirements			Existing Monitoring Components
4.7.1 Illicit Discharges and Improper Disposal: to detect illicit discharges and prevent improper disposal into the storm drain system	**5.3 Dry Weather Screening Program: to detect presence of illicit connections and improper discharges to the MS4**	**5.4 Area and/or Source Identification Program**	
Submit inspection schedule, inspection criteria, and documentation regarding protocols and parameters of field screening, and allocation of resources in each Annual Report. Report accomplishments of the program in each Annual Report.	Describe the protocol used in each Annual Report with a justification for its use. Use procedures described in the SWMP as guidance.		While the inspection schedule, inspection criteria, protocols and parameters of field screening documentation, and resource allocations are being updated and addressed in revised SOPs and the program's Strategic Plan, they have not been included in previous Annual Reports.
Implement procedures to prevent, contain, and respond to spills to the MS4. Provide training of appropriate personnel in spill prevention and response procedures.			DDOE has an Emergency Response Coordinator, who assesses DDOE's responsibility in spills, and calls in other local or federal agencies as needed to assist.

Recommendations on dry weather screening

- Improve documentation of programmatic elements (e.g., Strategic Plan for IDDE Program and Stormwater Program Annual Report)
- Improve communication with other DDOE monitoring programs
- Estimate volume and frequency of flow
- Incorporate step to conduct chemical testing immediately after discovery of an illicit discharge
- Improve documentation of the issuance of fines, tracking, and reporting efforts.
- Improve availability of inspection data through incorporation of information into a geodatabase.

5. Results of Crosswalk Comparison, Recommendations, and Next Steps

This report summarized the requirements for monitoring in the District's MS4 permit and evaluated if those requirements are currently being met by existing MS4 or non-MS4 programs. Overall, the wet weather outfall monitoring and dry weather screening requirements are close to being met (given some minor adjustments), but other, new requirements in the permit present significant gaps that need to be filled. Another significant finding is that in order to meet all the requirements in the permit, close coordination is required between the MS4, ambient, IDDE, and other monitoring programs in DDOE. Ideally, any redundancies between the programs, if identified, will be eliminated, and efficiencies realized by integrating the monitoring programs.

Specific recommendations and additional information needs were identified in each section, as well as in the Appendix. These items are summarized in Table 6.

Table 6. Recommendations and Remaining Information Needs Identified in this Crosswalk Comparison

Report Section	Recommendations/Items for Follow-up
2.1 Program Objectives	Evaluate the objectives required of the MS4 permit to ensure consistency with: - Other objectives DDOE has identified for its MS4 monitoring program, - The MS4 program in general (including related efforts such as the TMDL IP), and - Objectives of non-MS4 programs. Identify additional objectives to guide the development, implementation, and any future modifications of the Revised Monitoring Program. Suggested additional objectives to consider are included in Appendix 1.
2.2 Wet Weather Loading Estimates	See Section 3, Wet Weather Discharge Monitoring
2.3 Statistically Significant and Interpretable Data	Select the number of monitoring locations and frequency of sampling based on desired confidence level and trend detection Eliminate rotating basin monitoring schedule Additional items are included in Appendix 1
2.4 Assess Health of Receiving Waters	Fill data gaps with respect to the ambient monitoring program biological and geomorphic indicators needed to assess the health of receiving waters Consider evaluating additional stream condition indices to incorporate additional indicators or approaches (several examples are discussed in Appendix 1) Incorporate receiving water data information gathered through other efforts (e.g., illicit discharge inspection data, information developed for TMDL Implementation Plan, etc.) into an adaptive plan for prioritizing efforts for additional receiving water monitoring Develop a Monitoring Task Force to facilitate communication on the Stormwater Program between the various Branches and Divisions of DDOE Address each of the issues identified by EA in their 2009 evaluation of the Monitoring and Assessment Branch that still need to be fixed, and apply to evaluating the health of the receiving

Report Section	Recommendations/Items for Follow-up
	waters requirement in the MS4 permit (a selection are listed below) - Improve data management and sharing between Water Quality and Stormwater Divisions - Maintain data within an accessible database of all monitoring data (biological, water quality, etc.) maintained concurrently and available from a single source or location (not in multiple spreadsheets) - Maintain data in a format consistent with other local programs, such as the Metropolitan Washington Council of Governments (MWCOG) water quality database or Chesapeake Bay Program's CIMS database. - Ensure data are updated and current in STORET and CIMS databases and available for download data directly from the District's website - Develop a sediment monitoring program to supplement receiving waters health evaluation and to determine whether sediments within the District are a significant source of contaminants to surface waters - Incorporate bacterial source tracking Ensure that macroinvertebrate samples that are collected by the ambient program are regularly and consistently analyzed Implement rapid trash assessment method in development by MWCOG
2.5 Evaluate Quality of Stormwater Program	Develop a "Report Card" or "Score Card" to evaluate the quality of the stormwater program. Examples and discussion are provided in Appendix 1.
2.6 Use Additional Monitoring	Increase the utility of outfall and facility inspections under the Illicit Discharge Program to source identification (e.g., more extensive chemical analysis in follow-up monitoring when screening efforts result in a "hit"). Coordinate with ambient monitoring program in order to use data for WLA tracking Align monitoring stations with TMDL watersheds to aid in WLA tracking Target illicit discharge inspections/screening efforts in certain subwatersheds based on outfall monitoring results
2.7 Identify and Approve Additional Efforts	Improve coordination with Water Quality Division to identify additional data collection needs that may meet shared objectives Develop an approach to prioritize waters in the District that may require protection (rather than just restoration) Use MS4 outfall monitoring data to prioritize areas of the District for targeted BMP implementation Coordinate efforts with TMDL IP approach in addressing impaired waterbodies and those with TMDLs Incorporate additional recommendations from approved Watershed Implementation Plans, as appropriate (included in Appendix 1)
2.8 Identify Water	Evaluate monitoring protocols (number of sites, number of sampling events, etc.) to ensure they form the basis for a "statistically significant" approach to data collection that facilitates trend

Report Section	Recommendations/Items for Follow-up
Quality Improvement or Degradation	analysis Facilitate inter-departmental data sharing - Maintain data within an accessible database of all monitoring data (biological, water quality, etc.) maintained concurrently and available from a single source or location (not in multiple spreadsheets) - Maintain data in a format consistent with other local programs, such as the Metropolitan Washington Council of Governments (MWCOG) water quality database or Chesapeake Bay Program's CIMS database. - Ensure data are updated and current in STORET and CIMS databases and available for download data directly from the District's website
2.8 Use of Appropriate Analytical Methods	Evaluate alternative methods where necessary Consider implementing in situ monitoring using a Continuous Low-Level Monitoring device (CLAM) to evaluate pesticides, herbicides, PAH's, and other trace organics from water
3. Wet Weather Discharge Monitoring	Collecting additional data during wet weather events Evaluate monitoring locations Discontinuing dry weather discharge monitoring, and instead ensure that dry weather discharge frequency/volume and environmental impact is incorporated into the dry weather screening program Additional discussion is included in Appendix 1
4.Dry Weather Screening	Improve documentation of programmatic elements (e.g., Strategic Plan for IDDE Program and Stormwater Program Annual Report) Improve communication with other DDOE monitoring programs Estimate volume and frequency of flow Incorporate step to conduct chemical testing immediately after discovery of an illicit discharge Improve documentation of the issuance of fines, tracking, and reporting efforts. Improve availability of inspection data through incorporation of information into a geodatabase.

5.1 Next Steps

The next step of this process will include the development of a comprehensive Revised Monitoring Program that incorporates current permit requirements, leverages and refines existing DDOE monitoring activities, and addresses recommendations referenced herein. The intent of the Revised Monitoring Program is to meet DDOE's goal of a more fully functional, integrated, and efficient monitoring framework that will comply with MS4 permit requirements as well as those of DDOE's other non-MS4 monitoring efforts.

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National Research Council (NRC) 2009. *Urban Stormwater Management in the United States.* National Academy of Sciences http://www.nap.edu/catalog.php?record_id=12465

US Environmental Protection Agency (USEPA) 1992 EPA. Compendium of Watershed-Scale Models for TMDL Development. EPA 841-R-92-002. Office of Water, Washington, DC.

USEPA 2011. FACT SHEET National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit No. DC0000221 (Government of the District of Columbia)

Appendix 1: Recommendations for District of Columbia MS4 Monitoring Program from Crosswalk Comparison

The District Department of Environment (DDOE) is required to develop a Revised Monitoring Program as established in the District of Columbia's (District's) Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) permit (U. S. EPA 2011 and U. S. EPA 2012). The revised monitoring program supports implementation of the MS4 program. The aim of monitoring is to:

- Provide defensible data to allow estimates of wet weather pollutant loading from MS4 outfalls.
- Evaluate the health of District receiving waters.
- Support source identification and wasteload allocation (WLA) tracking.
- Analyze chemicals in accordance with approved analytical methods.

The Crosswalk Comparison document compares current monitoring efforts to the Districts needs and MS4 permit requirements in order to identify any gaps that exist and any recommendations for next steps. Where necessary, additional discussion on the interpretation of permit terminology is also included.

This Appendix provides additional detail to text discussed in specific sections of the main Crosswalk Comparison document. The section headings below correspond to those in the Main Crosswalk document.

Section 2.1 MS4 Program Objectives

It is recommended that DDOE evaluate the objectives of the MS4 permit to ensure consistency with any other objectives DDOE has identified for its MS4 monitoring program, the MS4 program in general (including related efforts such as the TMDL IP), as well as objectives of non-MS4 programs, such as the Ambient Monitoring Program. It is recommended that part of this evaluation include the identification of additional objectives to guide the development, implementation, and any future modifications of the Revised Monitoring Program. Suggested additional objectives to consider include:

- Foster coordination of efforts between the MS4 outfall and ambient monitoring programs (including data management/sharing, staff, equipment, etc.) to improve the efficiency of meeting multiple program requirements and the TMDL Implementation Plan (IP). This includes:
    - Develop land use based EMCs for potential application in the IP Modeling Tool through MS4 wet weather monitoring (i.e., identify drainage areas that are mostly one type of land use)
    - Implement continuous flow monitoring and flow-weighted TSS and nutrient monitoring during wet weather at least one station per watershed
    - Monitor pre- and post-BMP implementation for a demonstration neighborhood to evaluate BMP effectiveness and implementation priorities
    - Monitor for TMDL pollutants during ambient water quality monitoring efforts to verify 303(d) listing

  - Evaluate the sources of 303(d) listed pollutants (in conjunction with the IDDE program)
  - Evaluate the status and long term trends in receiving waters associated with MS4 stormwater discharges;
  - Assess the chemical, biological, and physical effects of MS4 discharges on receiving waters; and
  - Assess progress towards meeting TMDL pollutant load reduction benchmarks
- Incorporate revised objectives within the updated Stormwater Management Plan (currently in development

Section 2.3 "Statistically Significant and Interpretable"

DDOE has interpreted "statistically significant and interpretable" to mean that the dataset collected through the monitoring program must be robust enough to test for statistical significance in trends over time and among monitoring stations. There must be enough data collected to say with some level of confidence that these data are actually representative of the water body being monitored.

To ensure the data collected by DDOE is "statistically significant and interpretable", DDOE's current station locations and frequency of collection must be evaluated to determine if this requirement can be met given the current sampling methodology, or if changes must be implemented.

Table A.1 provides an estimate of the number of years of data required to be collected in order to detect short and long term trends over time, as well as the confidence around the mean. This information is provided for a range of sampling frequency scenarios, based on an ambient monitoring program evaluated by LimnoTech for the Tualatin River Watershed in Oregon. The NPDES permit required sampling three times per year, but a statistical analysis showed that more frequent sampling was required to adequately assess watershed objectives and protect water resources. Thus, a variety of sampling frequency options was tested for significance to inform watershed managers. Note that data with inherent higher variability (e.g., fecal coliform bacteria) required longer periods of sampling to detect trends, and the confidence interval around the mean was larger. "Weak trends" were defined as 10% change per year and "strong trend" was defined as 50% change per year for this analysis (LimnoTech 2006). This example is recommended as a template to determine number of stations to sample per watershed (for the District "watershed" is defined as the three major basins—Rock Creek, Potomac River and Anacostia River) and frequency, based on what DDOE determines is the desired level of ability to detect trends and the confidence in mean data. While desired level of frequency will require further discussion and considerations of cost and staff resources, as well as potential coordination with other monitoring programs, it is likely that somewhere between the minimum required three events per year and monthly sampling will be adequate for a robust dataset.

Table A.1. Example Requirements for Detect Trends in Monitoring Data to and Confidence Around Mean. Source: LimnoTech 2006

Sampling frequency	# of stations per watershed	Confidence in mean (90% C.I.)	Years to detect weak trend	Years to detect strong trend
Weekly	1	±20%	1.4	0.6
Two per month	1	±24%	1.9	0.8
Monthly	1	±26%	2.6	1.1
Three per year	1	±30%	4.8	1.8
Annually	1	±42%	7.9	2.6
Weekly	3	±7%	0.9	0.3
Two per month	3	±9%	1.3	0.6
Monthly	3	±11%	1.9	0.9
Three per year	3	±17%	3.2	1.5
Annually	3	±21%	4.9	2.1
Weekly	5	±2%	0.8	0.2
Two per month	5	±3%	1.2	0.5
Monthly	5	±4%	1.6	0.8
Three per year	5	±9%	2.7	1.4
Annually	5	±16%	3.9	2.0

Consider Eliminating Rotating Basin Monitoring Schedule

Before the interim program was implemented, MS4 locations were monitored on a rotating basin schedule (i.e., only sites in one watershed [Rock Creek, Potomac, or Anacostia] were monitored in a particular calendar year). While this may have saved resources and allowed for efficiency with monitoring activities, this strategy is not favored for long term trend analysis. For example, it is not feasible to include a statistical analysis or develop time series for a single parameter at a single site using the current MS4 dataset (2001-2012) as there is a maximum of four data points for each station's annual wet weather concentration for this entire time period.

Additionally, it is only possible to compare sites within one watershed within a given year rather than being able to assess city-wide trends or identifying potential issues in the remaining two watersheds. While the interim monitoring program detailed in the MS4 permit includes only six sites that are all monitored annually, it will be important for the Revised Monitoring Program to include annual monitoring at additional sites (and potentially additional wet weather events per year) to have enough data for a statistically significant and interpretable dataset throughout the city each year. The number of sites per watershed, and events to be sampled each year will depend on the desired level of confidence and how quickly DDOE wants to be able to detect trends, as mentioned in the previous section.

Section 2.4: "Health of Receiving Waters"

Stream health is often defined as the ecological integrity of waters compared to a baseline, standard, or goal. Stream health can be measured using various indicators such as macroinvertebrates, fish, habitat, and physical condition. The first three types of indicators are currently monitored under DDOE's ambient program on a regular basis at a number of sites. While the use of physical indicators, such as

geomorphological factors, is required by the MS4 permit, this approach to evaluating the health of the District's receiving waters is not regularly used by DDOE other than in select stream restoration projects. It is recommended that this programmatic element be incorporated into the Revised Monitoring Program.

Use of the Current DDOE Ambient Monitoring Program to Fulfill MS4 Permit Requirements

To identify and prioritize additional efforts needed to address exceedances of water quality standards or impacts to receiving streams, DDOE must first evaluate the receiving waters and determine if there are impairments or threats. Waterbodies or waterbody segments not meeting the appropriate water quality standards are considered to be impaired. DDOE is required under the CWA to identify these impaired waters for inclusion on the 303(d) list and to develop Total Maximum Daily Loads (TMDLs).

These efforts are already being conducted through various programs in DDOE. The Water Quality Division's (WQD) Monitoring and Assessment Branch assesses the receiving waters to determine if they are impaired, and the Planning and Permitting Branch develops the TMDLs. The efforts needed to address exceedances of water quality standards, impairments (covered under the 303(d) list or TMDL) or threats will be addressed through DDOE's Integrated TMDL Implementation Plan. Programs to correct impairments are also addressed in the District's Integrated Report (IR). Additionally, watershed implementation plans (WIPs) have been developed that identify water body impairments. As discussed in the IR:

> "Aquatic life use support is based on the relationship between observed stream biological conditions as compared to the reference stream condition producing a percent of reference stream biological condition. This scale rates "impaired" at 0-79 percent, and "non-impaired at 80-100 percent" of reference condition. US EPA 305(b) guidelines on criteria for aquatic life use support classification recommend designation of "not supporting" if impairment exists, and "fully supporting" if no impairment exists" (DDOE 2012, p. 55).

A comment submitted on the draft MS4 permit mentions the existing work DDOE is performing with regard to its program to evaluate the health of the receiving waters. The comment and EPA's response are as follows:

> **Comment:** The federal requirement under Section 106 of the CWA is to prepare and submit a water quality report to the EPA. To evaluate the in-stream water quality involves substantial activities beyond evaluation of stormwater sources. It involves determinations on various sources other than stormwater, such as upstream sources, legacy contamination (ground water and sediment contaminations), and discharges from other than stormwater sources. The District water quality program that implements the evaluation of the health of the receiving waters is currently in part funded by the EPA. The Commenter believes that the activity should not be a requirement under the NPDES MS4 Permit, and that by making it an MS4 requirement, District taxpayers will have to absorb all the CWA section 106 function costs.
>
> **EPA Response**: The monitoring station locations for characterizing pollutants of concern in MS4 discharges are separate from the monitoring and analysis performed for the CWA Section 305(b) Report at the CWA Section 106 monitoring stations. The locations of the MS4 monitoring sites are designed to identify pollutants of concern, possible sources of contaminants, and to assess the SWMP, rather than provide an assessment of in-stream overall water quality.
>
> (EPA 2011)

While EPA attempted to respond to this comment, it did not address the issue of watershed health. The permit requires DDOE to "use the information to evaluate the quality of the stormwater program and the health of the receiving waters at a minimum…" This is not consistent with EPA's statement that the intent of the program is to "identify pollutants of concern, possible sources of contaminants, and to assess the SWMP, rather than provide an assessment of in-stream overall water quality." It appears that EPA missed the point of DDOE's comment regarding reliance upon data collected through its Ambient Monitoring Program to support the evaluation of the health of its receiving waters.

Identifying Existing Programmatic Modifications

Despite this apparent misunderstanding, DDOE has expressed a desire to identify redundancies and opportunities for efficiencies among its monitoring programs through the development of the revised MS4 outfall monitoring program. The need for DDOE to evaluate the health of its receiving waters in association with the MS4 permit is analogous to the need for DDOE to evaluate the health of its waters through 303(d) and 305(b) reporting requirements (combined into the District's Integrated Report) While this document is not intended to be an audit of the District's Ambient Monitoring Program, the overlap with these programs inevitably has resulted in the review and assessment of the Ambient Monitoring activities to help ensure that DDOE can (1) create a program that most efficiently meets the requirements of both programs and (2) ensure that the data collected are defensible in relation to the requirements of DDOE's MS4 permit.

Elements of a State Water Monitoring and Assessment Program (EPA 2003)

Transmittal memo:

- The document "*recommends the basic elements of a state water monitoring program and serves as a tool to help EPA and the states determine whether a monitoring program meets the prerequisites of CWA Section 106(e)(1).*"

- "*EPA expects this effort* [articulating monitoring program and resource needs] *will identify efficiencies to be gained through a holistic approach to program implementation.*"

- "*It is important that the strategy be comprehensive in scope and identify the technical issues and resource needs that are currently impediments to an adequate monitoring program.*"

Executive Summary:

- "*States should develop, over time, a monitoring program addressing the 10 elements…*"

- "*EPA believes that state monitoring programs can be upgraded to include all of the elements… within the next 10 years.*"

Recommended modifications to the Ambient Monitoring Program were previously identified through the *Evaluation of the District Department of the Environment Water Quality Division Monitoring and Assessment Branch* (EA 2009). This evaluation was based on the EPA guidance document *Elements of a State Water Monitoring and Assessment Program* (2003). The framework of the EPA guidance document contains 10 elements to evaluate ambient monitoring programs. The 10 elements include:

- Strategy
- ***Objectives***
- ***Design***
- ***Indicators***
- ***Quality assurance***

- ***Data management***
- ***Data analysis***
- ***Reporting***
- ***Program evaluation***
- General support and infrastructure

While not a regulatory requirement, EPA recommends these 10 elements be included in state programs within 10 years of the date of the publication of the guidance document (thus, by 2013). The 2009 EA program evaluation identified a number of issues that were not consistent with guidance standards. The EA report included key recommendations for each of the categories identified in bold italics, above. The following list includes those recommendations that this Crosswalk Comparison effort identified as still being unmet. These include:

Objectives:

- Develop monitoring objectives that reflect the data collection necessary to support inter-jurisdictional and regional efforts

Ambient Monitoring Program Design

- Conduct a trend analysis for key pollutants to determine if monitoring stations meet the District's water quality needs and are useful in the current program
- Design the monitoring program to include monitoring of the District's waters for all existing TMDLs parameters [e.g. polychlorinated biphenyls (PCBs), organics]
- Assess monitoring stations located on District borders to quantify specific pollutant loads entering the District from Maryland and Virginia.
- Evaluate sampling frequencies to determine if data are collected in a way that provides statistically sound results for key analytes and allows valid comparisons to ambient water quality standards in the District.
- Develop a sample design that supports the use of models to target pollutant reduction measures
- Design the monitoring program to allow DDOE to demonstrate impacts from best management practices (BMPs) or other pollutant reduction strategies
- Incorporate the collection of sediment data to determine whether sediments within the District are a significant source of contaminants to surface waters.
- Incorporate bacterial source tracking

Receiving Water Indicator Use

- Use indicators as a way to determine whether or not the designated use has been attained as well as to determine the overall quality of the watershed
- Define a core set of monitoring indicators (chemical/toxicological, physical/habitat, and biological/ecological endpoints) to assess attainment with District and EPA water quality standards

  - Include supplemental indicators that would be employed once a pollutant is identified or reasonably suspected using core indicators. Supplemental indicators such as site-specific studies to reduce the pollutant of concern would then be implemented.
  - If these trends indicate that a pollutant is persistent at a station, and is related to human activities, then continue to monitor at that station, including assessment of any pollutant reduction measures.
  - If a station has not had any statistically significant changes in priority pollutants in decades, reconsider its priority.
  - Start to incorporate precipitation and stormwater, and river flow conditions in all datasets, as those conditions substantively affect data interpretation and conclusions.
- Incorporate indicators that reflect decisions made at scales beyond the District boundaries (e.g., inter-jurisdictional waters).

Quality Assurance

This Crosswalk Comparison did not include review of the EPA laboratory at Ft. Meade. While the EA review identified numerous QA/QC issues with the laboratory, without a more current assessment of these issues, it is unclear if the issues identified by the questions below are still applicable. QA/QC issues will need to be evaluated further in association with the development of the Revised Monitoring Program. This evaluation will deed to determine:

- Are QA measures associated with the analytical laboratory facilities sufficient?
- Are QA measures associated with analyses performed in-house sufficient?
- When will the QAPP be updated to reflect current staff and analytical laboratory services?
- Does the laboratory have current standard operating procedures (SOPs) for its analyses?
- Are SOPs for sampling methods available and current field tests that are conducted, are they in a central location, and are updates to all field and laboratory SOPs performed at regular intervals (e.g., annually)?
- Are split sample results available - run in triplicate by each laboratory participating in the program, and the results returned to CBP on a data form specifically designed for the split sample program?
- Is a regular programmatic evaluation of the field and sampling program performed?
- Is there a dedicated QA officer available at the laboratory?

Data Management

- Maintain data within an accessible database at MAB (not in multiple spreadsheets)
- Maintain data in a format consistent with other local programs, such as the MWCOG water quality database or CBP's CIMS database.
- Ensure data are updated and current in STORET and CIMS databases
- Update data management system to include a database of all monitoring data (biological, water quality, etc.) maintained concurrently and available from a single source or location

- Develop a mechanism to integrate all readily available and existing information including data from branches and divisions other than MAB.
- Make data available to the public within months of laboratory analyses and data validation in a usable format (searchable and amenable to statistical analyses), available to download data directly from the District's website.

Data Analysis

- Evaluate confidence in using previously collected ambient monitoring data. Because of the lack of QA/QC oversight noted above, EA noted that conclusions based upon MAB-generated data are unable to document that the results obtained are accurate and representative.
- Have a documented method for assessing water quality based on analysis of various types of data (chemical, physical, biological, land use) from various sources.
- Generate seasonal trends analysis tables for targeted pollutants
- Evaluate data on a regular basis for implementing appropriate water pollution control activities
- Develop and document a method for assessing stressors (causes/sources) associated with impaired or vulnerable waters
- Make statistical determinations as to the strength/validity of the water quality data
- Use statistical analyses and trends to re-evaluate the field sampling program
- Ensure data analysis plans are formulated to address other water program needs (e.g., NPDES program effectiveness and permitting, trend analyses, water effect ratios, and TMDL calculations).
- Include modeling the flow/loading of surface water pollutants within the watershed.

Program Evaluation

- Conduct periodic reviews of its monitoring program in consultation with EPA
- Include a formal external monitoring program evaluation process
- Objectively evaluate the overall network of stations on a regular basis (i.e., annually) to determine whether it meets the current needs of the District

General

- Staff/resources - Retain a benthic taxonomist or subcontract samples to a certified taxonomist for all benthic samples.
- Introduce a formal training process for new field staff
- Equipment - Evaluate new sensor technologies for real-time water quality monitoring and hydrolabs. Acquire equipment needed to complete organic analyses (gas chromatography electron capture apparatus) at the laboratory. Consider obtaining equipment that allows the analysis of volatile and semi-volatile organic compounds.

Recommendations

Address each of the remaining issues identified by EA in their 2009 evaluation of the ~~Monitoring and Assessment Branch~~Ambient Monitoring Program that apply to the MS4 permit requirement to "evaluate the health of the receiving waters". Other related recommendations identified in association with the development of this Crosswalk Comparison document include:

- Ensure that macroinvertebrate samples that are collected by the ambient program are regularly and consistently analyzed
- Evaluate the appropriateness of reference streams
- Evaluate/develop metrics to evaluate receiving water quality
- Evaluate the frequency and type of monitoring (e.g., which parameters) to conduct at each monitoring station
- Add a geomorphologic monitoring component to the monitoring program that is coordinated with other monitoring activities
- Improve data management and sharing between Water Quality and Stormwater Divisions
- Evaluate the restructuring of Division/Branch monitoring efforts to ensure improved coordination of and streamline programmatic efforts
- Implement rapid trash assessment method in development by MWCOG

Section 2.5: "Quality of Stormwater Program"

The term "quality" is not explicitly defined in the permit nor in the fact sheet, so for the purposes of the Crosswalk, this term has been interpreted to mean the ability of DDOE to meet the water quality and programmatic goals (e.g., benchmarks and milestones) set forth in association with its stormwater program. While this program evaluation requirement is included within the monitoring section of the MS4 permit, DDOE recognizes the use of monitoring data alone is not sufficient, nor appropriate, to effectively evaluate stormwater program "quality".

While this specific programmatic requirement was not found in other MS4 permits during the development of this Crosswalk Comparison, there are several example "tools" that may be adapted in a way that facilitates DDOE meeting this permit requirement. For instance, the California Stormwater Quality Association (CASQA) has developed a multi-level approach for stormwater program effective effectiveness assessments. Commonly used by MS4s in California, this tool is also referenced in EPA's "Evaluating the Effectiveness of Municipal Stormwater Programs". The CASQA approach evaluates a program's effectiveness through program/environmental outcomes, as demonstrated in the figure below in a gradation from activity-based to water quality-based outcomes. It also integrates a range of assessments from implementation of compliance activities to receiving water quality assessment. As stated in an associated CASQA white paper (CASQA 2005), this multi-level approach is used because "[i]n instances where water quality assessment is used to draw conclusions about overall program effectiveness, results are usually very general and require extended periods of analysis." A graphic depiction of this approach is included in Figure A.1.

Recommendations

- Develop or adapt an existing tool or approach facilitate the assessment of programmatic and water quality trends in a comprehensive manner

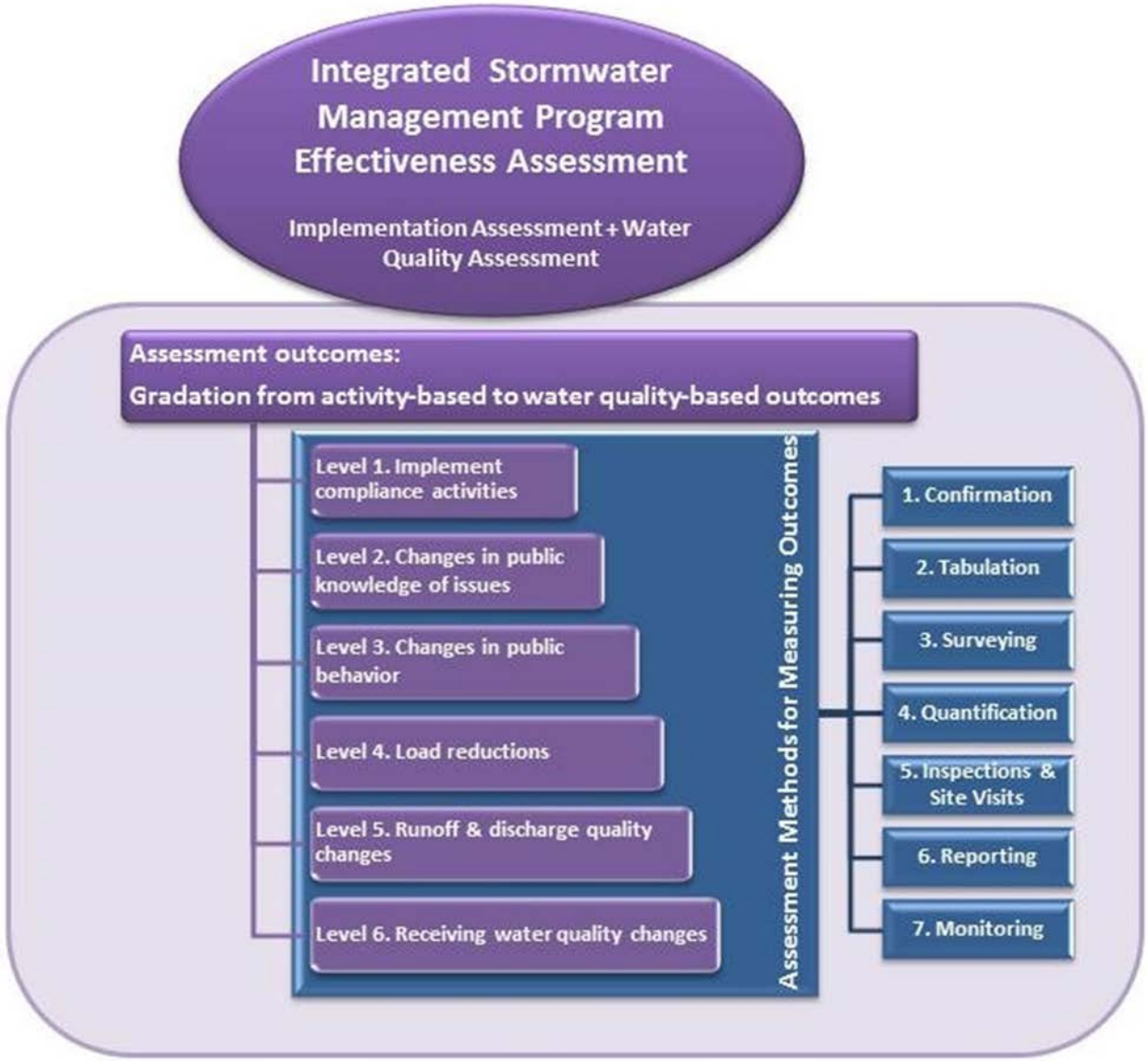

Figure A.1. Stormwater Management Program Effectiveness Assessment (Adapted from CASQA 2005)

Section 2.7: Water Quality Exceedances and Receiving Stream Impairments

Section 5.1.2.2 of DDOE's MS4 permit requires the District to use the information collected from the Revised Monitoring Program to identify and prioritize additional efforts needed to address water quality exceedances, and receiving stream impairments and threats. Many additional, recommended efforts to address exceedances and impairments have already been identified in several Watershed Implementation Plans (WIPs) developed by DDOE to provide an overview of the waterbody and applicable TMDLs, propose management measures to address pollutants, and discuss existing

monitoring to measure progress. It is recommended that these recommendations (summarized below) be carefully considered for implementation.

Integrate Monitoring

- Use a holistic approach to monitoring to get better data and to save money
- Examine all the monitoring sites to ensure they are representative of the watershed.
    - If sites are physically clumped together, could they be better spread apart to represent the entire watershed?
    - If they are temporally close, could they be spread out better across the year?
    - Make more efficient use of resources - If the contractor is out taking stormwater samples at an outfall during a storm event, could they also collect samples from the stream during the same event?
- Integrate monitoring for reporting purposes - including the results from both stormwater and stream outfalls in reports would give a more complete picture of the health of the waters

Correlate Pollutants to Total Suspended Solids

- Evaluate the presence of those pollutants known to bond with sediment and have low water solubility (e.g., thirteen of the 16 listed pollutants impairing Rock Creek).
- Correlate the loads for these pollutants with Totals Suspended Solids and then monitor for TSS and tie reductions in those pollutants to and load reductions seen in TSS.
- Evaluate substituting TSS for the following pollutants:
    - Lead – bonds easily with sediment and has a low water solubility
    - Arsenic – like lead, bonds easily with sediment and has a low water solubility
    - Copper – bonds easily with sediment and has a low water solubility
    - Mercury – bonds easily with sediment and has a low water solubility
    - PAH1, PAH2, PAH3 – bonds easily with sediment and has a low water solubility
    - Chlordane – is banned so source control is not possible. It also bonds easily with sediment and has a low water solubility
    - Heptachlor epoxide – is banned so source control is not possible. It also bonds easily with sediment and has a low water solubility
    - Dieldrin – like chlordane it is banned so source control is not possible. It also bonds easily with sediment and has a low water solubility
    - DDT, DDD, DDE – is banned so source control is not possible. It also bonds easily with sediment and has a low water solubility

Monitor to Support TMDL Delisting

- Evaluate evidence that many of the pollutants listed in DC should not have been listed or that the waterways now meet TMDL loads
- Examine historical monitoring records to determine if there is sufficient evidence to warrant delisting.
- Conduct additional focused monitoring of pollutants in the listed tributaries and at the DC/MD line if some evidence exists, but not enough to justify delisting.

Monitor of Organic Pollutants

- Evaluate implementing a dual strategy of biological monitoring and continuous in situ water quality monitoring
    - Biological monitoring will examine fish tissue samples to ascertain the presence of organic pollutants that are harmful to human health.
    - In situ monitoring could be done using a Continuous Low-Level Monitoring device, or CLAM. The CLAM is a submersible extraction sampler, using EPA approved SPE (Solid Phase Extraction) media to sequester Pesticides, Herbicides, PAH's, TPH, and other trace organics from water.
    - Monitoring efforts can help DDOE to both determine the presence or absence of these chemicals, but also help localize their sources.
- Implement this sampling approach would involve beginning at the lowest reaches of the waterbody and its tributaries and move upstream. By moving upstream with subsequent samples DDOE can pinpoint the source(s) of organic pollution, if any.
- Conduct fish tissue analyses to show if there are high levels of organic and metals pollutants that may be harmful to human health if consumed.

Monitor Both Upstream and at the Mouth of Tributaries

- Conduct upstream/downstream monitoring only in targeted watersheds.
- Base this expansion on the results of the current review of the District monitoring protocols.
- Evaluate incorporating upstream/downstream monitoring in watersheds where focused restoration work is taking place or performing this monitoring in watersheds on a rotating basis (as is done for the MS4 permit).

Monitor the Efficiency of Practices

- Conduct additional sampling during implementation of specific practices to better quantify their effectiveness (removal efficiencies of structural and non-structural BMPs) and to develop more detailed data specific to conditions
- Monitor new and innovative techniques and devices to better understand the cost-effectiveness of these techniques (pollutant load removed per dollar spent).
- Allow for better prioritization of projects for installation.

Section 3: Wet Weather Discharge Monitoring

Recommendations include the following:

Consider Collecting Additional Data during Wet Weather Events

Several recommendations are listed below that will facilitate integration between the revised MS4 monitoring program and the TMDL Implementation Plan (IP).

- Implement continuous flow monitoring and flow-weighted TSS and nutrient monitoring during wet weather at least one station per watershed
- Monitor pre- and post-BMP implementation for a demonstration neighborhood to evaluate BMP effectiveness and implementation priorities
- Monitor for TMDL pollutants (as appropriate, at appropriate stations) to verify 303(d) listing and to facilitate WLA tracking
- Develop data sharing agreement with DC Water to access their four rain gages (Brentwood Reservoir, Bryant St, Main Pumping Station, Rock Creek Pumping Station) for more localized rain event information (data is currently collected and maintained by a private company and access is by password only).

Evaluate Monitoring Locations

Both past and existing (Interim) monitoring locations must be evaluated to ensure they meet MS4 permit requirements and other project/program need. Tasks for evaluation of the outfall monitoring locations include:

- Verify that all locations are indeed part of the MS4 and not waters of the U.S. (discussed in further detail below)
- Coordinate with TMDL WLA tracking
- Evaluate all outfall locations for representativeness of District land use/area
- Evaluate locations/current frequency for contribution to statistical significance
- Coordinate with biological and geomorphologic monitoring (co-location would be ideal) to meet "health of receiving waters" requirement
- Conduct desktop analysis and field visits to address above needs and verify access

Discontinue Dry Weather Discharge Monitoring

From 2004 to 2011, dry weather discharge monitoring was performed twice per year at the same monitoring locations as where wet weather monitoring is conducted. Dry weather discharge monitoring was performed on the same rotating basin schedule as wet weather monitoring and for the same parameters as required for wet weather monitoring under the 2004 MS4 permit. Since DDOE has acknowledged that dry weather discharge monitoring has not been required under the District's 2004 or 2012 revised permit. It is recommended that dry weather discharge monitoring is not continued, and instead ensure that dry weather discharge frequency/volume and environmental impact is implemented as part of the dry weather screening program.

Incorporate Sediment Monitoring

Sediment monitoring for a variety of contaminants has been widely used as a robust indicator of water quality and stream health. The following rationale explains the case well, and may be considered by DDOE for the MS4 and/or ambient programs:

> "A variety of ambient monitoring programs can be used to evaluate the impacts of stormwater discharges. Typically this can include water column monitoring, biological monitoring, or sediment monitoring. **Since few stormwater pollutants reside in the water column, instead settling to the bottom of receiving waters, biological and sediment monitoring are the best at evaluating the cumulative impacts of stormwater discharges to receiving waters. In particular, the bioassessment and sediment monitoring techniques are excellent tools to help determine "hot spots" where stormwater treatment retrofit projects should be implemented** (p.5)" [emphasis added] (Florida DEP 2013).

Improve Data Recording, Sharing, and Availability

Data oversight, management, and availability continue to be an ongoing issue of concern within DDOE. While this issue is discussed further in Section 2.4, above, additional recommendations include the development of an Interdepartmental Monitoring Task Force.

Identifying Waters of the US vs. Piped Streams

DDOE's MS4 permit states that it "covers all areas within the jurisdictional boundary of the District of Columbia served by, or otherwise contributing to discharges from, the Municipal Separate Storm Sewer System (MS4) owned or operated by the District of Columbia."

The Proposed Rule on Waters of the US (79 FR 22188) has raised questions regarding discharges from what has been considered historically as part of this MS4 versus flow in piped streams. In many urban areas, small creeks and storm sewer systems are sometimes interconnected, some to the point where it is difficult to distinguish one from the other. This is often the result of many years of development, addressing flood control issues and piping and paving over streams to facilitate development. Those small piped streams are, subsequently, used for storm conveyance as well as stream flow. Initial review of DDOE's stormwater documentation and mapping information indicates that this is the situation within the District. For instance, as explained in the internal DDOE document, *Stormwater Characterization Sample Analysis Results* report (2001-2011 data), "many of the DC storm sewers enclose what were once running streams" (Bekele 2012)

In one section of the preamble to the proposed rule (79 FR 22199; 3rd column), tributaries are described to include:

> *The term tributary means a water physically characterized by the presence of a bed and banks and ordinary high water mark, as defined at 33 CFR 328.3(e), which contributes flow, either directly or through another water, to a water identified in paragraphs (a)(1) through (4). In addition, wetlands, lakes, and ponds are tributaries (even if they lack a bed and banks or ordinary high water mark) if they contribute flow, either directly or through another water to a water identified in paragraphs (a)(1) through (3).* ***A water that otherwise qualifies as a tributary under this definition does not lose its status as a tributary if, for any length, there are one or more man-made breaks (such as bridges, culverts, pipes, or dams), or one or more natural breaks (such as wetlands at the head of or along the run of a stream, debris piles, boulder fields, or a stream that flows underground) so long as a bed and banks and an ordinary high***

> ***water mark can be identified upstream of the break.*** *A tributary, including wetlands, can be a natural, man-altered, or man-made water and includes waters such as rivers, streams, lakes, ponds, impoundments, canals, and ditches not excluded in paragraphs (b)(3) or (4). (emphasis added)*

Given the way the proposed rule defines "tributaries", it will be necessary to assess all streams within the MS4 area to verify which portions are truly part of the storm sewer system and which are creeks or streams (or were historically creeks and streams and defined as "tributaries" under the proposed rule).

If any current monitoring locations are found to be "waters of the US" instead of part of the MS4, they will be removed from consideration for future outfall discharge monitoring, but may require other water quality assessments.

While initial review of DDOE's stream and MS4 data and information indicate this as a potential issue within the District, a more thorough analysis will be conducted using GIS data of historical streams to quantify the extent of the issue and the need for modifications to the MS4 program as a result. Because a final determination associated with the proposed rule is not expected until the end of 2014 at the earliest, it is recommended that DDOE come to internal consensus regarding how to interpret the Rule and how that interpretation will impact the Revised Monitoring Program.

Section 4: Dry Weather Screening

While most elements of the Illicit Discharge Program are being addressed, some modifications are necessary to meet permit requirements. Communication with Illicit Discharge Program staff, including Josh Rodriquez (Branch Chief of the Inspection and Enforcement Branch), identified that Program staff are receptive to making these modifications and are currently updating existing documents (i.e., SOPs) and formalizing programmatic documentation (development of a Strategic Plan and Enforcement Plan). Several recommendations were identified through the review of the program and through communication with DDOE staff. These include:

- Improve documentation of programmatic elements – currently in progress through the development of a Strategic Plan for the program. Also report this information in the Stormwater Program Annual Report
- Improve communication with other DDOE monitoring programs:
    - Ambient Monitoring Program – can help improve identification of additional monitoring needs, such as the Ambient Program monitoring for toxics in a particular area where the Illicit Discharge program has identified a potential issue. Hickey Run is also a target area for the Illicit Discharge Program, but the Monitoring and Assessment Branch doesn't monitor there due safety concerns related to bacteria issues. Additional focused monitoring might be initiated based on improved coordination and communication.
    - MS4 Wet weather monitoring program – this could help facilitate identification of target areas or issues based on shared data and observations.
- Estimate the presence or absence of flow during outfall screening to allow staff to estimate the volume of these flows during inspections and their potential impacts to receiving waters.
- Incorporate step to conduct chemical testing immediately after discovery of an illicit discharge if, for instance, screening level activities are unable to identify the source or the pollutants of concern. Currently any follow-up includes only a repeat visit to the site. Hickey Run; however, is the only "problem watershed" where follow-up occurs (for instance, a grant was awarded to develop strategy for identifying sources in Hickey Run watershed involving analytical work and use of robotics to identify groundwater plumes, etc.)
- Improve documentation of the issuance of fines, tracking, and reporting efforts. The EPA audit of the DDOE MS4 program identified the need to develop a formal mechanism for tracking the enforcement response and conclusion of illicit discharge investigations. A Strategic Enforcement Plan is currently being developed.
- Improve availability of inspection data through incorporation of information into a geodatabase. Allowing inspection data to be cross referenced with GIS can help identify issues and areas of concern and facilitate communication with other Divisions to share these data.

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