Quality Assurance Project Plan for Targeted Stormwater Management Program Effectiveness Monitoring

Conducted Under Section S8.E of the Phase I Municipal Stormwater Permit

by

Clark County

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Title and Approval Sheet

Quality Assurance Project Plan

Phase I Municipal Stormwater NPDES Permit

Internal Review and Approval

External Review and Approval

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Quality Assurance Plan

This Quality Assurance Project Plan (Plan) was prepared by U.S. Geological Survey and revised by Clark County's Department of Environmental Services Clean Water Program. The Plan describes the quality assurance procedures for activities associated with targeted stormwater management program effectiveness monitoring conducted by Clark County, as required by Section S8.E of the National Pollutant Discharge and Elimination System and State Waste Discharge General Permit for Discharges from Large and Medium Municipal Separate Storm Sewer Systems (Phase I Permit or Permit). The primary goal of this Plan is to meet the monitoring requirements defined in the Permit by presenting the design strategy of the proposed program, assuring the quality and representativeness of the results and the delivery of defensible products and decisions.

This document was developed with guidance from the Department of Ecology's, Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology 2004).

This Plan is organized into the following sections:

A. Goals and objectives of stormwater management effectiveness monitoring program
B. Type, quality, and quantity of data needed to meet program objectives
C. Sampling procedures to acquire data needed
D. Quality assurance procedures to ensure the Plan is implemented as prescribed
E. Assessment procedures to determine if the data conform to the specified criteria and will satisfy the program objectives, and the analysis and format for presentation of the results

Large tables that are for frequent reference during the life of the monitoring program are located in a Tables section following the text, noted with a "T" prefix.

Section A. Goals and Objectives of the Program

This section covers basic program management, including history and objectives, delegation of responsibilities, and other details to ensure that the program is well defined and understood by all participants. The following elements are included:

1. Background
2. Program description
3. Organization and schedule

1. Background

Targeted stormwater management program effectiveness monitoring is required to be conducted by Clark County according to Section S8.E of the Phase I Permit as modified by the Final Settlement Agreement between the Washington Department of Ecology and Phase I Permittees. Program effectiveness monitoring is focused on assessment of the overall impact of stormwater management programs. One of the required components of a stormwater management program is public education and outreach. This monitoring program is focused on evaluating the effectiveness of a targeted education program designed to reduce pesticide and fertilizer use and their subsequent runoff in stormwater from residential areas.

1.1 Permit overview and monitoring requirements

The Washington State Department of Ecology (Ecology) issued the current Phase I Permit on January 17, 2007 with modifications on June 17, 2009. The Phase I Permit applies to all entities in Washington State that are required to have stormwater permit coverage under federal Clean Water Act stormwater regulations. This includes unincorporated portions of counties whose populations exceed 100,000 in the 1990 census, specifically Clark County.

In accordance with the Phase I Permit, each permittee is required to develop and implement stormwater management programs to reduce the discharge of pollutants to the

maximum extent practicable. Consistent with Special Condition S8.E of the permit, one monitoring component required of the County is to assess the effectiveness of certain targeted activities and outcomes of the County's stormwater management program. More generally, the required monitoring program shall include the following components:

- Stormwater characterization monitoring (S8.D)
- Targeted stormwater management program effectiveness monitoring (S8.E)
- Stormwater treatment and hydrologic management best management practices evaluation monitoring (S8.F).

A separate Plan is developed for each component of the monitoring program; this Plan provides details on the targeted stormwater management program effectiveness monitoring component only. Ecology requires each permittee to conduct effectiveness monitoring in order to evaluate questions like the following: Are stormwater management programs reaching the right people? Is information being disseminated and used? How best should scarce resources be deployed to achieve results?

1.2 The problem

Section 5.C of the Phase I Permit defines the components of the stormwater management program (SWMP) that are required for the term of the Permit. The SWMP includes both administrative and legal components to ensure program implementation, as well as components specifically directed toward reducing pollutants and impacts. These include requirements for programs to control stormwater runoff and pollutant sources as well as public education and outreach (among others). This Plan describes a SWMP effectiveness monitoring program that is focused on public education as a tool to achieve source control of fertilizer and pesticide runoff in high-density residential areas of un-incorporated Clark County. The public education campaign will be specifically targeted toward homeowners to encourage yard and garden care techniques that are protective of water quality.

According to Permit Section S8.E.1, the targeted SWMP effectiveness monitoring must be designed to answer each of the following questions:

- What is the effectiveness of a targeted action?
- What is the effectiveness of achieving a target outcome?

Effectiveness of targeted action Clark County's targeted action is to develop a public outreach and education campaign to provide information and assistance to reduce fertilizer and pesticide use in high-density residential areas. The effectiveness of this action will be evaluated by comparing results from a pre- and post-education knowledge and behavior survey between two comparable neighborhoods, one of which was targeted for education and the other that was not, thereby serving as the control. The specific hypothesis to be evaluated by this component of the program is that the education campaign will result in measurable and significant changes in attitudes and behavior in the test neighborhood related to use of fertilizers and pesticides, relative to the control neighborhood. This targeted action is significant because public education and outreach is a required component of the SWMP mandated by the Phase I Permit. Results from this component of the program may help guide the development and implementation of similar education programs in other areas.

Effectiveness of targeted outcome The targeted outcome for this study is the change in attitudes and behavior in the target audience as a result of the education campaign. The effectiveness of this outcome will be measured by any reductions that are observed in fertilizer and pesticide runoff to storm drains. This component of the program will align with the coincident stormwater characterization monitoring program (S8.D) by utilizing the same high-density residential neighborhood selected for its monitoring as the target neighborhood for the education campaign. Data for concentrations and loads of nutrients and pesticides will be compared for the periods prior to and after the education campaign to evaluate whether measurable reductions are observed. Pesticides targeted for education will be determined after the first year of stormwater characterization, but will be a subset of the pesticides already targeted for monitoring (Table T 1). Under ideal conditions, it would be preferable to also collect pesticide data in stormwater runoff from the control neighborhood, i.e. the neighborhood that is not subject to the education campaign. However, it is doubtful that funding will be sufficient to add this component

to the monitoring program. Therefore, limited inferences will be able to be made for areas beyond this outcome monitoring area. As an alternative, the education campaign will not be administered until after at least the first full year of stormwater characterization from the target neighborhood is complete. In this way, comparisons can be made between pesticide concentrations and loads before and after the campaign.

The effectiveness of this outcome will be assessed by evaluating the observed reduction in nutrient and pesticide concentrations and loads in stormwater from the neighborhood that was targeted in the campaign. The general hypothesis that will be evaluated is that measurable reductions of nutrient and pesticide loads in stormwater runoff will be associated with samples taken after the targeted education campaign. Additional evaluation of the effectiveness of this outcome will be assessed by comparing pesticide reductions for specific compounds to evaluate which showed the greatest response to the education campaign. Particular attention will be given to the distinction between pesticides carried in the dissolved load versus those compounds carried in sediment.

This targeted outcome is significant because it will provide data to help focus the education component of the SWMP more effectively, especially relative to non-point pollutant sources. The issue of source control is critical for stormwater management, and it is generally understood that voluntary compliance with source limitation is preferable. Results from this study will document the effectiveness of approaches to achieving this voluntary compliance through education.

1.3 Study area

The greater study area includes urban land in unincorporated Clark County (Figure 1). Much of Clark County is within the northern-most portion of the Willamette Valley Ecoregion. Land use can be described as suburban within the developed areas and rural residential outside of the developed parts of the Urban Growth Area. Urbanization during the late 20th Century and early 21st Century has converted much of the farmland near Vancouver into residential subdivisions and small commercial areas along existing arterials and highways. Generally, the study area is comprised of gently rolling hills,

about 200 to 300 feet above sea level, which are cut by small stream systems draining to Salmon Creek or Lake River. Late Ice Age Cataclysmic Flood Deposits underlay the study area and provide a source for fine-grained sediment.

Two high-density residential neighborhoods will provide paired test and control areas for evaluating the effectiveness of the targeted action. The test neighborhood will be the same high-density neighborhood that is already selected for stormwater characterization monitoring (S8.D) (Figure 2). This neighborhood is approximately 240 acres in size and is characterized by an average lot size of less than ¼ acre. The paired control neighborhood has not been selected. The intention is to utilize a high-density neighborhood of similar size and density as well as with comparable demographic characteristics to that of the test neighborhood.

1.4 Monitoring challenges

Evaluating the effectiveness of SWMP programs, especially those focused on public education campaigns, is complicated by the difficulty in measuring changes in human attitudes and behavior. Inherent to these kinds of assessment is the issue that all data are self-reported. Consequently, the validity of results depends heavily on the willingness of the participants to report their knowledge and behavior accurately. Additional challenges arise because of the inherent variability in concentrations and loads of pollutants in stormwater, which can vary significantly under different types of storm events throughout the year.

2. Program Description

This section presents the goals and objectives of the program in detail, including the information requirements, specific target parameters to be monitored, and the data required to meet the program objectives. Study area boundaries and practical constraints that will need to be addressed are also discussed.

2.1 Goal and objectives

The goal of this program is to collect data to evaluate the effectiveness of a targeted public education campaign focused on reducing fertilizer and pesticide use in high-density residential neighborhoods, in order to comply with Section S8.E of the Permit.

The specific objectives of the program include:

1. Select a high-density neighborhood (control) to utilize as a paired basin with the high-density neighborhood already selected for monitoring under S8.D (test)
2. Evaluate S8.D water quality monitoring data from the test neighborhood for at least one year to estimate current use and runoff patterns for fertilizers and pesticides
3. Develop and perform the first round of an assessment mechanism, e.g. a survey and/or other means, for measuring the baseline knowledge and behavior related to the use of alternatives to fertilizers and pesticides in both control and test neighborhoods
4. Develop and conduct a targeted education campaign in the test neighborhood, focused on describing and encouraging alternatives to currently used fertilizers and pesticides
5. Administer a second round of an assessment mechanism similar to the first to determine the level of knowledge and behavior related to alternatives to fertilizer and pesticide use in both test and control neighborhoods
6. To evaluate the targeted action, compare results from both assessments to determine if attitudes and behaviors changed after the education campaign in the test neighborhood relative to the control neighborhood
7. To evaluate the targeted outcome, compare monitoring data from the test neighborhood for pre- and post-education campaign periods to determine if reductions in concentrations and loads can be detected after the education campaign

2.2 Information requirements

The information necessary to meet these objectives include the following—

- Land use data to identify a comparable high-density neighborhood for the control
- Expertise in assessing pre- and post-education campaign knowledge and behaviors
- Flow and chemical monitoring data from the test neighborhood to describe conditions prior to and after the education campaign
- Expertise in developing and administering a targeted education campaign

2.3 Data collection

Data collection will include development and implementation of assessment mechanisms to describe knowledge and behaviors related to alternatives to fertilizer and pesticide use. This component of the program will be administered by the Education and Outreach Coordinator of Clark County's Clean Water Program and is not yet fully developed. The outline of what is proposed is presented in this Plan.

Additional data will be provided by the on-going monitoring program for nutrients and pesticides at the high-density residential neighborhood, as required by S8.D of the Phase I Permit. This data collection program is described in detail in the Quality Assurance Project Plan for stormwater characterization (S8.D), and will not be duplicated in this Plan.

2.4 Target population

The target population for this program effectiveness monitoring component is two-fold: first, attitudes and behaviors relative to alternatives to fertilizer and pesticide use in Clark County high-density neighborhoods; and second, concentrations and loads of nutrients and pesticides in stormwater before and after a targeted education campaign focused on reducing their use.

2.5 Study area boundary

The study area boundary encompasses the two target neighborhoods, only one of which has currently been identified (Figure 2). Both of these neighborhoods must lie within the bounds of unincorporated Clark County, which is subject to the requirements of the Phase I Permit.

2.6 Practical constraints

Both the assessments of knowledge and behavior relative to the use of fertilizers and pesticides and the targeted education campaign will need to be focused on the specific compounds that are in use in the target neighborhood. Because the pesticides in use will

reflect the specific issues that are of concern, the assessments and education campaign will need to address those issues in order to be most effective. Additionally, some pesticides are applied in early spring while others are applied later in the summer. To be most effective, targeting the education campaign toward the season of maximum overlap with the application of pesticides of concern will be an important component of this program. There are currently no comprehensive data describing pesticide use within Clark County, especially at the level of neighborhoods. As a result, the necessary context to infer the patterns of pesticide use for the target neighborhoods will depend upon the pesticide occurrence patterns observed within the first year of S8.D stormwater monitoring data. The assessment tools and education campaign will be developed after the first year of monitoring, based on these observed pesticide runoff patterns.

3. Organization and Schedule

This section describes the components of the program team and schedule, including any special training that will be required as well as the process of revising this document when appropriate.

3.1 Roles and responsibilities

Below is a table describing the positions and corresponding responsibilities of the targeted action component for the program's effectiveness monitoring effort.

Table 1. Program roles and responsibilities.

Position	Role and responsibility
Department of Ecology Permit Coordinator	Review of Plan and program deliverables from Clark County to Ecology
Program representative for Clark County	Overall management of the County's NPDES Phase I compliance activities. Monitor and assess the quality of work. Comply with corrective action requirements.
Project Manager (PM)	Develop, implement, and maintain the Plan. Verify the Plan is followed and the program is producing data of known and acceptable quality. Initiate corrective action as appropriate. Analyze data and prepare reports.
Education and Outreach Coordinator	Acquire and verify survey data. Ensure adequate training, supervision, and reporting of all survey data collection and education activities.

3.2 Schedule

The following table indicates the estimated implementation schedule of the targeted action component for the program's effectiveness monitoring effort.

Table 2. Anticipated program schedule.

Activity	Anticipated Date of Initiation	Anticipated Date of Completion	Deliverable	Deliverable Due Date
Evaluate concentration and load patterns for nutrients and pesticides	January 2011	Ongoing	Identify pesticides in current use and runoff patterns	Ongoing status reports
Develop mechanisms to assess knowledge and behavior	March 2011	April 2011	Pre- and post- "survey" assessments	Ongoing status reports
Pre-education campaign assessment	May 2011	May 2011	Assessment of knowledge and behavior in target neighborhoods	Ongoing status reports
Develop targeted education campaign	June 2011	October 2011	Targeted education campaign	Ongoing status reports
Administer education campaign	November 2011	October 2012	Completed education campaign	Ongoing status reports
Post- education campaign assessment	November 2012	December 2012	Assessment of knowledge and behavior in target neighborhoods	Ongoing status reports
Final report	Ongoing	Ongoing	Annual Stormwater Report—2011	March 31, 2012

3.3 Special training needs

Project staff will require the following training and experience:

- Knowledge and behavior assessment techniques
- Targeted education techniques
- Assessment data analysis software and techniques

3.4 Revisions

Changes to the Plan that are substantial enough to require the Plan to be revised and resubmitted to Ecology for approval are considered external revisions. Smaller changes do not require Ecology approval, and are considered internal revisions. As necessary, any internal revisions will be documented in a Plan Addendum to be distributed to all program personnel. If multiple addendums are prepared, they will be compiled and distributed.

Section B. Type, Quality, and Quantity of Data Needed

This section defines the quality of data required to meet the study goals and objectives, and the sampling process design, which determines the type and quantity of data to be collected. Again, this section focuses on the targeted action component of the program. The quality of data required to meet the study goals and objectives for the targeted outcome component of the program are described in the QAPP prepared for stormwater characterization under S8.D.

4. Quality objectives

This section discusses the issues of data quality objectives (DQOs) and measurement quality objectives (MQOs) for the monitoring program. The standard approach for defining these kinds of objectives in a typical water-quality monitoring program includes collection of quality control (QC) samples to provide estimates of bias, precision, and accuracy of the measurements, based on the characteristic sources of error. These include the potential for contamination in the field or laboratory process, variability due

to inappropriate sampling procedures, and bias due to matrix effects. In assessments of human knowledge and behavior, however, the associated sources of potential error are quite different. These include:

- The survey questions
- The accuracy and interpretability of the responses
- The accuracy of information about the membership of the target population
- Refusal to participate among selected sample members
- Specific item non-responses by participants

The Quality Assurance component of this program will be developed specifically to reduce, to the extent practicable, these sources of error in the assessments. Specific attention will be placed on reducing "total survey error" rather than specific components of error. This will require ongoing discussion about tradeoffs between acceptable versus unacceptable errors, as well as the costs and resources needed to reduce these possible errors. This action will require knowledge of both the strategies to reduce errors and the costs of the resources involved.

To the extent practicable, given the available resources and funding, the quality of assessment results will be evaluated with standard survey measures of confirmability, dependability, transferability, and credibility. Confirmability is a measure of reliability, and will be based primarily on the use of audit trails that describe the approach to data collection and all decisions about how to collect and interpret the data. Dependability refers to the relative stability of the data, and will be evaluated by questions designed to evaluate the internal consistency of responses. Transferability provides a measure of the potential for generalizing results for one population to other populations, specifically between the test and control neighborhoods. Detailed descriptions of the survey respondents will provide the basis for inferring the extent to which the survey findings are applicable for both populations. Finally, the credibility of survey results refers to their general trustworthiness, which is difficult to measure. For this program, credibility will be enhanced by the explicit consideration of multiple lines of evidence that may be available to support study findings.

5. Sampling process design

This section describes the sampling process design, especially focusing on the key features of knowledge assessment by surveys. Other methods of assessment may be utilized to assess baseline knowledge and behavior as well, such as workshop responses. These are not described in this Plan.

5.1 General assessment approach

The basic components of surveys include the following—

- Sampling of participants
- Questioning of participants
- Standardization and quantification of questions

As in most assessment efforts, it will not be possible for this program to assess the knowledge and behavior of every person in the target neighborhoods because of the prohibitive cost of sampling every household. Instead, the program will rely on random sampling methods to select a subset (or "sample") of the broader target populations for both the pre- and post-education assessment components of the study. A key factor of sampling design that must be considered is the sampling frame (or available database) that is used to define the target populations for sub-sampling. To assure comparable sample units for the assessments, the sampling frames for the test and control neighborhoods will utilize the same data—based on households within each neighborhood—to identify sample participants.

Questioning of study participants, and the corresponding issue of self-reporting, is a key characteristic that separates knowledge and behavior assessments from typical water-quality monitoring that rely on some form of direct observation. A number of different styles of asking questions may be utilized, including questionnaires that are mailed, in-person interviews, web sites with interactive forms, and telephone interviews. Each of these forms of questioning has advantages and disadvantages. A key effort for this

program is selecting the appropriate form or multiple forms of questioning to reduce the rate of non-response by survey participants.

In order to provide valid comparison between the pre- and post-education campaign assessment results, questions asked must be standardized. In other words, questions must be worded similarly, if not identically, in the two assessments. To deal with this issue, the same assessment mechanism will be administered in both the pre- and post-education assessments. Because the sample from each target neighborhood will be selected randomly and independently, it is highly unlikely that the same households will be targeted for sampling both before and after the education campaign. As such, each sample can be reliably inferred to represent the target population at the time of the assessment.

5.2 General approach to education campaign

The education campaign will be focused on distributing educational materials within the test neighborhood, or conducting equivalent outreach activities, focusing on reducing fertilizer and pesticide contaminated runoff into stormwater. Particular focus will be given to describing and encouraging steps that can be taken to reduce stormwater pollution from these sources. The education campaign will make every effort to be based on local practices and will incorporate a variety of strategies to ensure maximum coverage within the target neighborhood. These could include:

- Brochures or fact sheets for general public and specific audiences
- Alternative information sources, such as web sites, bumper stickers, and refrigerator magnets
- Volunteer citizen educators conducting workshops targeted toward alternatives to fertilizers and pesticides
- Event participation with educational displays at neighborhood functions

5.3 Development of assessment mechanism and education campaign

The goal of the assessment mechanism is to describe attitudes and behavior related to use of fertilizers and pesticides in the target populations, while the goal of the education campaign is to change those attitudes and behavior. To appropriately target and focus the assessment and education campaigns, their development will be based on data collected by the basic stormwater characterization program at the high-density residential monitoring site. Patterns of nutrient and pesticide runoff that are observed during the first year of the monitoring program will provide important information about the patterns of fertilizer and pesticide use within the target neighborhood.

Monitoring fertilizer runoff is the more straightforward component of this program, and will be conducted by measuring stormwater concentrations and loads of nitrogen and phosphorus. Monitoring pesticide use is more complex, depending on the nature of the specific compounds of interest. The target group of pesticides will be identified from the data collected during the first year of stormwater characterization. Data will be evaluated for dissolved compounds that are carried in stormwater as well as those adsorbed to sediment. The assessment and education programs will be targeted toward those pesticides that are found in monitoring results above laboratory method reporting limits (i.e. reliably measured within the drainage area's stormwater or sediments). These materials will be targeted as appropriate, depending on the characteristic uses of the pesticides of interest. For example, DCPA and 2,4-D are herbicides that are commonly used on residential yards and gardens. Triclopyr, on the other hand, is a pyridine herbicide that is primarily used to control plants along rights-of-way, and may not be widely used by homeowners. Depending on the specific focus of the assessment and education campaign, the target audience of users may differ depending on whether the goal is to control the source of Triclopyr versus DCPA or 2,4-D.

Section C. Sampling and Measurement Procedures

Sampling and measuring procedures related to the assessment of knowledge and behavior will be developed during the first phase of this program, as described in Table 2. These procedures will be based, as far as practicable given available resources and funding, on standard survey techniques. However, it is not anticipated that sufficient resources will be available for a large-scale and statistically significant survey approach. As the details of the assessment mechanism are developed, they will be presented in status reports and annual Stormwater Reports.

Sampling and measurement procedures for the targeted outcome component of this program are described in the QAPP prepared for stormwater characterization under S8.D.

Section D. Quality Assurance and Quality Control Procedures

The Quality Assurance and Quality Control component of this program will be focused on reducing the two major types of data errors:

- Errors in the data from falsification by participants
- Errors in the data from inaccurate data entries, data transfers, misinterpretation of responses, and inherent limitations of the assessment techniques

The guidelines presented here are intended to avoid or minimize errors in the data generated by this program. They are quite general in nature, and the specifics may vary as the program is developed.

Falsification by assessment participants will be minimized by careful construction of the assessment mechanisms, although it cannot be avoided completely. The most important component of the QA program addresses the second groups of errors by adequate education and training of the investigators and all other personnel involved in the implementation of the assessment mechanisms. This training should be conducted at the start of the program and at intervals during the study, as appropriate. Training should include not only discussions of the assessment mechanisms, but also sessions on how to

complete all necessary forms, enter the data into the designated databases, and basic concepts of research methods. The Education and Outreach Coordinator must be closely involved with all data collection activities in order to ensure high quality and timely conduct of survey work. Examination of data to identify possible outliers should be done routinely throughout the life of the assessment program.

Quality Assurance procedures associated with the targeted outcome component of this program are described in the QAPP prepared for monitoring under S8.D.

Section E. Assessment Procedures

6. Audits and reports

This section describes the processes that will ensure that the quality assurance procedures specified by this Plan are being adequately implemented, that the quality of the data is acceptable, and that corrective actions are conducted in a timely manner.

6.1 Audits

Audits are an important tool to verify that the quality assurance procedures described in this Plan are being adequately implemented as necessary. During an audit, the reviewer will check for the following—

- Sufficient documentation of all required activity
- Correction of any problems that have been identified

Audits may be scheduled by request from the Project Manager at Clark County or the Department of Ecology. The Project Manager or designee will be responsible for initiating audits, selecting the team of reviewers, and overseeing the implementation of the audit.

Audits of the assessment procedures will address the following questions:

- Are all assessment mechanisms conducted as specified?
- Are documentation records complete?

- Are problems identified and resolved appropriately?
- Are data management procedures adequate?

Any nonconformance to established protocols will result in appropriate corrective action. The results of the audit and oversight activities will be reported to the Program Representative for Clark County, who has ultimate responsibility for ensuring that the corrective action is appropriate, complete, and documented.

6.2 Reports

Reports that will be generated for this program include assessment files, education campaign files, status reports, and the Annual Stormwater Monitoring Report. Additional details regarding documentation of the targeted outcome component of the program are provided in the QAPP prepared for monitoring under S8.D.

Assessment files Sample files are not required by the Phase I Permit, but will be maintained to track the details of each assessment mechanism. They will include all supporting information and documentation of the assessment, including the procedure for selecting the subset for sampling, all supporting information describing the assessment participants, details of the assessment approach (survey questions, workshop evaluations, etc), and the results of the assessment. Other supporting documentation may include notes regarding any assessment anomalies or other issues that could impact data analysis and reporting. The Education and Outreach Coordinator is responsible for maintaining these files.

Education campaign files Similarly, these files are not required by the Phase I Permit, but will be maintained to track the progress of the education campaign. They will include all supporting information and documentation of all components of the education campaign, including the process for developing each component of the campaign, and the details of the approach for each component (e.g. brochures, workshops, etc). Any anomalies or other conditions that could impact the outcome of the education campaign should be included. The Education and Outreach Coordinator is responsible for maintaining these files.

Status reports Status reports will be prepared and submitted to the Program Representative for Clark County, either quarterly or as requested. These will include a summary of the successful and valid assessments to date, a summary of the education campaign after it is implemented, a summary of any quality control issues for survey results, and a discussion of all issues that may need to be addressed. The Education and Outreach Coordinator is responsible for preparing these reports.

Annual stormwater monitoring report The Stormwater Monitoring Report is required to be submitted with the annual report every year (S8.H). Each report will contain all monitoring data collected during the previous water year (October 1 through September 30). As appropriate, the reports will integrate data from earlier years into the analysis of results and will incorporate results from this program as they become available.

Reports will be primarily written by the Project Manager and submitted in both paper and electronic form and will include:

- A summary description of each target neighborhood (test and control), describing location, land use, drainage area, and pertinent demographic characteristics
- The status of implementing the SWMP effectiveness monitoring program, including supporting data from the stormwater characterization component of the program
- A comprehensive report of assessment and education results, as appropriate, with an explanation and discussion of the results
- Comparison of knowledge and behavior characteristics of the test neighborhood for the periods prior to and following the education campaign, relative to the control neighborhood
- Comparison of concentrations and loads for nutrients and pesticides in stormwater runoff from the test neighborhood for the periods prior to and following the education campaign

The monitoring report will explain the program results, present the data, document the overall quality of the data, and discuss any data anomalies. Additionally, the report will describe any planned changes to the current Plan that may be appropriate to address QA issues that have been observed.

7. Data review and verification

This section describes the data review and verification procedures that determine whether the data conform to the criteria required by the program objectives. The most basic criterion is that the sampled participants provide an unbiased sample of the target population. While the sample selected for the assessment may have been similar in composition to the population as a whole, it is possible that some targeted respondents may choose to not respond to the assessment. Comparison of the characteristics of the actual respondents with the characteristics of the target neighborhoods as a whole may be necessary to verify whether they are representative.

Data review is the process of examining the data for errors or omissions. This will be done by prompt examination of all survey forms for completeness. All omissions should be followed up and completed if possible. The Education and Outreach Coordinator or designee is responsible for ensuring that assessment data are reviewed and verified. After each successful assessment event, a review will be made of all data for gross error (e.g. incongruous responses or data gaps) to verify the completeness of the data. The Education and Outreach Coordinator will also check to see that assessment data were collected in accordance with required procedures.

Data review and verification procedures for the targeted outcome component of the program are described in the QAPP prepared for monitoring under S8.D.

7.1 Methods of verification and validation

This section presents a brief overview of the methods that may be used for verifying and validating data, including the input that will be necessary, the specific methods to be used, and the output from the verification process.

Data input A variety of records will be necessary for data verification and validation. These could include, but are not limited to, the following—

- Field logs
- Assessment forms

Data verification methods Data verification methods will be documented throughout the course of the process, and may be revised as appropriate to the situation. These methods may include:

- Identification of data gaps or missing data
- Identification of response anomalies outside the limits of reality
- Cross checks with demographic data
- Evaluation of expected patterns versus observed

Data verification products Outputs from the data verification process include both the verified data and the verification documentation. Verified data will be submitted to the final quality or usability assessment described in the next section. Verification documentation may be included in status reports and/or the QA/QC section of the Annual Stormwater Monitoring Report. Data verification documentation should also include a discussion of any perceived shortcomings of the data.

8. Data Quality Assessment

Once data have been reviewed and verified, the final data quality assessment is conducted. The main goals of this assessment are to determine if the data meet the objectives of the program and are assessed to be usable to evaluate the effectiveness of the education campaign.

Usability assessment is a qualitative process where data are evaluated relative to three levels of data quality—

- Accepted: data meet all requirements
- Qualified: data meet most requirements with only minor deviations
- Rejected: data do not meet critical requirements

The usability assessment includes examination of outliers, and verification that the data are complete and representative of the target populations.

Data quality assessment for the targeted outcome component of the program is described in the QAPP prepared for monitoring under S8.D.

9. Data analysis and presentation

This section describes the content of the Annual Stormwater Monitoring Report, including data collected during the previous water year. The following elements will be included as applicable:

- Target neighborhood summaries
- Data and QA report
- Evaluation of targeted action
- Comparison of attitudes and behavior results for two time periods for test and control neighborhoods
- Evaluation of targeted outcome
- Comparison of concentrations and loads for nutrients and selected pesticides for two time periods for test neighborhood

9.1 Neighborhood summaries

Each neighborhood summary will describe the location, land use, drainage basin area, and general hydrology. Additionally, an overview description of the relevant demographic characteristics will be presented, as appropriate. Finally, the report will document all substantial land use, climate, and demographic changes in the drainage basin that could potentially impact either knowledge and behavior or pollutant loading.

9.2 Data summary

The data summary will briefly describe procedures for obtaining data, including all assessment mechanisms that were utilized. Summary tables will describe all assessment results and education efforts. Changes in knowledge and behavior, and concentrations and loads, will be reported as appropriate.

9.3 QA summary

This section will include the following elements:

- Data verification / validation information for each assessment that describes any QA issues and corrective actions, as appropriate

- Summary QA report, including:
  - Overview narrative summarizing all data validation information
  - General assessment of usability and representativeness of data
  - Description of any proposed changes to the existing QAPP to deal with observed QA problems

Table T 1. Nutrients and pesticides to be analyzed in stormwater and sediment.

Parameters analyzed in stormwater
Nutrients
Total phosphorus
Orthophosphate
Total Kjeldahl nitrogen
Nitrite-nitrate
Organics
Herbicides (2,4-D, MCPP, Triclopyr, Dichlobenil, Pentachlorophenol) *
Pesticides, nitrogen (Prometon) *
Pesticides, organo-P (Diazinon, Malathion, Chlorpyrifos) *
Parameters analyzed in sediment
Organics
Herbicides (Pentachlorophenol)
Pesticides, organo-P (Diazinon, Malathion, Chlorpyrifos)

Figure 1. Clark County Washington, with outfall site for designated high-density residential monitoring basin to be utilized as the test basin.

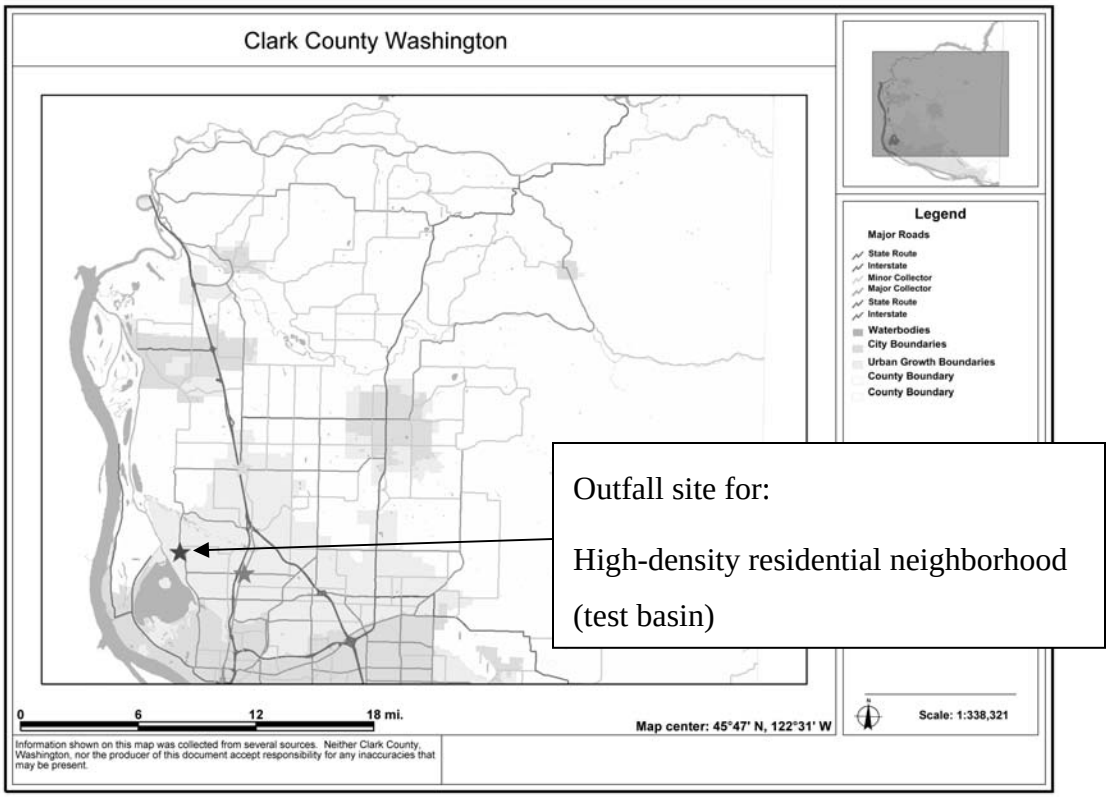

Figure 2. Orthophotography for high-density residential neighborhood (test basin).