

# Eastern Washington Stormwater Effectiveness Studies

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## Quality Assurance Project Plan (QAPP)

### Car Wash Wastewater Management Education and Outreach Effectiveness Study

#### *Study Classification:*

- Structural BMP       Operational BMP       Education & Outreach

#### *Study Objective(s):*

- Evaluate Effectiveness       Compare Effectiveness



July 2021

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## **QAPP Publication Information**

The Study Design Proposal and QAPP will be available to the public on the City of Yakima website (<https://www.yakimawa.gov/services/wastewater-treatment-plant/stormwater/>).

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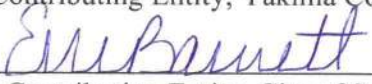
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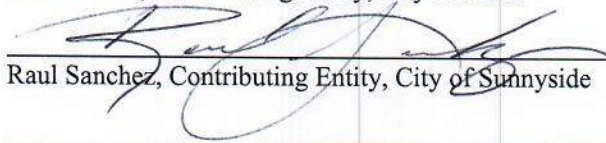
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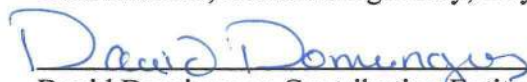
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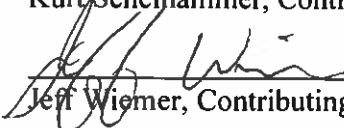
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## 2.0 Executive Summary

Under the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer Systems (MS4s) Phase II Permit (Permit), jurisdictions such as the City of Yakima, Washington, (Yakima) are required by Washington State Department of Ecology (Ecology) in Eastern Washington (EWA) to manage discharges from their MS4s. The Permit requires Permittees to evaluate the effectiveness of a Permit-required stormwater management program (S8 Monitoring and Assessment) and conduct studies on education and outreach programs (S5.B.1.b). The study proposed in this document is designed to meet the requirements of both Permit requirements.

Yakima has chosen to focus their education and outreach (E&O) program to target the car washing behaviors of Yakima residents who drive one or more vehicles. City of Yakima staff have observed residents washing their car outside their homes and allowing car wash wastewater to reach the storm drain. Car wash wastewater exposes harmful amounts of chemicals such as detergents, sediment, nutrients, and metals into storm drains. This can be prevented by following vehicle washing best management practices (BMPs). The goal of the E&O program is for City of Yakima residents who drive one or more vehicles to adopt car washing BMPs that will limit the impacts to stormwater and to understand those impacts. In turn, the goal of the effectiveness study is to evaluate the effectiveness of the City's E&O program.

Preferred vehicle washing BMPs were identified through a literature review of similar studies. The BMPs that could be used by residents include use of commercial car washes, diverting stormwater to permeable surfaces, use of less harmful soaps or no soap, only washing the exterior of the car, limiting the frequency of car washing, and reporting spills or car wash wastewater entering the storm system. Potential barriers for adopting behavior were also identified through the literature search.

The E&O program will be deployed during the dry season, beginning in summer 2021 and finishing in fall 2021. In order to reach a range of generations of Yakima drivers, a multimedia approach will be used to reach the target population. E&O materials will be deployed using materials and methods such as social media posts, stickers, and door knockers delivered to neighborhoods, as well as towels for car washing and brochures provided at the Central Washington State Fair.

To determine the performance of the designed E&O program, baseline and follow-up data will be compared from surveys submitted by Yakima residents and observational data. Survey responses will provide insight of residents' understanding of car wash wastewater illicit discharges to the stormwater system, preferred vehicle washing BMPs, and barriers preventing the BMPs from being adopted. Social media posts, newspaper advertisements, a banner on the City website, and a booth at the Central Washington State Fair will be used to advertise the survey to the target audience. Incentives will also be provided to those who take the survey (see Sections 8.2.2 and 8.2.3). To confirm the survey data, City officials will gather observational data via drive-by visits through three neighborhoods where car washing behaviors have been witnessed. Baseline survey and observational data will be collected prior to the implementation of the E&O program, and follow-up survey and observational data will be collected following

the implementation of the E&O program. The data collected from each of these before- and after-E&O methods will be analyzed to determine the effectiveness of the program.

A goal of this study is to inform City of Yakima drivers of effective strategies for preventing car wash wastewater from harming the downstream watersheds. Barriers identified in this study can be used to improve the E&O program components. Once the E&O materials are updated, the effectiveness study could be repeated for future use as the E&O program evolves.

## **3.0 Background**

### *3.1 The Stormwater Education and Outreach (E&O) Program*

A new E&O program is being developed for the City of Yakima which will inform a target audience of the impacts of car wash wastewater and adoption of proper car washing BMPs, which are the targeted behaviors. The target audience for the study includes City of Yakima residents who drive one or more vehicles, especially residents who live within three specific neighborhoods (see Section 4.3). The E&O program developed will include distributing E&O materials through social media and at the Central Washington State Fair annually, as well as at any additional locations deemed necessary. The E&O materials used each year may include, but are not limited to: brochures, door knockers, stickers, and social media or website posts which contain educational information regarding the impacts of car wash wastewater on receiving waters and use of car washing BMPs. Specific materials will be provided as part of this study to evaluate the new E&O program.

The effectiveness of the new E&O program will be evaluated in terms of a change in awareness and adoption of targeted behaviors by City of Yakima residents. Specifically, the E&O program will be deemed effective if an increase in awareness and adoption of targeted behaviors are found through the study. Additional E&O materials will be used during this study to increase participation by the target audience, including additional doorknockers, social media posts, website posts, and newspaper advertisements used specifically to advertise the survey for the study (see Section 8.1), as well as the use of towels for car washing and car wash coupons to incentivize taking the survey at the Central Washington State Fair (see Section 4.6). The E&O program is described in more detail in Section 7.4.

### *3.2 Problem Description*

The 2019-2024 Eastern Washington (EWA) NPDES Phase II MS4 Permit requires Permittees to prohibit, through ordinances or other regulatory mechanism, non-stormwater discharges into the MS4 (Washington State Department of Ecology, 2019). Additionally, Permittees are required to implement an E&O program designed to reach the general public regarding subject areas such as potential impacts from stormwater discharges, methods for avoiding, minimizing, or reducing the impacts of those discharges, and actions individuals can take to improve water quality. There currently is no E&O program in the City of Yakima that targets residential car washing behaviors. However, empirical observations by City of Yakima officials have indicated that a program targeting residential car washing behaviors is needed.

City of Yakima officials have observed residents within Yakima city limits who drive one or more vehicles tend to wash vehicles in their driveways during the dry season, from May through September. The wash wastewater then flows from the driveway into storm drains in the streets. Based on literature findings from other regions (citations for these studies are included in the QAPP), it is probable that residents who drive one or more vehicles may not be aware of the impacts of these actions.

Residential car wash water is often a primary source of stormwater pollution (Smith & Shilley, 2009). The wash water is composed of oils, silt, sand, clay, hydrocarbons, and metals such as

zinc and copper (Grisso, et al., 1998). Dissolved copper exposure contained in stormwater may have the potential to impair the sensory biology of Coho salmon (a salmonoid listed as a protected species), which is used for every aspect of their survival. Copper also is lethal to phytoplankton, the basis of the aquatic food chain (Smith & Shilley, 2009). Surfactants that are composed of nitrogen and phosphorus are commonly found in car wash soaps to create suds. Exposing these chemical compounds to waterways results in algae blooms which are harmful to the natural environment. Surfactants are also responsible for causing abnormal birthing defects in the development of juvenile fish. The chemicals included in all detergents are detrimental to fish that live in these waterways, as they destroy fish mucus membrane and gills (Oknich, 2016).

On a small scale, one individual washing a vehicle and allowing the discharge to drain into the storm system will likely not have a measurable impact on the receiving waters. It has been predicted that approximately 10-40 liters of wash water are produced per vehicle washed (Taylor & Wong, 2002). Smith & Shelley, 2009, noted that if roughly 444,000 residential car washes are averaged each year, then pollutant loadings can have a detrimental impact on aquatic life depending on the size of the receiving waters. Studies have found that stormwater pollutant concentrations collected downstream of residential car washing can compare similarly to levels of pollutants found in utility wastewater (Sablayrolles, Vialle, & Montrejaud-Vignoles, 2010). The only difference being that stormwater is often not treated before entering waterways compared to wastewater which is typically treated or required to be treated by all known, available, and reasonable methods of prevention, control, and treatment for domestic and industrial wastewater facilities (Washington State Legislature, 1987; Washington State Legislature, 1990).

### **3.3 Results of Prior Studies**

A review of literature was performed to assist with developing the E&O campaign for this study, as well as develop the study design and instruments (e.g., surveys and observational data collection forms). Sections 7 and 8 provide more details about how this information informed the development of these items. The literature search focused on understanding the target audiences' perceptions, as well as the car wash BMPs. A synthesis of this review is the focus to this section.

#### **3.3.1 Prior Study Insight of Target Audience**

The literature search focused on understanding behaviors and perceived stormwater knowledge of the target audience which included reviewing studies and fact sheets (Bartlett, 2005; City of Bellevue, n.d.; Smith & Shilley, 2009; Taylor & Wong, 2002; Trechter, Janke, Hadley, & Parks, 2008). Barriers that prevented drivers of one or more vehicles from using environmentally friendly car washing BMPs were found in the previous citations, as well as through the *International Carwash Association 2014 Consumer Study Report*. The findings reported in the literature review were based on the results from surveys or other instruments to collect data, to the approach defined for this study. Key findings from these studies are summarized in this section.

#### **Behaviors and Target Audience**

A 2005 study revealed that out of a population of 1,000 individuals over the age of 18, roughly 750 owned a vehicle. Of this sample, 56% reported washing their vehicle on a paved surface



rather than washing on a permeable surface such as grass, dirt, or gravel. Geographical region was the most noted reason for choosing to wash a vehicle on pavement rather than a permeable surface (Bartlett, 2005). Specifically, people who live in urban areas have more paved (hard surfaces) areas, while rural areas tend to have less paved areas which are also more spread out and disconnected. A 2007 study revealed that men are more likely to wash their vehicles at home than other genders (Trechter, Janke, Hadley, & Parks, 2008). A study conducted between the summers of 2007 and 2008 identified sunny and dry weather to be a predictable indicator for car washing to take place (Smith & Shilley, 2009).

### Target Audience Stormwater Perception

A common misconception exists among the general population that stormwater is always treated and filtered before reaching waterways and, for that reason, it is acceptable to allow car wash wastewaters to drain directly into a storm drain from upstream pavement (Trechter, Janke, Hadley, & Parks, 2008). Surveys conducted by the International Carwash Industry between 1999 to 2008 revealed that a majority of residents washing their vehicles at home consistently feel as though residential car washing is better for the environment than commercial car washes (International Car Wash Association, 2008). Bartlett, 2005, provided a reason for this misperception; specifically the “self-serving bias”, which is: “the tendency for humans to take credit for success but to blame external causes for failure.” Residential car wash wastewater is not treated and flows directly into storm systems and into local waterways, carrying debris and pollutants (Taylor & Wong, 2002; Grisso, et al., 1998; Oknich, 2016).

### Washington Car Wash Wastewater Management E&O Programs

E&O programs from other Washington state jurisdictions were considered to understand which aspects were effective in educating residents on the consequences of residential car washing. Only three programs were identified during the literature search, and only program materials and/or costs were discussed for those programs. One program, funded by Ecology, distributed car wash kits to Eastern Washington Permittees, including City of Wenatchee, City of Ellensburg, and City of Pullman, to be loaned out to the public for use during fundraiser car washes or by individual residents. Kitsap County hosts a vehicle wash program that sends E&O materials to community groups that could hold fundraiser car washes. The program requires 10-15 hours of staff time over a 25-week span, and cost \$3,000 in 2001. Tacoma, Washington, hosts a Clean Bay Car Wash Kits program, which promotes the use of car wash kits to limit car wash wastewater entering the storm system. The campaign cost the City less than two weeks of staff time per year and \$2,000 in 2001 (Taylor & Wong, 2002). These programs promote car wash BMPs that, if implemented, have the potential to entirely stop the majority of car wash wastewater pollutants from entering the storm system.

### Barriers to Implementing Car Wash BMPs

Additionally, categories of barriers to car washing BMPs were identified from the literature.

- **Cost:** A factsheet provided by the City of Bellevue identifies cost being a concern to using commercial car washes or buying waterless car washing products (City of Bellevue, n.d.). The *International Car Wash Association 2014 Consumer Report* also confirms that some drivers do not find taking their vehicle to a commercial car wash is worth the money (International Car Wash Association, 2008). Presumably, the Clean Bay

Car Wash Kits program run by Tacoma (Taylor & Wong, 2002) would address this issue by providing car wash kits to residents who want to avoid the cost of a commercial car wash.

- **Lack of knowledge:** Survey results have suggested that many individuals do not know or understand the negative consequences that washing vehicles on pavement has on the downstream watershed (Treichler, Janke, Hadley, & Parks, 2008). Residential car washing is also perceived as less environmentally impactful than using commercial car washes (International Car Wash Association, 2008).
- **Time/Convenience:** Some drivers do not find that it is important enough to take the time to drive their vehicle to a commercial car wash. These drivers admit that these efforts are not taken because they do not want to expend the extra effort or time (International Car Wash Association, 2008).
- **Lack of access to materials:** Depending on the location of where drivers live will have an impact on whether car washing BMPs are practical or not. This includes not living in close proximity to commercial car washes, or living in an urban area where there is no non-paved area to direct car wash wastewater (International Car Wash Association, 2008).
- **Quality of product:** Survey results have shown that some drivers do not like the level of service that is provided by a commercial car wash. The majority of commercial car wash users drive older generations of cars. Drivers with newer model cars tend to hand wash their vehicles at home due to feeling they can provide more attention to detail and a higher quality wash (International Car Wash Association, 2014).

### 3.3.2 Literature Defined BMPs

Existing literature identified BMPs for proper management of residential car wash wastewater. These BMPs involve commercial car washes, preventing wastewater from entering storm drains, avoiding harmful soaps, only washing the exterior of the car, limiting residential car washes, and knowing illicit spill protocol. The details of each BMP are listed below, as well as a summary of literature associated with the BMP.

- **Use of commercial car washes rather than washing cars at home:**  
The most effective BMP to protect stormwater is to take vehicles to a commercial car wash that uses environmentally friendly practices (Stream Team, n.d.). These commercial carwashes recycle their car wash wastewater which, after a few cycles, will eventually drain to the sanitary sewer system that has treatment. Car washes that do not recycle water send car wash wastewater to the sanitary sewer system, which also prevents pollutants in car wash wastewater from entering the storm system.

If the general public washes their car by hand, the following BMPs will also help protect the downstream watershed.

- **Prevent car wash wastewater from draining into storm drains** (City of Issaquah, n.d.; Geer, n.d.; City of Wenatchee, n.d.; City of Bellingham, n.d.): instead of allowing car wash wastewater to flow into a storm drain, residents should divert the car wash wastewater into a permeable area with sandbags, towels for car washing, or other makeshift barricade using items found around the home (City of Kirkland, n.d.). Permeable ground will naturally filter out pollutants. To bypass the need for barricading items, it is suggested to use an area with permeable surface such as grass, gravel, or dirt as the at-home vehicle washing area (City of Wenatchee, n.d.; City of Bellingham, n.d.; City of Kirkland, n.d.). Once the soapy water in a wash bucket is finished being used, the remaining car wash wastewater can be poured in a garden, lawn, or other permeable surfaced area rather than on a paved surface or directly into the storm drain (City of Wenatchee, n.d.; Stream Team, n.d.).
- **Avoid using soap, use chlorine-free and phosphate-free soap, or use biodegradable soap:** the City of Federal Way and the City of Calgary both recommend to not use soap while washing your vehicle, and to just use water (Oknich, 2016). There are also waterless car wash products available for purchase which do not involve the use of water or soap. These products are sprayed onto the vehicle via a spray-bottle and wiped off with a cloth, leaving the vehicle clean and storm drains clear of potential car wash wastewater pollution (City of Marysville, n.d.; City of Tacoma, 2009). If washing with soap and water is unavoidable, the public can opt to check labels while purchasing cleaning products (City of Marysville, n.d.). Products with chlorine or phosphorus are known to be environmentally detrimental to waterways (City of Moses Lake, n.d.; City of Bellingham, n.d.; City of Kirkland, n.d.; Stream Team, n.d.). Washing vehicles with eco-friendly biodegradable soaps are ideal to use over permeable surfaces, but are still not safe to enter the storm system without filtration before discharging to a paved surface (Washington Stormwater Center, n.d.; City of Bellingham, n.d.; City of Wenatchee, n.d.).
- **Only wash the exterior of the vehicle:** cleaning the engine bay, truck cargo area, mounted equipment, or the undercarriage of the vehicle is not recommended, as harmful pollutants are generated in these areas (San Luis Obispo County, n.d.). Avoiding engine and wheel degreasers is also good practice (City of Moses Lake, n.d.).
- **Limit frequency of residential car washing:** reducing the frequency of at home car washes is key to improving local waterways. Educating the public to reduce the frequency of at home car washes will be a key component to this E&O program to reduce stormwater utility pollution, benefit the environment, and encourage residents to use environmentally friendly practices (Oknich, 2016).
- **Report spills of car wash wastewater:** Car wash wastewater from cleaning vehicles is not an allowable discharge to the storm system and should be treated as an illicit discharge if it does enter the storm system. . In the event that an illicit discharge does occur, reporting the incident to the City Stormwater team to contain & treat the area immediately is strongly encouraged (MassDEP; Geosyntec Consultants, n.d.; Washington Stormwater Center, n.d.).

### 3.4 *Regulatory Requirements*

This study is being conducted to meet the requirements of the 2019 EWA NPDES Phase II MS4 Permit issued to the City of Yakima by the Washington State Department of Ecology. Specifically, this study is designed to meet the following Permit requirements:

- **Section S8.** of the Permit requires Permittees to evaluate the effectiveness of their Permit-required stormwater management program activities or BMPs and recommended future actions based on the findings. The City of Yakima plans to evaluate an E&O program and serve as the lead entity during the study.
- The evaluation will also address **Section S5.B.1.b** of the Permit (Washington State Department of Ecology, 2019). According to the Permit requirements in section S5.B.1.b, Permittees are required to measure the understanding and adoption of a targeted behavior for at least one target audience in at least one subject area. As such, results from this study will be used to direct E&O resources most effectively, as well as to evaluate changes in the adoption of targeted behaviors.

## **4.0 Project Overview**

### **4.1 Study Goal**

This study was developed to meet the effectiveness requirements defined in Section 3 of this document. The goal of the study is to evaluate the effectiveness of a new education program that informs the public about proper car washing BMPs to prevent runoff from entering storm drains and discharging to receiving water bodies. The study will evaluate effectiveness through the following:

- Measure the target audience's (see Section 4.3) awareness of the impact of their actions on receiving water quality
- Measure the target audience's awareness of proper car washing BMPs
- Measure the target audience's adoption of the E&O program's targeted behavior (i.e. using proper car washing BMPs)

The results of this study will be used to identify any barriers to adoption of targeted behaviors and recommend improvements for the residential car washing E&O program. The improvements are expected to increase adoption of the targeted behavior and will help to direct E&O resources more effectively. In compliance with S5.B.1.b, results from this study will be used to direct E&O resources most effectively, as well as to evaluate changes in the adoption of targeted behaviors.

### **4.2 Study Description and Objectives:**

This study will evaluate the effectiveness of the new E&O program that informs City of Yakima residents who drive one or more vehicles. The E&O program will provide information about the impacts of car wash wastewater and proper car washing BMPs to prevent car wastewater from entering the storm system. The study will target the City of Yakima residents who drive one or more vehicles, specifically focusing on three neighborhoods for data collection (see Section 4.3 on why these neighborhoods were selected).

Before the deployment of the new educational program, responses from a baseline survey and field observational data will be collected to measure the target audience's understanding of the impacts of car wash wastewater on receiving waters and use of proper car washing BMPs. The survey will also identify barriers preventing the public from following proper car washing BMPs. Observational data, consisting of a count of residents washing their car with or without using proper BMPs, will be collected during observational drive-by visits (see Section 8.2) by lead entity and participating entity staff in the three target neighborhoods (see Section 4.3). The survey will be deployed to the population of Yakima online through SurveyMonkey® (Momentive™) or a similar platform at approximately the same time as observational site visits are occurring and will be advertised via doorknockers in the target neighborhoods, the City's social media accounts, the City website, and a newspaper advertisement.

Following the baseline survey and observational data collection, the E&O program will be deployed. The E&O program will consist of delivery of materials to homes in the target neighborhoods, posts on the City's website and social media accounts, and handing out materials during the Central Washington State Fair (see Section 7.4). Education and outreach materials

that will be used include brochures, stickers, doorknockers, and towels for car washing that promote awareness of the impacts of car wash wastewater and proper car washing BMPs. Materials will be developed in English and Spanish, as described in Section 7.4.

Following the implementation of the new educational program, a follow-up survey and field observations will be conducted to measure the adoption of the car washing BMPs. The follow-up survey will be made available through the same platform used for the baseline survey and will be advertised using doorknockers in the target neighborhoods, the City's social media accounts, the City website, and the Central Washington State Fair. Drive-by visits to collect observational data will occur in the three target neighborhoods within one week of the distribution of the follow-up survey.

To evaluate the effectiveness of the new educational program, the survey and observational data collected before (baseline) and after (follow-up) the E&O campaign is launched will be compared. Results from the analysis will be used to determine whether there were any changes (based on the results of a statistical analysis) in the target audiences car washing behavior. If any barriers are identified following the follow-up survey, the information will be summarized and addressed in the final recommendations of the study and to direct resources more effectively.

The objectives of this study are:

- Understand to what extent the target audience currently uses proper car washing BMPs
- Develop and implement an E&O program targeting adoption of proper car washing BMPs
- Measure adoption of targeted behaviors by the target audience
- Develop recommendations based on the study findings and use the recommendations to revise and implement a modified E&O program

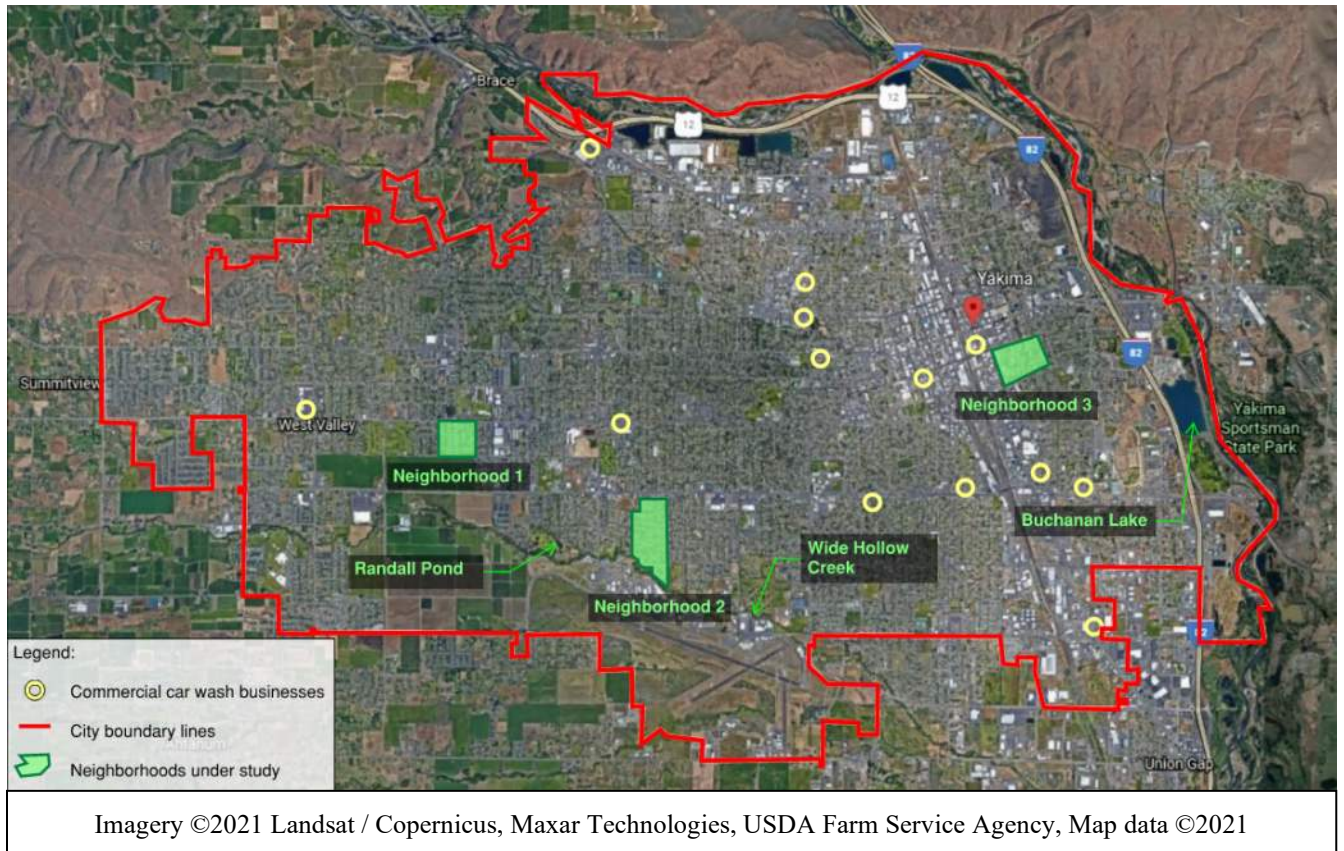
### 4.3 *Study Location and Target Population*

The study is located within the Yakima city limits (see Figure 4.3), and the target population for the study will consist of residents of the City of Yakima that drive one or more vehicles. No control populations or sites have been identified for this study: data collected before and after the E&O program is implemented will be compared to evaluate effectiveness. As such, the anticipated population is expected to be approximately 31,000 households, assuming the national average of households with access to a car (91.3%) (Peterson, 2021) is an appropriate estimate for Yakima, which has approximately 34,000 households (United States Department of Commerce, 2019). The sample size selected is 500 to 1,000 respondents (see Section 7.2).

Three neighborhoods were selected to collect additional data because the City has observed evidence of car washing in the past, and because the neighborhoods consist of homogenous housing developments. The three neighborhoods consist of single-family homes with paved driveways on paved streets. Residents in these neighborhoods are expected to own at least one or more vehicles. The homes in these neighborhoods are supplied with running water (to wash cars) and have a storm system that connects to the City's MS4. There are approximately 700 parcels where observational data will be collected. The proximity of Neighborhood 1 to a commercial car wash is approximately two miles. Neighborhood 2 is located approximately two miles to the

nearest commercial car wash, and Neighborhood 3 is located a mile away from the nearest car wash (see Figure 4.3). Neighborhood 1 drains into Randall Pond located in Randall Park, and Neighborhood 2 drains to Wide Hollow Creek. Both waterbodies ultimately discharge to the Yakima River. Neighborhood 3 area drains into Buchanan Lake. Descriptions for each of the three neighborhoods where additional data will be collected are in Table 4.3.

**Figure 4.3: Approximate locations of local commercial car washes and target neighborhoods**



**Table 4.3 Study Neighborhood Locations**

<b>Neighborhood Name</b>	<b>Description</b>
Neighborhood 1	This neighborhood is named the Tancara neighborhood and is located in the western portion of the City. This neighborhood is bordered by Tieton Dr. & Arlington St. to the North and South and by S 54 <sup>th</sup> Ave. & S 58 <sup>th</sup> Ave. to the East and West. There are approximately 160 parcels in this community.
Neighborhood 2	This neighborhood does not have an official community name. Located in the southern portion of the City, this neighborhood is bordered by Nob Hill Blvd. & Suncrest Way to the North and South and by S 32 <sup>nd</sup> Ave. & S 36 <sup>th</sup> Ave. to the East and West. Approximately 300 parcels make up this community.
Neighborhood 3	This neighborhood does not have an official community name. Located in the eastern portion of the City, this neighborhood is bordered by Pine St. & Race St. to the North and South and to the East and West by S 2 <sup>nd</sup> St. & S 7 <sup>th</sup> St. There are approximately 240 parcels within this community.



#### 4.4 Data Needed to Meet Objectives

The data listed in Table 4.4 is required to meet the objective of the study.

**Table 4.4 Data Needed to Meet Objectives**

Data Type	How Data Will Be Collected	Purpose
List of Target Neighborhoods	Boundaries provided by City, and Google Maps	Identifies the location of the target population for this study
Baseline Survey Data	Online questionnaire before implementing E&O campaign	Identify target audience knowledge about proper car wash BMPs and identifies barriers
Follow-Up Survey Data	Online questionnaire after implementing E&O campaign	Evaluate whether the E&O program had an impact on the target audience's perception and behavior
Baseline Observational Data	Drive-by site visit; inspect for evidence of residential car washes	Measure baseline car washing techniques and behaviors
Follow-Up Observational Data	Drive-by site visit; inspect for evidence of residential car washes	Measure adoption of targeted behaviors

#### 4.5 Tasks Required to Conduct Study

Table 4.5 provides a summary of the tasks required to conduct the study and the corresponding project deliverables.

**Table 4.5 Tasks Required to Conduct Study**

Task Title and Description	Deliverable
<b>1.0 Develop Study Design and QAPP</b> <ul style="list-style-type: none"> <li>Proposal Development</li> <li>QAPP Development</li> <li>Ecology Proposal Review</li> <li>Proposal and QAPP Revisions</li> </ul>	<ul style="list-style-type: none"> <li>Study Design Description (submitted to Ecology before 6/30/21)<sup>1</sup></li> <li>Draft and Final QAPP (includes Detailed Study Design Proposal)<sup>1,2</sup></li> <li>Responses to TAG and Ecology Comments</li> </ul>
<b>2.0 Data Collection &amp; Analysis</b> <ul style="list-style-type: none"> <li><u>Identify Target Audience</u> – identify the target neighborhoods in the City of Yakima.</li> <li><u>Baseline Observational Drive-By Visit</u> – record observation of areas where car washing practices take place.</li> <li><u>Baseline Survey</u> – deploy survey prior to E&amp;O program.</li> </ul>	<ul style="list-style-type: none"> <li>List/Description of Target Neighborhoods</li> <li>Baseline Observational Drive-By Visit Data</li> <li>Baseline Survey Results</li> <li>Draft and Final E&amp;O Materials</li> <li>Follow-Up Survey Results</li> </ul>

Task Title and Description	Deliverable
<ul style="list-style-type: none"> <li>• <u>Development of E&amp;O Program</u> – develop E&amp;O program and materials in English and Spanish.</li> <li>• <u>Deploy and Redeploy E&amp;O Materials</u> – provide E&amp;O materials to residents of Yakima, with a greater focus on residents in Neighborhood 1, Neighborhood 2, and Neighborhood 3.</li> <li>• <u>Follow-Up Survey</u> – deploy a second survey after the E&amp;O program has taken place with an additional question to filter between baseline and follow-up survey respondents.</li> <li>• <u>Follow-Up Drive-By Observation Visit</u> – record observations of areas where car wash practices take place.</li> <li>• <u>Analyze Baseline Survey Results</u> – use survey results to determine the baseline for understanding of awareness and adoption of targeted behaviors.</li> <li>• <u>Analyze Follow-Up Survey Results</u> – use survey results to measure understanding of awareness and adoption of targeted behaviors.</li> <li>• <u>Compare Results of Surveys and Observational Data</u> – compare the results between all baseline and follow-up surveys and drive-by visits to measure adoption of targeted behaviors and change in awareness and adoption of proper car washing BMPs.</li> <li>• <u>Manage Technical Advisory Group (TAG)</u> – review the project status, work complete, collect comments on the work complete and coordination for audits, data verification and document review.</li> </ul>	<ul style="list-style-type: none"> <li>• Follow-Up Observational Drive-By Visit Data</li> <li>• Responses to TAG and Ecology Comments on deliverables</li> <li>• TAG Meeting PowerPoint Presentations</li> </ul>
<p><b>3.0 Technical Report</b>            Develop annual reports, study fact sheet, and technical report, as defined in the QAPP Section 14.0. This will include analyzing and interpreting the data collected during the study.</p>	<ul style="list-style-type: none"> <li>• Draft and Final Annual Report Project Summary<sup>1</sup></li> <li>• Draft and Final Fact Sheet<sup>1</sup></li> <li>• Draft and Final Technical Evaluation Report (TER)<sup>1</sup></li> <li>• Responses to Ecology Comments</li> </ul>

<sup>1</sup> Submittals to Ecology.

<sup>2</sup> The QAPP submitted to Ecology meets the requirements of both the Detailed Study Design Proposal and QAPP for an Effectiveness study. As such, the QAPP will be submitted to Ecology as a Detailed Study Design Proposal and a QAPP.

#### 4.6 Potential Constraints

Potential constraints are defined as conditions which may impact the project schedule, budget, and scope. Table 4.6 lists potential constraints, as well as the actions to be taken to mitigate the

impact of the conditions. Additional details regarding strategies for mitigating these constraints are discussed in Section 7.0 and are part of the study design and implementation.

**Table 4.6 Potential Constraints**

<b>Potential Constraint</b>	<b>Mitigation Approach</b>
Residents' lack of access to a computer to take online survey	Survey provided online and can be accessed via smart-phone, public computer access, or any other technology with internet access. Follow-up survey will be available via a tablet at a booth at the Central Washington State Fair (see Section 7.1).
Language barrier	English and Spanish versions of E&O materials and survey will be provided to reach a larger audience (see Section 7.4).
Residents not being aware of survey	A multimedia format will be used to advertise the survey: doorknockers, newspaper advertisement, banner on City's website homepage with link to the survey, social media posts, and in-person at a booth at the Central Washington State Fair (see Section 7.1).
Residents' unwillingness to complete survey	Incentives will be offered upon completion of the survey at the Central Washington State Fair, such as free car wash coupons or car towels (see Sections 8.2.2 and 8.2.3).
High number of respondents during Central Washington State Fair who haven't seen E&O materials	The survey questions for the Baseline and Follow-Up surveys will be the same, and a question will be included on both surveys asking respondents whether they have seen the E&O materials (see Sections 8.2.2 and 8.2.3).
Limited City of Yakima stormwater personnel to do field work	Contributing entities to assist with field work and other duties (see Table 5.1).
Difficulty collecting residential car washing observational data during working hours during the work week	The observational data will be collected by staff on at least one day on two consecutive weekends (see Section 8.2.1 and 8.2.4).
Inconsistent responses provided on survey	Utilize carefully worded questions to guide participant responses through the survey. Survey will be pilot tested before providing to target audience. Responses will be coded using a consistent process and validated (see Section 8.1).
Educational materials not reaching every household member that drives at least one vehicle	A multimedia approach will be used to distribute the E&O materials which should support reaching a wide demographic of people (see Section 7.1).

<b>Potential Constraint</b>	<b>Mitigation Approach</b>
Residents' unwillingness to adopt target behavior	The study will identify barriers to adoption of behaviors and will address solutions to overcome these barriers during implementation of the revised E&O program in 2022 (see Section 7.1).
Residents falsely answering survey questions due to social-desirability bias	Survey questions will be written in neutral voice that does not influence residents to select a desired answer (see Section 6.0).

## 5.0 Organization and Schedule

### 5.1 Key Project Team Members: Roles and Responsibilities

**Table 5.1 Key Project Team Members: Roles and Responsibilities**

Key Team Members	Role	Contact Information
Randy Meloy City of Yakima	Lead Entity <sup>1,3,5,7,8</sup>	<a href="mailto:randy.meloy@yakimawa.gov">randy.meloy@yakimawa.gov</a> (509) 576-6606
Jack Wells Yakima County	Contributing Entity <sup>4,5,6,7,8</sup>	<a href="mailto:jack.wells@co.yakima.wa.us">jack.wells@co.yakima.wa.us</a> (509) 574-2350
Erin Barnett City of Selah	Contributing Entity <sup>4,6</sup>	<a href="mailto:Erin.Barnett@selahwa.gov">Erin.Barnett@selahwa.gov</a> (509) 698-7331
Raul Sanchez City of Sunnyside	Contributing Entity <sup>4,5,6,7</sup>	<a href="mailto:rsanchez@sunnyside-wa.gov">rsanchez@sunnyside-wa.gov</a> (509) 836-6566
David Dominguez City of Union Gap	Contributing Entity <sup>4,6,9</sup>	<a href="mailto:david.dominguez@uniongapwa.gov">david.dominguez@uniongapwa.gov</a> (509) 249-9211
Jeff Wiemer Asotin County, City of Asotin, & City of Clarkston	Contributing Entity <sup>5,6,10</sup>	<a href="mailto:jwiemer@co.asotin.wa.us">jwiemer@co.asotin.wa.us</a> (509) 243-2071 Ext. 1430
Bill Aukett City of Moses Lake	Contributing Entity <sup>6,13</sup>	<a href="mailto:baukett@cityofml.com">baukett@cityofml.com</a> (509) 764-3792
Andrea Jedel Department of Ecology	Ecology Approval	<a href="mailto:ajed461@ecy.wa.gov">ajed461@ecy.wa.gov</a> (509) 575-2807
Brandi Lubliner Department of Ecology	Ecology Approval	<a href="mailto:brandi.lubliner@ecy.wa.gov">brandi.lubliner@ecy.wa.gov</a> (360) 407-7140
Aimee Navickis-Brasch, PhD, PE Osborn Consulting, Inc.	Principal Investigator <sup>2</sup>	<a href="mailto:aimeen@osbornconsulting.com">aimeen@osbornconsulting.com</a> (509) 995-0557
Taylor Hoffman-Ballard, PE Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:taylorh@osbornconsulting.com">taylorh@osbornconsulting.com</a> (952) 836-7863
Makenna Lindberg Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:makennal@osbornconsulting.com">makennal@osbornconsulting.com</a> (425) 451-4009 Ext. 108
Nicole Chen Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:nicolec@osbornconsulting.com">nicolec@osbornconsulting.com</a> (206) 628-9133 Ext. 232
Mark Maurer Osborn Consulting, Inc.	QA/QC Lead <sup>12</sup>	<a href="mailto:markm@osbornconsulting.com">markm@osbornconsulting.com</a> (509) 867-3654

1. Lead Entity Project Manager – Responsible for ensuring the study is conducted as described in this QAPP. The Project Manager is the primary point of contact for the lead entity.
2. Principal Investigator – Responsible for developing the Ecology approved Detailed Study Design Proposal, Quality Assurance Project Plan (QAPP), Technical Evaluation Report (TER), and Fact Sheet, as well as conducting the study.
3. Study Financial Support – Responsible for the study cost, except costs related to TAG management.
4. TAG Financial Support – Responsible for TAG management costs.
5. E&O Materials Financial Support – Responsible for providing E&O materials for the Central Washington State Fair or another event during the study.

6. Technical Advisory Group (TAG) Member – The goal of the TAG is to provide insight, suggestions, and professional opinions to the Principal Investigator throughout the study. The primary responsibilities of TAG members include attending up to six project meetings (by webinar or in person) and participating in the meeting discussion; review and provide comment on research materials (i.e., QAPP, data collected, data analyzed, final report, etc.) prior to the lead entity submitting the documents to Ecology. Members of the TAG may also serve as an Auditor to verify the study conforms to the plan and procedures as defined in the QAPP and/or a Data Verifier who reviews the analyzed data and verifies the analysis is correct and that the data being analyzed matches the data collected.
7. Distribution of Materials – The contributing entity will hand deliver materials relevant to the study to specific neighborhoods that are identified when the QAPP is developed. Material may include fliers about the survey or the educational materials that are developed. It is anticipated that the fliers will be hand delivered and left on the front door of residents’ homes in the target areas.
8. Observational Data Collection – The contributing entity will conduct drive-by visits in target areas on two consecutive weekends, and on at least one day per weekend in July and in September. The contributing entity will record observations made regarding evidence of residential car wash behavior during the visits.
9. Data Verifier – Data verifiers will review the analyzed data and verify the analysis is correct and that the data being analyzed matches the data collected.
10. Auditor – Responsible for conducting audits to verify the study conforms to the plan and procedures of this document. This may include: verifying staff collecting the data are trained and follow SOPs for data collection; verifying data management procedures are followed including reviewing data records to ensure they are consistent, correct and complete, with no errors or omissions; and traveling where the data is stored to review the data records compared to the QAPP Data Management Plan. Auditors will report their findings directly to the Lead Entity PM.
11. Research Assistant – Responsible for assisting the Principal Investigator.
12. QA/QC Lead – Responsible for providing QA/QC review of reporting related to study.
13. Commercial Car Wash Usage Data Collection – Responsible for requesting and obtaining (if possible) commercial car wash usage data from all commercial car washes in the City of Yakima for at least the previous two years through October 2021.

Confirmation of each contributing entity’s roles was provided in the form of a letter. The letters from each contributing entity are included in Appendix H.

## 5.2 *Project Schedule*

A billable task timeline based on quarterly tasks is shown in Table 5.2.

City of Yakima  
Car Wash Wastewater Management E&O Effectiveness Study

**Table 5.2 Proposed Study Timeline**

Task #	Task Description	2021										2022		
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
<b>1</b>	<b>Project Management</b>													
	Project Setup/Closeout													
	Project Schedule Management													
	Client Meetings													
	Invoicing / Status Reporting													
<b>2</b>	<b>Design Study</b>													
	Draft & Final Brief Study Description	Note 1												
	TAG Review													
	Draft Proposal			Note 1										
	Ecology & TAG Proposal Presentation				TG									
	Draft QAPP													
	TAG Review				TG									
	Ecology Review (ER)				ER									
	Final QAPP				Note 1									
<b>3</b>	<b>E&amp;O Program Development</b>													
	Draft & Final Slogan													
	TAG Review (TG)				TG									
	Draft & Final Brochure													
	TAG Review (TG)				TG									
	Deploy E&O Program													
	Modify & Replot E&O Program													
<b>4</b>	<b>Conduct Effectiveness Study</b>													
	Survey Development													
	Pilot Test Survey			TG										
	Deploy Pre-Survey				Note 1									
	Deploy Post-Survey													
	Data Analysis & Management													
	Audits & Data Verification				TG	TG	TG			TG				
	Report Data - Graphs/Figures/Tables													
<b>5</b>	<b>Manage TAG</b>													
	Assemble TAG													
	TAG Meeting 1			TG										
	TAG Meeting 2				TG									
	TAG Meeting 3							TG						
	TAG Meeting 4									TG				
<b>6</b>	<b>Report Study Findings</b>													
	Draft & Final Annual Report													
	Draft & Final Fact Sheet											Note 2		
	TAG Review (TG)											TG		
	Draft Technical Evaluation Report										Note 3,4			
	TAG Review (TG)										TG			
	Ecology Review (ER)											ER	ER	
	Final Technical Evaluation Report													

Note 1. Permit deadlines associated with S8.A are as follows: Brief Study Description - 6/30/2021; Detailed Study Design Proposal - 9/30/2022; QAPP - 7/31/2023; Begin to conduct study - 12/1/2023.

Note 2. Per S8. the fact sheet is due 90 days after completing study.

Note 3. Per S5.B.1.b permitting shall measure the understanding, adoption, and evaluate changes in targetted behavior and use results to direct E&O

Note 4. Per S8. the TER is due 60 days after completing study.

### 5.3 Budget and Funding Sources

Per City of Yakima, funding for the project will primarily come from the City of Yakima with additional support from participating entities. The Yakima-area programs – specifically Yakima County, Selah, Union Gap, and Sunnyside – will provide the TAG member management cost (Task 5) of the study. A portion of the funding for E&O materials (not included in table below) will be covered by Asotin County, City of Asotin, and City of Clarkston. A budget for the study is included in Table 5.3.

**Table 5.3 Summary of Fees by Task**

<b>Task #</b>	<b>Task Name</b>	<b>Fees</b>
1	Project Management	\$18,341
2	Develop Study Design	\$29,800
3	Develop and Implement Education and Outreach Program	\$22,077
4	Conduct Study	\$27,325
5	Manage Technical Advisory Group	\$21,823
6	Report Study Findings	\$25,388
<b>Total:</b>		<b>\$144,754</b>



## 6.0 Quality Objectives

This section of the QAPP provides a roadmap of the quality assurance and quality control (QA/QC) plan that will be implemented in the experimental design and employed throughout the study.

The purpose of a QAPP is to ensure that the data collected during the study is scientifically and legally defensible (Washington State Department of Ecology, 2018). The QAPP documents how quality assurance (QA) and quality control (QC) will be applied to a research project to assure that the results obtained are of the type and quality needed and expected. The QA/QC plan for this study is embedded throughout the QAPP and emphasizes how the data quality indicators (DQIs) and respective measurement performance criteria (MPCs) are addressed during the study.

DQIs are qualitative and quantitative measures that characterize the aspects of quality data (EPA, 2006). DQIs are goals for data quality that are specific to each study. DQIs are intended to minimize error and improve the accuracy of the data. DQIs guide the development of the experimental design as well as the process of creating and analyzing data. The seven principle DQIs for this study are:

- Validity
- Reliability
- Objectivity
- Credibility
- Transferability
- Completeness
- Integrity

Once established, the DQIs provide the basis for the MPCs, which are the acceptance criteria for the DQIs, that specify how good the data must be to meet the project objectives. Table 6.1 first defines each DQI, then the approach for addressing DQIs and the respective MPCs for this study.

Reference Section 12.0 for details regarding the process that will be employed to evaluate the quality and usability of the data for meeting the project objectives, which is based primarily on whether the MPCs were met for the applicable DQIs.

**Table 6.1 Summary of the Seven Principle Data Quality Indicators (DQIs) and Associated Measurement Performance Criteria (MPCs)**

Data Quality Indicator (DQI)	Approaches for Addressing DQI in Studies	Approaches for Writing Measurement Performance Criteria (MPCs)
<p><b>Validity</b> – Closeness between the measured value and the true value. An instrument is considered valid when it measures what it is purported to measure (Biddix, 2016; Radhakrishna, 2012).</p>	<ul style="list-style-type: none"> <li>• Survey designed for this study was developed using literature regarding proper car wash wastewater management (see Section 3.3).</li> <li>• Survey questions were written in language that is accessible to the target audience (i.e., general public).</li> <li>• Survey questions will be pilot tested by Consultant staff to validate instruments before broad application (see Section 8.3).</li> </ul>	<ul style="list-style-type: none"> <li>• Pilot testing the survey and observational data checklist will be used to validate the instruments (see Section 8.3). The MPC for this DQI is that the group pilot testing mutually agrees on the interpretation of the survey and interview questions.</li> </ul>
<p><b>Reliability</b> – The degree to which an instrument produces stable and consistent results on repeated measurements (Radhakrishna, 2012). The level of precision or reliability, also called sampling error, is the range in which the true value of the population is estimated to be.</p>	<ul style="list-style-type: none"> <li>• SOPs are defined and consistently followed for collecting and measuring data (Section 8.2).</li> <li>• Multiple instruments will be used to collect data: participants will be able to access both surveys online and observational data will be collected via a written form to verify survey responses.</li> <li>• Survey questions will be pilot tested by Consultant staff to validate instruments before broad application (see Section 8.3).</li> </ul>	<ul style="list-style-type: none"> <li>• Audits will be used to verify procedures are being followed. Data will be considered acceptable if it is being collected in accordance with SOPs (see Section 11.0).</li> <li>• See description of pilot testing MPCs for validity.</li> <li>• Responses from the surveys and observational data will be compared for consistency. The MPC for this DQI is that the responses are consistent; if the responses are not consistent, procedures are described in Section 13.1.</li> </ul>
<p><b>Objectivity</b> – Attempt to diminish or eliminate the investigator’s bias (Clark, 1994). An objective investigator is neutral and open all sides of the argument without imposing their own bias, motivations, interested or perspectives (Guba, 1981; Radhakrishna, 2012).</p>	<ul style="list-style-type: none"> <li>• Data analysis procedures and methods are used that are appropriate for the types of data collected (see Section 13.0).</li> <li>• Data coding and hypothesis testing will be used to provide evidence that conclusions are based on findings.</li> <li>• SOPs are defined and will be consistently followed during the survey and observational data collection (see Section 8.2).</li> </ul>	<ul style="list-style-type: none"> <li>• The survey and observational data SOPs will be followed for all participants.</li> <li>• Peers debriefing will be used to validate coding and the group will mutually agree on the interpretation of the coding (see Section 13.0).</li> <li>• Hypothesis testing will be used to compare baseline and follow-up E&amp;O program implementation data at a defined confidence interval (see Section 13).</li> </ul>
<p><b>Completeness</b> – The amount of valid data needed to be obtained from the measurement system (Lombard &amp; Kirchner, 2004). Data is considered complete when: the sample size is representative of the target population.</p>	<ul style="list-style-type: none"> <li>• The sample size is 500-1,000, which is equivalent to a 95% or higher confidence interval (see Section 7.2).</li> <li>• Procedures for handling missing data are defined in Section 10.3.</li> <li>• Missing data will be reported with appropriate coding.</li> </ul>	<ul style="list-style-type: none"> <li>• The sample size identified for the study is consistent with the number who participated in the study.</li> <li>• Procedures for handling missing data and coding defined in Section 10.3 are followed.</li> </ul>

	<ul style="list-style-type: none"> <li>• Results will include consideration for how missing data from the survey or interview could limit transferability of the data set.</li> </ul>	
<p><b>Credibility</b> – Credibility is often referred to as social desirability bias. This describes a type of response bias where survey respondents answer questions in a manner they believe will be viewed favorably by others. It can take the form of over-reporting "good" or under-reporting "undesirable" behavior (Grimm, 2010).</p>	<ul style="list-style-type: none"> <li>• Careful consideration was taken regarding social desirability bias and questions were phrased to not lead respondents to the socially appropriate answer. (see Section 8.2).</li> <li>• Multiple types of instruments and sources will be used to collect and cross check survey responses. Specifically, observational data collected will be used to check survey responses provided by the public (see Section 13.1).</li> </ul>	<ul style="list-style-type: none"> <li>• Responses from the survey and observational data will be compared for consistency. The MPC for this DQI is that the responses are consistent; Section 13.2 describes the procedures to deal with inconsistent responses.</li> <li>• Mixed methods will be used to collect data including the survey and observational data. The MPCs with respect to this DQI are as described in the previous bullet.</li> </ul>
<p><b>Transferability</b> – The extent to which sample data can be transferred from a sample to a population. Datasets are considered transferable if the instruments, data sources, data collection procedures, sample selection procedures, and reporting are equivalent (Washington State Department of Ecology, 2011).</p>	<ul style="list-style-type: none"> <li>• The City of Yakima residents who drive one or more vehicles were defined as the target audience. The study area is within the City limits.</li> <li>• The sample size is 500-1,000, which is equivalent to a 95% or higher confidence interval (see Section 7.2).</li> </ul>	<ul style="list-style-type: none"> <li>• Data will be considered transferable if the participants or target audience being assessed consists of residents who drive one or more car and live in the City of Yakima limits.</li> <li>• The sample size identified for the study is consistent with the number who participated in the study.</li> </ul>
<p><b>Integrity</b> – Integrity is concerned with minimizing errors through the process of collecting, recording, and analyzing data (Radhakrishna, 2012).</p>	<ul style="list-style-type: none"> <li>• SOPs will be consistently followed during data collection (see Section 8.2).</li> <li>• Data recording and reporting procedures were developed (see Sections 8.2 and 10.2).</li> <li>• The survey and observational data checklist are standard forms which will be used to collect all data.</li> <li>• Data will also be reviewed to ensure it has been properly recorded.</li> <li>• The research team will develop and consistently follow SOPs during data collection.</li> </ul>	<ul style="list-style-type: none"> <li>• Audits will be used to verify that procedures are being followed. Data will be considered acceptable if it is being collected in accordance with SOPs (see Section 11.0).</li> <li>• All those involved in data collection will collect data according to the SOPs and be trained prior to data collection.</li> <li>• Because data being collected is not paired, observational data will be used to verify that survey data accurately reflects changes in awareness and behavior. If the survey responses are found to be similar to observational data collected, it will be assumed that the participant’s survey responses accurately reflect the implementation of proper car wash BMPs.</li> </ul>

## 7.0 Experimental Design

### 7.1 Study Design

This study will evaluate Yakima’s car wash E&O program by utilizing surveys to the target audience as well as observational data from specific neighborhoods. The surveys will be distributed before and after the implementation of the E&O program to gather information regarding awareness and adoption of proper car wash BMPs by residents who drive one or more vehicles. The results of the first survey will be used as a baseline to measure awareness and behavior before the E&O program. The observational data will be collected before and after the implementation of the program in the form of drive-by visits in the target neighborhoods discussed in Section 4.3. The observational data will be used to assess the validity and credibility of the survey data. The following paragraphs provide an overview of the study design, specifically, the E&O program and target population, instruments used to collect data, the approach to evaluating effectiveness and measuring adoption of behaviors, and justification for selecting the approaches noted. The subsequent sections (Sections 7.2-7.5) provide more details regarding the study design.

The target populations for this study are Yakima residents; specifically, those who drive one or more vehicles. Justification for selecting the target population is provided in Section 7.2, and a list of the targeted neighborhoods will be included in data collected for the study (see Section 7.3). The targeted behavior of this study is to adopt the car washing BMPs stated in Section 3.3, which prevent car wastewater from entering storm drains and discharging to receiving waterbodies. The E&O program being developed and implemented by the City is meant to provide information to residents regarding the targeted behavior and inform the target audience about how car wash wastewater impacts the water quality of waterbodies (see Section 7.4). The E&O program will be distributed either in person or online (see Appendix D, E). The study intends to measure the effectiveness of the new E&O program, and the following paragraphs detail how data collection will occur during the development and implementation of the E&O program.

At the start of the study, before the E&O program begins, a baseline survey will be distributed to the target population. The baseline survey will be released in late July when car washing is expected to occur and will be available on SurveyMonkey® (Momentive™) or a similar platform. The baseline survey link will be accessible through the City of Yakima’s website, the City’s social media posts, and a newspaper advertisement. In addition, a doorknocker will be distributed with information about the survey in the target neighborhoods. To increase the survey response rate, incentives will be offered to people who complete the survey, such as commercial car wash coupons. The survey is located in Appendix B and contains questions designed to gauge awareness and adoption of car wash BMPs, as well as residents’ knowledge of the impacts of car wash wastewater on receiving waters. The BMPs on the survey were identified in literature specific to car wash wastewater management (see Section 3.3) and include:

- Use commercial car washes
- Divert car wash wastewater to permeable surfaces or away from storm drains
- Avoiding using soap, or use biodegradable, chlorine-free and phosphate-free soap
- Only wash the exterior of the car (excluding undercarriage, wheel wells, and engine)

- Reduce the frequency of residential car washing
- Reporting spills

Additionally, the survey will include questions asking respondents whether they have seen E&O materials related to car wash wastewater and, if so, when they saw them and where they found the materials (e.g., utility bill, doorknocker, fair booth, etc.). For the baseline survey, information about whether respondents have seen the materials will be used to confirm the survey is a baseline (pre-E&O program) measurement, and that there aren't other E&O programs being implemented on car wash wastewater. The same questions will be included on the follow-up survey distributed later in the year.

Baseline observational data will be collected at approximately the same time the baseline survey is distributed. Observational data will be collected through drive-by visits of the three target neighborhoods (see Sections 4.3 and 7.3) and will note evidence of car washing behaviors on the observational checklist in Appendix C. The lead and/or contributing entities will perform the data collection on at least one day for two consecutive weekends. A map of parcels in each neighborhood will be used to ensure observational data is collected for each household. Observational data that will be collected for each parcel focuses on whether car washing is occurring, if preferred car washing BMPs are practiced, and whether there is evidence that car wash wastewater flows into the storm system.

Following the baseline survey distribution and observational data collection, the E&O program will be implemented with materials expected to be distributed in August through late September. The E&O materials (Appendix D) will be distributed in person as well as online. Distribution will include:

- The E&O materials in Appendix D will be printed in the format of doorknockers, which will be distributed to homes in the target neighborhoods. The back of the doorknocker will include information about the follow-up survey with a web link.
- To reach a wider audience, the materials will also be distributed through the City of Yakima's website, the City's social media posts, and the Central Washington State Fair.

Beginning at the Central Washington State Fair in late September, the follow-up survey distribution will begin. The follow-up survey will also include questions asking respondents whether they have seen the E&O materials and, if so, when they saw the materials and where they found the materials (e.g., utility bill, doorknocker, fair booth, etc.). Information about when and where respondents found the materials will be collected and used to determine how best to distribute the E&O materials in the future. Only responses that indicate they have read the materials will be included in the follow-up data set. Responses that indicate they have not read the materials will be included in the baseline data set. Material distribution will include:

- City of Yakima and other contributing entities will have a booth at the fair with - staff distributing brochures (see Appendix D) and stickers of the E&O program slogan and logo (see Appendix D). The back of the brochure will include information about the survey with a web link and QR code to take the survey.

- Staff will encourage people attending the fair to take the survey using a smart phone or with tablets provided by participating entity staff.
- To increase the survey response rate at the fair, incentives will be offered to people who complete the survey, such as towels for car washing. The E&O program slogan and logo will be printed on the towel.
- Doorknockers will again be distributed to homes in the target neighborhoods. In addition, the materials will also be distributed through the City of Yakima's website, the City's social media posts, a newspaper advertisement, and a QR code with the survey link located on water utility bills.

Follow-up observational data will be collected at approximately the same time as the follow-up survey is distributed after the fair. Observational data will again be collected through drive-by visits of the three target neighborhoods (see Sections 4.3 and 7.3) using the same observational checklist in Appendix C. The lead and/or contributing entities will perform the data collection on at least one day for two consecutive weekends.

Following data collection, the effectiveness of the E&O program and adoption of targeted behaviors will be evaluated using the methods defined in Section 13. The results of each site visit and associated survey and observational data will be compiled and compared (baseline vs. follow-up) to determine whether there is a change in the target audiences' behaviors and understanding of the impacts of car wash wastewater on receiving waters following implementation of the E&O program. A Likert Scale will be used to convert qualitative survey and observational data to quantitative data, and the percentage of residents using preferred car wash wastewater BMPs will be calculated. The survey and observational data from the site and drive-by observational visits will be scored separately and compared to determine whether the survey results accurately represent what is observed in the field. This comparison will support whether the MPC for Credibility is achieved (see Section 6 and Table 6.1). If survey data and observational data do not match for a particular BMP, the survey data will be flagged (see Section 13) to indicate that there was a discrepancy between the survey responses and observed condition in that target neighborhood. The process described in this paragraph will be repeated for the survey and observational data created during the follow-up site and drive-by visits.

Once the data has been compiled, the data sets will be compared to assess the effectiveness of the E&O program. The program will be considered effective if there is a statistically significant increase in the target audiences' awareness about the impact of their actions on receiving water quality, as well as an awareness and adoption of proper car washing BMPs. If the differences are insignificant, then the survey responses will be evaluated to develop recommendations for modifying the E&O program. For example, responses related to barriers for implementing preferred car wash BMPs will be evaluated to identify modifications to the E&O program that could remove barriers. Survey responses regarding where the respondent saw the E&O materials will also be evaluated to recommend places where these materials should be distributed in the future. Additional details regarding the evaluation of effectiveness are described in Section 13.0.

Please note: at the time this QAPP was submitted, commercial car wash usage data was being investigated as additional data that could be used to verify the survey responses and supplement observational data. Commercial car wash usage data, if it is available, will be requested for at least the previous two years through October 2021. The contributing entity who will request the data is documented in Table 5.1 and discussion of car wash usage data and data analysis is included in Section 13.

## *7.2 Process for Selecting the Test-Site and Target Population*

The test site for the study consists of residences in the city limits of Yakima, Washington, and the target audience is City of Yakima residents who drive, own, and maintain at least one or more vehicles. Residents have been observed by City staff washing cars at their homes and allowing the wash wastewater to enter storm drains in the street. Because of these observations and because no prior E&O program has been implemented targeting this behavior, the City elected to target this audience for this study. The following paragraphs describe how the target population and sample size were selected.

The population of the City of Yakima is 93,637 according to 2019 United States Census data (United States Department of Commerce, 2019), with approximately 34,000 households. Assuming the national average of 91.3% of households have access to vehicles (Peterson, 2021) is applicable in the City of Yakima, then the target audience for this study is approximately 31,000 households.

The sample population was estimated based on previous studies conducted on car wash wastewater management behaviors (see Section 3.3) and confirmed with published tables. Both methods are documented as acceptable approaches for selecting a sample size based on the target population size (Israel, 1992). The studies reviewed in Section 3.3 had sample sizes ranging from approximately 500 for a target population of approximately 50,000 people (Trechter, Janke, Hadley, & Parks, 2008), to 1,000 for a target population of approximately 26,000,000 people (Bartlett, 2005). Given the City of Yakima population is within that range, it is expected that a sample size between 500 to 1,000 would be appropriate. In a fact sheet published by the University of Florida (Israel, 1992), tables are provided that identify sample sizes obtained based on the size of the target population and a confidence interval. For a target population of 31,000 households, a sample size of 400 responses and 1,000 responses is associated with a 95% and 97% confidence interval, respectively. The three neighborhoods targeted for observational data (see Section 4.3) contain approximately 700 parcels, which also falls within the range of 400 to 1,000 households (from Section 3.3 studies) exceeding a confidence interval of 95%. Since a confidence interval of 95% is a commonly accepted level for most research studies, 400 survey responses and data collected from observational data should be sufficient. To compensate for unknowns regarding the representativeness of the population in the target neighborhoods compared to the general populations in Yakima and since observation data is not collected every day of the study, it is desirable to obtain a sample size of responses and observational data from 500 to 1,000.

## *7.3 Type of Data being Collected*

The data required to meet the objectives of this study are described in Table 7.3.

**Table 7.3: Summary of data being collected**

Data Type	Location of Collection	Frequency of Collection	Number of Samples	Purpose
List of target neighborhoods and parcel maps (before data collection starts)	City of Yakima	One-time	3 (one for each neighborhood)	This study will focus on three participating neighborhoods (see Section 4.3) to collect observational field data to measure before (baseline) and after (follow-up) the E&O program. The targeted neighborhoods will receive E&O materials at their homes after the baseline survey data has been collected.
Reponses from Baseline and Follow-up Surveys	SurveyMonkey® (Momentive™) or similar	Two times during the study (prior to and after E&O program implemented)	500-1,000 per time	Survey responses will be provided from the online questionnaire and used to gather information regarding implementation of target behaviors (use of car washing BMPs) by residents who drive one or more vehicles. The responses will be compared against observational data for any differences in apparent practices that may be used. This information will be analyzed with observational data to evaluate and compare the effectiveness of the E&O program. Lastly, the information will be used to identify barriers prohibiting adoption of the targeted behaviors.
Baseline & Follow-Up Observational Data including parcel maps indicating which properties observational data was collected (baseline and follow-up)	Target Neighborhoods (See Section 4.3)	Two times during the study (prior to and after E&O program implemented)	Up to 700 per time	The purpose of collecting observations is to validate the findings from the survey. Observational data will consist of documenting whether there is any evidence of car washing including whether preferred car washing BMPs were used. This data will be used to compare any differences between survey responses and apparent practices that may be used. This information will be analyzed with survey responses to evaluate and compare the effectiveness of the E&O program.



#### **7.4 Implementation of E&O Program Component during the Study**

There is currently no known E&O program in the City of Yakima or Yakima County that addresses the impacts of and proper practices to manage car wash wastewater. As described in Section 7.2, improper practices have been observed by City staff in the target neighborhoods described in Section 4.3. An E&O program to address these behaviors has been developed as part of this study (see Appendix D) and will be implemented during this study to target the general public, specifically the City of Yakima residents who drive one or more vehicles, about the impacts of car wash wastewater entering storm drains and proper car washing BMPs that will prevent the car wash wastewater from entering the storm system.

The materials that have been developed for the E&O program as part of this study will include doorknockers, stickers, brochures, and towels for use during car washing. The doorknockers will be delivered in-person to homes in the target neighborhoods. The other materials will be distributed at the Central Washington State Fair. Around the same time the doorknockers are being delivered, a copy of the brochure will be posted on the City website and social media posts will be created using the City of Yakima's social media accounts to reach a broader audience. Social media posts will include material consistent with the material included in the brochure (see Appendix D). The social media posts will be implemented through October, and a copy of the posts is included in Appendix E. Materials will be developed in English and Spanish, as the population of Yakima is 45.7% Hispanic or Latino (United States Department of Commerce, 2019). Materials used for the E&O program for this study can be found in Appendix D.

The distribution of the E&O program materials will be modified from what will typically be implemented to accommodate data collection. Specifically, it is not anticipated that in-person delivery of E&O materials (e.g., doorknockers) will occur in the future. The in-person delivery was included as part of the study for target neighborhoods to increase awareness and survey responses where observational data will be collected. After the study, it is anticipated that the materials will be distributed through social media posts during the summer months, when car washing is expected to occur, and at the Central Washington State Fair. Responses from a survey question regarding where the respondent saw the E&O materials will be evaluated to recommend how best to distribute the E&O materials after the study is complete. Results from the survey will also be used to determine whether the materials should be developed in more languages than English and Spanish.

#### **7.5 Other E&O Programs**

There are no other car wash E&O programs in the study area which may influence the target audience's responses. The target population for the study consists of City of Yakima residents who drive one or more vehicles. By excluding other jurisdictions and involving other jurisdictions in the area in the TAG, there should be no outside E&O programs to influence the target population's responses. Additionally, no residential car washing E&O program has previously been implemented in the City of Yakima and, therefore, should not influence the target population's responses.

## 8.0 Instrument Design and Development

This section describes the instruments that will be used during the study, the procedures used to collect data, and the process used to validate the instruments. The instruments for this study will be the survey (see Appendix B) and observational data, which is recorded via online survey platform [such as SurveyMonkey® (Momentive™)], as well as an observational checklist (see Appendix C).

### 8.1 Instrument Design

The instruments utilized for this study include a survey and observational checklist, which will be used to collect survey responses from Yakima residents and observational data in the target neighborhoods. The instruments were designed to meet the overall objectives of the study as well as the QA/QC objectives (see Section 6.0). The following paragraphs describe the survey and checklist in detail.

The survey will be disseminated via newspaper advertisement, social media posts, the City website, and the Central Washington State Fair. A copy of the survey can be found in Appendix B. The survey consists of 13 multiple-choice questions and is expected to take 5-10 minutes to fill out. The development of the questions was guided by literature detailing proper practices, which are summarized in Section 3.3. The questions are worded using language accessible to the target audience (i.e., City of Yakima residents) to improve validity. Additionally, during the development of this document, the consultant team pilot tested the survey to verify the interpretation of questions which supports the reliability of responses (see Section 6.0 and Table 6.1).

The survey questions were selected specifically to meet some of the objectives of the study including: understanding whether City of Yakima residents understand the impacts of car wash wastewater on receiving waters; understanding whether residents currently implement proper car wash BMPs; measuring adoption of targeted behaviors (i.e., use of proper practices); and evaluation of the effectiveness of the City's new E&O program related to car wash wastewater. The questions included in the survey were designed to collect this information, as well as address the QA/QC requirements in Section 6.0.

Observational data will be recorded through the use of a checklist in the field (see Appendix C). The observational data is expected to improve the reliability and credibility of the survey data (see Section 6.0 and Table 6.1); specifically, observational data will be compared to compiled survey responses during data analysis to verify that survey responses match what is occurring in the field in the target neighborhoods. If observational data for a particular target neighborhood does not match survey responses during data analysis, the data will be flagged and used to inform recommendations for E&O methods in the final report. If observational data and survey responses match, the MPCs are met (see Section 12 for further discussion).

To make accurate comparisons between baseline and follow-up survey data, it is important to attain sufficient responses. The goal is to obtain survey responses from a minimum of 400, with preferred responses from 500 to 1,000 residents (see Section 7.2). There are several strategies that will be employed to achieve the desired response rate, including survey design and

advertisement of the survey. The survey was designed using language that is clear and concise for those participating. This was achieved by pilot testing the survey, as described in Section 8.3. The number of survey questions was also limited so it will only take 5-10 minutes to complete. This was done because studies have found that shorter surveys have a higher response rate. A multimedia approach will be used to advertise the survey and make City of Yakima residents aware of the survey. Doorknockers, social media posts, a page on the City website, an advertisement in a local newspaper, and a booth at the Central Washington State Fair are expected to reach a wide range of the population and, thereby, increase survey responses.

## ***8.2 Standard Operating Procedures (SOPs) for Collecting Data***

Standard operating procedures (SOPs) will be consistently used during this study to describe how data should be collected. The use of SOPs also addresses Section 6.0 DQIs for Objectivity, Reliability, Integrity, and Transferability. The standard operating procedures (SOPs) that will be followed during this study include:

- Baseline Observational Drive-By Visit
- Baseline Survey
- Follow-Up Survey
- Follow-Up Observational Drive-By Visit

### ***8.2.1 Baseline Observational Drive-By Visit***

This section describes the procedures for performing the baseline drive-by visit of Neighborhood 1, Neighborhood 2, and Neighborhood 3. These drive-by visits are intended to collect observational data prior to the implementation of the E&O program, which is expected to occur approximately one month after baseline observational and survey data collection starts. The data recorded will reflect car washing behaviors of residents who drive one or more vehicles within these neighborhoods. The following steps will be completed for each of the three neighborhoods.

**Step 1:** In late July, on two consecutive weekends, and on at least one day per weekend, officials from the City of Yakima and contributing entities will drive to Neighborhood 1, Neighborhood 2, and Neighborhood 3 in any order of their choosing with a pen, parcel map, and an abundance of observational data forms (Appendix C) in their possession.

**Step 2:** The officials will slowly drive throughout the neighborhoods, driving down each street to observe each residence. During these drive-by visits, officials are looking for evidence of residents washing or recently having washed their vehicles. Data recorded may include methods that an individual is using to wash their car, the location where the car wash is taking or has taken place (grass, gravel driveway, paved road, etc.), whether soap suds are running into the paved roadway, or other applicable observations. The drive-by visits are anticipated to take approximately half a day.

**Step 3:** If there are any observations made, the official driving the vehicle is to park in a safe location and record observations on an individual observational data form (Appendix C). If there is no evidence of car washing, an observational form will not be completed. Each location where evidence of a car being washed is observed will be documented on a separate

observational form. The official will fill out the form with their name, date and time of the observation, name of the jurisdiction they work for, and the location of the car wash observation will be documented on a parcel map. The following section of the observational form provides checkboxes to fill in reflecting whether any car wash BMPs listed in Section 3.3 are being followed. In the next section of the form, the official will check *yes* or *no* if there is any evidence of car wash wastewater entering, or in, the storm drain system. If it appears water has flowed from a residence to the street, the downstream catch basin should be observed to determine if suds or soapy water is present. The final section of the form provides space for any other general descriptions of observations.

**Step 4:** Once the observational data form has been filled out entirely for that event, the official will move on and continue driving through the remainder of the neighborhood following the same protocol outlined in Steps 2-3.

**Step 5:** After each residence in a neighborhood has been observed for evidence of car washing, the official will follow Steps 2-4 for the remaining two target neighborhoods. If there is any car washing evidence witnessed en-route outside of these target neighborhoods, that observational data should also be recorded on a separate observational data form to supplement observational data.

**Step 6:** The data recorded on all observational data forms including the parcel map will be scanned and sent to the Principal Investigator for data analysis.

The observations from this baseline site visit will be recorded and saved for later access to compare data collected between drive-by visits. See Section 10.0 and Section 13.0 for further detail on how observational data will be reported and analyzed for the study.

### **8.2.2 Baseline Survey**

This section describes the procedures for advertising, distributing, and collecting the baseline survey answers. One survey was designed to collect both baseline and follow-up survey (see Appendix B). Any responses received prior to distributing the E&O materials will be included in the baseline data set. These steps will be intended to reach all residents throughout the City of Yakima who drive one or more vehicles.

**Step 1:** In late July, officials from the City of Yakima will post a survey (see Appendix B for survey questions) on an online platform such as SurveyMonkey® (Momentive™) for residents who live in the City of Yakima to access and fill out according to their personal knowledge and experience regarding car washing techniques.

**Step 2:** To get the word out about this baseline survey, the City will advertise the survey link through multiple platforms.

**Step 2.1:** The City of Yakima will post information about the online survey on social media posts. These posts will include a link to access the online survey (Appendix B). This will be released before the E&O program material is released.

**Step 2.2:** The City of Yakima will post a banner at the top of their City website homepage that will direct website-visitors to the website for the online survey by clicking on it (Appendix B).

**Step 2.3:** The Yakima Herald Republic will be an advertisement directing readers to the link for the online survey to copy into their search bar on their device and access the survey (Appendix B).

**Step 2.4:** Information about the survey will be delivered to the target neighborhoods via doorknockers containing a QR code.

**Step 3:** Once the link for the survey has been accessed, survey participants will be guided through the survey asking them to answer a series of questions regarding their vehicle washing habits, their knowledge of the impacts these practices may have on the downstream watershed, and what barriers may be preventing them from using environmentally safer practices.

**Step 4:** Once all questions have been answered, the survey will be submitted. The final page confirming the survey has been submitted will contain an alert that if the respondent is one of the first 200 people to bring a printout or screenshot of that page to the City's booth at the Central Washington State Fair, then they can receive a free car wash coupon at the booth. Once the survey is submitted, the Principal Investigator will have access to the data recorded from each survey.

The survey results from this baseline survey will be recorded and saved for later access to compare data collected between surveys. See Section 10.0 and Section 13.0 for further detail on how survey data will be reported and used for the study.

### **8.2.3 Follow-Up Survey**

This section describes the procedures for advertising, distributing, and collecting the follow-up survey answers. These steps will be intended to reach all residents throughout the City of Yakima who drive one or more vehicles.

**Step 1:** One survey was designed to collect both baseline and follow-up surveys (see Appendix B). If respondents indicate they have read the E&O materials, the response will be included in the follow-up data set. If the respondent indicates they have not read the E&O materials, the response will be included in the baseline data set. In addition, any responses received prior to distributing the E&O materials will be included in the baseline data set.

**Step 2:** The survey will be distributed using the same multimedia approach as described in Section 8.2.2, with the additional distribution at the Central Washington State Fair. At the fair, the survey will be introduced to potential respondents. Officials from the City of Yakima and contributing entities may elect to share the following information with the potential respondent to provide additional detail about the survey:

- Why interviews are being conducted

- Expected length of interview
- Expected number of questions

To incentivize greater survey participation at the fair, towels that advertise the E&O icon and slogan (see Appendix D), as well as Yakima Spill Hotline contact information, will be provided to those who choose to complete the survey. These items will be given to participants once the survey has been submitted.

**Step 3:** Once all questions have been answered, the survey will be submitted. Once submitted, the Principal Investigator will have access to the data recorded from each survey.

The survey results from this follow-up survey will be recorded and saved for later access to compare data collected between surveys. See Section 10.0 and Section 13.0 for further detail on how survey data will be reported and used for the study.

#### ***8.2.4 Follow-Up Observational Drive-By Visit***

This section describes the procedures for performing the follow-up drive-by visit of Neighborhood 1, Neighborhood 2, and Neighborhood 3. These drive-by visits are intended to collect observational data following the implementation of the E&O program. The data recorded will reflect car washing behaviors of residents who drive one or more vehicles within these neighborhoods. The steps will be the same as those included in Section 8.2.1, except the follow-up observational drive-by visit will occur on two consecutive weekends following the fair in late September to early October.

The observations from this follow-up observational site visit will be recorded and saved for later access to compare data collected between drive-by visits. See Section 10.0 and Section 13.0 for further detail on how observational data will be reported and used for the study.

#### ***8.3 Instrument Validation***

Validation is the process to verify that the instrument measures what it was intended to measure and produces stable results. Validation addresses MPCs for validity and reliability (see Section 6.0, Table 6.1). The survey and observational data checklist were validated using pilot testing. Pilot testing included a group of staff from Osborn Consulting taking the survey. Then this group met to compare interpretation of the questions. Where there are differences in the interpretation of the questions, the group discussed their interpretation and modified the questions until they mutually agreed on the interpretation of the wording.

## **9.0 Quality Control**

The purpose of this section is to describe the QC procedures that will be employed during the study to minimizing errors and support the integrity of the data through the process of collecting, recording, and analyzing data (Radhakrishna, 2012). This section describes the procedure for addressing Section 6.0 DQI/MPC for Completeness.

### **9.1 Study QC Procedures**

For all the data that will be created during this study, the following quality control procedures will be implemented to assure data reliability, integrity, and objectivity.

- SOPs were developed (see Section 8.2) that define procedures for collecting data. Prior to the start of data collection, all staff who collect data will be trained on the SOPs to ensure consistent responses.
- Data recording and reporting procedures were developed and will be consistently followed (refer to Section 10.0 Data Management Plan Procedures).
- Standard forms for data collection during interviews will be developed and consistently used to collect interview responses (see Section 10.0).
- Audits will be performed to verify that QAPP is being followed (see Section 11.0).
- The officials from the City of Yakima and contributing entities will be the same individuals for each study location.

### **9.2 Corrective Action**

Corrective actions are developed when it is found (through audits, for example) that part of the QAPP is not being followed. If a problem is identified, each issue will need to be evaluated to determine the potential impact on the project, which may include flagging data, rejecting data, and developing a corrective action plan to prevent these issues from occurring again. If problems arise during the study, a corrective action plan will be developed that includes procedures that will be followed to correct or compensate for problems. All corrective actions will be summarized in the table located in Appendix F and included in the final report. For example, if the SOPs are not followed during the observational data collection process, the data collected would be evaluated by the lead entity and the principal investigator as described in Section 12.2 and corrective action would be taken and documented to reduce any issues.

## 10.0 Data Management Plan Procedures

This section defines the data management plan; specifically, how the data collected will be managed, stored, and archived during the study. The purpose of the data management plans is to reduce the potential for errors during the data collection and analysis phases of the project; this also ensures that should an unanticipated change in Key Team Members take place, the project can be more easily continued by a new team member. This section describes the procedure for addressing Section 6.0 DQI/MPC for integrity.

### 10.1 Data Identification

The data in this study will be confidential because no identifying information about the participant is requested. Each survey will be submitted online and logged with a unique identification number that corresponds with the order in which the survey was submitted, as well as the day/time it was submitted/received. All baseline data will start with a “B” and all follow-up data an “F.” Survey and observational data will be identified by an “S” and “O”, respectively. For example, baseline survey data submitted on 8/15/2021 at 10:50am will be coded as BS20210815\_1050. Whereas, follow-up observational data collected on 10/8/2021 from the 12<sup>th</sup> parcel where data was collected with be coded as FO20211008\_012.

Additional data identification for observational data will be recorded by a City representative or participating entity on a field form. At the top of each observational data form, the inspector name and drive-by visit date are required. The representative performing the drive-by visit will be required to record the approximate location of the evidence of a residential car wash on a parcel map.

### 10.2 Data Recording & Reporting Requirements

- Survey Data – All survey questions are multiple-choice questions regarding the individual’s car washing behaviors, knowledge of car washing BMPs, and awareness that residential car washes can impact downstream water bodies. The responses to the survey will be collected on the online survey platform, exported into an Excel file, and organized by question and into a format that can be analyzed according to Section 13.
- Observational Data – A standard observational form has been created. A City representative or participating entity will fill out the following information for each location where evidence of car washing is observed. Recorded data will also include where the car wash is taking or has taken place and whether any BMPs are being used. On the next business day after the data is collected, the observational data forms will be scanned and sent to the Principal Investigator. Data on each form will be transcribed into Excel, and organized by question and into a format that can be analyzed according to Section 13.
- The Lead Entity Project Manager is responsible for sending copies of the observational checklist to the Principal Investigator. The Principal Investigator is responsible for transferring data to Excel for analysis. The Data Verifiers (see Section 5.0) are responsible for verifying that the data collected from the survey and observational data has been correctly transferred in the Excel format.



### *10.3 Procedures for Missing Data*

Any data missing on the data collection forms will be documented in the Excel spreadsheet by coding the data “M” (for missing). In addition, a note will be added to the spreadsheet explaining the reasons why the data is missing (if known). Missing data will be reported in the final technical report along with a description of how the data set was analyzed without the missing data.

### *10.4 Acceptance Criteria for Existing Data*

This section is not applicable to this study. No existing data will be used to evaluate effectiveness of this E&O program. All data that will be used to evaluate effectiveness will be collected during this study.

## 11.0 Audits

This section identifies the audits that will be conducted during the study and defines the procedures for conducting the audit. The Auditor, as defined in Section 5.1, is responsible for conducting each audit. Qualitative audits will be performed to verify that the study is conducted in conformance to the QAPP. A copy of the Audit Checklist for this study can be found in Appendix G.

Audits that will be conducted include:

- Verify that the SOPs are followed for data collection and data recording in Section 8.2.
- Verify the data management procedures defined in Section 10.0 are followed.
- Each audit will include:
  - Interviewing the Lead Entity PM (and anyone who is collecting data for the study) regarding the SOPs they are following during data collection and comparing their responses to the SOPs.
  - Interviewing the Lead Entity PM and Principal Investigator (and anyone who is participating in data management) regarding their data management procedures and comparing interview responses to the Data Management Plan in Section 10.0.
  - Reviewing the electronic files to verify that the data management procedures are followed.
  - Where a discrepancy is found, reference Section 9.2 for the process of developing a corrective action plan.

Audits will be conducted four times according to the following schedule:

- Prior to use of the checklist for observational data, to confirm the field crew has been trained and understands the SOPs (see Section 8.2.1) and the data recording/reporting requirements (see Section 10.2).
- Following the use of the checklist for observational data, to confirm the field crew are following the SOPs (see Section 8.2.1) and data recording/reporting requirements (see Section 10.2).

## **12.0 Data Verification and Usability Assessment**

This section defines the process that the project will employ to verify the instruments, evaluate the quality of the data, and evaluate the usability of the data for meeting the project objectives. The process for validation of the instrument (survey) is provided in Section 8.3. This section defines the process to determine if the Section 6.0 measurement performance criteria (MPCs) are met for the relevant data quality indicators (DQIs).

### *12.1 Data Verification*

This section describes the process that will be employed to evaluate the quality of the data created during the study and identify the responsible party for verifying the data. Verification of the data will be performed by a person other than the one collecting and analyzing the data. For example, the Data Verifiers listed in Table 5.1. The data verification process may include:

- Review all the data records to ensure they are consistent, correct and complete, with no errors or omissions.
- Review the results from the QC section.
- Review the results from the audit section.
- Examine data to determine if MPC's were met.
- Peer debriefing will be used to validate coding of responses and barriers identified during the site visits: one researcher will code the data and provide two other researchers with their coding, which they will use to code a portion of the data. The researchers will meet to compare their results until they mutually agree on the interpretation of the coding, including adding additional codes. Reference Section 13.3 for more details.

### *12.2 Data Usability Assessment*

This section describes the process and procedures that will be used to establish the usability of the data for meeting the project objectives. This should include:

- Results from the data verification.
- Results from the audit (Section 11.0 of the QAPP).
- Whether the MPCs for the project (described in QAPP) have been met. Generally, if the MPCs have been met, then data should be of sufficient quality to be usable for meeting project objectives. If the MPCs have not been met, the data will be evaluated by the lead entity and the principal investigator. If it is determined that data is still of the quality needed to meet the study goals and objectives, the data will be considered useable and included in the data set analyzed. Otherwise, the data will be considered unusable and not included in the data set for analysis. The process for deciding whether data is useable will be documented in the final report.

## 13.0 Data Analysis Methods

This section describes analysis methods for qualitative and quantitative data. Hypothesis testing using quantitative data is also summarized, as well as examples of how data could be presented in the final report.

### 13.1 Quantitative Data Analysis Methods

Data collected as part of this study is in the form of multiple-choice responses and is qualitative data. Quantitative data generated from qualitative data will be used to evaluate the effectiveness of the E&O program. Qualitative data will be converted to quantitative data and analyzed following these steps:

1. The qualitative data will be converted into numeric data using a Likert Scale similar to what is shown in Table 13.2.

**Table 13.2 Likert Scale for Coding Categories**

Data Type	Associated Value
Fully aware of BMPs	3
Partially aware of BMPs	2
Somewhat aware of BMPs	1
No awareness of BMPs	0
Full adoption of BMPs	3
Frequent adoption of BMPs	2
Some adoption of BMPs	1
Adoption of BMPs none of the time	0

2. The Likert Scale values will be averaged for each survey and each observational visit and recorded in Excel.
3. To assess change in adoption of BMPs, the percent of people who have either fully adopted, frequently adopted, partially adopted, or not adopted BMPs will be calculated for each category. This will be estimated by dividing the number of respondents or observations in each category by the total number of respondents or observations made. The percent change will be calculated for the baseline and follow-up site survey responses and observational data. The percentages will then be compared to determine

whether a change occurred between the baseline and follow-up surveys and observational visits.

4. If the change in adoption of BMPs calculated for observational data differs from the change calculated from survey responses, the data for that neighborhood will be flagged because this indicates that social desirability bias may have influenced the response (see Section 6.0, Table 6.1, Credibility). Recommendations for the E&O program will consider these results in the final report. Specifically, results from both the observational and survey data will be reported. However, discussion will be included regarding how social desirability results may have influenced the results.

Following the quantitative analyses outlined in this section, adoption of targeted behaviors (use of BMPs) will be analyzed further by statistical methods (see Section 13.3).

Please note: at the time this QAPP was submitted, commercial car wash usage data was being investigated as additional data that could be used to verify the survey responses and supplement observational data. If commercial car wash usage data is available, it will also be used in Steps 3-4 to verify survey data in determining whether a change occurred. Specifically, commercial car wash usage data from months during which the E&O program is implemented will be compared to average usage data prior to implementation of the E&O program. If the change in adoption of BMPs (specifically the use of commercial car washes) indicated by survey responses is consistent with car wash usage data, the data will be used to support the validity of survey responses. If the survey response data differs from the car wash usage data, the responses will be flagged and potential reasons for the difference will be assessed. Recommendations for the E&O program will consider these results in the final report.

### 13.2 Hypothesis Testing

A statistical comparison will be conducted to determine whether there was a statistically significant difference between the baseline survey and observational data and the follow-up survey and observational data. The data used in the statistical comparison will include the Likert Scale values calculated for the baseline and follow-up data, described in Step 2 of Section 13.2. The method of converting survey responses and observational data to quantitative data to be used in the statistical comparison is described further in Sections 13.1 and 13.2. For a Likert scale, the data is assumed to be non-normally distributed; as such, a Wilcoxon rank sum test (a nonparametric analogue to the paired t-test) will be used. The specific null hypothesis ( $H_0$ ) and alternative hypothesis ( $H_a$ ) evaluated are:

- $H_0$ : No change in awareness or adoption of targeted behaviors
- $H_a$ : A change in awareness or adoption of targeted behaviors

The statistical comparison will be based on a confidence level of 95% ( $\alpha = 0.05$ ).

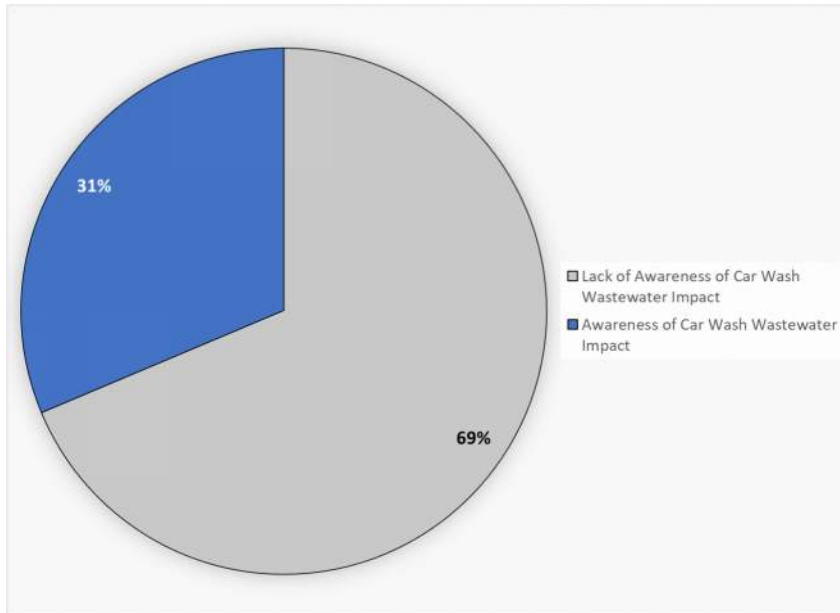
### 13.3 Data Presentation Methods:

The purpose of this section is to describe how the data will be presented (e.g., tables, charts, and/or graphs) in the final reports to illustrate trends, relationships, and anomalies. Data collected

during this study will be presented primarily in tables, bar-chart, or pie-style graphics to illustrate key findings.

Data will be depicted in graphics if the data warrant visual representation. For example, Figure 13.4.1 and Figure 13.4.2 are pie graphs that illustrate the entire surveyed population that identified awareness for proper car washing BMPs before and after the implementation of the E&O program. Pie graphs will also be used to represent the public's adoption of car wash BMPs before and after the implementation of the BMPs.

**Figure 13.4.1 Surveyed Residents' Baseline Awareness to BMP Implementation**



**Figure 13.4.2 Surveyed Residents' Baseline Adoption of Car Wash BMPs**

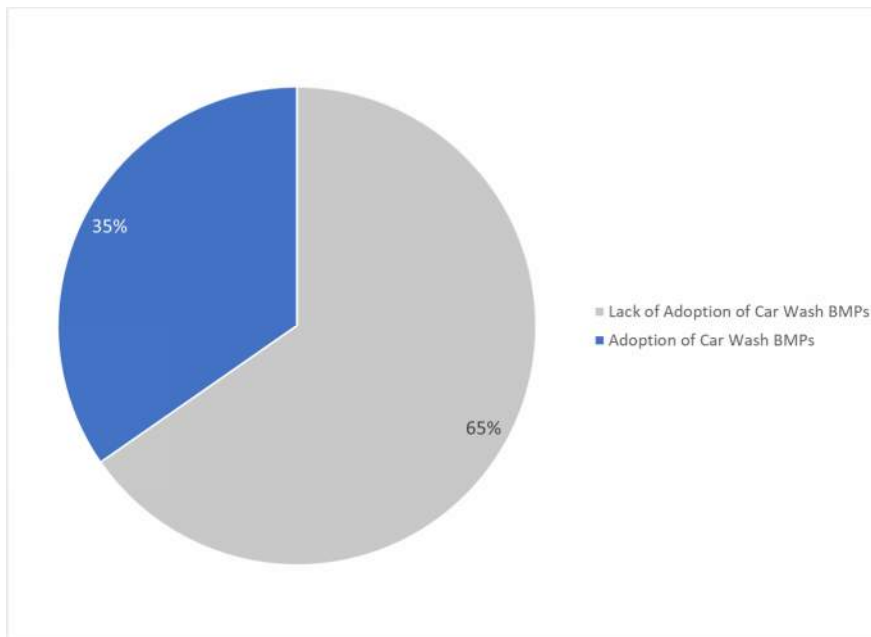
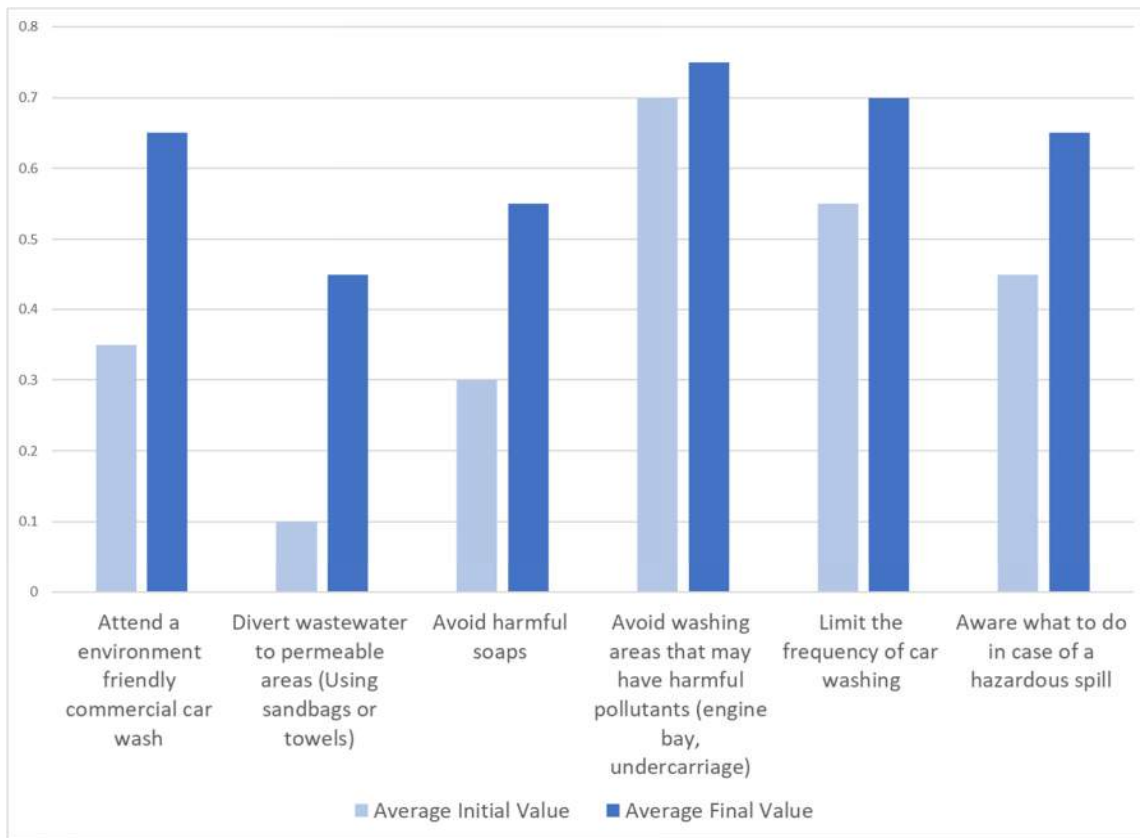


Figure 13.4.3 is a bar graph which illustrates the initial awareness of car wastewater impacts before the implementation of program and final awareness of car washing BMPs after the deploy of the program. Figure 13.4.4 represents a bar graph that shows the initial and final adoption of car wastewater impacts. A bar chart will also be used to show the level of adoption of different BMPs by neighborhood.

**Figure 13.4.3 Surveyed Residents Level of Adoption of Car Washing BMPs**



Tables which summarize data will also be used. For example, Table 13.4.1 summarizes the baseline and follow-up survey results for the initial and final target behaviors. Table 13.4.2 summarizes the change in adoption of each BMP during the study, and whether there was a statistically significant difference in adoption from the start to the end of the study.

**Table 13.4.1 Initial and Final Comparison of Awareness and Car Wash BMP Adoption**

Survey Results					
	Lack of Awareness of Car Wash Wastewater Impact	Awareness of Car Wash Wastewater Impact	Lack of Adoption of Car Wash BMPs	Adoption of Car Wash BMPs	Total Surveyed
<b>Initial</b>	60%	40%	75%	25%	600
<b>Final</b>	35%	65%	35%	65%	600



**Table 13.4.2 Summary of Specific BMP Adoption during Study**

BMP Type	Survey Results			Observational Data Results								
	Entire Population			Neighborhood 1			Neighborhood 2			Neighborhood 3		
	Average Initial Value	Average Final Value	Statistically Significant Change?	Average Initial Value	Average Final Value	Statistically Significant Change?	Average Initial Value	Average Final Value	Statistically Significant Change?	Average Initial Value	Average Final Value	Statistically Significant Change?
Attend an environment friendly commercial car wash	35%	65%	Yes	25%	45%	Yes	55%	75%	Yes	15%	45%	Yes
Divert wastewater to permeable areas (Using sandbags or towels)	10%	45%	Yes	5%	15%	Yes	10%	40%	Yes	15%	55%	Yes
Avoid harmful soaps	30%	55%	Yes	25%	45%	Yes	30%	50%	Yes	50%	60%	Yes
Avoid washing areas that may have harmful pollutants (engine bay, undercarriage)	70%	75%	No	70%	75%	No	65%	70%	No	50%	55%	No
Limit the frequency of car washing	55%	70%	Yes	55%	75%	Yes	60%	80%	Yes	40%	55%	Yes
Aware what to do in case of a hazardous spill or illicit discharge	45%	65%	Yes	35%	55%	Yes	45%	60%	Yes	60%	80%	Yes

## 14.0 Reporting

This section describes how the study findings will be reported and disseminated.

### 14.1 Final Reporting

This section should identify the reports that are required for the project and the party responsible for preparing the reports. Reports required by the MS4 Permit include:

- Annual Reports (S8.B.1.a) – interim results will be described, and status of the study will be documented by the Lead Entity.
- Final Report (S8.B.1.b) – final results of the study, as well as the recommendations for future actions based on the findings will be documented by the Principal Investigator within the final report. An outline will also be provided that identifies the contents of the final report (see Table 14.1 for proposed content).
- Study Fact Sheet (S8.B.1.c) – key points of the study and study findings will be summarized by the Principal Investigator in a fact sheet.

**Table 14.1 Proposed Effectiveness Study Report Content**

Final Report Sections	Effectiveness Studies
0.0 Cover Letter	✓
1.0 Executive Summary	✓
2.0 Introduction	See Note 1
3.0 Technology Description	See Note 1
4.0 Sampling Procedures	See Note 1
5.0 Data Summaries and Analysis	✓
6.0 Discussion	✓
7.0 Conclusions	✓
8.0 Future Action Recommendations	✓
9.0 Appendices	✓

1. Reference the approved QAPP for these sections. Indicate any changes made to the study since the QAPP was approved.

### 14.2 Dissemination of Project Documents

The Detailed Study Design Proposal and QAPP will be shared with those included on the Distribution List and posted to the City of Yakima website (<https://www.yakimawa.gov/services/wastewater-treatment-plant/stormwater/>) along with the final report and fact sheet at the completion of the study.

## 15.0 References

- Association, I. C. (2014). *Consumer Study*.
- Bartlett, C. (2005). *Stormwater Knowledge, Attitude and Behaviors: A 2005 Survey of North Carolina Residents*. Raleigh: North Carolina Department of Environment and Natural Resources.
- Biddix, P. J. (2016). *Uncomplicated Reviews of Educational Research Methods Instrument Validity, Reliability*. Retrieved November 20, 2016, from Research Rundowns: <https://researchrundowns.com/quantitative-methods/instrument-validity-reliability/>
- City of Bellevue. (n.d.). *Keeping Our Waterways Clean*. Bellevue.
- City of Bellingham. (n.d.). *Protect Your Drinking Water - Car Washing*. Lake Whatcom Cooperative Management, Lake Whatcom Water and Sewer Department. Bellingham: Puget Sound Starts Here.
- City of Ellensburg. (2021, March 1). Ellensburg City Code. *Ordinance 4871*. Ellensburg, WA: Code Publishing Company.
- City of Issaquah. (n.d.). *Keep your Vehicle and Our Waters Clean*. Fact Sheet, Issaquah.
- City of Kirkland. (n.d.). *Wash Right*.
- City of Marysville. (n.d.). *Environmentally Friendly Car Wash Information*. Surface Water Management. Marysville: Puget Sound Starts Here.
- City of Moses Lake. (n.d.). *Car Washing*. Fact Sheet, Stormwater Department, Moses Lake.
- City of Tacoma. (2009). *EnviroTalk*. Fact Sheet, Public Works Environmental Services, Tacoma.
- City of Wenatchee. (n.d.). *Illicit Discharge Detection & Elimination Frequently Asked Questions About Vehicle Washing*. Washington State Department of Ecology, Wenatchee Valley Stormwater Program, Wenatchee.
- Clark, J. A. (1994). Objectivity, subjectivity, and relativism in educational research. *Curriculum Inquiry*, 24(1), 81-94.
- EPA. (2006). *Guidance on Systematic Planning Using the Data Quality Objectives Process*. Washington, D.C.
- Geer, J. (n.d.). *Do You Wash Your Car at Home*. Bothell: Puget Sound Starts Here.
- Grimm, P. (2010). Social desirability bias. *Wiley International Encyclopedia of Marketing*.
- Grisso, R., Hay, D., Jasa, P. J., Koelsch, R. K., Skipton, S., & Woldt, W. (1998). *EC98-795 Farm\*A\*Syst Nebraska's System for Assessing Water Contamination Fact Sheet 17: Improving*. Lincoln: Historical Materials from University of Nebraska-Lincoln Extension.

- Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *ECTJ*, 29(2), 75-91.
- Helsel, D. R., Hirsch, R. M., Ryberg, K. R., Archfield, S. A., & Gilroy, E. J. (2020). *Statistical Methods in Water Resources*. Reston: USGS. Retrieved May 2021, from <https://pubs.usgs.gov/tm/04/a03/tm4a3.pdf>
- International Car Wash Association. (2008). *ICA Study of Consumer Car Washing Attitudes and Habits*.
- Israel, G. D. (1992). *Determining Sample Size*. University of Florida, Institute of Food and Agricultural Services. Gainesville: Florida Cooperative Extension Service.
- Lombard, S., & Kirchmer, C. (2004). Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. *Manchester: Environmental Assessment Program*.
- MassDEP; Geosyntec Consultants. (n.d.). *Car Washing*. Retrieved from Massachusetts Clean Water Toolkit.
- Oknich, J. (2016, March 20). The Perceived Environmental Impact of Car Washing. Ramsey-Washington Metro Watershed District : Research Gate.
- Peterson, B. (2021, June 29). *Car Ownership Statistics (2021 Report)*. Retrieved from ValuePenguin by LendingTree: <https://www.valuepenguin.com/auto-insurance/car-ownership-statistics>
- Radhakrishna, R. (2012, June). Ensuring Data Quality in Extension Research and Evaluation Studies. *Journal of Extension*, 50(3), 3.
- Sablayrolles, C., Vialle, C., & Montrejaud-Vignoles, M. (2010). Impact of Carwash Discharge on Stormwater Quality. *Water Science and Technology*, 62(12), 2737-2746.
- San Luis Obispo County. (n.d.). *Outdoor Car Washing Best Management Practices*. Fact Sheet, Stormwater Management Program, San Luis Obispo.
- Smith, D., & Shilley, H. (2009, September 3). *Residential Car Washwater Monitoring Study*. Public Works Department Surface Water Management Division, Federal Way.
- Stream Team. (n.d.). *Car Washing - Clean Stream and Clean Cars*.
- Taylor, A., & Wong, T. (2002). *Non-Structural Stormwater Quality Best Management Practices - A Literature Review of Their Value and Life-Cycle Costs*. EPA Victoria. Cooperative Research Centre for Catchment Hydrology.
- Trechter, D., Janke, J., Hadley, S., & Parks, D. (2008). *Central Wisconsin Stormwater Survey A Summary of Resident's Knowledge and Practices*. University of Wisconsin, Survey Research Center . River Falls: UW Extension.

- United States Department of Commerce. (2019). *Quick Facts Yakima city, Washington*. Retrieved from United States Census Bureau: <https://www.census.gov/quickfacts/fact/table/yakimacitywashington/PST045219>
- Washington State Department of Ecology. (2011). *Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies*. Olympia: Washington State Department of Ecology.
- Washington State Department of Ecology. (2018). *Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies*. Olympia: Washington State Department of Ecology.
- Washington State Department of Ecology. (2019). *Eastern Washington Phase II Municipal Stormwater Permit*. Olympia, WA: Department of Ecology.
- Washington State Legislature. (1987, 11 12). RCW 173-221-010. *Washington Administrative Code*. Washington State Legislature.
- Washington State Legislature. (1990, 7 3). WAC 173-221A-010. *Washington Administrative Code*. Washington State Legislature.
- Washington Stormwater Center. (n.d.). *Pollution Prevention Fact Sheet: Car Washing*. Puyallup.
- World Population Review. (2021, July 12). *Yakima, Washington Population 2021*. Retrieved from <https://worldpopulationreview.com/us-cities/yakima-wa-population>

## **16.0 Appendices**

## **Appendix A: Ecology Comment Form**

Comment Number	Commenter Initials	Document Reviewed	Page Number	Section Number or Title	Comment	Suggested Revision	OCI Response	Incorporated
1	AJ	QAPP	2		Results of the study inform Yakima staff versus citizens	A goal of this study is to inform City of Yakima drivers...	Will revise as recommended.	X
2	AJ		5	Washington Car Wash Wastewater Management E&O Program	Include in discussion prior E&O car wash kits funded by Ecology and distributed to EWA Permittees.		Added text regarding E&O car wash kits funded by Ecology and distributed to EWA permittees.	X
3	AJ		17	Table 5.1	Define City of Moses Lake's roles		Will revise.	X
4	AJ		18	5.3	Update with Moses Lake info		Revised according to roles discussed at TAG Meeting and with Bill Aukett 8/5/2021.	X
5	AJ		19	5.2	Ensure dates are 2021 not 2023		As discussed, have revised figure to note dates below the table, and to note the year above the table instead of quarters.	X
6	AJ		24	7.1	Remove reference to county staff, as other entities may fulfill these roles		Will revise.	X
7	AJ		25		Change reference of Yakima County to participating entity staff		Will revise to "lead entity and/or contributing entity" to allow for flexibility.	X
8	BL	QAPP - Car Wash E&O		Section 2	First sentence in first paragraph	Change designated to required	Will revise.	X
9	BL	QAPP - Car Wash E&O		Section 2	Second paragraph. "Toxin" is biological, e.g. venom. I believe you were going for "Toxic" however I don't recommend a simple word replacement. Harmful is a better word because nutrients and sediment are also harmful even fatal but the mode of action is not toxicity..	Car wash wastewater carries harmful amounts of chemicals such as detergents, sediment, nutrients, and metals, into storm drains. This can be prevented by following vehicle washing best management practices (BMPs).	Will revise.	X
10	BL	QAPP - Car Wash E&O		Table 4.5	Make it clear which deliverables are between the city and the consultant and which are being sent to Ecology.	Could use superscripts	Will revise to clarify Ecology deliverables.	X
11	BL	QAPP - Car Wash E&O		Table 5.2	Acknowledge in a paragraph text suggestion below in section 5.2 and move table to section 5.2.	"This table is showing multiple timeframes. Primarily it is listing the one year timeframe of this study, but also stating the permit deadlines most of which are after this study timeline."	Will revise table as discussed in response to comment #5 and move table below Section 5.2.	X
12	BL	QAPP - Car Wash E&O		Footers	Ensure final has the same date on footers for all appendices		Will revise.	X
13	BL	QAPP - Car Wash E&O		Signature Page	Anyone listed on the signature page is approving this study	None - but roles are sometimes described as only reviewer and I want all parties to understand that for Ecology it is a combined review and approve role.	As discussed, have revised role for Ecology (Andrea Jedel and Brandi Lubliner) in Table 5.2 to "Ecology Approval"	X
14	AM	QAPP	7	3.3.2	Under Report spills: A spill is an illicit discharge, but not all illicit discharges are spills		Revised text to remove references to spills.	X
15	AM	QAPP	10	4.3	Remove duplicative sentence "descriptions for each of the three neighborhoods where additional data will be collected are in Table 4.3".		Remove duplicate sentence.	X
16	RM	QAPP		Appendix D	Used Yakima County's IDDE phone # and email address on brochure, one page flier and towel icon and slogan (black and white)	Use City of Yakima Spill Hotline # 509 575-6077; Yakima does not have an email address for IDDE	Will revise as recommended.	X
17	RM	QAPP		Appendix E	Best Management Practice Post #3 says to avoid using soap	Should #3 say "Avoid using non-biodegradable soap"? I can live with it. It seems a little confusing because it says to not use soap but it also says it's OK to use biodegradable soap.	Will revise as recommended.	X
18	Jwiemer	Car Wash QAPP	1	2.0 Executive Summary	First sentence of the first paragraph	"designated" should be changed to "required" by Washington State Department of Ecology	Will revise.	X
19	Jwiemer	Car Wash QAPP	19	Table 5.2	Task #2 & #4	Verify dates	See response to comment #5.	X



## **Appendix B: Online Survey Questions**

## Car Wash Wastewater Management Education and Outreach Effectiveness Study Survey

- 1) Where do you live?
  - a. City of Yakima
  - b. Outside of City of Yakima limits, but within Yakima County
  - c. Other
- 2) What is the primary language spoken in your household?
  - a. English
  - b. Spanish
  - c. Other (Include space to fill in response)
- 3) Do you drive a personal vehicle?
  - a. Yes
  - b. No
- 4) Have you seen information on car washing best management practices from the City of Yakima, and if so, how recently?
  - a. I have not seen any information
  - b. In the last week
  - c. 2-3 weeks ago
  - d. One to two months ago
  - e. Over two months ago
- 5) If you saw information on car washing best management practices from the City of Yakima, where did you see it?
  - a. City of Yakima website
  - b. City of Yakima social media (Facebook, Instagram, Twitter)
  - c. I received a brochure at my home
  - d. Not applicable/I have not seen any information
- 6) Which of the following best describes how often you wash your vehicle?
  - a. More than once a month
  - b. Once a month
  - c. 2-3 times a year
  - d. Once a year
  - e. Never
- 7) How often do you wash your vehicle at home?
  - a. Always
  - b. Frequently
  - c. Sometimes
  - d. Never
- 8) Where do you think it is best for the environment to wash your vehicle?
  - a. Commercial car wash
  - b. At home
  - c. Not sure
- 9) Did you know that car wash wastewater can pollute our streams, lakes, and rivers?
  - a. Fully aware
  - b. Mostly aware
  - c. Somewhat aware

d. Not aware

10) How frequently have you used these methods? Select all that apply.

	Always	Frequently	Sometimes	Never
Wash car at home				
Use a commercial car wash				
Wash car on pavement				
Wash car on grass or gravel				
Use waterless car washing products				
Use biodegradable or environmentally friendly soap				
Drain/hose water and soap into the street				
Contain soap spills immediately or call spill control hotline in an event of a soap spill				
Wash vehicle engine, undercarriage, mounted equipment, or tires				

11) Before taking this survey, how many environmentally friendly car washing methods were you aware of? Select all that apply

- Use a commercial car wash
- Wash vehicle less often
- Wash vehicle on grass, dirt or gravel to prevent car wastewater from entering the street
- Use waterless car washing products
- Use biodegradable or environmentally friendly soap
- Call spill control hotline in an event of a soap spill
- Avoid washing the engine, undercarriage, mounted equipment, or tires

12) How willing are you to change your car washing methods to be more environmentally friendly?

- a. All in!
- b. Mostly willing
- c. Somewhat willing
- d. Not at all willing
- e. Not applicable

13) Which of these categories are barriers that prevent you from practicing environmentally friendly car wash techniques?

- Cost
- Lack of Knowledge
- Time/Convenience
- Lack of access to materials
- Quality of product
- Other
- None

## **Appendix C: Observational Data Form**

**Observational Data Form # \_\_\_\_\_**

Name of the Inspector: \_\_\_\_\_

Inspection Date and Time: \_\_\_\_\_

Jurisdiction the inspector works for: \_\_\_\_\_

Location of the observed evidence of residential car wash (neighborhood, street name, etc.):

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Were any of the following car wash practices observed?

- Vehicle washed on pervious surface (grass, dirt, or gravel) and wash water not entering street
- Vehicle washed on impervious surface
- Washing of the engine, undercarriage, mounted equipment, or tires
- Objects used to divert car wash wastewater away from storm drain to permeable surface
- Other, please specify

Is there evidence of car wash wastewater entering the storm drain?

- Yes
- No

Please provide a brief description of what you observed (for example: no barriers used to prevent wash water from entering storm drain, barriers used to prevent wash water from entering storm drain but is not effective, etc.)

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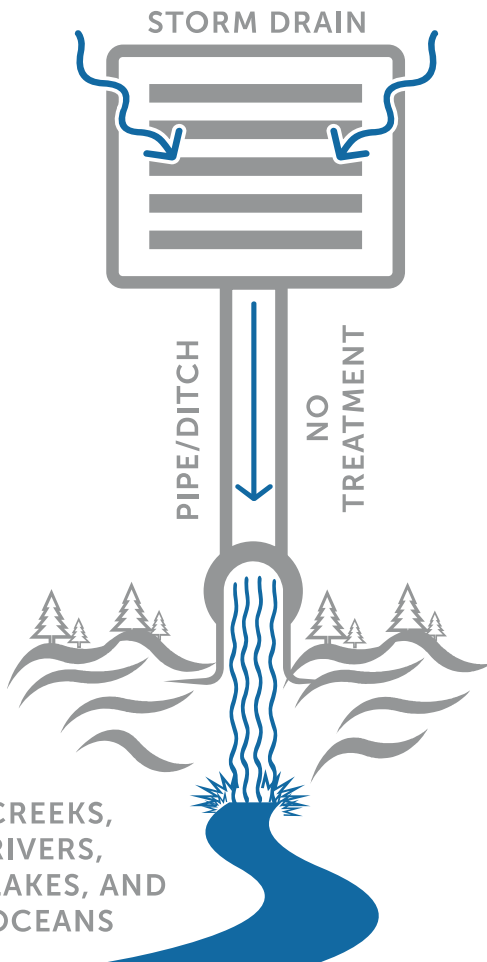
## **Appendix D: E&O Program Materials**

*Appendix D.1 Brochure*

## Tri-Fold Brochure (Front)

Washing your car on the street or in your driveway causes wash wastewater to flow into the storm drain system.

Water collected by a storm drain **IS NOT TREATED** and goes directly into our natural environment.



How do you wash your car?  
Follow the QR code link above  
to take our survey!

**REPORT A SPILL**

**509.575.6077**

**CAR WASHING  
BEST MANAGEMENT  
PRACTICES**

MADE BY: OSBORN CONSULTING, INC.  
FOR THE CITY OF YAKIMA





# WASH CARS, NOT FISH

## THE FACTS

Changing the way you wash your car can help protect our natural environment.

Outdoor car washing has the potential to result in high loads of nutrients, dirt, metals, and hydrocarbons as the detergent-rich water used to wash the grime off our cars flows down the driveway and the street and into the storm drain.

These pollutants degrade the water quality of our streams and endanger the wildlife that lives in or near the streams.



**If a commercial car wash isn't an option, wash cars on an area that absorbs water**, such as gravel, grass, or loose soil. Some soapy water can filter through vegetation and soil before entering ground water or running off into a storm drain. This technique can be used only when using biodegradable, non-toxic cleaners.



**Avoid using soap**, instead, try just using water or a waterless car wash product that can be applied and wiped off with a cloth, leaving the storm drains clear of potential pollutants. If you need soap, be sure to use chlorine-free and phosphate-free soap, or use biodegradable soap.

**Only wash the exterior of your car.** Cleaning the engine bay, truck cargo area, mounted equipment, or the undercarriage of your vehicle can lead to harmful pollutants generated in these areas entering the storm system.



### IN CASE OF SPILL:

Car wash wastewater from cleaning vehicles is an illicit discharge when it enter the storm system. In the event that a spill does occur, call **509.575.6077**.

Tri-Fold Brochure (Back)

## BEST MANAGEMENT PRACTICES

(what you can do!)

*Appendix D.2 Flier*



# CAR WASHING BEST MANAGEMENT PRACTICES

(what you can do!)



Changing the way you wash your car can help protect our natural environment. Outdoor car washing has the potential to result in high loads of nutrients, dirt, metals, and hydrocarbons as the detergent-rich water used to wash the grime off our cars flows down the driveway and the street and into the storm drain. These pollutants degrade the water quality of our streams and endanger the wildlife that lives in or near the streams.

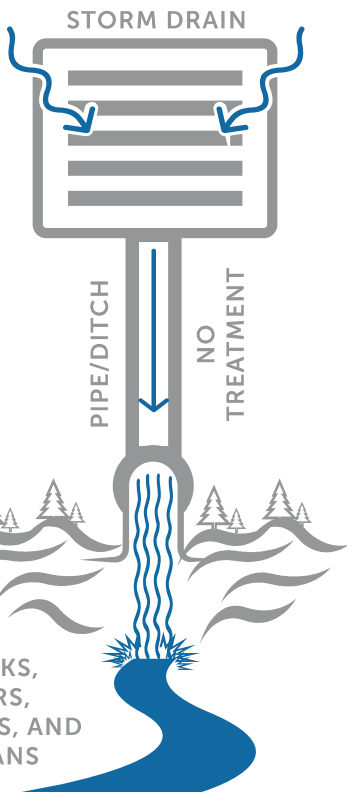
Washing your car on the street or in your driveway causes wash wastewater to flow into the storm drain system.



**Use a commercial car wash.** Commercial car washes are required to send all their wash water to sanitary sewers for treatment and recycle most of the water. Most commercial car washes use 60% less water in the entire washing process compared to rinsing your car at home.

Water collected by a storm drain **IS NOT TREATED** and goes directly into our natural environment.

**If a commercial car wash isn't an option, wash cars on an area that absorbs water**, such as gravel, grass, or loose soil. Some soapy water can filter through vegetation and soil before entering ground water or running off into a storm drain. This technique can be used only when using biodegradable, non-toxic cleaners.



**Avoid using soap**, instead, try just using water or a waterless car wash product that can be applied and wiped off with a cloth, leaving the storm drains clear of potential pollutants. If you need soap, be sure to use chlorine-free and phosphate-free soap, or use biodegradable soap.

**Only wash the exterior of your car.** Cleaning the engine bay, truck cargo area, mounted equipment, or the undercarriage of your vehicle can lead to harmful pollutants generated in these areas entering the storm system.



## IN CASE OF SPILL:

Car wash wastewater from cleaning vehicles is an illicit discharge when it enters the storm system. In the event that a spill does occur, call **509.575.6077**.



*Appendix D.3 Program Logo and Slogan*

Icon and Slogan - Full Color





*Appendix D.4 Towel Logo, Slogan, and Spill Hotline*



**SPILL HOTLINE: 509.575.6077**



Icon and Slogan - White



**SPILL HOTLINE: 509.575.6077**

*Appendix D.5 Postcard*

Postcard (Front)



The City of Yakima wants to hear from you!

Follow the QR code on the back to tell us about how you wash your car.

¡La Ciudad de Yakima quiere saber de usted!

Siga el código QR en la parte posterior para informarnos sobre cómo lava su coche.



## Postcard (Back)



Thank you for  
participating in our  
survey!



¡Gracias por  
participar en nuestra  
encuesta!



## **Appendix E: Media Outreach Package**

## Social Media & Public Relations Plan

### Initial Survey Post:

The City of Yakima wants to hear from you on how you wash your cars. If you have a minute, please take our survey to provide your feedback, available in both English and Spanish. [Link to webpage with surveys.](#)



**How do you wash your car?**

Follow the link or scan the QR code to take our survey!



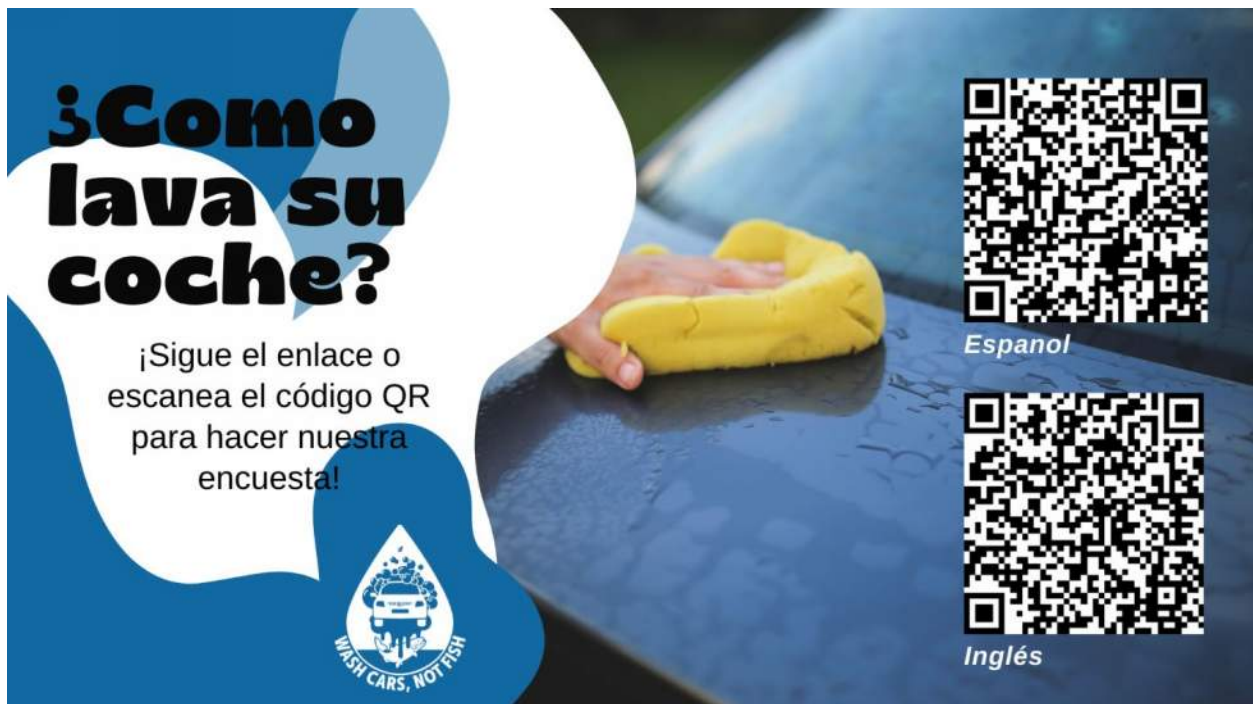
English



Spanish




La Ciudad de Yakima quiere saber de usted sobre cómo lava sus coches. Si tiene un minuto, por favor toma nuestra encuesta para proporcionar sus comentarios, disponibles tanto en inglés como en español.



**¿Cómo lava su coche?**

¡Sigue el enlace o escanea el código QR para hacer nuestra encuesta!



Español



Inglés



**Survey Reminder Post:**

Today is the last day to take our survey on your car washing habits. Incentives included for completing the survey! Follow this link: [Link to webpage with surveys](#)



Hoy es el último día para hacer nuestra encuesta sobre sus hábitos en lavado de coches. ¡Incentivos incluidos para completar la encuesta! Sigue este enlace: [Enlace a página web con encuestas](#)



**Best Management Practice Post #1:**

Use a commercial car wash. Commercial car washes are required to send all their wash water to sanitary sewers for treatment and recycle most of the water. Most commercial car washes use 60% less water in the entire washing process compared to rinsing your car at home.

**CAR WASHING**

**BEST MANAGEMENT PRACTICE #1**

Use a  
commercial  
car wash.



**Best Management Practice Post #2:**

If a commercial car wash isn't an option, wash cars on an area that absorbs water, such as gravel, grass, or loose soil. Some soapy water can filter through vegetation and soil before entering ground water or running off into a storm drain. This technique can be used only when using biodegradable, non-toxic cleaners.

**CAR WASHING**

**BEST MANAGEMENT PRACTICE #2**

Wash cars on  
an area that  
absorbs water.





**Best Management Practice Post #3:**

Avoid using non-biodegradable soap, instead, try just using water or a waterless car wash product that can be applied and wiped off with a cloth, leaving the storm drains clear of potential pollutants. If you need soap, be sure to use chlorine-free and phosphate-free soap or use biodegradable soap.

**CAR WASHING**

**BEST MANAGEMENT PRACTICE #3**

Avoid using  
non-  
biodegradable  
soap.



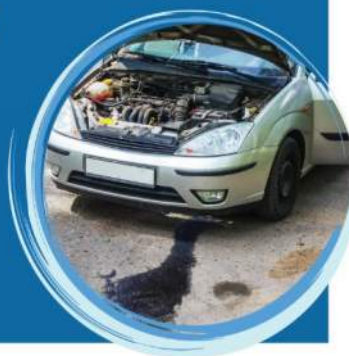
**Best Management Practice Post #4:**

Only wash the exterior of your car. Cleaning the engine bay, truck cargo area, mounted equipment, or the undercarriage of your vehicle can lead to harmful pollutants generated in these areas entering the storm system.

**CAR WASHING**

**BEST MANAGEMENT PRACTICE #4**

Only wash the  
exterior of  
your car.



Graphic for Potential 5<sup>th</sup> Post if needed:

**SAFE CAR WASHING IS AS EASY AS  
1, 2, 3 (& 4)!**

1. Use a commercial car wash
2. Wash cars on an area that absorbs water
3. Avoid using soap
4. Only wash the exterior of your car

*Help protect us!*



Repeat two initial and reminder survey posts for second round of surveying.

**Website:**

### **2021 Car Wash Survey**

### **2021 Encuesta sobre lavado de coches**



#### **Front Page Text Draft:**

The City of Yakima, in partnership with Osborn Consulting, wants to hear from you about how you wash your car. Your anonymous response will vitally impact future education and outreach programs implemented by the City of Yakima to help preserve our natural environment. Click “Read More” for surveys in English and Spanish to provide your feedback and receive incentives for completing the survey. [Read More >>](#) (Link to intermediate page)

La Ciudad de Yakima quiere saber de usted sobre cómo lava sus coches. Su respuesta anónima tendrá un impacto vital en los futuros programas de educación y programas alcance implementado por la Ciudad de Yakima para ayudar a preservar nuestro medio ambiente natural. Haga clic en "Read More" para ver las encuestas en inglés y español para proporcionar sus comentarios y recibir incentivos por completar la encuesta. [Read more >>](#)

#### **Intermediate Page Text (English & Spanish):**

#### **Take the survey to help preserve our natural environment and receive a carwash voucher!**

This five-minute survey developed by Osborn Consulting, Inc. is part of a research study to understand current methods of car washing in the City of Yakima. Your anonymous response will vitally impact future education and outreach programs implemented by the City of Yakima to help preserve our natural environment.

The first 200 City of Yakima residents who take the survey and bring a printout or screenshot of the survey confirmation page to the Stormwater Booth in the SunDome at the Central Washington State Fair, will receive a voucher for a free commercial car wash in Yakima. The next 500 City of Yakima residents who do the same, will receive a \$3 off coupon at a commercial car wash in Yakima.

#### **¡Tome la encuesta para ayudar a preservar nuestro medio ambiente natural y recibe un cupón para lavado de coches!**

Esta encuesta de cinco minutos desarrollado por Osborn Consulting, Inc. es parte de un estudio de investigación para comprender los métodos actuales para lavado de coches en la Ciudad de Yakima. Su

respuesta anónima tendrá un impacto vital en los futuros programas de educación y programas alcance implementado por la Ciudad de Yakima para ayudar a preservar nuestro medio ambiente natural.

Los primeros 200 residentes de la Ciudad de Yakima que tomen la encuesta y lleven una copia impresa o una captura de pantalla de la página para confirmación de la encuesta a la Stormwater Booth en el SunDome en la Feria Estatal Central de Washington, recibirán un cupón para un lavado de coches comercial gratuito en Yakima. Los próximos 500 residentes de la Ciudad de Yakima que hagan lo mismo, recibirán un cupón de descuento de \$3 en un lavadero de coches comercial en Yakima.

Newspaper Ad for Yakima Herald – 5 Column Tab – 8.833” x 10.625”:

**THE CITY  
OF YAKIMA  
WANTS TO  
HEAR FROM  
YOU**



Follow the QR  
code to tell us  
about how you  
wash your car.



## **Appendix F: Corrective Action Table**



## **Appendix G: Audit Form**



Auditor name:		Date/Time:
Name(s) of personnel conducting data collection, data recording, interviews, data management:		
<b>Standard Operating Procedure (SOP)</b>	<b>Actions Compliant with SOPs?</b>	<b>Comments:</b>
	<b>Overall SOP audit notes:</b>	
<b>Baseline Observational Drive-By Visit</b>		
Neighborhood 1, Neighborhood 2, and Neighborhood 3 are inspected for car washing behavior		
Evidence of at-home car washing behavior observed is recorded		
Observational form is filled out entirely for each observed at-home car wash		
Data will be recorded on the forms and scanned for analysis		
	<b>Overall SOP audit notes:</b>	
<b>Baseline Survey</b>		
Survey made available to each participant via online platform		
Incentives will be distributed to participants		
Responses are exported to Excel		
	<b>Overall SOP audit notes:</b>	
<b>Follow-Up Survey</b>		
Survey made available to each participant via online platform		
Incentives will be distributed to participants		
Responses are exported to Excel		
	<b>Overall SOP audit notes:</b>	
<b>Follow-up Observational Drive-By Visit</b>		
Neighborhood 1, Neighborhood 2, and Neighborhood 3 will be inspected for car washing behavior		
Evidence of at-home car washing behavior observed is recorded		
Observational form is filled out entirely for each observed at-home car wash		
Data will be recorded on the forms and scanned for analysis		

<b>Data Management Procedures</b>	<b>Actions Compliant with Procedures?</b>	<b>Comments:</b>
<b>Data Identification</b>		<b>Overall data management procedures audit notes:</b>
Data collected unique identification number that incorporates order and date/time received/recorded		
Baseline data is identified with “B”, follow-up data is identified with “F”		
Survey and observational data identified with “S” and “O” respectively		
<b>Data Recording &amp; Reporting Requirements</b>		<b>Overall data management procedures audit notes:</b>
Survey responses exported from SurveyMonkey® and recorded in Excel		
Observational forms will be scanned and transcribed into Excel		
<b>Procedures for Missing Data</b>		<b>Overall data management procedures audit notes:</b>
Missing data is coded with "M" in Excel and note explaining why data is missing (if known)		

## **Appendix H: Confirmation of Contributing Entity Role Letters**

August 5, 2021

Mr. Randy Meloy  
Surface Water Engineer  
City of Yakima  
129 N Second Street  
Yakima, WA 98901

**Subject: Confirmation of Contributing Entity Role for City of Yakima Car Wash Wastewater Management E&O Effectiveness Study**

Dear Randy:

This letter signifies that the City of Asotin, City of Clarkston and Asotin County has reviewed their role noted in the City of Yakima Car Wash Wastewater Management E&O Effectiveness Study Quality Assurance Project Plan (QAPP) and will perform the role as described in the QAPP, which is also summarized in Attachment A. The City of Asotin, City of Clarkston or Asotin County is bound to this role for the entirety of the study. In the event of an internal staff change, the City of Asotin, City of Clarkston or Asotin County will contact you to provide the new contact information.

Sincerely,

A handwritten signature in black ink, appearing to read "Jeff Wiemer". The signature is fluid and cursive, with a long horizontal stroke at the end.

Jeff Wiemer, Stormwater Coordinator

Asotin County Regional Stormwater Program

Attachment A – Key Project Team Members: Roles and Responsibilities

## Attachment A - Key Project Team Members: Roles and Responsibilities

Key Team Members	Role	Contact Information
Randy Meloy City of Yakima	Lead Entity <sup>1,3,5,7,8</sup>	<a href="mailto:randy.meloy@yakimawa.gov">randy.meloy@yakimawa.gov</a> (509) 576-6606
Jack Wells Yakima County	Contributing Entity <sup>4,5,6,7,8</sup>	<a href="mailto:jack.wells@co.yakima.wa.us">jack.wells@co.yakima.wa.us</a> (509) 574-2350
Erin Barnett City of Selah	Contributing Entity <sup>4,6</sup>	<a href="mailto:Erin.Barnett@selahwa.gov">Erin.Barnett@selahwa.gov</a> (509) 698-7331
Raul Sanchez City of Sunnyside	Contributing Entity <sup>4,5,6,7</sup>	<a href="mailto:rsanchez@sunnyside-wa.gov">rsanchez@sunnyside-wa.gov</a> (509) 836-6566
David Dominguez City of Union Gap	Contributing Entity <sup>4,6,9</sup>	<a href="mailto:david.dominguez@uniongapwa.gov">david.dominguez@uniongapwa.gov</a> (509) 249-9211
Jeff Wiemer Asotin County, City of Asotin, & City of Clarkston	Contributing Entity <sup>5,6,10</sup>	<a href="mailto:jwiemer@co.asotin.wa.us">jwiemer@co.asotin.wa.us</a> (509) 243-2071 Ext. 1430
Bill Aukett City of Moses Lake	Contributing Entity <sup>6,13</sup>	<a href="mailto:baukett@cityofml.com">baukett@cityofml.com</a> (509) 764-3792
Andrea Jedel Department of Ecology	Ecology Approval	<a href="mailto:ajed461@ecy.wa.gov">ajed461@ecy.wa.gov</a> (509) 575-2807
Brandi Lubliner Department of Ecology	Ecology Approval	<a href="mailto:brandi.lubliner@ecy.wa.gov">brandi.lubliner@ecy.wa.gov</a> (360) 407-7140
Aimee Navickis-Brasch, PhD, PE Osborn Consulting, Inc.	Principal Investigator <sup>2</sup>	<a href="mailto:aimeen@osbornconsulting.com">aimeen@osbornconsulting.com</a> (509) 995-0557
Taylor Hoffman-Ballard, PE Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:taylorh@osbornconsulting.com">taylorh@osbornconsulting.com</a> (952) 836-7863
Makenna Lindberg Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:makennal@osbornconsulting.com">makennal@osbornconsulting.com</a> (425) 451-4009 Ext. 108
Nicole Chen Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:nicolec@osbornconsulting.com">nicolec@osbornconsulting.com</a> (206) 628-9133 Ext. 232
Mark Maurer Osborn Consulting, Inc.	QA/QC Lead <sup>12</sup>	<a href="mailto:markm@osbornconsulting.com">markm@osbornconsulting.com</a> (509) 867-3654

1. Lead Entity Project Manager – Responsible for ensuring the study is conducted as described in this QAPP. The Project Manager is the primary point of contact for the lead entity.
2. Principal Investigator – Responsible for developing the Ecology approved Detailed Study Design Proposal, Quality Assurance Project Plan (QAPP), Technical Evaluation Report (TER), and Fact Sheet, as well as conducting the study.
3. Study Financial Support – Responsible for the study cost, except costs related to TAG management.
4. TAG Financial Support – Responsible for TAG management costs.
5. E&O Materials Financial Support – Responsible for providing E&O materials for the Central Washington State Fair or another event during the study.
6. Technical Advisory Group (TAG) Member – The goal of the TAG is to provide insight, suggestions, and professional opinions to the Principal Investigator throughout the study. The primary responsibilities of TAG members include attending up to six project meetings

(by webinar or in person) and participating in the meeting discussion; review and provide comment on research materials (i.e., QAPP, data collected, data analyzed, final report, etc.) prior to the lead entity submitting the documents to Ecology. Members of the TAG may also serve as an Auditor to verify the study conforms to the plan and procedures as defined in the QAPP and/or a Data Verifier who reviews the analyzed data and verifies the analysis is correct and that the data being analyzed matches the data collected.

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12. QA/QC Lead – Responsible for providing QA/QC review of reporting related to study.
13. Commercial Car Wash Usage Data Collection – Responsible for requesting and obtaining (if possible) commercial car wash usage data from commercial car washes in the City of Yakima for at least the previous two years through October 2021.



# CITY OF SELAH

## Code Enforcement

222 South Rushmore Road  
Selah, Washington 98942

Phone 509 698-7365  
Fax 509 698-7372

August 5, 2021

Mr. Randy Meloy  
Surface Water Engineer  
City of Yakima  
129 N Second Street  
Yakima, WA 98901

**Subject: Confirmation of Contributing Entity Role for City of Yakima Car Wash Wastewater Management E&O Effectiveness Study**

Dear Randy:

This letter signifies that The City of Selah has reviewed their role noted in the City of Yakima Car Wash Wastewater Management E&O Effectiveness Study Quality Assurance Project Plan (QAPP) and will perform the role as described in the QAPP, which is also summarized in Attachment A. In the event that the City of Selah's role changes, The City of Selah will send a letter to you at the City of Yakima notifying the City of the change to their role. In the event of an internal staff change, The City of Selah will contact you to provide the new contact information.

Sincerely,

Erin Barnett  
Stormwater Management  
City of Selah  
(509) 698-7331

Attachment A – Key Project Team Members: Roles and Responsibilities



## Attachment A - Key Project Team Members: Roles and Responsibilities

Key Team Members	Role	Contact Information
Randy Meloy City of Yakima	Lead Entity <sup>1,3,5,7,8</sup>	<a href="mailto:randy.meloy@yakimawa.gov">randy.meloy@yakimawa.gov</a> (509) 576-6606
Jack Wells Yakima County	Contributing Entity <sup>4,5,6,7,8</sup>	<a href="mailto:jack.wells@co.yakima.wa.us">jack.wells@co.yakima.wa.us</a> (509) 574-2350
Erin Barnett City of Selah	Contributing Entity <sup>4,6</sup>	<a href="mailto:Erin.Barnett@selahwa.gov">Erin.Barnett@selahwa.gov</a> (509) 698-7331
Raul Sanchez City of Sunnyside	Contributing Entity <sup>4,5,6,7</sup>	<a href="mailto:rsanchez@sunnyside-wa.gov">rsanchez@sunnyside-wa.gov</a> (509) 836-6566
David Dominguez City of Union Gap	Contributing Entity <sup>4,6,9</sup>	<a href="mailto:david.dominguez@uniongapwa.gov">david.dominguez@uniongapwa.gov</a> (509) 249-9211
Jeff Wiemer Asotin County, City of Asotin, & City of Clarkston	Contributing Entity <sup>5,6,10</sup>	<a href="mailto:jwiemer@co.asotin.wa.us">jwiemer@co.asotin.wa.us</a> (509) 243-2071 Ext. 1430
Bill Aukett City of Moses Lake	Contributing Entity <sup>6,13</sup>	<a href="mailto:baukett@cityofml.com">baukett@cityofml.com</a> (509) 764-3792
Andrea Jedel Department of Ecology	Ecology Approval	<a href="mailto:ajed461@ecy.wa.gov">ajed461@ecy.wa.gov</a> (509) 575-2807
Brandi Lubliner Department of Ecology	Ecology Approval	<a href="mailto:brandi.lubliner@ecy.wa.gov">brandi.lubliner@ecy.wa.gov</a> (360) 407-7140
Aimee Navickis-Brasch, PhD, PE Osborn Consulting, Inc.	Principal Investigator <sup>2</sup>	<a href="mailto:aimeen@osbornconsulting.com">aimeen@osbornconsulting.com</a> (509) 995-0557
Taylor Hoffman-Ballard, PE Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:taylorh@osbornconsulting.com">taylorh@osbornconsulting.com</a> (952) 836-7863
Makenna Lindberg Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:makennal@osbornconsulting.com">makennal@osbornconsulting.com</a> (425) 451-4009 Ext. 108
Nicole Chen Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:nicolec@osbornconsulting.com">nicolec@osbornconsulting.com</a> (206) 628-9133 Ext. 232
Mark Maurer Osborn Consulting, Inc.	QA/QC Lead <sup>12</sup>	<a href="mailto:markm@osbornconsulting.com">markm@osbornconsulting.com</a> (509) 867-3654

1. Lead Entity Project Manager – Responsible for ensuring the study is conducted as described in this QAPP. The Project Manager is the primary point of contact for the lead entity.
2. Principal Investigator – Responsible for developing the Ecology approved Detailed Study Design Proposal, Quality Assurance Project Plan (QAPP), Technical Evaluation Report (TER), and Fact Sheet, as well as conducting the study.
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August 5, 2021

Mr. Randy Meloy  
Surface Water Engineer  
City of Yakima  
129 N Second Street  
Yakima, WA 98901

**Subject: Confirmation of Contributing Entity Role for City of Yakima Car Wash Wastewater Management E&O Effectiveness Study**

Dear Randy:

This letter signifies that City of Sunnyside has reviewed their role noted in the City of Yakima Car Wash Wastewater Management E&O Effectiveness Study Quality Assurance Project Plan (QAPP) and will perform the role as described in the QAPP, which is also summarized in Attachment A. City of Sunnyside is bound to this role for the entirety of the study. In the event of an internal staff change, City of Sunnyside will contact you to provide the new contact information.

Sincerely,

A handwritten signature in black ink, appearing to read "Raul Sanchez", with a long horizontal flourish extending to the right.

Raul Sanchez, Wastewater/ Stormwater Supervisor  
City of Sunnyside

Attachment A – Key Project Team Members: Roles and Responsibilities

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Key Team Members	Role	Contact Information
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Jack Wells Yakima County	Contributing Entity <sup>4,5,6,7,8</sup>	<a href="mailto:jack.wells@co.yakima.wa.us">jack.wells@co.yakima.wa.us</a> (509) 574-2350
Erin Barnett City of Selah	Contributing Entity <sup>4,6</sup>	<a href="mailto:Erin.Barnett@selahwa.gov">Erin.Barnett@selahwa.gov</a> (509) 698-7331
Raul Sanchez City of Sunnyside	Contributing Entity <sup>4,5,6,7</sup>	<a href="mailto:rsanchez@sunnyside-wa.gov">rsanchez@sunnyside-wa.gov</a> (509) 836-6566
David Dominguez City of Union Gap	Contributing Entity <sup>4,6,9</sup>	<a href="mailto:david.dominguez@uniongapwa.gov">david.dominguez@uniongapwa.gov</a> (509) 249-9211
Jeff Wiemer Asotin County, City of Asotin, & City of Clarkston	Contributing Entity <sup>5,6,10</sup>	<a href="mailto:jwiemer@co.asotin.wa.us">jwiemer@co.asotin.wa.us</a> (509) 243-2071 Ext. 1430
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Mark Maurer Osborn Consulting, Inc.	QA/QC Lead <sup>12</sup>	<a href="mailto:markm@osbornconsulting.com">markm@osbornconsulting.com</a> (509) 867-3654

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CITY OF  
**UNION GAP**  
1883

August 12, 2021

City of Yakima  
Randy Meloy, Surface Water Engineer  
129 N. Second Street  
Yakima, WA 98901


**RE:** Confirmation of Contributing Entity Role  
Car Wash Wastewater Management  
E & O Effectiveness Study

Dear Randy:

This letter signifies that the City of Union Gap has reviewed their role noted in the City of Yakima Car Wash Wastewater Management E & O Effectiveness Study Quality Assurance Project Plan (QAPP) and will perform the role as described in the QAPP, which is also summarized in Attachment A.

The City of Union Gap is bound to this role for the entirety of the study. In the event of an internal staff change, the City will contact you to provide the new contact information.

Sincerely,

  
David Dominguez  
Civil Engineer

## Attachment A - Key Project Team Members: Roles and Responsibilities

Key Team Members	Role	Contact Information
Randy Meloy City of Yakima	Lead Entity <sup>1,3,5,7,8</sup>	<a href="mailto:randy.meloy@yakimawa.gov">randy.meloy@yakimawa.gov</a> (509) 576-6606
Jack Wells Yakima County	Contributing Entity <sup>4,5,6,7,8</sup>	<a href="mailto:jack.wells@co.yakima.wa.us">jack.wells@co.yakima.wa.us</a> (509) 574-2350
Erin Barnett City of Selah	Contributing Entity <sup>4,6</sup>	<a href="mailto:Erin.Barnett@selahwa.gov">Erin.Barnett@selahwa.gov</a> (509) 698-7331
Raul Sanchez City of Sunnyside	Contributing Entity <sup>4,5,6,7</sup>	<a href="mailto:rsanchez@sunnyside-wa.gov">rsanchez@sunnyside-wa.gov</a> (509) 836-6566
David Dominguez City of Union Gap	Contributing Entity <sup>4,6,9</sup>	<a href="mailto:david.dominguez@uniongapwa.gov">david.dominguez@uniongapwa.gov</a> (509) 249-9211
Jeff Wiemer Asotin County, City of Asotin, & City of Clarkston	Contributing Entity <sup>5,6,10</sup>	<a href="mailto:jwiemer@co.asotin.wa.us">jwiemer@co.asotin.wa.us</a> (509) 243-2071 Ext. 1430
Bill Aukett City of Moses Lake	Contributing Entity <sup>6,13</sup>	<a href="mailto:baukett@cityofml.com">baukett@cityofml.com</a> (509) 764-3792
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Aimee Navickis-Brasch, PhD, PE Osborn Consulting, Inc.	Principal Investigator <sup>2</sup>	<a href="mailto:aimeen@osbornconsulting.com">aimeen@osbornconsulting.com</a> (509) 995-0557
Taylor Hoffman-Ballard, PE Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:taylorh@osbornconsulting.com">taylorh@osbornconsulting.com</a> (952) 836-7863
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Mark Maurer Osborn Consulting, Inc.	QA/QC Lead <sup>12</sup>	<a href="mailto:markm@osbornconsulting.com">markm@osbornconsulting.com</a> (509) 867-3654

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# Public Services

128 North Second Street • Fourth Floor Courthouse • Yakima, Washington 98901  
(509) 574-2300 • 1-800-572-7354 • FAX (509) 574-2301 • [www.co.yakima.wa.us](http://www.co.yakima.wa.us)

LISA H. FREUND – Director

August 5, 2021

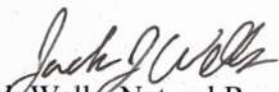
Mr. Randy Meloy  
Surface Water Engineer  
City of Yakima  
129 N Second Street  
Yakima, WA 98901

**Subject: Confirmation of Contributing Entity Role for City of Yakima Car Wash Wastewater Management E&O Effectiveness Study**

Dear Randy:

This letter signifies that Yakima County has reviewed their role noted in the City of Yakima Car Wash Wastewater Management E&O Effectiveness Study Quality Assurance Project Plan (QAPP) and will perform the role as described in the QAPP, which is also summarized in Attachment A. Yakima County is bound to this role for the entirety of the study. In the event of an internal staff change, Yakima County will contact you to provide the new contact information.

Sincerely,

  
Jack Wells, Natural Resource Specialist-Stormwater Lead  
Yakima County Public Services-Water Resources Division

Attachment A – Key Project Team Members: Roles and Responsibilities



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Aimee Navickis-Brasch, PhD, PE Osborn Consulting, Inc.	Principal Investigator <sup>2</sup>	<a href="mailto:aimeen@osbornconsulting.com">aimeen@osbornconsulting.com</a> (509) 995-0557
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8. Observational Data Collection – The contributing entity will conduct drive-by visits in target areas on two consecutive weekends, and on at least one day per weekend in July and in September. The contributing entity will record observations made regarding evidence of residential car wash behavior during the visits.
9. Data Verifier – Data verifiers will review the analyzed data and verify the analysis is correct and that the data being analyzed matches the data collected.
10. Auditor – Responsible for conducting audits to verify the study conforms to the plan and procedures of this document. This may include: verifying staff collecting the data are trained and follow SOPs for data collection; verifying data management procedures are followed including reviewing data records to ensure they are consistent, correct and complete, with no errors or omissions; and traveling where the data is stored to review the data records compared to the QAPP Data Management Plan. Auditors will report their findings directly to the Lead Entity PM.
11. Research Assistant – Responsible for assisting the Principal Investigator.
12. QA/QC Lead – Responsible for providing QA/QC review of reporting related to study.
13. Commercial Car Wash Usage Data Collection – Responsible for requesting and obtaining (if possible) commercial car wash usage data from commercial car washes in the City of Yakima for at least the previous two years through October 2021.



August 27, 2021

Mr. Randy Meloy  
Surface Water Engineer  
City of Yakima  
129 N Second Street  
Yakima, WA 98901

**Subject: Confirmation of Contributing Entity Role for City of Yakima Car Wash Wastewater Management E&O Effectiveness Study**

Dear Randy:

This letter signifies that the City of Moses Lake has reviewed their role noted in the City of Yakima Car Wash Wastewater Management E&O Effectiveness Study Quality Assurance Project Plan (QAPP) and will perform the role as described in the QAPP, which is also summarized in Attachment A. The City of Moses Lake is bound to this role for the entirety of the study. In the event of an internal staff change, Richard Law, City Engineer will contact you to provide the new contact information.

Sincerely,

Bill Aukett, Stormwater Program Manager  
City of Moses Lake

Attachment A – Key Project Team Members: Roles and Responsibilities

cc Dave Bren Municipal Services Director, Richard Law City Engineer

## Attachment A - Key Project Team Members: Roles and Responsibilities

Key Team Members	Role	Contact Information
Randy Meloy City of Yakima	Lead Entity <sup>1,3,5,7,8</sup>	<a href="mailto:randy.meloy@yakimawa.gov">randy.meloy@yakimawa.gov</a> (509) 576-6606
Jack Wells Yakima County	Contributing Entity <sup>4,5,6,7,8</sup>	<a href="mailto:jack.wells@co.yakima.wa.us">jack.wells@co.yakima.wa.us</a> (509) 574-2350
Erin Barnett City of Selah	Contributing Entity <sup>4,6</sup>	<a href="mailto:Erin.Barnett@selahwa.gov">Erin.Barnett@selahwa.gov</a> (509) 698-7331
Raul Sanchez City of Sunnyside	Contributing Entity <sup>4,5,6,7</sup>	<a href="mailto:rsanchez@sunnyside-wa.gov">rsanchez@sunnyside-wa.gov</a> (509) 836-6566
David Dominguez City of Union Gap	Contributing Entity <sup>4,6,9</sup>	<a href="mailto:david.dominguez@uniongapwa.gov">david.dominguez@uniongapwa.gov</a> (509) 249-9211
Jeff Wiemer Asotin County, City of Asotin, & City of Clarkston	Contributing Entity <sup>5,6,10</sup>	<a href="mailto:jwiemer@co.asotin.wa.us">jwiemer@co.asotin.wa.us</a> (509) 243-2071 Ext. 1430
Bill Aukett City of Moses Lake	Contributing Entity <sup>6,13</sup>	<a href="mailto:baukett@cityofml.com">baukett@cityofml.com</a> (509) 764-3792
Andrea Jedel Department of Ecology	Ecology Approval	<a href="mailto:ajed461@ecy.wa.gov">ajed461@ecy.wa.gov</a> (509) 575-2807
Brandi Lubliner Department of Ecology	Ecology Approval	<a href="mailto:brandi.lubliner@ecy.wa.gov">brandi.lubliner@ecy.wa.gov</a> (360) 407-7140
Aimee Navickis-Brasch, PhD, PE Osborn Consulting, Inc.	Principal Investigator <sup>2</sup>	<a href="mailto:aimeen@osbornconsulting.com">aimeen@osbornconsulting.com</a> (509) 995-0557
Taylor Hoffman-Ballard, PE Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:taylorh@osbornconsulting.com">taylorh@osbornconsulting.com</a> (952) 836-7863
Makenna Lindberg Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:makennal@osbornconsulting.com">makennal@osbornconsulting.com</a> (425) 451-4009 Ext. 108
Nicole Chen Osborn Consulting, Inc.	Research Assistant <sup>11</sup>	<a href="mailto:nicolec@osbornconsulting.com">nicolec@osbornconsulting.com</a> (206) 628-9133 Ext. 232
Mark Maurer Osborn Consulting, Inc.	QA/QC Lead <sup>12</sup>	<a href="mailto:markm@osbornconsulting.com">markm@osbornconsulting.com</a> (509) 867-3654

1. Lead Entity Project Manager – Responsible for ensuring the study is conducted as described in this QAPP. The Project Manager is the primary point of contact for the lead entity.
2. Principal Investigator – Responsible for developing the Ecology approved Detailed Study Design Proposal, Quality Assurance Project Plan (QAPP), Technical Evaluation Report (TER), and Fact Sheet, as well as conducting the study.
3. Study Financial Support – Responsible for the study cost, except costs related to TAG management.
4. TAG Financial Support – Responsible for TAG management costs.
5. E&O Materials Financial Support – Responsible for providing E&O materials for the Central Washington State Fair or another event during the study.
6. Technical Advisory Group (TAG) Member – The goal of the TAG is to provide insight, suggestions, and professional opinions to the Principal Investigator throughout the study. The primary responsibilities of TAG members include attending up to six project meetings

(by webinar or in person) and participating in the meeting discussion; review and provide comment on research materials (i.e., QAPP, data collected, data analyzed, final report, etc.) prior to the lead entity submitting the documents to Ecology. Members of the TAG may also serve as an Auditor to verify the study conforms to the plan and procedures as defined in the QAPP and/or a Data Verifier who reviews the analyzed data and verifies the analysis is correct and that the data being analyzed matches the data collected.

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