APPROVED

Clean Water Services

NPDES MS4 Stormwater Monitoring Plan

December 2020

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List of Abbreviations

2016 Permit	Clean Water Services' NPDES Watershed-Based Waste Discharge Permit
BMP	best management practice
CFR	Code of Federal Regulations
cfs	cubic foot/feet per second
District	Clean Water Services
DEQ	Oregon Department of Environmental Quality
DO	dissolved oxygen
EMC	event mean concentration
EPA	U.S. Environmental Protection Agency
LIMS	Laboratory Information Management System
LOQ	level of quantitation
MS4	municipal separate storm sewer system
NELAP	National Environmental Laboratory Accreditation Program
NPDES	National Pollutant Discharge Elimination System
ODFW	Oregon Department of Fish and Wildlife
Plan	Stormwater Monitoring Plan
QA/QC	quality assurance/quality control
SWMP	Stormwater Management Plan
TMDL	total maximum daily load
USGS	U.S. Geological Survey

Section 1
Introduction

The Clean Water Services (District) National Pollutant Discharge Elimination System (NPDES) Watershed-Based Waste Discharge Permit (numbers 101141, 101142, 101143, 101144 and MS4), issued April 22, 2016 (2016 Permit) requires the District to include proposed monitoring program objectives matrix and a proposed monitoring plan as part of the MS4 permit renewal application. Although required as part of the MS4 permit renewal and titled a stormwater monitoring plan, this monitoring plan is also required to address in-stream water quality monitoring, including biological and physical monitoring. Specific requirements pertaining to watershed monitoring and municipal separate storm sewer system (MS4) monitoring are included in Schedules B.1 and B.15 , respectively, of the 2016 Permit.

The stormwater monitoring program includes two components. The first component is *programmatic monitoring*, which involves the tracking and assessment of programmatic activities, as described in the District's Stormwater Management Plan (SWMP). Tracking and assessment are conducted through the use of measurable goals and tracking measures that are defined in the SWMP for individual activities (best management practices [BMPs]). The second component is *environmental monitoring,* which includes the collection and analysis of stormwater and surface water samples.

Programmatic monitoring allows the District to evaluate whether the program elements are being implemented as set forth in the SWMP. Environmental monitoring information allows for the iterative management of the District's stormwater program. Continual programmatic and environmental monitoring are conducted to provide information that will support the monitoring objectives.

For the most part, the purpose of this Stormwater Monitoring Plan (Plan) is to address environmental monitoring. However, with respect to monitoring objectives and the District's adaptive management strategy (Sections 2-3), the role of programmatic monitoring is also discussed. This Plan is organized into the following sections:

Section 2. Stormwater Monitoring Objectives

Identifies how each monitoring objective is addressed and how the sources of information are used.

Section 3. Adaptive Management Approach

Describes the role and specific uses of monitoring program efforts in implementing the District's adaptive management approach.

Section 4. Long-Term Monitoring Strategy

Describes the relationship between environmental monitoring and the District's long-term monitoring program strategy.

Section 5. Environmental Monitoring Activities

Describes the various environmental monitoring tasks/activities including monitoring process/study design, monitoring locations, storm selection criteria, monitoring frequency, sample collection methods, analytical methods, and responsible sampling coordinator.

Section 6. Quality Assurance and Control

Summarizes quality control procedures.

Section 7. Documentation and Data Management

Summarizes the documentation, record-keeping, data management, review, validation, and verification procedures.

Section 2

Stormwater Monitoring Objectives

This Monitoring Plan addresses the following objectives:

A. *Evaluate the source(s) of the pollutants in the 2018/2020 Integrated Report/303(d) list associated with stormwater discharges and applicable to the permittee's jurisdictional area.*

B. *Evaluate the effectiveness of Best Management Practices (BMPs) in order to inform BMP implementation priorities.*

C. *Characterize stormwater based on land use type, seasonality, geography or other catchment characteristics.*

D. *Evaluate status and long-term trends in receiving waters associated with MS4 stormwater discharges.*

E. *Assess the chemical, biological, and physical effects of MS4 stormwater discharges on receiving waters.*

F. *Assess progress towards meeting total maximum daily load (TMDL) pollutant load reduction benchmarks.*

The District meets the monitoring objectives through a combination of programmatic monitoring, environmental monitoring, and data review and evaluation. The matrix provided in Table 2-1, below, provides an overview of the monitoring activities conducted to meet each objective. Each of the environmental monitoring activities is further described in Section 5, including a narrative description of how the monitoring objectives will be met.

Environmental Monitoring							
Stormwater monitoring	5 land use sites/ 3 storm events per year	✓	✓	✓	N/A	✓	✓
Instream monitoring	15 sites/6 times per year (quarterly hardness, Cu, Pb & Zn; twice yearly for Hg)	N/A	✓	N/A	✓	✓	✓
Biological monitoring	15 sites per permit term	N/A	✓	N/A	✓	✓	N/A
Physical conditions monitoring	15 sites per permit term	N/A	✓	N/A	✓	✓	N/A
Pesticide monitoring	5 land use sites/1 storm event per permit term	N/A	✓	✓	N/A	✓	N/A
Additional Monitoring Activity							
Data evaluation	Review and evaluate data	✓	✓	✓	✓	✓	✓
Adaptive management	Use information gathered to inform assessment of District activities	✓	✓	✓	✓	✓	✓

✓= supports objective, N/A = not applicable

Section 3
Adaptive Management Approach

This section summarizes the District's adaptive management approach and includes the following:

- A routine assessment of the need to further improve water quality and protection of beneficial uses
- A review of available technologies and practices
- A review of monitoring data and analyses required in Schedule B of the Permit
- A review of measurable goals and tracking measures
- An evaluation of resources available to implement the technologies and practices

Generally, the District's adaptive management activities include an annual review process associated with MS4 annual reporting, and a five-year review process associated with permit renewal.

Both programmatic monitoring and environmental monitoring data are reviewed annually. Program monitoring includes a review of the SWMP BMP tracking measures as indicators of adequate program implementation. All tracking measures are reviewed to assess whether measurable goals and tracking measures were met during the reporting year and to determine whether programmatic changes should be considered. For example, tracking measures could indicate patterns regarding the detection of illicit discharges, erosion control violations, retrofit implementation, etc. Difficulty in meeting tracking measures may also indicate a need for additional program resources. Environmental monitoring data are reviewed for anomalies and/or water quality criteria exceedances. If deemed necessary, adjustments may be made to management activities to address issues.

For the five-year assessment, environmental monitoring data are reviewed with respect to trends when compared to historical data. If results are encountered that indicate a potential problem, possible sources will be evaluated and modifications to BMPs will be considered. As an example, pesticide monitoring data may be used to identify targeted outreach activities related to pesticide usage and possible refinement of appropriate outreach/education BMPs.

In these ways, monitoring data will be used both annually and during the permit renewal process to support adaptive management and ongoing improvements of stormwater management activities. In addition, monitoring results may lead to adaptive management of this Plan.

Section 4
Long-Term Monitoring Strategy

The District is committed to protecting water resources in the Tualatin River watershed. Protection of these resources is aided by environmental monitoring data to identify and describe the status of the resources and to provide an understanding of the factors that affect them. As a result, the District developed an integrated, watershed-wide monitoring program intended to meet watershed-wide objectives. The intent of the overall monitoring program is to take a watershed-wide look at all monitoring needs and develop a scientifically sound monitoring program to address them as effectively as possible. A total of 39 monitoring objectives were originally defined by the District relating to physical habitat, riparian function, water quantity, watershed health, and water quality. The District consolidated those objectives into the following six overall and watershed-wide monitoring objectives:

1. Define status and trends
2. Document effectiveness of District actions
3. Perform regulatory monitoring for wastewater treatment plants and MS4 sources
4. Perform regulatory programmatic monitoring for MS4 sources
5. Implement trading program/determine assimilative capacity
6. Consider emerging issues

This Plan specifically addresses stormwater and surface water monitoring and represents a subset of the District's overall watershed monitoring program and associated watershed monitoring plan. This Plan supports watershed-wide objectives 1, 2, and 3 with respect to stormwater runoff. Data are collected as part of this Plan to evaluate receiving water trends with respect to MS4 discharges, to evaluate the effectiveness of stormwater management BMPs, and to evaluate MS4 sources of pollutants.

Section 5
Environmental Monitoring Activities

The District conducts stormwater, instream, biological, physical, and pesticide monitoring in accordance with Table 5-1 to address the established monitoring objectives described in Section 2. While the number of monitoring locations in this Plan is anticipated to remain consistent throughout the permit term, monitoring locations may change as a result of adaptive management. Therefore, a map of monitoring locations is not provided with this Plan. Each year, in the Stormwater Annual Report, a map or site list will be provided to DEQ of the locations where monitoring was conducted during the year. Data gathered from environmental monitoring, including stormwater monitoring, instream monitoring, biological monitoring, physical monitoring, and pesticide monitoring, along with program monitoring, are evaluated and considered in the District's adaptive management of its MS4 program, as described in Section 3.

Stormwater monitoring	5 land use-based sites	3 times per year
Instream monitoring (Field parameters, Conventional, Nutrients)	15 sites	6 times per year (3 during the dry season and 3 during the wet season)
Instream monitoring (Copper, lead and zinc (total and dissolved); hardness)	15 sites	4 times per year
Instream monitoring Mercury (total and dissolved	15 sites	2 times per year
Biological monitoring	15 sites	1 time per permit term
Physical conditions monitoring	15 sites	1 time per permit term
Pesticide monitoring	5 land use-based sites	1 time per permit term

This section is organized according to the following monitoring activities:

- Stormwater monitoring
- Instream monitoring
- Biological monitoring
- Physical monitoring
- Pesticide monitoring

For each of the five monitoring activities listed above, the following information is provided:

- A description as to how the activity meets the required monitoring objectives
- A description of monitoring activities
- Monitoring study design
- Sample collection methods
- Parameters analyzed

5.1 Stormwater Monitoring

Identification of Monitoring Objectives

Stormwater sampling conducted by the District addresses objectives A, B, C, E and F:

A. *Evaluate the source(s) of pollutants in the 2018/2020 Integrated Report/303(d) list applicable to the permittees jurisdictional area;*
B. *Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;*
C. *Characterize stormwater based on land use type, seasonality, geography or other catchment characteristics;*
E. *Assess the chemical, biological, and physical effects of MS4 discharges on receiving waters; and,*
F. *Assess progress towards meeting TMDL pollutant load reduction benchmarks.*

5.1.1 Description of Stormwater Monitoring Activities

The District conducts stormwater monitoring at five locations. Currently, the land use-based sites represent older residential, newer residential, high-density development, industrial office park, and commercial land uses. As a result of adaptive management and continual refinements to address monitoring objectives, these site locations may change during the permit period. However, site locations will continue to target a distribution of land use categories. The actual site locations will be reported each year in the Stormwater Annual Report.

5.1.2 Monitoring Study Design

The study design for stormwater monitoring was developed for the May 2006 *Interim Evaluation Report* submittal to DEQ. Previously, the study design was based on stormwater monitoring data that were collected for the permit application (1993–95) and to meet monitoring requirements for the first permit term (1995–2000). Stormwater sampling stations were selected in 2006 with the objective of adding to the robustness of the local land use-related stormwater characterization database.

In terms of the study design for this Plan, sampling will continue to build on historical data. Sampling will be conducted at five land use sites to evaluate and compare water quality characteristics from different land uses and eventually to evaluate trends when sufficient data have been gathered. Results may also potentially be used to assist in source identification efforts, especially for 303(d)-listed pollutants. In addition, it is anticipated that the results would be used to refine total maximum daily load (TMDL) wasteload allocation attainment analysis and benchmark evaluations.

5.1.3 Sample Collection Methods

Sampling will be conducted at each of the five locations during three storm events per year. Characteristics associated with the monitored storm events include the following:

- The monitored storm event is greater than 0.1 inch
- The monitored storm event has a minimum of a 24-hour antecedent dry period with a goal of 48 hours
- If rainfall discontinues during sample collection, the maximum intra-event dry period is 6 hours to still be considered a valid storm event for monitoring
- The rainfall depth will be estimated for each monitored event

All sample parameters that need to be analyzed in the field will be analyzed using field sampling methods. All samples analyzed in the laboratory will be collected as flow-proportioned composites, except samples collected for the analysis of *E. coli* and total and dissolved mercury. For *E. coli*, grab samples will be collected because of potential changes in bacteria populations over time. For mercury, grab samples will be collected because of the need to follow specialized procedures for trace metals sampling and the contamination risk associated with compositing samples. Flow-proportioned samples are collected using automated samplers.

The District's lab manager is the sampling coordinator and is generally responsible for managing staff who perform sample collection, field sampling activities, and transfer of samples to the appropriate analytical testing location.

5.1.4 Sampling Parameters

Parameters analyzed in stormwater samples are summarized in Table 5-2. For each parameter, the type of analysis and the analytical method are also provided. Other approved methods may be used when appropriate.

Field	Specific conductivity	Grab[a]	SM 2510 B
Field	Temperature	Grab[a]	SM 2550 B
Field	Turbidity	Grab[a]	SM 2130 B
Lab	E. coli	Grab	SM 9223 B (Colilert Quanti-Tray)
Lab	Total hardness	Composite	SM 2340 B
Lab	Total organic carbon	Composite	SM 5310 C
Lab	Solids: total suspended	Composite	SM 2540 D
Lab	Total phosphorus as P	Composite	EPA 365.4
Lab	Ortho-phosphorus as P	Composite	SM 4500-P F
Lab	Ammonia as N	Composite	SM 4500-NH_3 G
Lab	Nitrite and nitrate as N	Composite	EPA 300.0
Lab	Copper, total	Composite	EPA 200.8
Lab	Copper, dissolved	Composite	EPA 200.8
Lab	Lead, total	Composite	EPA 200.8
Lab	Lead, dissolved	Composite	EPA 200.8
Lab	Zinc, total	Composite	EPA 200.8
Lab	Zinc, dissolved	Composite	EPA 200.8
Lab	Mercury, total	Grab	EPA 1631 E
Lab	Mercury, dissolved	Grab	EPA 1631 E

a. *For these parameters, the lab instrument/probe is immersed into the flow (if there is sufficient depth) and a reading is recorded after the meter has stabilized. If depth is insufficient, a sample is collected in a container and the reading is taken from the container.*

In addition to pollutant parameters, flow or rainfall data are collected or estimated for each monitored event. Hourly rainfall data are collected from around the District on an ongoing basis through a system of rain gages owned and operated by the District. For reporting purposes, rainfall

depth associated with the most representative rain gage will be reported for each stormwater monitoring location.

5.2 Instream Monitoring

Identification of Monitoring Objectives

Instream sampling conducted by the District addresses the following monitoring objectives B, D, E, and F:

B. Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;

D. Evaluate status and long-term trends in receiving waters associated with MS4 stormwater discharges.

E. Assess the chemical, biological, and physical effects of MS4 discharges on receiving waters.

F. Assess progress towards meeting TMDL pollutant load reduction benchmarks.

5.2.1 Description of Instream Monitoring Activities

The District conducts instream monitoring at 15 locations. All locations are either on the Tualatin River main stem, or on tributaries to the Tualatin River.

While the District will collect samples annually from 15 sites, the site locations may change during the permit period based on adaptive management decisions. The sampling locations will be provided to DEQ on a list or map each year in the Stormwater Annual Report.

5.2.2 Monitoring Study Design

The study design for instream monitoring was developed for the May 2006 *Interim Evaluation Report* submittal to DEQ. At that time, the study design was based on the primary objective of collecting ambient water quality data to assess overall program effectiveness. To meet this objective, 15 locations were monitored. Some of these sampling locations have changed over the years and some have remained the same. Sampling locations are selected and maintained based on the following objectives:

- Describe changes in instream water quality along the length of the Tualatin
- Obtain information at specific locations (e.g., tributary confluence, urban growth boundary, etc.) along receiving waters
- Describe water quality conditions for a variety of contributing land use
- Describe conditions throughout the watershed
- Compare instream results to water quality criteria and assess progress related to TMDL benchmarks

The District will continue to sample at 15 instream locations. Over the years, instream sampling data have been used to assess water quality status and evaluate trends. Instream data collected under this Plan will continue to be used for that purpose. Instream data will also provide information regarding the chemical composition of receiving waters during the dry and wet weather seasons, and it will be used to assess progress toward meeting TMDL pollutant load reduction benchmarks.

5.2.3 Sample Collection Methods

Samples will be collected six times per year for field parameters, conventional pollutants and nutrients. Three of the sampling events will occur during the dry weather season (May 1 to October 31), and three of the sampling events will occur during the wet weather season (November 1 to April 30). Sampling for the six events will be separated by a minimum of 14 days. Samples will be collected quarterly for hardness, total and dissolved copper, lead, and zinc. Samples will be collected twice yearly for total and dissolved mercury.

All instream samples are collected as either grab samples or by field sampling. In grab sampling, a clean bottle/container is used to retrieve the sample from the sample stream. In shallow streams, bottles may be filled by hand. In deeper streams, a rope or bottle holder is used to lower bottles into the stream to collect samples. In field sampling, a probe or other instrument is immersed directly in the flow and measurement taken.

The District maintains a document that provides further details regarding health and safety procedures, sample collection and storage methods, and materials and apparatus used for sampling. This document is referred to as the *Clean Water Services, Laboratory Services Division Water Quality Lab, Sample Collection and Receipt Procedures*. The document is updated on a regular basis as a result of adaptive management.

The District's lab manager is the sampling coordinator and is responsible supervising staff who perform sample collection, field sampling activities, and transfer of samples to the appropriate analytical testing location.

5.2.4 Sample Parameters

Parameters to be analyzed on instream samples are summarized in Table 5-3. For each parameter, the type of analysis and the analytical method are also provided. Other approved methods may be used when appropriate.

Field	Specific conductivity	SM 2510 B
Field	pH	SM 4500-H+ B
Field	Temperature	SM 2550 B
Field	DO	SM 4500-O H
Field	Turbidity	SM 2130 B
Lab	E. coli	SM 9223 B (Colilert Quanti-Tray)
Lab	Total hardness	SM 2340 B
Lab	Total organic carbon	SM 5310 C
Lab	Solids: total suspended	SM 2540 D
Lab	Total phosphorus as P	EPA 365.4
Lab	Ortho-phosphorus as P	SM 4500-P F
Lab	Ammonia as N	SM 4500-NH3 G
Lab	Nitrite and nitrate as N	EPA 300.0
Lab	Copper, total	EPA 200.8
Lab	Copper, dissolved	EPA 200.8

Lab	Lead, total	EPA 200.8
Lab	Lead, dissolved	EPA 200.8
Lab	Zinc, total	EPA 200.8
Lab	Zinc, dissolved	EPA 200.8
Lab	Mercury, total	EPA 1631E
Lab	Mercury, dissolved	EPA 1631E

5.3 Biological Monitoring

Identification of Monitoring Objectives

Biological sampling conducted by the District addresses the monitoring objectives B, D, and E:

B. Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;

D. Evaluate status and long-term trends in receiving waters associated with MS4 stormwater discharges.

E. Assess the chemical, biological, and physical effects of MS4 discharges on receiving waters.

5.3.1 Description of Biological Monitoring Activities

The District performed biological (macroinvertebrate) monitoring in 2000, 2001, 2005, 2007, 2009, 2010, 2013, 2015, and 2018. The objective and number of sites monitored during each of the monitoring events is presented in the table below. The locations included a mix of both high-gradient and low-gradient sites and were coordinated with some of the District's instream monitoring locations.

2000	Assess biological conditions of area streams	44
2001	Assess biological conditions of area streams and identify relationships between environmental gradients and biological conditions	63
2005	Assess current biological conditions of area streams	63
2007	Assess current biological conditions of area streams	20
2009	Identify least disturbed low gradient streams and characterize benthic communities in these reaches	13
2009	Quantify differences in benthic assemblages between riffles and glides, and determine effects of instream and land use conditions in these differences.	17
2010	Assess current biological conditions of area streams and ascertain longer-term trends (2000-10)	33
2013	Assess current biological conditions of area streams and ascertain longer-term trends (2000-13)	13
2015	Assess current biological conditions of area streams and ascertain longer-term trends (2000-15)	13

2018	Assess current biological conditions of area streams and ascertain longer-term trends (2000-18)	15

The District will submit the results of the 2018 macroinvertebrate monitoring to DEQ with the NPDES permit renewal application.

The District will conduct macroinvertebrate monitoring at 15 locations during the permit term. Monitoring will focus on wadeable stream sections of the main stem Tualatin River and its tributaries. The sampling locations will be provided to DEQ on a map or list during the permit term in one of the Stormwater annual reports.

5.3.2 Monitoring Study Design

Macroinvertebrate monitoring will be conducted to build on previous efforts. It will be conducted to assess the current condition of biological communities in streams throughout the Tualatin River basin and to evaluate longer-term trends in these stream systems. The monitoring locations may also be selected to assess the effects of riparian restoration and stream flow enhancement projects on biological communities.

5.3.3 Sample Collection Methods

Sampling will be conducted at each of the 15 locations once during the permit term. To evaluate changes over time, the macroinvertebrate sampling will be conducted during September/October, when previous samples were collected. Macroinvertebrates will be collected using DEQ's *Benthic Macroinvertebrate Protocol for Wadeable Rivers and Streams*.

5.3.4 Sampling Parameters

Biological sampling will focus on macroinvertebrates (instead of fish) because there are a sufficient number of macroinvertebrate species to provide information and their response times to disturbance/restoration are faster.

In addition to macroinvertebrates, physical condition and water chemistry data will be collected at each site during the sampling event. Physical condition data will include channel dimensions and other environmental variables used to characterize the physical condition of stream reaches (see Section 5.4). Water chemistry data will include field measurements of temperature, dissolved oxygen (DO) saturation (percent), DO concentration (milligrams per liter) and specific conductance.

5.4 Physical Monitoring

Identification of Monitoring Objectives

Physical monitoring conducted by the District addresses the objectives B, D, and E:

B. Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;

D. Evaluate status and trends in receiving waters associated with MS4 stormwater discharges; and

E. Assess the chemical, biological, and physical effects of MS4 discharges on receiving waters.

5.4.1 Description of Physical Monitoring Activities

The District will conduct physical monitoring at 15 locations once during the permit term in conjunction with the biological monitoring activities described in Section 5.3. Physical monitoring activities include assessment of instream physical habitat and riparian habitat conditions. Data collection efforts include the assessment of the channel cross section and the adjacent riparian zone using direct measurements or visual estimation.

5.4.2 Monitoring Study Design

The physical monitoring will be conducted at each of the 15 locations once during the permit term, concurrently with macroinvertebrate sampling. Monitoring will focus on wadeable stream sections of the main stem Tualatin River and its tributaries. The sampling locations will be provided to DEQ on a map or list during the permit term in one of the Stormwater Annual Reports. The physical monitoring will support the assessment of the effectiveness of District actions.

5.4.3 Sample Collection Methods and Parameters

Instream physical habitat and riparian assessment efforts will use the modified Rapid Stream Assessment Technique, which includes data collection from channel habitat units (a sample reach equal to 20 times the wetted width or 75 meters, whichever is greater), channel cross sections, and the adjacent riparian zone.

Data will be collected as part of the habitat unit survey in accordance with the definitions outlined in the Oregon Department of Fish and Wildlife's (ODFW) *Methods for Stream Habitat Survey*s. Methods for assessing substrate composition are adapted from the U.S. Environmental Protection Agency's (EPA) environmental monitoring and assessment protocols for wadeable streams (Cole 2014).

The parameters to be established through physical monitoring are: channel dimensions, substrate conditions, bank condition, habitat types, riparian condition, percent canopy cover, and large wood rating.

5.5 Pesticide Monitoring

Identification of Monitoring Objectives

Pesticide monitoring efforts conducted by the District will be used to address monitoring objectives B, C, and E:

B. Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;

C. Characterize stormwater based on land use type, seasonality, geography or other catchment characteristics.

E. Assess the chemical, biological, and physical effects of MS4 discharges on receiving waters.

5.5.1 Description of Pesticide Monitoring Activities

The District conducted pesticide stormwater characterization monitoring as required by the 2016 Permit. During the next permit term, the District plans to analyze stormwater samples for pesticides collected during one storm event from the five land use sites described in Section 5.1.

5.5.2 Monitoring Study Design

Pesticide monitoring activities were selected to build on previous efforts conducted by the District and will also consider the efforts of other Phase I communities that recently completed pesticide monitoring requirements for NPDES MS4 permit compliance.

The District has a long history of working collaboratively with DEQ, the U.S. Geological Survey (USGS), and other parties coordinating pesticide sampling efforts in the Tualatin watershed[1,2]. Sample collection has historically occurred in a variety of media including surface waters, bed sediment, and fish tissue and has focused on the presence of legacy pesticides.

Pesticide monitoring conducted for this permit term will instead focus on the current-use pesticides identified by the District and those pesticides identified in the 2016 Permit. Analyses will be conducted to characterize concentrations of current-use pesticides in stormwater runoff from the five land use-based stormwater monitoring sites. Analyses will be contracted to a laboratory with experience in current-use pesticide analysis.

5.5.3 Sample Collection Methods

Sampling will be conducted at each of the five land use-based stormwater monitoring locations once during the permit term. As with the stormwater monitoring, characteristics associated with the monitored storm event include the following:

- The monitored storm event is greater than 0.1 inch
- The monitored storm event has a minimum of a 24-hour antecedent dry period with a goal of 48 hours
- If rainfall discontinues during sample collection, the maximum intra-event dry period is 6 hours to still be considered a valid storm event for monitoring
- The rainfall depth will be estimated for each monitored event consistent with the process outlined in Section 5.1

Additionally, , sample collection will be targeted during the spring season to coincide with typical pesticide application schedules, when application is expected to be highest.

Best efforts will be made to collect samples from all five locations during the same storm event, to better compare pesticide concentrations amongst locations. All samples will be collected as single grab samples to help ensure uniformity and consistency in the sample collection process and better target collection of all samples during the same storm event.

The District's lab manager is the sampling coordinator and is responsible for supervising staff who perform sample collection, field sampling activities, and transfer of samples to the appropriate analytical testing location.

5.5.4 Sampling Parameters

Current-use pesticides to be analyzed are provided in Table 5-5 below. For each parameter, a brief description and the analytical method are provided. The analytical methods are based on literature published by a local laboratory (testing location) equipped to perform the analysis. Table 5-5 also includes the rationale for including the pesticide for analysis (whether referenced in the 2016 Permit or identified by the District as a current-use pesticide). The specific parameters were selected on the

[1] USGS Water Resources Investigations Report 99-4107, *Selected Elements and Organic Chemicals in Bed Sediment and Fish Tissue of the Tualatin River Basin, Oregon*, 1992–96, 1999.

[2] USGS Scientific Investigations Report 2006-5101-D, *Effects of Urbanization on Stream Ecosystems in the Willamette River Basin and Surrounding Area, Oregon and Washington*, 2006.

basis of toxicity, frequency of detection in other local investigations, and the potential for their use to be addressed through public education programs.

2016 Permit	Bifenthrin	Pyrethroid insecticide	EPA 8270D
2016 Permit	Cypermethrin	Pyrethroid insecticide	EPA 8270D
2016 Permit	Permethrin	Pyrethroid insecticide	EPA 8270D
2016 Permit District product list	Triclopyr	Chlorinated herbicide	Modified EPA 8151A
2016 Permit	2,4-D	Chlorinated herbicide	Modified EPA 8151A
2016 Permit District product list	Glyphosate	Herbicide	EPA 8321B

Section 6
Quality Assurance and Control

The District uses three documents to guide its quality assurance/quality control (QA/QC) program. The documents are:

- *Sample Collection and Receipt*: This document includes the procedures and principles that are applicable to sample collection. It summarizes: health and safety procedures, materials and apparatus, reagents, and sampling procedures. The sampling procedures provide detail regarding: the containers used, sampling equipment used, calibration procedures, site setup, field testing, sample collection, sample storage, sample transport, chain of custody, and sample receipt. This is an evolving document and the most recent version is available on request. Collection of blanks and duplicates is decided on a case-by-case basis, taking into account the analytes involved, level of concern, past history, risk of contamination, and cost.
- *Bacteriological Sample Collection*: This document includes the same categories of information as those provided in the *Sample Collection and Receipt* document. However, the information in this document is specific to the collection of samples for microbiological analysis. This is an evolving document and the most recent version is available on request.
- *Quality Assurance/Quality Control Program Document*: The purpose of this document is to identify and document practices and standard operating procedures for those activities in the laboratory that affect the quality of the data. The quality control practices that are summarized in this document specify how samples are received, stored, and analyzed in the lab. This is an evolving document and the most recent version is available on request.

The District operates its own water quality lab for analyzing samples. The lab is a National Environmental Laboratory Accreditation Program (NELAP)-accredited laboratory and, as such, is subject to and follows current NELAP guidelines in administration, quality systems, and analyses.

Section 7
Documentation and Data Management

This section summarizes the District's data management procedures.

7.1 Data Review, Validation, and Verification

The District is responsible for the quality control of its samples prior to delivery at the laboratory. As noted in Section 6, field sample collection procedures are described in a District document summarizing sample collection and receipt procedures. For each monitoring event (instream and stormwater), data affiliated with each sampling activity are generated including: site, date, time of sample collection or field measurement, antecedent dry period (when applicable), calibration data, and field measurement results. Samples are collected under the general supervision of the District's lab manager.

Sample validation and verification are conducted at the laboratory and, following analysis, the monitoring results are provided to data review staff to validate and assess if the findings are consistent with expectations. Questionable monitoring results will be flagged for further review and possible follow-up in the field. If data quality indicators suggest that contamination or corruption of the sample occurred, data may be qualified, re-sampling may occur, and corrective action will be taken when indicated. If monitoring results are invalidated due to equipment failure, installation, calibration and/or maintenance procedures will be assessed and improved as necessary. If monitoring results are invalidated due to failures in the sample collection process, field techniques will be assessed and revised as necessary and staff trained as appropriate.

7.2 Data Management and Plan Modifications

The lab utilizes a commercial Laboratory Information Management System (LIMS) software program to manage, automate and document its sample collection and analysis activities, allowing for highly automated data analysis. The LIMS program maintains a permanent record of all laboratory data, and almost all instruments are connected to import data directly into the LIMS, eliminating the need for hand data entry.

The LIMS stores sample schedules and collection dates and methods in accordance with information initially entered into the system. The LIMS also provides a platform to record information applicable to the sample analysis including the following:

- Sample ID and date received,
- Preservation and preparation procedures including analyses to be run and associated holding times,
- Analyst name and qualifications,
- Reagents used and reagent logs,
- Instrumentation information including calibration data,
- QA/QC associated with the analysis, and
- Raw data and analytical results including detection levels, qualifiers, and analytical notes.

The District is responsible for compiling monitoring data. Monitoring data may be compiled by monitoring location and monitoring event. Data include dates, times, analytical results, and an

indication as to whether the sample represents a grab or flow composite sample. Monitoring data provided to DEQ annually are available in a usable digital format.

Modifications to monitoring locations and frequency as outlined in this Plan are permissible as long as the required number of monitoring data points (the product of monitoring location, parameter, frequency, and permit term) is maintained. Additionally, if on an annual basis the District is not able to collect the required samples because of climatic conditions, sampling conditions, equipment malfunction, monitoring location inaccessibility, etc., such inability is not directly reflective of a need to modify the Plan.

If a modification is required to the Plan, 30-day notice must be provided to DEQ in the form of a proposed Plan modification. As provided in Schedule B.15.b.v, written approval must be received from DEQ before such modification can be implemented. If DEQ does not respond within 30 days, the District may implement the proposed modification without written approval.