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**WSDOT NPDES Municipal Stormwater Permit**  
**Highway Runoff Characterization and BMP Effectiveness**  
**Stormwater Monitoring Status Report**  
**(S7.B, S7.C, and S7.E)**

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Prepared by

Stormwater and Watersheds Program  
Environmental Services Office  
P.O. Box 47332  
Olympia, WA 98504-7332



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# 1 Introduction

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## 1.1 Permit Overview

In February 2009, the Washington State Department of Ecology (Ecology) issued a National Pollutant Discharge and Elimination System (NPDES) and State Waste Discharge Permit (permit) (Ecology 2009) to the Washington State Department of Transportation (WSDOT) (Permit #WAR043000A). Under Special Condition S7 of the permit, WSDOT must collect baseline stormwater monitoring data from its highways, rest areas, ferry terminals, and maintenance facilities. In addition, the department must evaluate the effectiveness of stormwater treatment and hydrologic (flow control) best management practices (BMPs) following guidelines from Ecology's *Guidance for Evaluating Emerging Stormwater Treatment Technologies, Technology Assessment Protocol – Ecology* (TAPE) (Ecology 2008).

Under Special Condition S8.F of the permit, a final water quality report for each monitoring program outlined in Special Condition S7 must be submitted within one month prior to the end of the permit expiration date. The following report satisfies this requirement and provides a summary of ongoing monitoring activities at WSDOT highway runoff characterization and BMP effectiveness monitoring sites (S7.B, S7.C, and S7.E). A separate report covers monitoring activities completed at WSDOT non-highway facilities (rest areas, maintenance facilities, and ferry terminals) (S7.D).

## 1.2 Monitoring Requirements

WSDOT was required by permit to develop and implement a monitoring program to collect high-quality data that characterizes stormwater runoff from state highways. In addition, the permit required a monitoring program to evaluate the effectiveness of stormwater treatment and hydrologic BMPs.

The highway runoff characterization and BMP effectiveness monitoring programs established under the 2009 permit will continue under the reissued NPDES and State Waste Discharge Permit in 2014. However, seasonal first flush toxicity testing will no longer be required under the new permit.

### ***Baseline Monitoring of WSDOT Highways (S7.B and S7.C)***

WSDOT is required to collect water quality and quantity data for stormwater runoff from the pavement edge at five highway locations across the state. The department must meet the following requirements:

1. WSDOT must establish highway monitoring stations at locations with the following annual average daily traffic (AADT) thresholds (S7.B.3):
  - Two highly urbanized western Washington sites ( $\geq 100,000$  AADT)

- One urbanized western Washington site ( $\leq 100,000$  and  $\geq 30,000$  AADT)
  - One rural western Washington site ( $\leq 30,000$  AADT)
  - One urbanized eastern Washington site ( $\leq 100,000$  and  $\geq 30,000$  AADT)
2. WSDOT must collect and analyze sediments at highway sampling sites each year (S7.B.7).
  3. Under the 2009 permit, WSDOT must collect seasonal first flush toxicity samples from three untreated highway runoff monitoring locations once each year (S7.C.3). Site locations are based on the following AADTs:
    - One highly urbanized site ( $\geq 100,000$  AADT)
    - One urbanized site ( $\leq 100,000$  and  $\geq 30,000$  AADT)
    - One rural site ( $\leq 30,000$  AADT)

### **Monitoring Effectiveness of BMPs (S7.C and S7.E)**

WSDOT must collect influent and effluent samples from at least two treatment BMPs, at no less than two sites per BMP. Monitoring must continue until statistical goals are met as defined by TAPE (Ecology 2008) (S7.E.2).

In addition, WSDOT must collect continuous rainfall and surface runoff data from one flow reduction BMP that is in use or planned for installation, such as a low-impact development (LID) BMP (S7.E.2).

Under the 2009 permit, seasonal first flush toxicity sampling was required from three BMP effluent locations. At least one BMP location must be categorized as enhanced treatment for metals.

- One highly urbanized site ( $\geq 100,000$  AADT)
- One urbanized site ( $\leq 100,000$  and  $\geq 30,000$  AADT)
- One rural site ( $\leq 30,000$  AADT)

## **1.3 Monitoring Schedule**

In accordance with Special Condition S7.G.1.c, *Quality Assurance Project Plans (QAPPs) for Baseline Monitoring of WSDOT Highway Runoff* (WSDOT 2011a) and *WSDOT Roadway Stormwater Treatment Evaluation: Best Management Practices* (WSDOT 2011b) were submitted for approval to Ecology on September 2, 2011. The department received a QAPP approval letter from Ecology on September 16, 2011. These QAPPs describe the objectives of the highway runoff characterization and BMP effectiveness monitoring programs and the procedures used to ensure the quality and integrity of collected data. The QAPPs also identify project timelines and schedules.

Under permit Special Condition S7.G.1.d, WSDOT was required to fully implement the monitoring program no later than September 6, 2011. On October 20, 2011, as required under General Condition G20 in the permit, WSDOT notified Ecology that it would be

unable to fully comply with this deadline due primarily to government hiring and equipment purchase freezes in effect through early summer 2011.

In a letter to Ecology on January 13, 2012, WSDOT proposed a revised schedule and phased approach for initiating the highway and BMP effectiveness monitoring components of its program. The letter proposed sampling at one highway and BMP monitoring site beginning May 1, 2012, with the remainder of the sites operational by June 15, 2012. WSDOT successfully met the revised timelines and schedule.

Due to the schedule revisions described above, this highway runoff characterization and BMP effectiveness monitoring report describes the status of the monitoring program from October 1, 2012, through September 30, 2013 (water year 2013). This report does not include monitoring data analyses which will be included in a detailed report available in October 2014.

For additional information, the *WSDOT NPDES Municipal Stormwater Permit Highway Runoff and BMP Effectiveness Stormwater Monitoring Report, Water Year 2012* (WSDOT 2013) provides a detailed description of the highway runoff characterization and BMP effectiveness monitoring programs including site descriptions, sampling methods, quality assurance and quality control procedures, and water year 2012 monitoring results.

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## 2 Status Report

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### 2.1 Baseline Monitoring of WSDOT Highways (\$7.B)

For highway runoff characterization monitoring, the permit requires (\$7.B.6) sampling 67 percent of forecast qualifying storms that result in actual qualifying events up to a maximum of 14 storm events per water year. Future data analyses will demonstrate whether these targets have been successfully achieved.

Monitoring records demonstrate that the WSDOT stormwater monitoring field teams employed good faith efforts and professional practice in attempts to meet storm targets. In water year 2013 (WY13), stormwater monitoring field teams made a total of 102 stormwater sampling attempts at highway runoff characterization monitoring sites.

WSDOT encountered challenges in meeting all stated permit goals. Grab samples were particularly challenging to collect as travel time and intermittent rainfall limited success. Other challenges included:

- Inaccurate weather forecasts
- Lack of staff availability for station maintenance and equipment set-up in advance of storms
- Equipment failure
- Safety concerns with work along the highway, particularly during peak traffic hours
- Lack of qualifying storms and freezing temperatures during the winter months of 2013 (most notably in eastern Washington)
- Lack of one full year of rainfall/runoff data due to the delay in station installation in 2012 that made programming monitoring equipment to sample storms difficult
- Difficulty in meeting antecedent dry period criteria

The Department of Ecology recently agreed to align storm criteria at highway runoff characterization sites with criteria described in the *Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies: Technology Assessment Protocol – Ecology* (TAPE) (Ecology 2011). We believe the TAPE criteria more closely represent rainfall conditions typical of the Pacific Northwest. This change should greatly improve sampling success rates in water year 2014 (WY14).

#### **Baseline Sediment Testing**

WSDOT field staff successfully collected sediment samples for each of WSDOT's five highway characterization sites in water year 2013 (WY13). Four of five sites had sufficient sediment volume for analysis of all permit-required analytes. At the site with

reduced sediment volume, staff collected analytes in the permit-specified order of priority.

## 2.2 Seasonal First Flush Toxicity Testing (S7.C)

Field teams collected toxicity samples in September and October 2013. Preliminary results show no significant toxicity and a high survival rate for the target species, *Hyalella azteca*, with EC<sub>50</sub> values at or above 100 percent for all samples collected.

Rainwater reference samples were also collected to determine whether rainwater alone caused toxicity to *Hyalella azteca*. Rainwater collection occurred near stormwater sampling locations but away from roadway influence. Staff collected rainwater in precleaned stainless steel bowls elevated at least 30cm from the ground and away from sources that may have contributed inputs other than rain, such as road spray.

No significant mortality (i.e., mean survival  $\geq$  95%) was observed for *Hyalella azteca* in the 100 percent (undiluted) stormwater or associated site reference samples (Brian Hester, NewFields Laboratory, written communication, January 7, 2014).

Detailed information on toxicity sampling results will be presented in the October 2014 report.

## 2.3 BMP Effectiveness Monitoring (S7.E)

WSDOT combined permit-required highway runoff characterization and BMP effectiveness monitoring sites at two locations along Interstate 5 (I-5) and one location along State Route 9 (SR 9). The following BMPs were selected for monitoring:

- Vegetated filter strips (VFS)
- Compost-amended VFS (CAVFS)
- Modified (experimental) VFS

Detailed information on monitoring site locations, site set-up, sampling designs, monitoring methods, and quality assurance procedures are included in the *WSDOT Quality Assurance Project Plan (QAPP) for Roadway Stormwater Treatment Evaluation: Best Management Practices* (WSDOT 2011b). Additional information is available in the *WSDOT NPDES Municipal Stormwater Permit Highway Runoff and BMP Effectiveness Stormwater Monitoring Report, Water Year 2012* (WSDOT 2013).

BMP effectiveness monitoring is an ongoing requirement under the 2014 NPDES municipal stormwater permit. Our vegetated filter strip (VFS) studies will continue until statistical goals in TAPE are met, or 35 storm events have been successfully sampled. In preparation for the October 2014 annual report, we will have our first chance to conduct a thorough statistical analysis of the BMP effectiveness data.

## **2.4 Projected Work for the Next Reporting Period**

WSDOT will continue to collect stormwater monitoring data from its highway runoff characterization and BMP effectiveness monitoring locations following the permit provisions. A report in October 2014 will provide WY13 monitoring results from highway runoff characterization sites and an update on progress in evaluating the effectiveness of WSDOT BMPs. If statistical goals are met, WSDOT will include monitoring results from BMP effectiveness study sites in the October report.

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## 3 Literature Cited

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Ecology. 2008. Guidance for Evaluating Emerging Stormwater Treatment Technologies, Technology Assessment Protocol – Ecology (TAPE), 2008 revision. Washington State Department of Ecology, Olympia, WA. Publication No. 02-10-037.

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🔗 <http://www.wsdot.wa.gov/Environment/WaterQuality/#NPDES>