

Data Analysis Plan and Study Design

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Stormwater Source Control Effectiveness Study
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Introduction

This document provides a description of the anticipated data analysis plan for the Regional Stormwater Monitoring Program (RSMP) source control effectiveness study. The main outcome of the study will be an assessment of stormwater source control inspection data from NPDES municipal stormwater permittees (Phase I and Phase II permittees, Ecology 2013a and 2013b). The findings and results from this data assessment are intended to help Ecology and the permittees identify opportunities to improve or streamline NPDES-related inspection programs, especially ones that include inspection of stormwater source control efforts and best management practices (BMP). The effectiveness studies of the RSMP are funded by municipal stormwater permittees in western Washington.

The overall objective of the assessment is to answer questions articulated by NPDES permittees, Ecology, and other stakeholders based on experience implementing the municipal stormwater permit. Each source control effectiveness question is discussed in detail in this study plan, and specific potential objectives and ideas for data analysis are identified based on the type, quality, and quantity of data expected to be available. Potential data analysis methods and types of answers to the effectiveness questions are provided as well. Per the general study design outlined in the scope of work (Lakewood 2015), this data analysis plan will be finalized after data are obtained and reviewed.

Definition of Source Control

Source control in a stormwater context refers to the essential idea of preventing pollutants from entering stormwater runoff. Stormwater, as defined by the NPDES permit, refers to “runoff during and following precipitation and snowmelt events, including surface runoff, drainage or interflow” that “travels across the land surface and discharges to water bodies either directly or through a collection and conveyance system” (Ecology 2013b). A pollutant in this context is defined as any undesirable substance in stormwater runoff, including chemical, physical, or biological constituents.

Source control of stormwater pollution is achieved by a variety of practices, techniques, and activities collectively termed as best management practices (BMPs). A source control BMP is defined by the permit as “a structure or operation that is intended to prevent pollutants from coming into contact with stormwater through physical separation of area or careful management of activities that are sources or pollutants” (Ecology 2013a). These BMPs serve to prevent the generation of potential pollutants or manage and treat them at the source once generated. Source control BMPs are not intended to prevent all stormwater impacts, but rather a combination of BMPs is typically required in practice to minimize impacts.

Source Control Effectiveness Questions

The Effectiveness Subgroup of the RSMP engaged in an extended process to identify and prioritize a large list of questions to be answered by effectiveness studies. The list of questions was approved by the Puget Sound Ecosystem Monitoring Program Stormwater Work Group (SWG, Ecology 2016), which is composed of a range of stakeholders, including Ecology and NPDES municipal permittees working to

develop a “cooperative stormwater monitoring and assessment framework” in the Puget Sound region. The RSMP identified two main source control effectiveness questions, with five subquestions under the first main question.

The topics of the source control effectiveness questions include inspection frequency of stormwater treatment and control facilities, proper use of source control BMPs at businesses, the effectiveness of focusing on property owners versus business owners for private facility inspections, compliance rates, and barriers to BMP implementation. The first main question and its subquestions are being addressed in this phase of the project (data assessment) and the second main question is expected to be addressed during a later phase of the project intended to develop a coordinated inspection framework. The original source control effectiveness questions (EQ) are as follows:

1. What is the optimum frequency of inspections to maintain the functionality of stormwater treatment and control facilities and ensure the proper use of source control best management practices (BMPs) at businesses?
 - a. Which is more effective for specific high value BMPs: focusing on the property owners or focusing on the business owners, or a combination of the two?
 - i. Target both structural and operational BMP types, and situations where a business owner is and is not cooperative and willing.
 - b. Which required BMPs were implemented based upon follow up inspection? Which optional BMPs were installed based upon follow up inspection?
 - c. What were the primary barriers to not adopting or installing BMPs?
 - d. Address the connection between in-person visits and source control BMPs, and identify situations where technical assistance and/or follow-up inspections are needed to ensure required BMPs are implemented.
 - i. Gather data about percent compliance. Partner with Ecology Local Source Control program to do this study.
2. Are stormwater source control inspections more effective if combined with other types of inspections? How can coordination of inspections be improved or better organized regionally for referral of issues to the correct entity?

Some explanation and refinement of these questions is needed in order to identify data analysis objectives. The first main question asks about the optimum frequency of inspections, but it refers to two general types of stormwater source control at two types of locations: functionality of stormwater treatment and control facilities, and BMPs at businesses. This distinction is understood to refer to different BMPs used at treatment/control facilities versus at businesses. The BMPs in use at these locations generally fall into three categories as described in the stormwater management manual for western Washington (Ecology 2012):

Treatment and flow control BMPs: facilities or structures designed to remove or reduce pollutants, such as vaults, oil-water separators, ponds, and treatment BMPs for specific pollutants, such as electrocoagulation for metals removal.

Structural Source Control BMPs: physical structures or mechanical devices or facilities that are part of an industrial or business process, such as containment structures and covers for material storage, devices to capture and reuse material such as solvent sinks, and diversion structures to capture and contain contaminated wash water. Some structural source control BMPs are also used for treatment and flow control.

Operational Source Control BMPs: institutional non-structural practices that prevent or reduce pollutants, such as spill prevention, training, and housekeeping.

The subquestions under question one refer to BMPs at businesses and are understood to apply to the second part of the question referring to structural and operational BMPs at businesses. In addition, subquestions 1a and 1d have directive comments related to addressing those questions. Furthermore, it is understood that treatment and flow control BMPs of interest for this assessment are those on commercial property and do not include BMPs on public property, municipally owned property, or on roads in the right-of-way. Distinguishing between BMP types, the questions can be rewritten as follows (changes in italics). The restated questions being addressed in this phase of the project are the starting point for developing a data analysis plan:

- 1.1. What is the optimum frequency of inspections to maintain the functionality of *structural BMPs for treatment and flow control at stormwater facilities on private commercial property*?¹
- 1.2. What is the optimum frequency of inspections to ensure the proper use of *structural and operational* source control BMPs at businesses?

- a. Which is more effective for specific high value BMPs: focusing on the property owners or focusing on the business owners, or a combination of the two?

Comment: Target both situations where a business owner is and is not cooperative and willing.

- b. Which required BMPs were implemented based upon follow up inspection? Which optional BMPs were installed based upon follow up inspection?
- c. What were the primary barriers to not adopting or installing BMPs?
- d. Address the connection between in-person visits and source control BMPs, and identify situations where technical assistance and/or follow-up inspections are needed to ensure required BMPs are implemented.

Comment: Gather data about percent compliance. Partner with Ecology Local Source Control program to do this study.

NPDES Permit Context

The NPDES municipal stormwater permit is primarily intended to reduce the discharge of pollutants to the MS4. The permit includes developing a Stormwater Management Plan (SWMP) for this purpose, which is a requirement of all permittees. Among the permits of interest here (Phase I and Phase II municipal permits), differences exist for what is required for stormwater source control activities. The Phase I permit SWMP is required to describe how compliance is met for the source control program for existing sites (S5.C.7). The Phase II permit is absent of a source control program; however, several other sections contain requirements for controlling, managing, and treating stormwater runoff.

Table 1 shows a comparison of the Phase I and Phase II permit sections related to source control with the relevant source control effectiveness questions noted for each permit topic. As indicated, question 1.1 is relevant for the sections that focus on source control explicitly (Phase I permittees only), treatment and flow control facilities, and controlling runoff in development areas. Question 1.2 and its subquestions are relevant to the permit sections that focus on illicit discharges and public involvement and education in both permits and to the source control section in the Phase I permit. In a few permit sections there are options that allow permittees to address requirements by activities relevant to multiple sections, thus some effectiveness questions are related to more than one permit section.

¹ The sub-questions 2a-c are also applicable and of interest to treatment and flow control BMPs, but are beyond the scope of this project.

Table 1. Alignment of NPDES Municipal Permit Topics and Annual Report Questions with Source Control Effectiveness Questions.

Topic	Relevant Source Control Effectiveness Questions	Phase I Permittees		Phase II Permittees	
		Permit Section	Relevant Annual Report Questions	Permit Section	Relevant Annual Report Questions
Controlling Runoff	1.1	S5.C.5 Controlling Runoff from New Development, Redevelopment and Construction Sites	22, 25	S5.C.4 Controlling Runoff from New Development, Redevelopment and Construction Sites	32-36, 37 38
Source Control	1.1, 1.2	S5.C.7 Source Control Program for Existing Development	35-37	n/a	n/a
Illicit Connections and Discharges	1.2, 1.2.a, 1.2.b, 1.2.c, 1.2.d	S5.C.8 Illicit Connections and Illicit Discharges Detection and Elimination	40, 48	S5.C.3 Illicit Discharge Detection and Elimination	11, 13
Stormwater Treatment and Flow Control Facilities	N/A. This section is relevant to municipally operated facilities, which are not typically on private or commercial property.	S5.C.9 Operation and Maintenance Program	N/A	S5.C.5 Municipal Operations and Maintenance	N/A
Public Education and Outreach	1.2, 1.2.a, 1.2.b, 1.2.c, 1.2.d	S5.C.10 Education and Outreach Program	67, 69	S5.C.1 Public Education and Outreach	5, 7

*Annual Report Questions from: Phase I permit *Appendix 12 Annual Report Questions for Cities and Counties*; and from Phase II permit *Appendix 3 Annual Report Questions for Cities, Towns, and Counties*. A selection of the overall annual report questions is noted in the table for those relevant to the source control assessment.

The alignment of source control-related permit sections with the effectiveness questions points to the type of data (or potential data) that will be available and analyzed for this study. This is indicated in Table 1 by the annual report question numbers for the relevant permit sections (see the Appendix for the complete list of questions). Because of the focus in this study on inspection data from private or commercial property, some permit subsections and associated annual report questions noted in Table 1 may not be entirely relevant. For example, the section on operations and maintenance of treatment and flow control facilities, while very relevant to stormwater source control, applies only to properties “owned or operated” by the permittee, which in practice includes only public/municipal properties. The municipal programs that provide the information for answering the annual report questions will be surveyed with a request to provide the data and information that will be used to address the effectiveness questions. The specific data anticipated to be available are explored in the sections below and includes in-depth discussion of each effectiveness question and how it will be addressed.

Data Sources and Acquisition

Inspections of stormwater facilities at businesses and on commercial and municipal properties has been a requirement of each permittee's Stormwater Management Program since the previous municipal permit period began in 2007. Data for this assessment will be solicited from NPDES municipal stormwater permittees in western Washington. We expect several robust data sources to be available from jurisdictions that have long-standing programs, have relatively large jurisdictions to manage, and/or have relatively more sophisticated programs and resources available. The solicitation will be by a data request letter, data variables list, and survey emailed to NPDES permit managers. In 2014, a preliminary survey and comment form was sent to a handful of permittees during the proposal stage of this project. The survey inquired about the availability of data that could be used to address the effectiveness questions, existing data analysis efforts that jurisdictions may have already done using their own data, and an open question asking for suggestions to improve or add to the study design of compiling and analyzing regional data. Information in this data analysis design document incorporates answers and information that permittees provided in response to that proposal-stage survey.

A ubiquitous comment by permittees in that survey indicated that for some questions existing data could be used as-is (e.g. dates of inspections to calculate inspection frequency) and for other questions, data would need to be combined, parsed, qualified, or quantified (e.g. business owners versus property owners in context of high value BMPs). The amount of data preparation needed will be determined during and after the survey process and will depend on data condition, availability of municipal staff to provide specific data (versus just a data dump of all program data), and consideration of the scope and budget for this assessment.

It is worth noting that a range of permit implementation methods are in use across western Washington municipalities. While the NPDES permit is prescriptive in many regards, such as requiring a minimum of annual inspections at all stormwater treatment and flow control facilities, it is also open-ended and allows permittees to increase inspection frequency if desired as well as reduce the frequency based on maintenance records. Indeed, some permittees go beyond the minimum permit requirements, and it is expected that a range of source control program sophistication is present among permittees. This variability in programs will translate to a range in the breadth, quality, and detail of data and information available.

In addition to data from NPDES municipal permittees, a relevant data source is available from Ecology's Local Source Control program (LSCP). Data from the LSCP will also be requested and included in the assessment to the extent possible. The LSCP focuses specifically on public education and technical assistance (with emphasis on operational BMPs) for conditionally exempt small quantity generators (SQG), but not on compliance. Some permittees implement the LSCP as part of their permit-required source control efforts; thus, program data directly from those jurisdictions may be more thorough and complete than what is provided by the LSCP.

Effectiveness Questions Discussion

This section discusses how the effectiveness questions are understood and what type of answers might be provided from this analysis. The extent to which the questions can be answered will be a result of the type, amount, and quality of the data. Discussion is provided about the relevant permit sections and the types of inspections and associated data that will be used in the analysis. Per the scope of work for the project, this data analysis plan will be updated after data are reviewed, and more specific data analysis steps will be articulated based on data available.

Given the expected potential data available and the permit requirements for inspection of structural stormwater treatment and flow control facilities, the following data analysis goal and objectives are identified to address the effectiveness questions:

Goal: Evaluate variables present in permittees' municipal stormwater program data to compare inspection frequencies and the usage and functionality of structural BMPs at stormwater treatment and flow control facilities on private commercial property and of structural and operational BMPs at businesses.

Objectives:

1. Request permittee information in a survey and data request that relate specifically to the types of data related to inspection frequency for the permit-related sections.
2. Assemble list of structural BMPs in use at stormwater treatment and flow control facilities on private commercial property.
3. Assemble list of structural and operational BMPs in use at businesses.
4. Identify functionality requirements for treatment and flow control BMPs at stormwater facilities.
5. Identify usage and compliance requirements for BMPs at businesses.
6. Assemble and standardize data for comparability.
7. Evaluate data to identify the dates, reasons, and types of inspections that are relevant to each effectiveness question.
8. Evaluate data to address inspection frequencies among permittees.
9. Evaluate data to compare each of structural and operational BMP types among permittees to address the effectiveness questions (EQ) under EQ 1.2

EQ 1.1. What is the optimum frequency of inspections to maintain the functionality of structural BMPs for treatment and flow control at stormwater treatment and control facilities on private property?

In the context of stormwater BMP inspections, frequency is understood to refer to the average time between inspections expressed in units such as inspections per quarter or per year. Inspection is understood to refer to on-site evaluation, and for purposes of this assessment, the treatment and flow control facilities of interest are any structural BMP on private commercial property intended for stormwater treatment or flow control. This excludes BMPs on public property and in the right-of-way. A separate effectiveness study is being implemented by King County specific to catch basins maintenance in the MS4 (J. Colton, personal communication).

Inspections of stormwater treatment and flow control facilities are required in one Phase I permit section (see Table 1) and two Phase II sections. In the section on controlling runoff from new development and redevelopment, inspections are required as part of maintenance plans for permanent stormwater treatment and flow control facilities (S5.C.5.a.v.4). In the section on source control for existing development, inspections are required for commercial and industrial properties with the potential to generate pollutants to the permittee's MS4 (S5.C.7.b.iii). In the Phase II permit, inspections are required as part of maintenance plans for permanent stormwater treatment and flow control facilities upon completion of construction after February 2007 (S5.C.4.b.iv) and annually thereafter (S5.C.4.c.iii).

The relevant permit sections for this effectiveness question require annual inspection at a minimum percentage of permanent stormwater treatment and flow facilities. Thus, data analysis results will be considered in the context of the permit-required inspection frequencies.

It is expected that multiple frequencies of inspection will be calculated for data grouped by BMP type, among other variables. Also, it is expected that some permittees perform more or less frequent inspections of stormwater treatment and flow control BMPs depending on the need and the cost. To the extent possible, variables will be evaluated such as reason for inspection and how permittees define “functionality” of BMPs that may shed light on why some permittees go beyond the minimum requirements.

Data evaluation is expected to include calculation of inspection frequencies and assignment of reasons motivating the inspection. Data will be graphed for visual comparison and basic trend analysis. Statistical evaluation of inspection frequencies may include summary statistics such as averages, minima, and maxima. Inspection frequencies may also be evaluated with respect to compliance rates. Thus, data evaluation is expected to include a summary of associations between inspection frequencies and compliance rates.

The data needed to evaluate factors that influence inspection frequency of stormwater treatment and flow control facilities include, among others: date of inspection; date of follow-up activities; type of inspection; reason for inspection; type of BMPs inspected; the level of BMP evaluation (functionality and/or usage); dates of BMP maintenance; and programmatic information from the permittee about their inspection objectives and methods.

EQ 1.2 What is the optimum frequency of inspections to ensure the proper use of structural and operational source control BMPs at businesses?

The focus of EQ 1.2 is on both structural and operational BMPs in use at businesses, which is understood to include any private property with a business of any size. Inspections of structural and operational BMPs at businesses are required and are referred to in three Phase I permit sections (see Table 1) and two Phase II sections. As with EQ 1.1, inspections are required for commercial and industrial properties with the potential to generate pollutants to the permittee’s MS4 (S5.C.7.b.ii) and the program should include a “source control inventory which lists businesses and/or properties identified based on the presence of activities that are pollutant generating.” In addition, section S5.C.7.b.i notes that “operational source control BMPs shall be required for all pollutant generating sources [and] structural source control BMPs shall be required for pollutant generating sources if operational source control BMPs...[are]...inadequate stormwater controls.” Thus in addition to just operational BMPs at businesses, it is expected that some jurisdictions will combine their efforts for inspecting structural treatment and flow control BMPs and operational BMPs located on the same property.

In the Phase I section on illicit discharges and connections, inspections are not explicitly required but it is expected that some permittees will have relevant data based on the requirement to implement an ongoing program with procedures to detect and identify illicit discharges and connections to the MS4 (S5.C.8.c). In addition, procedures “may also include source control inspections” that would likely include inspection of BMPs at businesses when investigating illicit connections and tracing illicit discharges. The third Phase I permit section related to operational source control BMPs at businesses is the public education and outreach section, which includes a program to reduce or eliminate behaviors and practices that could result in adverse stormwater impacts (S5.C.10). While the educational program requirements are primarily intended to target the general public, other possible target audiences are listed in the permit, including businesses (home-based and mobile).

In the Phase II permit, inspections of operational source control BMPs are not required, per se,

but are often included as part of the illicit discharge detection and elimination program (S5.C.3) and public education and outreach program (S5.C.1). Both of these Phase II permit sections have nearly identical guidance and requirements as in the complementary sections of the Phase I permit as discussed above.

Both the Phase I and Phase II permits require completing a minimum annual percentage of inspections on private property, including properties developed since the last permit cycle (beginning February 2007 for Phase IIs). Thus, an expected baseline frequency of inspections is expected to be determined based on permit requirements. However, the permit allows for return or follow-up visits to the same business to be counted toward the annual minimum, thus the frequency of inspection may be relatively higher at some businesses or some business sectors. Thus, inspection frequency can be dictated by factors other than minimum requirements, including chronic issues, risk or potential of pollution, complexity of the types of BMPs in use, construction activities on property, industrial processes and discharges, targeted education efforts, spills or illicit discharges, and special BMP maintenance, to name a few.

Given the open-ended nature of exactly how many businesses and types of BMPs would be inspected during an annual period, a simple frequency calculation may not distinguish what drives an inspection or how the frequency relates to the “proper use” of stormwater BMPs as the question asks. Thus, data used to address this question will be assigned a reason code to represent the type of inspection in order to compare similar inspections across jurisdictions and calculate frequencies of inspections related to BMP usage. This will improve the comparability of data sources, and the evaluation of inspection frequency may result in several types of frequencies calculated for different types of BMPs or businesses, or other factors that influence inspections.

As noted above, the term inspection is generally considered to be an on-site visual evaluation. However, communications, reporting, and desk research before and after on-site inspections contribute to the resolution of issues and desired compliance. Thus, it is expected that some data sources will include the dates of contact and correspondence as part of the record leading to compliance. It may be useful to consider some of these activities to inform the determination of inspection frequency for the complete inspection cycle, which may include multiple onsite inspections or other activities related to BMP usage, such as initial inspection, education and outreach, follow-up inspection, and compliance status evaluation.

Data evaluation is expected to include calculation of inspection frequencies for a variety of inspection activities, business types, BMP types, and reasons motivating the inspection. Data will be graphed for visual comparison and basic trend analysis. Statistical evaluation of inspection frequencies may include summary statistics such as averages, minima, and maxima. Inspection frequencies may also be evaluated with respect to compliance rates. Thus, data evaluation is expected to include a summary of associations between inspection frequencies and compliance rates.

Data variables needed to calculate frequencies of inspections of structural and operational BMPs at businesses include, among others: date of inspection; date of follow-up activities; type of inspection; reason for inspection; type of BMPs inspected; the level of BMP evaluation (functionality and/or usage); date of non-compliance, compliance, or similar benchmark parameter; size and type of business, including industrial processes that could affect stormwater; dates of BMP maintenance.

EQ 1.2.a Which is more effective for specific high value BMPs: focusing on the property owners or focusing on the business owners, or a combination of the two?

Comment: Target both structural and operational BMP types, and situations where a business owner is and is not cooperative and willing.

Question EQ 1.2.a refers to high value BMPs at businesses and distinguishes between property owners and business owners. The second part of the question is a comment to address both structural and operational BMPs and business managers or property owners who are not cooperative. "High value BMPs" is generally understood to refer to those BMPs that have the greatest positive effect on stormwater source control and treatment. However, which BMPs these are would be best answered by the permittees. In the data request, permittees will be asked to identify up to five high value BMPs for both structural and operational BMP types. Data needed to address high value BMPs should include the type of BMP and the value provided by the BMP (specific treatment or function). As with EQ 1.2, data collected by permittees for the illicit connections and discharges permit sections and the public education and outreach permit sections will provide the source material for addressing this question.

Because the high value BMPs in question are presumably located on commercial property, their effective operation may be affected by the property owner or business owner and the type of business activities. The distinction between property owners and business owners is important as some municipal inspectors have found that working with one or the other party or a combination of both is preferable at some businesses or properties. The extent of the data evaluation for this question will largely depend on whether or not inspection data includes these distinctions: the ability to distinguish between high value (and not high value) BMPs from inspection data, and if the contact person was the property owner or business owner.

It is expected that most existing data sources will not include these fine point distinctions about BMPs and contact persons. Parameters to distinguish these factors will be identified or added to the data set as possible. Following the clarifying comment of the question, it may also be possible to identify (or have jurisdictions identify) and evaluate a subset of inspections data where the business was not cooperative. If such a subset of data is available, it may be possible to compare the effectiveness and functionality of a variety of BMPs, including those that are high value, structural, and operational.

Data variables needed to evaluate the effectiveness of focusing on property owners versus business owners for high value BMPs include: inspection frequency variables from Question 1.2, distinguishing high-value BMPs, role of the contact person at the business, and information on how effective the communication was.

Data evaluation is expected to be similar to that for Question 1.2, with added comparisons based on the values of various BMPs as assigned by permittees and compliance rates of high value BMPs among business types. If data include information on the effectiveness of communicating with property owners versus business owners and when a business is not cooperative, then data evaluation would consider this in light of BMP type and compliance.

EQ 1.2.b Which required BMPs were implemented based upon follow-up inspection? Which optional BMPs were installed based upon follow-up inspection?

Question EQ 1.2.b refers to BMP implementation at businesses after a follow-up inspection and distinguishes between required and optional BMPs. Follow-up inspection is understood to refer to inspection activities related to issues identified during previous inspections. In this context,

BMPs implemented “based on” follow-up inspections is understood to mean simply after a follow-up inspection and not necessarily *caused* by the follow-up inspection. A related question is which BMPs were implemented without a follow-up inspection, and, as the converse of EQ 1.2.b, this question would also need to be answered.

In practice, follow-up activities only sometimes include revisiting a site to perform a “follow-up” inspection. Common follow-up activities may include emails, calls, and letter correspondence to ask for verbal or written confirmation of BMP implementation. While it may be possible to evaluate data of a variety of follow-up activities depending on available data, the question is inquiring about follow-up inspections. Thus, the data analysis for this question will consider just those records that include, among other activities, follow-up inspections linked to issues identified during a previous inspection.

The question also asks about required versus optional BMPs. In the context of municipal NPDES-driven inspections, required BMPs are those that are needed to treat or control stormwater at the source and any potential pollutants it may come in contact with. The options for BMPs are likely to be selected from the Stormwater Management Manual for Western Washington (Ecology 2012, especially volume III (Flow Control BMPs) and volume IV (Source Control BMPs)), from local ordinances and engineering standards, or some by state and federal regulations, such as the transportation and transfer of hazardous materials. The list of required BMPs varies according to the business activities, the potentially hazardous materials used, and a business’ waste generator status (small, medium, or large quantity generator). It is not known to what extent the data sources will explicitly note if BMPs were required or optional. It may be possible to code data records with this information based on the BMPs inspected; this would require assigning required versus optional values to the data in the context of applicable regulations and BMP guidance manuals.

An additional element to this EQ is the concept of compliance versus non-compliance for designating the status of a BMP or a business overall. Many jurisdictions emphasize outreach, education, incentives, and technical assistance for using BMPs correctly and deemphasize a strictly compliance oriented approach for routine inspections. However, the Phase I permit emphasizes compliance, and it is expected that data sources will include both approaches. Regardless of a jurisdiction’s emphasis on compliance, a working presumption for the data analysis design is that issues identified during previous inspections typically trigger follow-up inspections. Thus a compliance status or otherwise articulated outcome of an inspection cycle is necessary to define different inspections on the cycle, such as initial, follow-up, spill response, etc.

As with EQ 1.2, data collected by permittees for the illicit connections and discharges permit sections and the public education and outreach permit sections will provide the source material for addressing this question. It is expected that most existing data sources will include some degree of distinguishing between initial and follow-up inspections, and a desired compliance status or inspection outcome. Jurisdictions will be asked how they define compliance and link follow-up inspection data to specific issues in order to complement this information. The extent to which the data sources will have this link is unknown. It may be possible to add fields to data records to represent the type of inspection (screening, initial, follow-up, spill response, etc.) and associated compliance status.

Data variables needed to evaluate whether required or optional BMPs were implemented after a follow-up inspection are: date of inspection; date of follow-up activities; type of inspection (initial or follow-up); the BMP requirements (required or optional); and many of the inspection

frequency variables from Question 1.2. Data evaluation is expected to summarize compliance rates by BMP type for records that include follow-up inspections.

EQ 1.2.c What were the primary barriers to not adopting or installing BMPs?

Question EQ 1.2.c refers to barriers to using BMPs at businesses. If such data are collected by permittees during inspections, it is expected to be mostly in descriptive form via written or anecdotal accounts from inspection staff. However, this question would likely be best answered by businesses themselves. Although surveying businesses is outside the scope of work for this project, some jurisdictions may have existing survey data of local businesses that can be collected and summarized in addressing this question.

Assuming some data are available regarding BMP barriers, this question will be evaluated by segregating data by BMP type (structural or operational) and identifying if BMPs were used or not. Reason codes or descriptions of the barriers could be assigned to each BMP that wasn't adopted. If data are lacking to address this EQ, then anecdotal reasons and existing businesses survey results provided by permittees will be summarized. While cost is likely the overriding reason for not adopting BMPs, other reasons may be known and summarized, including complexity of installation or operation, English comprehension, clarity of communication by municipal inspectors about the necessity of BMPs, and attitudes of businesses toward environmental protection and government.

Data variables needed to evaluate barriers to adopting or installing BMPs include: date of inspection; date of follow-up activities; type of inspection; reason for inspection; type of stormwater BMP; date of non-compliance, compliance, or similar benchmark parameter; size and type of business; comments from inspectors; and conveyed information from business or property owners.

EQ 1.2.d Address the connection between in-person visits and source control BMPs, and identify situations where technical assistance and/or follow-up inspections are needed to ensure required BMPs are implemented.

Comment: Gather data about percent compliance. Partner with Ecology Local Source Control program to do this study.

Question EQ 1.2.d asks about the connection between in-person visits (i.e. inspections) at businesses and implementation of BMPs. Specifically, the question refers to situations that require technical assistance or follow-up inspections to make sure BMPs that are required are used. Additionally, the question includes instructional comments about using data on percent compliance and about including data from the statewide Ecology Local Source Control program (LSCP). The connection for partnering with the Ecology LSCP has been made, and an Ecology staff person associated with the LSCP is on the project advisory committee.

The concept of a connection between onsite inspections and BMP usage is understood to refer to the elements of inspections and inspection programs that lead to positive environmental outcomes. For some permittees (likely Phase Is) and types of businesses, BMP implementation may be most influenced by their environmental compliance status as identified during inspections and the possibility of monetary fines for non-compliance. But for other businesses and permittees (some Phase IIs), BMP implementation may be influenced by factors other than compliance status, such as technical or financial assistance provided by the permittee's inspection program.

The permit sections on public education and outreach include requirements for measuring the understanding and adoption of targeted behaviors for at least one target audience. Although businesses are only one of many possible target audiences, it is possible that enough data will be available to evaluate how the adoption of targeted behaviors at businesses may be related to business inspections and implementing BMPs.

Data variables needed to evaluate whether targeted behaviors translate to implementing BMPs include: dates of inspection and follow-up inspection; types of targeted behaviors promulgated by permittees; types of BMPs associated with the targeted behaviors; compliance rates of BMPs.

Data Analysis Methods Discussion

As a post-hoc evaluation of existing data, the assessment will focus on relationships among variables (such as correlation or regression) but will not be a cause-and-effect analysis that could be utilized under controlled experimental conditions. Thus, some elements of a data analysis design are not included here, such as data quality objectives, because the data for this study are observational and were not collected to test a hypothesis and meet associated data quality assumptions. In addition, the extent of the analysis to address some questions may be limited because of few or no data available, especially with questions that inquire about factors not typically recorded during inspections, such as barriers to BMP implementation (EQ 1.2.c). For many of the effectiveness questions the same data will be evaluated, with the main differences attributed to how the data are parsed.

The raw compiled data set will consist of categorical, quantitative and descriptive data. The majority of variables are expected to be categorical (qualitative). Some examples include jurisdiction, type of business, type of inspection, indication of compliance, types of follow-up actions, and type of BMP. The primary quantitative variables that may be used in the analysis are based on time, such as time since last inspection or number of inspections per year, and based on measured parameters associated with BMP maintenance. As such, the primary analysis methods used to evaluate the effectiveness questions will be based on proportions or rates. Some proportions will be summarized directly from the data (e.g., proportions of types of BMPs), while others will be calculated based on other variables (e.g., compliance rates based on discretized frequencies of inspection). Qualitative data summaries specific to the effectiveness questions will be provided in the form of tables and graphics.

Depending on the available data, some effectiveness questions may also be evaluated using more formal statistical summaries, including confidence intervals and hypothesis tests that make comparisons across groups. For example, for question 1.2.a, it may be possible to formally test for differences in compliance rates for high-valued BMPs by business type. Formal inference methods, however, require sufficient sample sizes in order to have adequate power to detect differences if they exist. Typical methods for inference for proportions may include z-tests for the difference between two population proportions, chi-square tests for homogeneity to compare a set of more than two proportions between two or more groups, or tests of independence for looking at the association between two quantitative variables.

Some other statistical methods that may be considered include: (a) logistic regression to model the probability of compliance given the time between inspections and (b) classification and regression trees (CART) to estimate the probabilities of compliance given various factors. CART methods may help identify the variables that are the best predictors for compliance. Logistic regression and CART both require relatively large sample sizes, so use of these methods will be highly dependent on available data.

Next Steps and Finalization of Plan

The initial data analysis plan described here is proposed based on the type, quality, and quantity of data thought to be available. This document will be updated after data are obtained and reviewed, especially the data analysis approach for each EQ and outcomes of the assessment. A database will be created to store and query the compiled dataset in preparation for data analysis. In addition to an updated version of this document, other project deliverables include the draft database, the compiled raw data provided by permittees, and a technical memo summarizing the process of reviewing and qualifying data and preparing the database. After the data analysis is completed per the scope of work, a draft report will be prepared for review by the project advisory committee, which is composed of permittee representatives. A final report and presentation of the project findings will be prepared as the last steps of this phase of the project.

References

Ecology 2012. Stormwater Management Manual for Western Washington. August 2012. See Volume III Flow Control BMPs, Volume IV Source Control BMPs, and Volume V Runoff Treatment BMPs.

Ecology 2013a. Phase I Municipal Stormwater Permit. National Pollution Discharge Elimination System and State Waste Discharge General Permit for discharges from Large and Medium Municipal Separate Storm Sewer Systems. Effective dates: August 1, 2013 to July 31, 2018. Reference includes associated appendices.

Ecology 2013b. Phase II Western Washington Phase II Municipal Stormwater Permit. National Pollution Discharge Elimination System and State Waste Discharge General Permit for discharges from Small Municipal Separate Storm Sewers in Western Washington. Effective dates: August 1, 2013 to July 31, 2018. Reference includes associated appendices.

Ecology 2016. Google Docs website for the Stormwater Work Group for Puget Sound. Selection of Effectiveness studies page:
<https://sites.google.com/site/pugetsoundstormwaterworkgroup/home/selection-of-effectiveness-studies>.

J. Colton 2016. Personal communication regarding the Western Washington Catch Basin Inspection and Maintenance Study being led by King County.

Appendix – Annual Report Questions for the NPDES Municipal Stormwater Permit:

- **Appendix 12 to the Phase I permit**
- **Appendix 3 to the Phase II permit**

Appendix 12 - Annual Report Questions for Cities and Counties

Permittees are required to submit annual reports online or in a format provided by Ecology, pursuant to Special Condition S9.A.

1.	Attach a notification of any annexations, incorporations or jurisdictional boundary changes resulting in an increase or decrease in the Permittee's geographic area of permit coverage during the reporting period per S9.D.6.
2.	Attach updated annual Stormwater Management Program Plan (SWMP Plan). (S5.A.1)
3.	Implemented an ongoing program to gather, track, and maintain information per S5.A.2, including costs or estimated costs of developing and implementing the SWMP?
4.	Maintained mapping data for the features listed in S5.C.2.a?
5.	<u>Counties</u> : Mapped tributary conveyances, as described in S5.C.2.a.v., for any urban/higher density rural sub-basins not mapped under the previous permit ? (Required no later than December 31, 2017, S5.C.2.b.i)
6.	<u>Counties</u> : Mapped existing, known connections greater than 8 inches in nominal diameter to tributary conveyances mapped in accordance with S5.C.2.b.i ? (Required no later than December 31, 2017, S5.C.2.b.ii)
7.	Mapped existing, known connections equal to 8 inches in nominal diameter to tributary conveyances mapped in accordance with S.5.C.2? (Required no later than December 31, 2017, S5.C.2.b.iii)
8.	Mapped connections between stormwater treatment and flow control BMPs/facilities and tributary conveyances mapped in accordance with S5.C.2. ? (Required no later than December 31, 2017, S5.C.2.b.iv)
8b.	Mapped all associated emergency overflows? (Required no later than December 31, 2017, S5.C.2.b.iv)

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9.	Implemented internal coordination agreement(s) or directives to facilitate compliance with the permit? (S5.C.3.a)
10.	Attach a written description of internal coordination mechanisms. (<i>Required to be submitted once</i> no later than March 31, 2015, S5.C.3.a)
11.	Implemented coordination mechanisms clarifying roles and responsibilities for control of pollutants between physically interconnected MS4s per S5.C.3.b.i?
12.	Coordinated stormwater management activities for shared waterbodies among Permittees and Secondary Permittees, as necessary to avoid conflicting plans, policies and regulations? (S5.C.3.b.ii)
13.	Describe in <i>Comments</i> field opportunities created for the public to participate in the decision making processes involving the development, implementation and updates of the SWMP. (S5.C.4.a)
14.	Posted the updated SWMP Plan and latest annual report on your website no later than May 31? (S5.C.4.b)
14b.	NOTE website address in <i>Comments</i> field.
15.	Submitted draft enforceable requirements, technical standards and manual to meet site and subdivision-scale requirements of S5.C.5.a to Ecology no later than July 1, 2014? (S5.C.5.a.iii)
16.	Adopted and made effective the Ecology-approved enforceable requirements, technical standards and manual to meet site and subdivision-scale requirements of S5.C.5.a no later than July 1, 2015? (S5.C.5.a.iii)
17.	Number of adjustments granted to the minimum requirements in Appendix 1? (S5.B, S5.C.5.a.i, and Section 5 of Appendix 1)
18.	Number of exceptions/variances granted to the minimum requirements in Appendix 1? (S5.B, S5.C.5.a.i, and Section 6 of Appendix 1)
19.	Reviewed Stormwater Site Plans for all proposed development activities that meet the thresholds in S5.C.5.a.i? (S5.C.5.a.v(1))

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19b.	Number of stormwater site plans reviewed during the reporting period?
20.	Inspected, prior to clearing and construction, permitted development sites per S5.C.5.a.v(2)?
21.	Inspected permitted development sites during construction to verify proper installation and maintenance of required erosion and sediment controls per S5.C.5.a.v(3)?
22.	Inspected permitted development sites upon completion of construction and prior to final approval or occupancy to ensure proper installation of stormwater facilities per S5.C.5.a.v(4)?
23.	Number of construction sites inspected per S5.C.5.a.v?
24.	Number of enforcement actions taken during the reporting period (based on construction phase inspections at new development and redevelopment projects)? (S5.C.5.a.v(2), (3) and (4))
25.	Verified that a maintenance plan is completed and responsibility for maintenance is assigned for stormwater treatment and flow control BMPs/facilities? (S5.C.5.a.v(4))
26.	Achieved at least 80% of scheduled construction-related inspections? (S5.C.5.a.v.(5))
27.	Made Ecology's <i>Notice of Intent for Construction Activity</i> and <i>Notice of Intent for Industrial Activity</i> available to representatives of proposed new development and redevelopment? (S5.C.5.a.vi)
28.	All staff whose primary job duties are implementing the program to control stormwater runoff from new development, redevelopment, and construction sites are trained to conduct these activities? (S5.C.5.a.vii)
29.	Reviewed, revised and made effective development-related enforceable documents to incorporate and require LID Principles and LID BMPs no later than July 1, 2015? (S5.C.5.b.i)
30.	Attach a summary of the LID review and revision process that includes the requirements listed in S5.C.5.b.ii. (Required once no later than March 31, 2016)

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31.	<u>Counties</u> : Notified Ecology of the selected or proposed alternative watershed no later than October 31, 2013? (S5.C.5.c.i) Insert watershed name in <i>Comments</i> field.
32.	<u>Counties</u> : Submitted a scope of work and a schedule to Ecology for the complete watershed planning process no later than April 1, 2014? (S5.C.5.c.ii)
33.	<u>Counties</u> : Submitted a final watershed stormwater plan no later than October 1, 2016? (S5.C.5.c.iv)
34.	Submitted a list of planned, individual projects scheduled for implementation during this permit term with the information and formatting specified in Appendix 11 by March 31, 2014? Attach an updated list annually thereafter. (S5.C.6.c)
35.	Implemented a program to identify commercial and industrial properties which have the potential to generate pollutants to the Permittee's MS4 per S5.C.7.b.ii?
36.	Attach a summary of actions taken to implement the source control program per S5.C.7.b.iii and S5.C.7.b.iv.
37.	Number of sites inspected per S5.C.7.b.iii?
38.	Implemented an ongoing source control training program per S5.C.7.b.v?
39.	Updated, if necessary, the regulatory mechanisms to effectively prohibit illicit discharges into the MS4 per S5.C.8.b no later than February 2, 2018? If Yes, cite the code reference in <i>Comments</i> field.
40.	Implemented procedures for conducting illicit discharge investigations in accordance with S5.C.8.c.i? Cite field screening methodology used in the <i>Comments</i> field.
41.	Provide the percentage of conveyance systems screened in reporting year per S5.C.8.c.i(1). (Required to screen 12% each year.)

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42.	<u>Cities</u> : Field screened all the conveyance systems within the Permittee's incorporated area at least once no later than July 31, 2018? (S5.C.8.c.i.(2))
43.	<u>Counties</u> : Field screened all of the conveyance systems within the Permittee's urban/higher density rural sub-basins at least once no later than July 31, 2018?(S5.C.8.c.i(3))
44.	Provide the hotline telephone number for public reporting of spills and other illicit discharges in the <i>Comments</i> field. (S5.C.8.c.ii)
44b.	Number of hotline calls received?
45.	Implemented an ongoing illicit discharge training program for all municipal field staff per S5.C.8.c.iii?
46.	Implemented an ongoing program to characterize, trace, and eliminate illicit discharges into the MS4 per S5.C.8.d?
47.	Number of illicit discharges, including illicit connections, eliminated during the reporting year? (S5.C.8.d.iii and iv)
48.	Attach a summary of actions taken to characterize, trace and eliminate each illicit discharge found by or reported to the permittee. For each illicit discharge, include a description of actions according to required timelines per S5.C.8.d.iv.
49.	Trained staff responsible for illicit discharge detection and elimination activities per S5.C.8.e?
50.	Participated in a regional emergency response program, or implemented procedures to investigate and respond to spills and improper disposal? (S5.C.8.f)
51.	Updated and implemented maintenance standards per S5.C.9.a no later than June 30, 2015?
52.	Applied a maintenance standard for a facility or facilities which do not have maintenance standards specified in the Stormwater Management Manual for Western Washington? If so, note in the <i>Comments</i> field what kinds of facilities are covered by this alternative standard. (S5.C.9.a)

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53.	Evaluated and, if necessary, updated the existing ordinances or other enforceable documents requiring maintenance of all permanent stormwater treatment and flow control BMPs/facilities (including catch basins that are part of the facilities) regulated by the Permittee. (S5.C.9.b.i)
54.	Implemented an ongoing inspection program for stormwater treatment and flow control BMPs/facilities regulated by the Permittee per S5.C.9.b.ii.
55.	If using reduced inspection frequency on stormwater treatment and flow control BMPs/facilities regulated by the Permittee for the first time during this permit cycle, attach documentation per S5.C.9.b.ii.
56.	Inspected permanent stormwater treatment and flow control BMPs/facilities and catch basins in new residential developments every 6 months per S5.C.9.b.iii?
57.	Achieved at least 80% of inspections required per S5.C.9.b.ii and iii? (S5.C.9.b.iv)
58.	Number of known municipally owned or operated stormwater treatment and flow control BMPs/facilities? (S5.C.9.c.i)
58b.	Number of municipally owned or operated stormwater treatment and flow control BMPs/facilities inspected during the reporting period? (S5.C.9.c.i)
58c.	Number of municipally owned or operated stormwater treatment and flow control BMPs/facilities for which maintenance was performed during the reporting period? (S5.C.9.c.i)
59.	If using reduced inspection frequency for municipally owned or operated stormwater treatment and flow control BMPs/facilities for the first time during this permit cycle, attach documentation per S5.C.9.c.i.
60.	Conducted spot checks and inspections (if necessary) of potentially damaged stormwater treatment and flow control BMPs/facilities after major storm events? (S5.C.9.c.ii)
61.	Achieved at least 95% of required inspections per S5.C.9.c.iii?

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62.	Inspected municipally owned or operated catch basins and inlets every year or used an alternative approach? Cleaned as needed? (S5.C.9.d.i)
62b.	Number of known catch?
62c.	Number of catch basins inspected during the reporting period?
62d.	Number of catch basins cleaned during the reporting period?
62e.	Attach documentation of alternative catch basin inspection approach, if used. (S5.C.9.d.i.(1), (2), or (3))
63.	Achieved at least 95% of required catch basin inspections? (S5.C.9.d.iii)
64.	Implemented practices, policies, and procedures to reduce stormwater impacts per S5.C.9.e?
65.	Implemented an ongoing training program per S5.C.9.f.?
66.	Implemented a Stormwater Pollution Prevention Plan for all heavy equipment maintenance or storage yards, and material storage facilities per S5.C.9.g?
67.	Attach description of public education and outreach efforts conducted per S5.C.10.
68.	Created stewardship opportunities (or partnered with others) to encourage resident participation in activities such as those described in S5.C.10.b?
69.	Used results of measuring the understanding and adoption of targeted behaviors among at least one audience in at least one subject area to direct education and outreach resources and evaluate changes in adoption of targeted behaviors. (<i>Required no later than February 2, 2016, S5.C.10.c</i>) Attach description of how this requirement was met.
70.	Complied with the Total Maximum Daily Load (TMDL)-specific requirements identified in Appendix 2? (S7.A)

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71.	For TMDL listed in Appendix 2: Attach a summary of relevant SWMP and Appendix 2 activities to address the applicable TMDL parameter(s). (S7.A)
72.	Attach a description of any stormwater monitoring or stormwater-related studies per S8.A.
73.	Submitted payment for participating in cost-sharing for regional stormwater monitoring program (RSMP) status and trends monitoring? (S8.B.1.a)
74.	If choosing to conduct monitoring in accordance with S8.B.1.b, attach a data report in accordance with the approved QAPP per S8.B.1.b.iii. (Required to begin monitoring no later than July 31, 2014)
75.	<u>Clark County</u> : Continued stormwater discharge monitoring per S8.B.2.a?
76.	<u>Clark County</u> : Submitted a revised QAPP no later than February 2, 2014? (S8.B.2.b)
77.	Submitted payment for participating in cost-sharing for RSMP effectiveness studies (S8.C.1)?
78.	If choosing to conduct stormwater discharge monitoring in accordance with S8.C.2, submitted a QAPP to Ecology no later than February 2, 2014? (S8.C.2.c)
79.	If choosing to conduct discharge monitoring, attach an annual stormwater monitoring report in accordance with S8.C.2 and Appendix 9. (Submit reports beginning March 31, 2016).
80.	Participated in cost-sharing for RSMP effectiveness studies in accordance with S8.C.3.a?
81.	Submitted a detailed effectiveness study proposal to Ecology no later than February 2, 2014 per S8.C.3.b.i?

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82.	Submitted a QAPP to Ecology within 120 days of Ecology’s approval of the detailed effectiveness study proposal? (S8.C.3.b.ii)
83.	Began full implementation of the effectiveness study no later than 6 months following QAPP approval? (S8.C.3.b.iii)
84.	Attach interim results and status report. (S8.C.3.b.iv)
85.	Submitted payment for participating in the RSMP for source identification and diagnostic monitoring information repository? (S8.D)
86.	Notified Ecology in accordance with G3 of any discharge into or from the Permittee’s MS4 which could constitute a threat to human health, welfare or the environment? (G3)
87.	Number of G3 notifications provided to Ecology?
88.	Took appropriate action to correct or minimize the threat to human health, welfare, and/or the environment per G3.A?
89.	Notified Ecology within 30 days of becoming aware that a discharge from the Permittee’s MS4 caused or contributed to a known or likely violation of water quality standards in the receiving water? (S4.F.1)
90.	If requested, submitted an Adaptive Management Response report in accordance with S4.F.3.a?
91b.	Attach a summary of the status of implementation of any actions taken pursuant to S4.F.3 and the status of any monitoring, assessment, or evaluation efforts conducted during the reporting period? (S4.F.3.d)
91.	Notified Ecology of the failure to comply with the permit terms and conditions within 30 days of becoming aware of the non-compliance? (G20)
92.	Number of non-compliance notifications (G20) provided in reporting year? List permit conditions described in non-compliance notification(s) in <i>Comments</i> field.

Appendix 3 - Annual Report Questions for Cities, Towns and Counties

Permittees are required to submit the following information in an online annual report form, or an alternative format provided by Ecology if requested, pursuant to Special Condition S9.A.

1. **Attach** updated annual Stormwater Management Program Plan (SWMP Plan). (S5.A.2)
2. **Attach** a copy of any annexations, incorporations or boundary changes resulting in an increase or decrease in the Permittee's geographic area of permit coverage during the reporting period per S9.D.5.
3. Implemented an ongoing program to gather, track, and maintain information per S5.A.3, including costs or estimated costs of implementing the SWMP.
4. Coordinated among departments within the jurisdiction to eliminate barriers to permit compliance. (S5.A.5.b)
- 4b. **Attach** a written description of internal coordination mechanisms. (*Required to be submitted* no later than March 31, 2015, S5.A.5.b)
5. **Attach** description of public education and outreach efforts conducted per S5.C.1.a.i and ii.
6. Created stewardship opportunities (or partnered with others) to encourage resident participation in activities such as those described in S5.C.1.b.
7. Used results of measuring the understanding and adoption of targeted behaviors among at least one audience in at least one subject area to direct education and outreach resources and evaluate changes in adoption of targeted behaviors. (*Required* no later than February 2, 2016, S5.C.1.b)

Attach description of how this requirement was met.
8. Describe in *Comments* field the opportunities created for the public to participate in the decision making processes involving the development, implementation and updates of the Permittee's SWMP. (S5.C.2.a)

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9. Posted the updated SWMP Plan and latest annual report on your website no later than May 31. (S5.C.2.b)

List the website address in *Comments* field.

10. Maintained a map of the MS4 including the requirements listed in S5.C.3.a.i.-vi.
11. Implemented a compliance strategy, including informal compliance actions as well as enforcement provisions of the regulatory mechanism described in S5.C.3.b. (S5.C.3.b.v)
12. Updated, if necessary, the regulatory mechanism to effectively prohibit illicit discharges into the MS4 per S5.C.3.b.vi. (*Required* no later than February 2, 2018)

If Yes, cite the code reference in *Comments* field

13. Implemented procedures for conducting illicit discharge investigations in accordance with S5.C.3.c.i.
14. Percentage of MS4 coverage area screened in reporting year per S5.C.3.c.i. (*Required to screen* 40% of MS4 no later than December 31, 2017 (except no later than June 30, 2018 for the City of Aberdeen) and 12% on average each year thereafter. (S5.C.3)
15. List the hotline telephone number for public reporting of spills and other illicit discharges in the *Comments* field. (S5.C.3.c.ii)
- 15b. Number of hotline calls received.
16. Implemented an ongoing illicit discharge training program for all municipal field staff per S5.C.3.c.iii.
17. Informed public employees, businesses, and the general public of hazards associated with illicit discharges and improper disposal of waste. Describe actions in *Comments* field. (S5.C.3.c.iv)
18. Implemented an ongoing program to characterize, trace, and eliminate illicit discharges into the MS4 per S5.C.3.d.
19. Number of illicit discharges, including illicit connections, eliminated during the reporting year. (S5.C.3.d.iv)

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20. **Attach** a summary of actions taken to characterize, trace and eliminate each illicit discharge found by or reported to the permittee. For each illicit discharge, include a description of actions according to required timeline per S5.C.3.d.iv
21. Municipal illicit discharge detection staff are trained to conduct illicit discharge detection and elimination activities as described in S5.C.3.e.
22. Implemented an ordinance or other enforceable mechanism to address runoff from new development, redevelopment and construction sites per the requirements of S5.C.4.a.
23. Revised ordinance or other enforceable mechanism to effectively address runoff from new development, redevelopment and construction sites per the requirements of S5.C.4.a.i-iii. (*Required* no later than December 31, 2016, except no later than June 30, 2017 for Permittees in Lewis and Cowlitz counties, and no later than June 30, 2018 for the City of Aberdeen)

Cite code reference in *Comments* field.
24. Number of exceptions granted to the minimum requirements in Appendix 1. (S5.C.4.a.i., and Section 6 of Appendix 1)
25. Number of variances granted to the minimum requirements in Appendix 1. (S5.C.4.a.i., and Section 6 of Appendix 1)
26. Reviewed *Stormwater Site Plans* for all proposed development activities that meet the thresholds adopted pursuant to S5.C.4.a.i. (S5.C.4.b.i)
- 26b. Number of site plans reviewed during the reporting period.
27. Inspected, prior to clearing and construction, permitted development sites that have a high potential for sediment transport as determined through plan review based on definitions and requirements in Appendix 7 *Determining Construction Site Sediment Damage Potential*, or alternatively, inspected all construction sites meeting the minimum thresholds adopted pursuant to S5.C.4.a.i. (S5.C.4.b.ii)
- 27b. Number of construction sites inspected per S5.C.4.b.ii.
28. Inspected permitted development sites during construction to verify proper installation and maintenance of required erosion and sediment controls. (S5.C.4.b.iii)
- 28b. Number of construction sites inspected per S5.C.4.b.iii.

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29. Number of enforcement actions taken during the reporting period (based on construction phase inspections at new development and redevelopment projects). (S5.C.4.b.ii, iii and v)
30. Inspected all permitted development sites that meet the thresholds in S5.C.4.a.i upon completion of construction and prior to final approval or occupancy to ensure proper installation of permanent stormwater facilities. (S5.C.4.b.iv)
31. Achieved at least 80% of scheduled construction-related inspections. (S5.C.4.b.ii-iv)
32. Verified a maintenance plan is completed and responsibility for maintenance is assigned for projects. (S5.C.4.b.iv)
33. Implemented provisions to verify adequate long-term operation and maintenance (O&M) of stormwater treatment and flow control BMPs/facilities that are permitted and constructed pursuant to S5.C.4. a and b. (S5.C.4.c)
34. Updated provisions to verify long-term operation and maintenance of stormwater treatment and flow control BMPs/facilities that are permitted pursuant to S5.C.4.a and b. (*Required* no later than December 31, 2016, except no later than June 30, 2017 for Permittees in Lewis and Cowlitz counties, and no later than June 30 2018 for the City of Aberdeen, S5.C.4.c.i and ii)
35. Annually inspected stormwater treatment and flow control BMPs/facilities per S5.C.4.c.iii.
- 35b. If using reduced inspection frequency for the first time during this permit cycle, **attach** documentation per S5.C.4.c.iii
36. Inspected new residential stormwater treatment and flow control BMPs/facilities and catch basins every 6 months per S5.C.4.c.iv to identify maintenance needs and enforce compliance with maintenance standards.
37. Achieved at least 80% of scheduled inspections to verify adequate long-term O&M. (S5.C4.c.v)
38. Verified that maintenance was performed per the schedule in S5.C.4.c.vi when an inspection identified an exceedance of the maintenance standard.
- 38b. **Attach** documentation of any maintenance delays. (S5.C.4.c.vi)
39. Provided copies of the *Notice of Intent for Construction Activity* and *Notice of Intent for Industrial Activity* to representatives of proposed new development and redevelopment. (S5.C.4.e)

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40. All staff responsible for implementing the program to control stormwater runoff from new development, redevelopment, and construction sites, including permitting, plan review, construction site inspections, and enforcement are trained to conduct these activities. (S5.C.4.f)
41. Reviewed, revised and made effective the low impact development-related enforceable documents per S5.C.4.f.i. (*Required* by December 31, 2016, except by June 30, 2017 for Permittees in Lewis and Cowlitz counties, and by June 30, 2018 for the City of Aberdeen)
- 41b. **Attach** a summary of the LID review and revision process that includes the requirements listed in S5.C.4.f.ii. (*Required* with annual report due no later than March 31, 2017, except no later than March 31, 2018 for Permittees in Lewis and Cowlitz counties, and with the Fifth Year annual report for the City of Aberdeen)
42. Where applicable, participated and cooperated with the watershed-scale stormwater planning process led by a Phase I county. (S5.C.4.g)
43. Updated and implemented maintenance standards as protective, or more protective, of facility function as those specified in Chapter 4 of Volume V of the 2012 *Stormwater Management Manual for Western Washington*. (*Required* no later than December 31, 2016, except no later than June 30, 2017 for Permittees in Lewis and Cowlitz counties, and no later than June 30, 2018 for the City of Aberdeen, S5.C.5.a)
44. Applied a maintenance standard that is not specified in the 2012 *Stormwater Management Manual for Western Washington*. If so, please note in the *Comments* field what kinds of facilities are covered by this alternative maintenance standard. (S5.C.5.a)
45. Performed timely maintenance per S5.C.5.a.ii.
46. Annually inspected all municipally owned or operated permanent stormwater treatment and flow control BMPs/facilities. (S5.C.5.b)
- 46b. Number of known municipally owned or operated stormwater treatment and flow control BMPs/facilities. (S5.C.5.b)
- 46c. Number of facilities inspected during the reporting period. (S5.C.5.b)
- 46d. Number of facilities for which maintenance was performed during the reporting period. (S5.C.5.b)
47. If using reduced inspection frequency for the first time during this permit cycle, **attach** documentation per S5.C.5.b.
48. Conducted spot checks and inspections (if necessary) of potentially damaged stormwater facilities after major storms as per S5.C.5.c.

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49. Inspected all municipally owned or operated catch basins and inlets as per S5.C.5.d, or used an alternative approach. (*Required* once no later than August 1, 2017 and every two years thereafter, except once no later than June 30, 2018 and every two years thereafter for the City of Aberdeen)
- 49b. Number of known catch basins.
- 49c. Number of catch basins inspected during the reporting period.
- 49d. Number of catch basins cleaned during the reporting period.
50. **Attach** documentation of alternative catch basin cleaning approach, if used. (S5.C.5.d.i or ii)
51. Implemented practices, policies and procedures to reduce stormwater impacts associated with runoff from all lands owned or maintained by the Permittee, and road maintenance activities under the functional control of the Permittee. (S5.C.5.f)
52. Implemented an ongoing training program for Permittee employees whose primary construction, operations or maintenance job functions may impact stormwater quality. (S5.C.5.g.)
53. Implemented a *Stormwater Pollution Prevention Plan* for all heavy equipment maintenance or storage yards, and material storage facilities owned or operated by the Permittee in areas subject to this Permit that are not required to have coverage under an NPDES permit that covers stormwater discharges associated with the activity. (S5.C.5.h)
54. Complied with the Total Maximum Daily Load (TMDL)-specific requirements identified in Appendix 2. (S7.A)
55. For TMDLs listed in Appendix 2: **Attach** a summary of relevant SWMP and Appendix 2 activities to address the applicable TMDL parameter(s). (S7.A)
56. **Attach** a description of any stormwater monitoring or stormwater-related studies as described in S8.B.
57. Participated in cost-sharing for the regional stormwater monitoring program (RSMP) for status and trends monitoring. (S8.C.1)
- 57b. If choosing to conduct monitoring in accordance with S8.C.2.b, **attach** a data report in accordance with the approved QAPP. (*Required* to begin monitoring no later than July 31, 2014)

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58. Participated in cost-sharing for the regional stormwater monitoring program (RSMP) for effectiveness studies. (S8.D.1) (*Required to begin no later than August 15, 2014*)
- 58b. Participated in cost-sharing for the regional stormwater monitoring program (RSMP) for effectiveness studies. (S8.D.1) (*Required to begin no later than August 15, 2014*)
- 58c. If choosing to conduct discharge monitoring, **attach** an annual stormwater monitoring report in accordance with S8.D.2 and Appendix 9. (*Required to submit reports beginning March 31, 2016*)
59. Contributed to the RSMP for source identification and diagnostic monitoring information repository in accordance with S8.E.1. (*Required to begin no later than August 15, 2014*)
60. Notified Ecology in accordance with G3 of any discharge into or from the Permittees MS4 which could constitute a threat to human health, welfare or the environment. (G3)
61. Number of G3 notifications provided to Ecology.
62. Took appropriate action to correct or minimize the threat to human health, welfare, and/or the environment per G3.A.
63. Notified Ecology within 30 days of becoming aware that a discharge from the Permittee's MS4 caused or contributed to a known or likely violation of water quality standards in the receiving water. (S4.F.1)
64. If requested, submitted an Adaptive Management Response report in accordance with S4.F.3.a.
65. **Attach** a summary of the status of implementation of any actions taken pursuant to S4.F.3 and the status of any monitoring, assessment, or evaluation efforts conducted during the reporting period. (S4.F.3.d)
66. Notified Ecology of the failure to comply with the permit terms and conditions within 30 days of becoming aware of the non-compliance. (G20)
67. Number of non-compliance notifications (G20) provided in reporting year. List permit conditions described in non-compliance notification(s) in *Comments* field.