



City of Tukwila
Follow-up Assessment of Citizen
Understanding and Adoption of Targeted
Stormwater Behaviors

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Prepared by

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Research Goals and Objectives

Research Goal

According to the Phase II permit, section S5C1, the goal of the education program is to reduce or eliminate behaviors and practices that cause or contribute to adverse stormwater impacts. The minimum measures to achieve this include educational outreach to improve the target audience's understanding of the problem and what it can do to solve it. The Tukwila residents are cited as the top priority target audience for education. Each permittee (City of Tukwila) is required to measure the understanding and adoption of target behaviors of its citizens and to use measurement to direct the application of education and outreach resources in the most effective manner. Specifically, this research will reflect the changes to the NPDES permit requirements that were revised in 2013.

Objectives:

Content areas for research included:

- General impacts of stormwater flows into surface waters
- Knowledge of the benefit of pervious surfaces
- Source control BMPs and environmental stewardship actions and opportunities in the areas of pet waste, vehicle maintenance, and landscaping
- BMPs for use and storage of automotive parts, hazardous cleaning supplies, carwash soaps and other hazardous materials
- Knowledge of what constitutes an illicit discharge and how to report it
- Yard care techniques relating to protecting stormwater quality and knowledge of what constitutes pollution in the yard
- BMPs for use and storage of pesticides and fertilizers
- BMPs for the disposal of carpet cleaning fluids
- BMPs for auto maintenance
- Impact of illicit discharges
- How to report illicit discharges
- Low Impact Development (LID) Principles
- Low Impact Development (LID) BMPs
- Opportunities to become involved in stewardship activities
- Equipment Maintenance
- Prevention of illicit discharges

- Determined the success of the adoption of SWMP’s education and outreach program designed to reduce or eliminate behaviors and practices that cause or contribute to adverse stormwater impacts and encourage the public to participate in stewardship activities. These programs include the following:
- The education and outreach program for the area served by the MS4. The program was designed to educate target audiences about the stormwater problem and provide specific actions to minimize the problem
 - Determined the adoption and success of the programs meant to build general awareness. The target audience of the programs and the subject areas include the following:
 - The general public, including school age children and businesses
 - General impacts of stormwater on surface waters
 - Impacts from impervious surfaces
 - Impacts of illicit discharges and how to report them
 - Low impact development (LID) principles and LIB BMPs
 - Opportunities to become involved in stewardship activities
 - Determined the adoption and success of the programs designed to effect behavior change. The target audience of the programs and subject areas include the following:
 - The general public
 - Use and storage of automotive chemicals, hazardous cleaning supplies, carwash soaps, and other hazardous materials
 - Equipment maintenance
 - Prevention of illicit discharges
 - Residents, landscapers, and property managers/owners
 - Yard care techniques protective of water quality
 - Use and storage of pesticides and fertilizers and other household chemicals
 - Carpet cleaning and auto repair and maintenance
 - Vehicle, equipment and home/building maintenance
 - Principles and LID BMPs
 - Stormwater facility maintenance
 - Dumpster and trash compactor maintenance
 - Determined the adoption and success of each permittee creating stewardship opportunities and/or partnering with existing organizations to encourage residents to participate in activities such as stream teams, storm drain marking, volunteer monitoring, riparian plantings, and education activities.

Research Methodology

Sampling Frame

A list containing over 1,500 randomized telephone numbers of city residents was purchased from a commercial list company. The list company maintains a record of all telephone numbers appearing in all phone books in the United States. Using the zip codes covering the study area, the list company drew a random sample of phone numbers. High density areas have more phone numbers and, by randomly drawing from the list, the high and low density areas are properly proportioned. The resulting list for the city was loaded into Hebert Research’s CATI (Computer-Aided Telephone Interviewing) system which randomly selects phone numbers as required during the interviewing process. Phone numbers were called up to five times at different times during the day and evening. This helped to assure that the survey was administered to both those who are easy to reach and those who are more difficult to contact. Similar to the previous two research projects, Hebert Research sampled 105 residents of Tukwila, which were weighted back to the 2010 U. S. Census data by age and gender.

The following table represents the sample sizes for years 2011 through 2013 and 2015.

| Sample Totals | |
|---------------|-------------|
| Year | Sample Size |
| 2011 | 100 |
| 2012 | 100 |
| 2013 | 103 |
| 2015 | 105 |
| Total | 408 |

Questionnaire

The survey was created for administration to the general public within the City of Tukwila. Research questions were developed by Hebert Research with input from the city. The survey consisted of 31 variables, 28 of them relating directly to knowledge about stormwater issues and practices respondents had adopted, which protect the quality of stormwater. The remaining three questions dealt with an overall assessment of surface water quality, where illicit discharges should be reported, and which of stewardship activities that Tukwila residents have heard of or participated in within last year. There were 4 new questions added to the research of 2015. Of the 4 questions, three questions dealing with knowledge about low impact development practices, the remaining question dealing with stewardship activities measurement. Hebert Research completed all interviews using the same interactive voice (telephone) survey methodology that was utilized in the 2011, 2012 and 2013 assessment for Tukwila.

Research Controls

Hebert Research applied a variety of controls to help ensure that the research and analysis reached the highest quality that can be provided. The primary research controls employed in this study included the following:

Interviewer Training

All interviewers participated in a special training session for this study. During this training session, the questionnaire was read and a discussion was held regarding the objectives of the study, screening questions, skip patterns, and techniques for handling potential problems. Interviewers raised questions and provided their professional feedback regarding potential interviewing issues.

Pre-test the Survey

After the questionnaire was programmed in our CATI system, it was rigorously tested to assure all questions were asked and that data was accurately recorded. Thirty surveys were conducted during the pretest. The programming was deemed to be valid.

Conduct Interviews

Following a successful pretest of the questionnaire, telephone interviews were conducted using Ci3 CATI software from Sawtooth Software, a recognized leader in computer-aided interviewing. Potential respondents were called on weekdays at various times throughout the afternoon and evening until 9:00 pm. An appointment and callback procedure was used when necessary to minimize refusals and allow respondents to complete the survey at a convenient time. Interviews were conducted in English.

Monitoring

Telephone interviews were regularly monitored by the data collection supervisor and were found to be properly conducted.

Internal Peer Review

Hebert Research uses an internal review process called “CERA” (create, edit, review, approve) which is similar to academic peer review to ensure that each study meets or exceeds rigorous quality control standards. Through this process, several analysts review the statistical findings and offer critical feedback designed to increase the utility of the research and produce a clear and insightful report.

Margin of Error, Incidence and Response Rates

A total of 105 surveys were completed by adults living within the zip codes of Tukwila. At the 95% confidence level, the maximum margin of error for a sample size of 105 respondents is $\pm 9.78\%$. This margin of error means that if the survey was

repeated 100 times, the resulting percentages for each response for the city would be within $\pm 9.78\%$ (the margin of error) in 95 out of 100 cases for each question.

Over 1,500 phone numbers of residences in the city were included in the sampling frame. When a resident answered the phone and contact was made, we asked the respondent to participate in the survey. The *incidence rate* represents the percent of individuals we spoke to who were qualified to take the survey, meaning they spoke English and reported living within the city. The *response rate* represents the percent of qualified individuals we spoke to who agreed to participate and who completed an interview. Response rates above 50.0% are higher compared to other community-wide surveys and serve to increase confidence in the survey's validity and reliability. The incidence rate of the surveys was 57.22%; the response rate was 55.83 %.

Statistical Weighting

Statistical weighting is a technique that is commonly used in research to reduce sampling error. During the process of data collection, demographic data from the U.S. Census was obtained to identify population parameters for the survey. Sample demographics—specifically, gender—was compared with distributions in the population within each city. Using the same weighting methodology utilized for the survey of 2011, 2012 and 2013, the collected data was run through a statistical procedure and found that there is no significant difference between weighted and un-weighted data. Data in the report for 2015 uses the unweighted data.

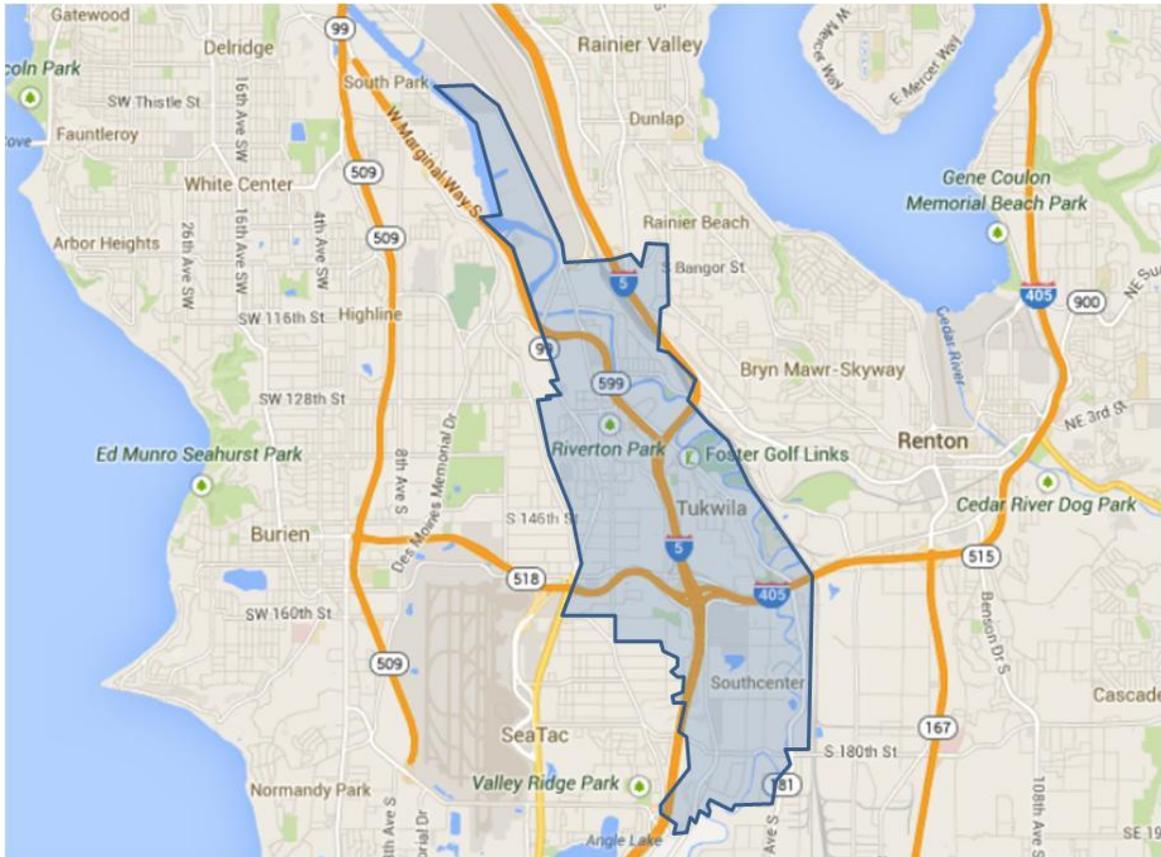
Use of Findings

Hebert Research has made every effort to produce the highest quality research product within the agreed specifications, budget and schedule. The customer understands that Hebert Research uses those statistical techniques, which, in its opinion, are the most accurate possible. However, inherent in any statistical process is a possibility of error, which must be taken into account in evaluating the results. Statistical research can reveal information regarding community perceptions only as of the time of the sampling, within the parameters of the project, and within the margin of error inherent in the techniques used.

Evaluations and interpretations of statistical research findings and decisions based on them are solely the responsibility of the customer and not Hebert Research. The conclusions, summaries and interpretations provided by Hebert Research are based strictly on the analysis of the data gathered, and are not to be construed as recommendations; therefore, Hebert Research neither warrants their viability nor assumes responsibility for the success or failure of any customer actions subsequently taken.

Geographical Map of Surveyed Area

The map below shows the geographic area from which the sample was drawn. The survey was administered within the sampling fractal defined by the incorporated area city boundary of Tukwila.



Explanation of Multivariate Analysis

The data for the research were analyzed using the chi square statistic to examine differences between respondents on a regional basis according to gender. Responses for the knowledge questions were first categorized as being either a correct response or an incorrect response. The incorrect response category was made up of wrong answers plus responses classified as “need more information,” “don’t know/refused,” and “not applicable.” Following classification, the chi square test was executed. For the questions dealing with the actions of the respondents, those who said the action did not apply to them were eliminated from the data set. Following their removal, the categories were classified as being “correct” or “incorrect” with the “incorrect” classification consisting of the collapsed categories as described above. The statistical test was run using these two categories.

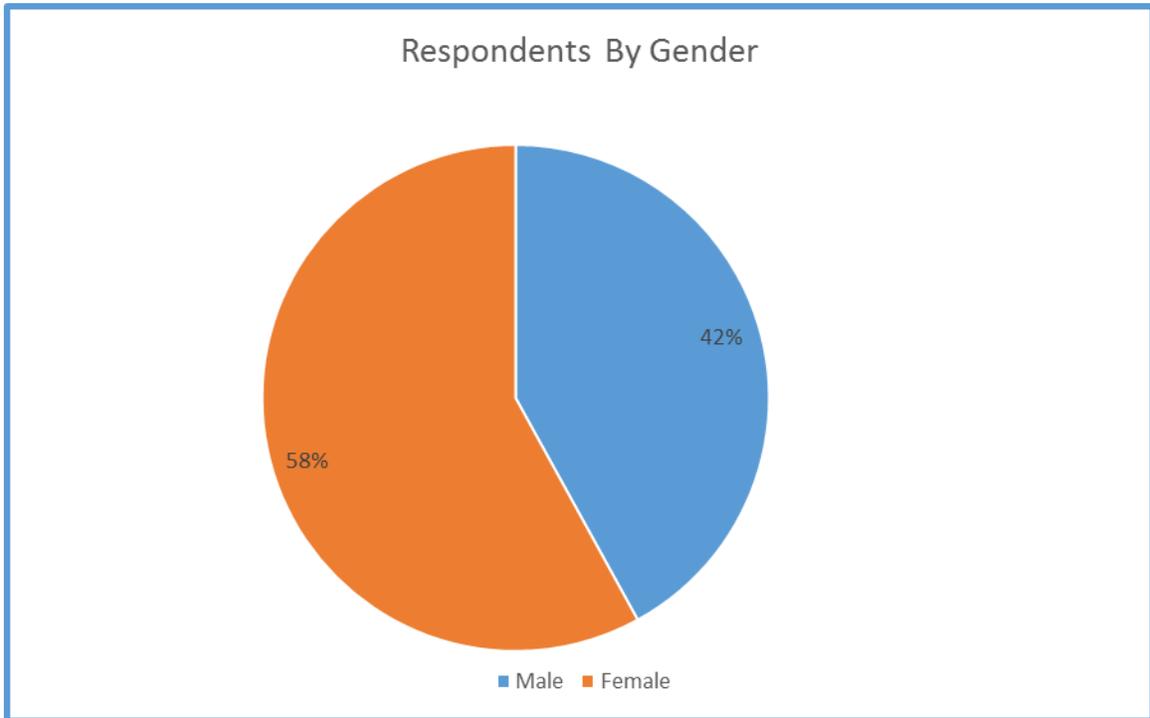
Hypotheses were tested using the 0.05 level of significance as the criterion value for the chi-square analysis. When differences between groups reached this value, the finding is reported along with its level of significance which is stated as a p-value (e.g., $p = 0.04$). Chi-square test results that reach the 0.05 level of significance indicate there is at least a 19-out-of-20 likelihood that the finding is true. This is a generally accepted level of reliability for public surveys. Findings of no significance are also reported to provide the basis for conclusions regarding the uniformity of opinion across the sample.

Cramér’s V is a statistical test that measures the degree of association between two categorical variables. For statistical tests that reach significance using chi-square, Cramér’s V values are provided to describe the strength of the association between the variables. This measurement ranges between 0.0 and 1.0. The higher the level of association, the greater is the probability that the independent variable is causing an effect on the dependent variable. A measurement of 0 indicates there is no association between the two, meaning it is likely the independent variable has no systematic effect on the dependent variable. A measurement of 1.0 indicates that variations in the independent variable completely match variations in the dependent variable.

Multivariate analyses were performed only between 2015 and 2013 data. Multivariate analysis consisted of Analysis of Variance (ANOVA) and Chi-Square Analysis. The 2011 data was included to provide a benchmark for the subsequent years; Priority classifications were based off the 2011 results for comparison (i.e. the questions involved in each Priority issue were kept the same each year, regardless if the questions may have shifted to another Priority classification).

Respondent Profile

The following chart describes the demographic profile of the sample for Tukwila by gender. As indicated in the methodology section, there is no significant difference between weighted and un-weighted sample by gender at the 95% confidence level. The percentages listed below are the un-weighted sample frequencies for gender.



Assessment of Water Quality in the Environment

Respondents rated the quality of water in Tukwila’s rivers, creeks and ponds on a 0-10 numeric scale where 0 meant “extremely polluted” and 10 meant “extremely clean.” The average rating for surface water quality was significantly higher in 2015 than in the previous three years. The rating increased from 5.94 in 2013 to 7.04 in 2015. This increase was statistically significant ($p = .002$). The chart below illustrates the mean rating of respondents by research year.

Figure 1. Respondent Rating of Surface Water Quality by Year

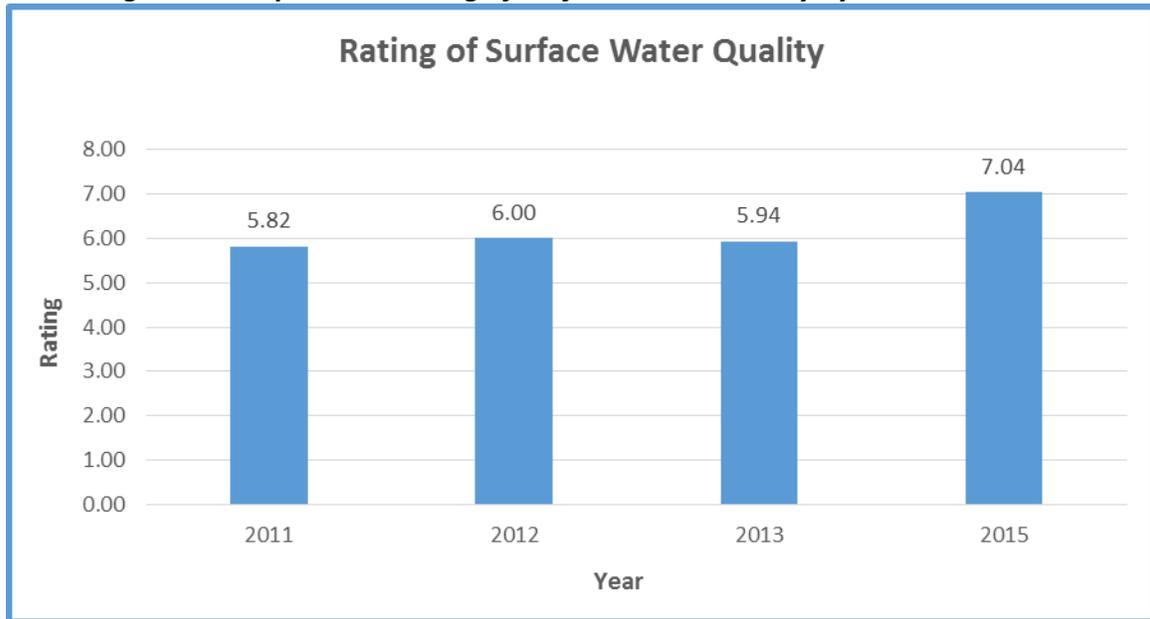
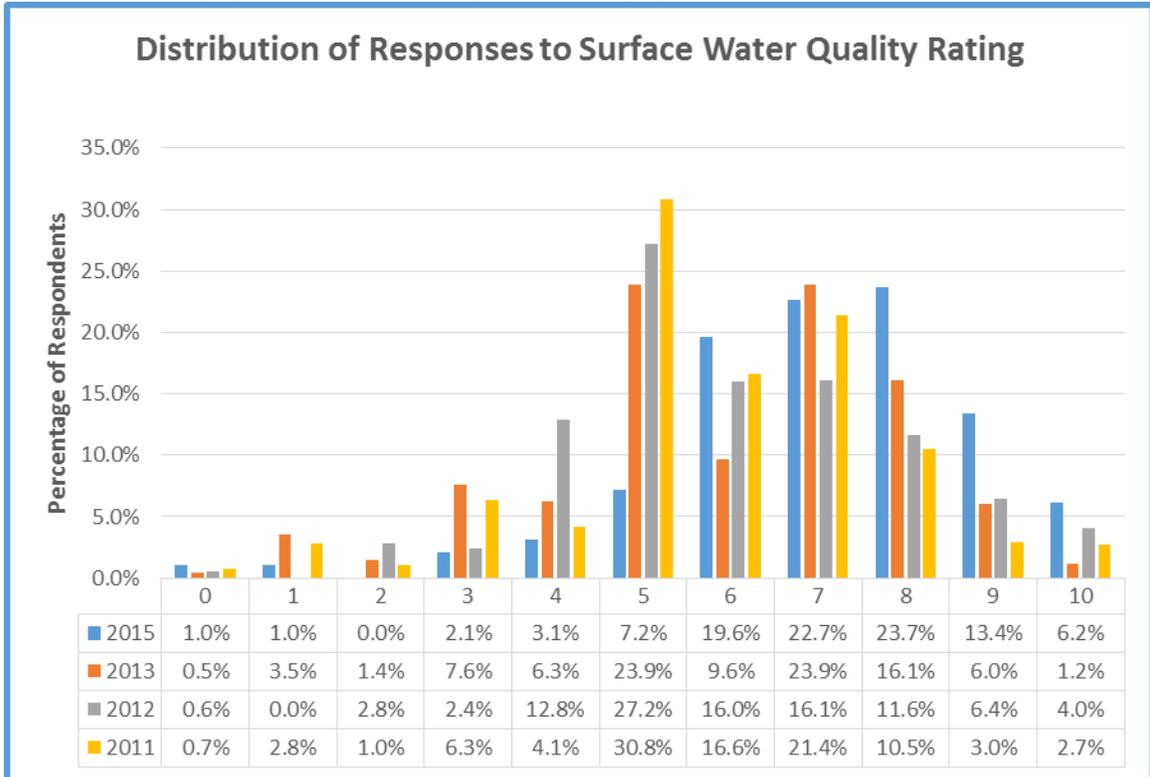


Figure 2 shows the distribution of respondent ratings for 2015, 2013, 2012, and for the 2011 results at each point along the rating scale.

About two-thirds of the respondents (66%) reported a surface water quality level of 7 or higher. This is an 18.8% increase in number of respondents responding with 7 or greater from 2013. The number of respondents giving a low surface water quality ratings (ratings 0-3) decreased from 13% in 2013 to 4.1% in 2015.

Figure 2: Rating by General Public of the Quality of Water in the Environment



Opportunities for Expansion and Focus of Education Programs

The two main purposes of this survey were to assess changes in the public’s stormwater knowledge and related behavior from 2011, 2012 and 2013 to 2015. These comparisons are needed because of the city’s educational program and to develop priorities for future stormwater public education and outreach.

As in the baseline study, the results are organized by the percent of the respondents who provided a correct answer for the current survey—the lower the percent of correct answers given by the sample, the higher the priority for education:

- Priority 1 Issues: Less than 50% correct answers
- Priority 2 Issues: From 50 to 80% correct answers
- Priority 3 Issues: Over 80% correct answers

In administering the questionnaire, respondents were presented with statements that were either true or false and were asked if they agreed or disagreed with the statement. Each of the statements in the tables appearing below include a letter indicating the correct answer for that statement, an **A** for “Agree” and a **D** for “Disagree.” When the word “Adopt” appears, it means the statement deals with whether respondents have “adopted” the desirable behavior mentioned in the statement. The combination of “**A Adopt**,” then, means the question deals with behavior and the desired response is A for “Agree.” This response equates to the respondent saying that he or she engages in the desired behavior mentioned in the statement.

Priority 1 Issues

Priority 1 issues represent areas of knowledge and behavior where less than half of the respondents provided the correct or desired response. Table 1 shows the percent of correct answers for Priority 1 issues in 2011, 2012, 2013 and 2015.

Table 1: Priority 1 Issues

| Priority 1 Issues (based on 2011 results) | | | | |
|---|-----------|--------|--------|--------|
| Questions | % Correct | | | |
| | 2011 | 2012 | 2013 | 2015 |
| The runoff from washing a car with biodegradable soap is safe in stormwater drains. D | 30.20% | 31.00% | 38.81% | 28.00% |
| Pollution in our rivers, wetlands and lakes is more the result of commercial discharge practices than individual human activity. D | 35.00% | 43.60% | 45.86% | 20.79% |
| Bricks or pavers offer no advantage for reducing runoff over concrete or asphalt pavement. D | 38.50% | 42.10% | 45.91% | 42.00% |
| Grass clippings and leaves are not regarded as harmful in stormwater. D | 42.80% | 50.00% | 51.41% | 51.00% |
| Sediment or dirt in stormwater is natural and not regarded as pollution. D | 48.00% | 53.30% | 48.72% | 39.00% |
| Green rooftops reduce the amount of stormwater runoff. A | N/A | N/A | N/A | 48.00% |
| Impervious surfaces and streets are better for managing runoff than porous ones. D | N/A | N/A | N/A | 39.00% |

**Yellow Highlights indicate a question dealing with behavior; how the respondent acts in that situation. Percents apply only to respondents who said the question applied to them. All “Does not apply” responses were combined with the “Don’t Know” response category for the knowledge questions since all of the knowledge questions apply to everyone. This table of Priority 1 issues is based on 2011 results. Thus, percentages for other years may exceed 50%.*

Related Multivariate Analysis Findings

The question where the public showed a statistically significant difference between the benchmark year 2013 and 2015 was:

- Pollution in our rivers, wetlands and lakes is more the result of commercial discharge practices than individual human activity. The percent of correct responses decreased from 45.86% in 2013 to 20.79% in 2015. (p-value = 0.049, Cramers’v = 0.138)

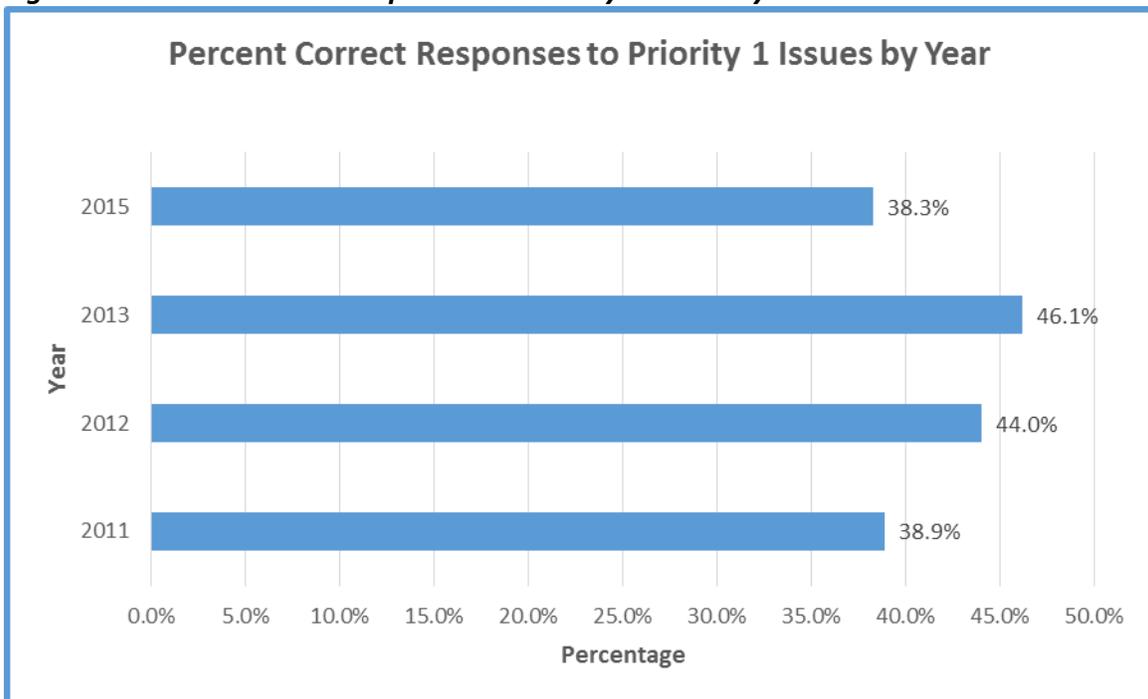
Statistically Significant Differences by Gender

There were no statistically significant differences in responses to Priority I issues when analyzed by Gender.

Topics for Public Education: Priority 1

The overall percentage of respondents who answered correctly for the 2011 Priority I issues was calculated for the 2011, 2012, 2013 and 2015 surveys. The overall percent in 2011 of 38.9% increased to 44% in 2012, increased to 46.1% in 2013 and decreased down to 38.3%. The overall percentage of correct responses in 2013 was not significantly different from the overall percentage for the same issues in 2015.

Figure 3: Percent Correct Responses to Priority 1 Issues by Year



Knowledge of how rivers, wetlands, lakes and the marine waters of Puget Sound become polluted by stormwater is an essential precursor to improving understanding, raising the desire to act responsibly, and bringing about behavioral change. Priority 1 educational programming and marketing campaigns should convey the following messages:

- *Biodegradable soap is not a safe addition to stormwater drains and should be kept from entering the stormwater drainage system.*
- *The primary cause of pollution in stormwater runoff is individual human activity, not commercial discharge. Success in reducing environmental pollution depends upon everyone's participation in helping to make a difference.*
- *Bricks or pavers help to reduce the volume of stormwater runoff and, therefore, help to reduce stormwater pollution in the environment.*
- *Grass clippings and leaves in stormwater are regarded as pollution and should be kept out of the stormwater drainage system.*
- *Sediment and dirt are pollution and should be prevented from entering the stormwater drainage system.*
- *Green rooftops help to reduce the volume of stormwater runoff and, therefore help to reduce stormwater pollution in the environment.*
- *Impervious surfaces and streets are better for managing runoff than porous ones. Impervious surfaces are significant contributors to pollution in stormwater runoff. Hence, it is important to keep impervious surfaces clean using acceptable cleaning techniques and, where possible, use pervious surfaces.*

Priority 2 Issues

Priority 2 issues represent areas of knowledge and behavior where 50% to 80% of the respondents provided the correct response. Table 2 shows the percent of correct answers for Priority 2 issues in 2011, 2012, 2013 and 2015.

Table 2: Priority 2 Issues

| Priority 2 Issues (based on 2011 results) | | | | |
|---|-----------|--------|--------|--------|
| Questions | % Correct | | | |
| | 2011 | 2012 | 2013 | 2015 |
| When I wash a motor vehicle at home, the soapy water ends up in a ditch or on the street. D Adopt | 51.20% | 45.80% | 46.47% | 39.24% |
| Drains on city streets for stormwater are connected to the same sanitary or sewage system for waste. D | 54.80% | 46.50% | 47.30% | 42.16% |
| All water going into stormwater drains on the street is treated before being discharged into the surface and ground water. D | 55.70% | 59.10% | 58.67% | 54.00% |
| The best place to dispose of water from cleaning a Latex paint brush is in a sink inside, not outdoors. A | 60.30% | 64.00% | 77.35% | 49.00% |
| Non-Point stormwater runoff is the leading cause of pollution in rivers, wetlands and lakes. A | 62.30% | 60.70% | 73.08% | 56.86% |
| Chemical treatments to kill moss on roofs pose little risk for polluting stormwater. D | 63.20% | 61.50% | 77.05% | 54.00% |
| An <i>illicit or unlawful stormwater discharge</i> is primarily defined as anything that enters a storm drain system that is not made up entirely of stormwater. A | 64.30% | 58.50% | 65.46% | 68.00% |
| Using a mulching lawnmower reduces the need to fertilize a lawn. A | 64.50% | 78.00% | 86.08% | 82.00% |
| Washing a vehicle at a commercial car wash causes less pollution than washing a vehicle on the street using a biodegradable soap. A | 67.40% | 62.50% | 73.67% | 68.00% |
| Impervious surfaces such as roads and driveways are not significant sources of pollution to stormwater. D | 71.60% | 71.90% | 71.47% | 53.00% |
| All of my family's vehicle parts with oil or grease on them are kept away from the weather. A Adopt | 71.80% | 82.00% | 95.48% | 85.90% |
| Carpet shampoo wastewater can be safely added to a stormwater drain. D | 75.60% | 77.40% | 88.16% | 68.00% |
| The best way to clean up spilled oil on the driveway is to fully absorb it using kitty litter or paper towels and deposit this waste in a garbage can. A | 76.40% | 81.80% | 82.01% | 83.00% |
| The downspouts at my house convey the water to an area where it is absorbed by the ground. A Adopt | 79.90% | 85.60% | 78.29% | 77.08% |

| | | | | |
|--|-----|-----|-----|--------|
| All automotive chemicals and cleaning supplies, can be stored and disposed of in the same manner | N/A | N/A | N/A | 56.00% |
|--|-----|-----|-----|--------|

**Yellow Highlights indicate a question dealing with behavior; how the respondent acts in that situation. Percents apply only to respondents who said the question applied to them. All “Does not apply” responses were combined with the “Don’t Know” response category for the knowledge questions since all of the knowledge questions apply to everyone. This table of Priority 2 issues is based on 2011 results. Thus, percentages for other years may not fall between 50% and 80%.*

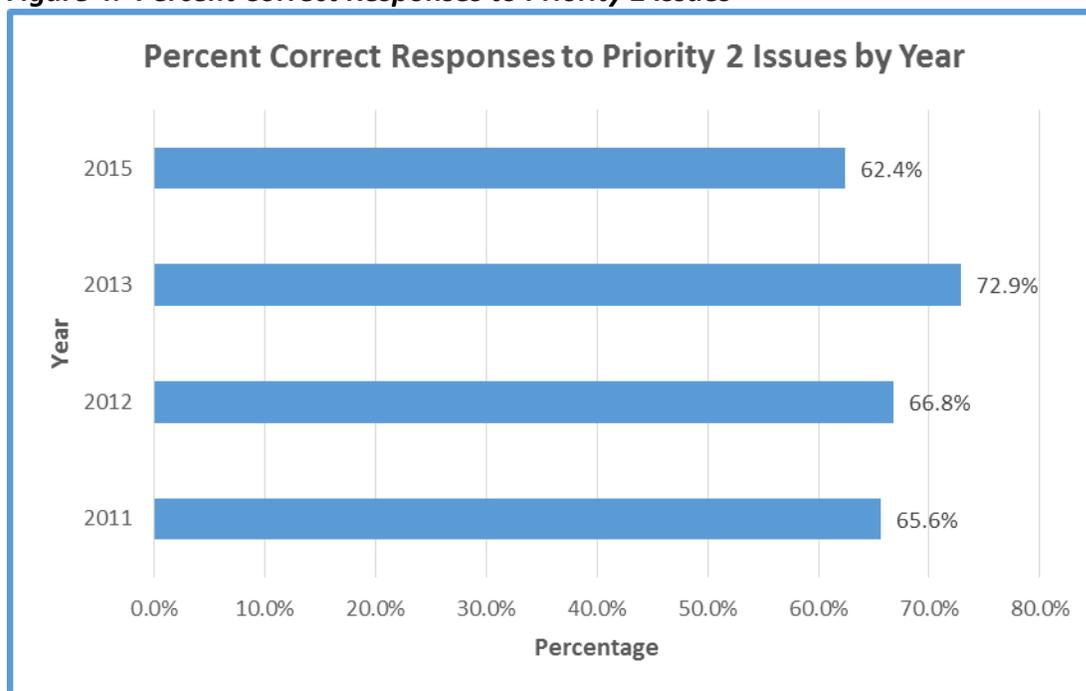
Related Multivariate Analysis Findings

There were no statistically significant differences in public knowledge of stormwater – Priority II issues between the 2013 results and 2015 results. There were also no statistically significant differences in responses to Priority II issues when analyzed by gender.

Topics for Public Education: Priority 2

The average percentage of respondents who answered correctly for the 2011 Priority 2 issues was calculated for the 2011, 2012, 2013 and 2015 surveys. The overall percent in 2011 of 65.6% increased to 66.8% in 2012, increased to 72.9% in 2013 and decreased significantly to 62.4% in 2015. This is the lowest correct percent recorded among the survey years. The decrease in overall correct responses from 2013 to 2015 was not statistically significant.

Figure 4: Percent Correct Responses to Priority 2 Issues



While more than half of the public responded correctly to these issues represents a desirable level of public knowledge, the goal remains to achieve a fully informed public. Consequently, Priority 2 issues continue to represent real opportunities for further public education and social marketing. Future educational and marketing campaigns addressing Priority 2 issues should contain the following messages:

- *To best protect the environment, soapy water from washing a motor vehicle is best handled by allowing it to be absorbed by a lawn or the ground. It should not be allowed to flow into the street or into a drainage ditch.*
- *The water in stormwater drains is not connected to the sanitary sewer system nor is all stormwater treated to remove pollutants before being released into the environment. Therefore, the quality of stormwater going into the drainage system is what determines the level of pollution in surface water.*
- *All water going into stormwater drains is not treated before being discharged into the environment.*
- *The best place to clean paint brushes is in a sink that drains into the sanitary sewer system, not outdoors.*
- *Non-Point Stormwater runoff is the leading cause of pollution in rivers, wetlands and lakes.*
- *The residue from chemical treatments that kill moss is a source of pollution.*
- *An illicit or illegal discharge is anything that enters a storm drain system that is not made up entirely of stormwater.*
- *A mulching lawnmower reduces the need for using fertilizer and, hence, represents a valuable method for eliminating fertilizer pollution in stormwater.*
- *Vehicles should be washed at commercial facilities, not at homes where runoff is allowed to drain into the streets.*
- *Impervious surfaces, such as roads and driveways, are a significant source of stormwater pollution.*
- *Store vehicle parts with oil or grease on them under a roof or cover.*

- *Proper disposal of used cleaning supplies, including carpet shampoo.*
- *Carpet shampoo wastewater cannot be safely disposed of at the stormwater drain.*
- *Proper methods for cleaning up oil and grease spills, such as using kitty litter and paper towels.*
- *Fix house downspouts to dispense the water to an area where it can be absorbed by the ground.*
- *All automotive chemicals and cleaning supplies, should be stored and disposed of in the different manner.*

Priority 3 Issues

Priority 3 issues represent areas of knowledge or behavior where more than 80% of the respondents provided the correct response. Table 3 shows the percentage of correct answers for Priority 3 issues in 2011, 2012, 2013 and 2015.

Table 3: Priority 3 Issues

| Priority 3 Issues (based on 2011 results) | | | | |
|--|-----------|--------|--------|--------|
| Questions | % Correct | | | |
| | 2011 | 2012 | 2013 | 2015 |
| Scrubbing oil and grease spots on outdoor concrete or asphalt with soap and hosing it off is a good way to prevent polluting stormwater runoff. D | 83.40% | 67.20% | 76.44% | 58.00% |
| I'm careful not to exceed the recommended amount of insecticide or weed killer than the directions say to use. A Adopt | 83.50% | 91.10% | 84.05% | 94.44% |
| My household recycles all used motor oil. A Adopt | 87.90% | 80.30% | 92.25% | 96.30% |
| I'm careful not to exceed the recommended amount of fertilizer than the directions say to use. A Adopt | 90.00% | 93.20% | 86.46% | 90.00% |
| My family stores all containers holding oil or antifreeze under a roof or cover. A Adopt | 92.60% | 93.20% | 97.92% | 91.01% |
| My household stores all yard fertilizers and pesticides inside a building or in a covered area out of the rain. A Adopt | 98.60% | 98.20% | 93.12% | 90.41% |

**Yellow Highlights indicate a question dealing with behavior; how the respondent acts in that situation. Percents apply only to respondents who said the question applied to them. All "Does not apply" responses were combined with the "Don't Know" response category for the knowledge questions since all of the knowledge questions apply to everyone. This table of Priority 3 issues is based on 2011 results. Thus, percentages for other years may be below 80%.*

Related Multivariate Analysis Findings

The questions where the public showed a statistically significant difference in knowledge between the benchmark year 2013 and 2015 were:

- My household recycles all used motor oil. The percent of correct responses increased from 92.25% in 2013 to 96.3% in 2015 (p-value = 0.007, Cramer's V = 0.206).

- I'm careful not to exceed the recommended amount of insecticide or weed killer than the directions say to use. The percent of correct responses increased from 84.05% in 2013 to 94.44% in 2015 (p-value = 0.025, Cramer's V = 0.177)

Statistically Significant Differences by Gender

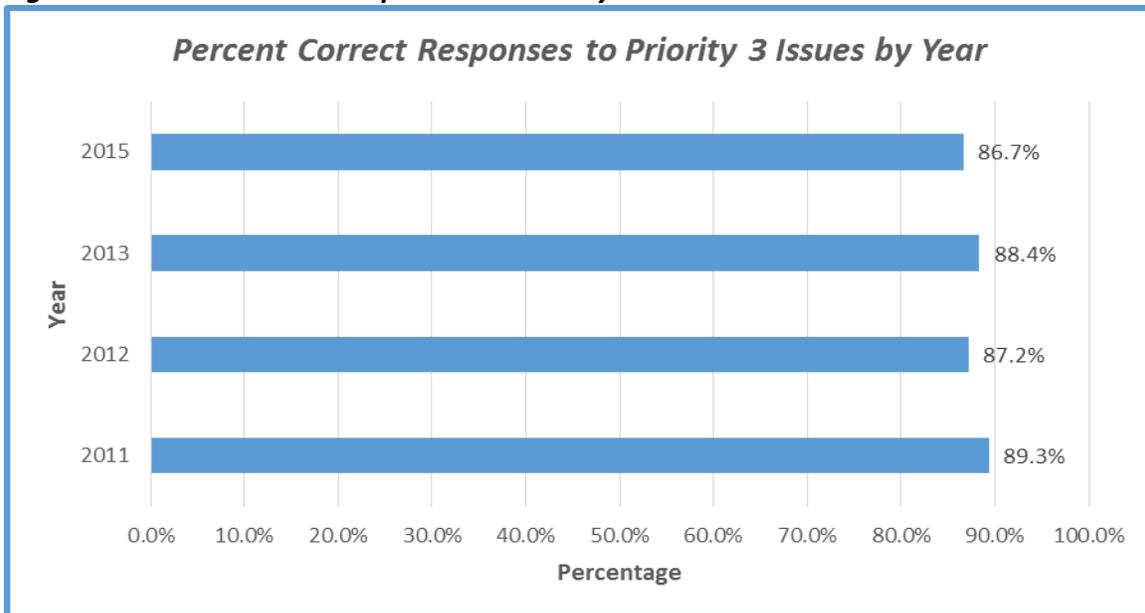
Males were more likely to correctly respond that “My family stores all containers holding oil or antifreeze under a roof or cover. Gender accounted for 21.2% of the differences in responses to this statement, as shown by Cramer’s V in the table below:

| My family stores all containers holding oil or antifreeze under a roof or cover. (A adopt) | | |
|---|----------------|------------------|
| Gender | Correct | Incorrect |
| Male | 97.56% | 2.44% |
| Female | 85.42% | 14.58% |
| Cramer's V: 0.212 P-value: 0.046 | | |

Topics for Public Education: Priority 3

The average percentage of respondents who answered correctly for the 2011 Priority 3 issues was calculated for the 2011, 2012, 2013 and 2015 surveys. The overall percent in 2011 of 89.3% decreased to 87.2% in 2012, slightly increased to 88.4% in 2013 and decreased to 86.7% in 2015. The overall percentage of correct responses in 2013 was statistically significant from the overall percentage for the same issues in 2015. (p value = .033)

Figure 5: Percent Correct Responses to Priority 3 Issues



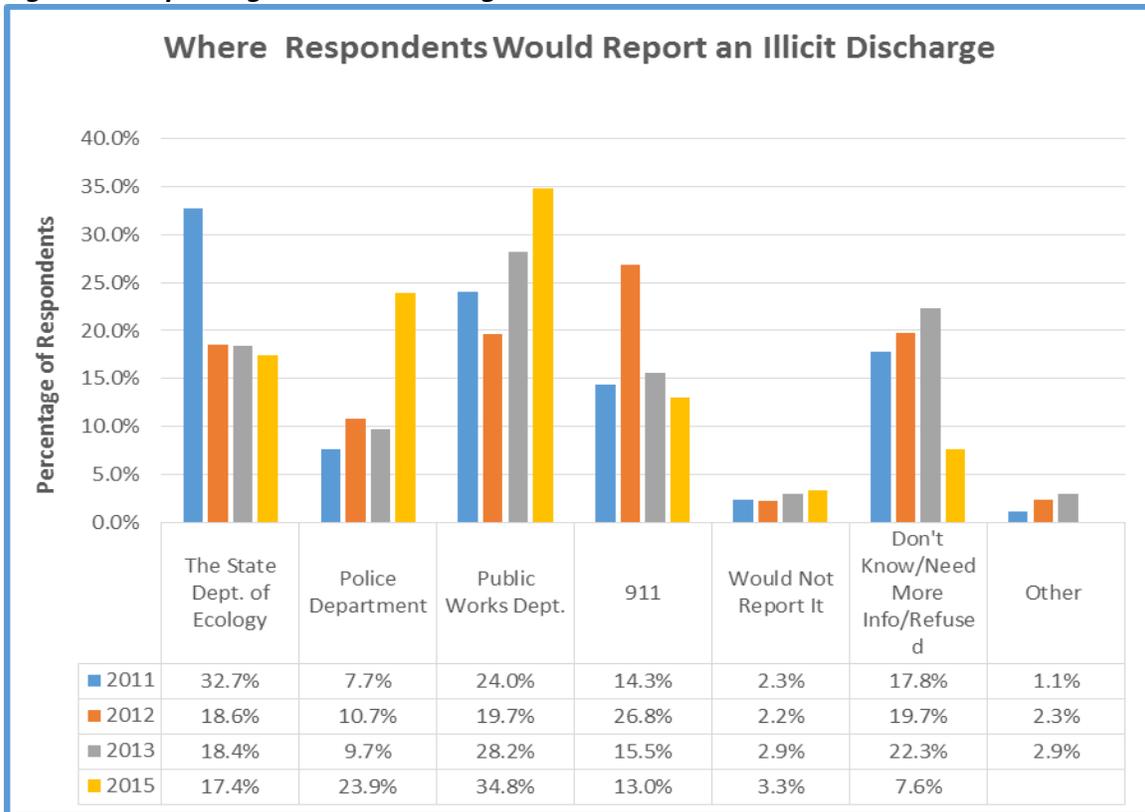
The relatively high percent of respondents who gave the correct responses in this category suggests that high behavioral compliance continues to take place. At minimum, it can be said that respondents knew the right thing to do and answered accordingly. To maintain and increase positive behaviors, it remains advisable to continue educating the public on these issues. Because of the already high level of knowledge/compliance for Priority 3 issues, the degree of emphasis on these issues may be lower compared to Priority 1 and Priority 2 issues. If Priority 3 issues are addressed during educational and marketing campaigns, the following messages should be included:

- *Scrubbing oil and grease spots on outdoor concrete or asphalt with soap and hosing it off is not a good way to prevent polluting stormwater runoff. Proper methods for cleaning up oil and grease spills, such as using kitty litter and paper towels.*
- *Apply fertilizer, insecticides or weed killer at recommended rates*
- *Recycle all used motor oil.*
- *Store containers holding oil or antifreeze under a roof or cover.*
- *Store all yard fertilizers and pesticides inside a building or in a covered area out of the rain.*

Reporting an Illicit Discharge

Respondents were asked the following question: “If you witnessed someone pouring a gallon of used paint thinner into a stormwater drain, which agency would you call first to report it?” A variety of options were given as choices. Over one-third (34.8%) of residents chose the correct choice, calling their City Public Works Department. This finding represents a 6.6% increase from the 28.2% of Tukwila respondents who said they would contact the Public Works Department in 2013, and a 10.8% increase from the 24% correct responses in 2011. Furthermore, 13% of respondents in 2015 would incorrectly report to 911 if they witnessed an illicit discharge. That is a 2.5% decrease from the 15.5% of incorrect responses in 2013 and a 1.3% decrease from the 14.3% in 2011. While 7.6% of the public remains unaware of the proper agency to call to report an illicit discharge. That is a 14.7% decrease from the 22.3% in 2013. 23.9% of respondents said that they would report police department if they witnessed an illicit discharge. This is a highest percent recorded among the 4 year surveys.

Figure 6: Reporting an Illicit Discharge



There was no statistically significant differences in the responses between 2013 and 2015 as well as males and female when analyzed by gender.

Stewardship Activities

Respondents were asked the following question: “Which of the following stewardship activities have you heard of within the last year?” the result is summarized in the table below. About (61%) of respondents reported that they have not heard of or participated in any stewardship activities. Of those who reported “heard of or participated in stewardship activities of the city within the last year,” 21 % of respondents reported they have heard of or participated in “Healthy Earth” while 23% reported they have heard or participated in “Duwamish Alive!”. Only 6% of those reported that they have heard of or participated in “Healthy 5K”.

| “Which of the following stewardship activities have you heard of or participated in within the last year?” | |
|--|--------|
| Haven't Heard of Any | 61.00% |
| Healthy Earth | 21.00% |
| Healthy 5k | 6.00% |
| Duwamish Alive | 23.00% |

Research Findings

- 1) The public perception in Tukwila is that the surface water is relatively clean and absent from pollutants. Although the lowest rating was given in 2011 at 5.82, the ratings have been generally high. With the highest average rating thus far of 7.04 in 2015, respondents are indicating that the perception of surface water quality will continue to increase, or at the very least, moderately clean.
- 2) As compared to 2013, the 2015 data revealed changes in Priority classifications. In 2015, there were two statements changing in their priority status, in both cases moving to a higher priority level. One moved from Priority II issues to Priority I issues. The below is the statement:
 - *The best place to dispose of water from cleaning a Latex paint brush is in a sink inside, not outdoors.*

While the other changed from Priority III to Priority II. The following is the statement described above:

- *Carpet shampoo wastewater can be safely added to a stormwater drain.*

In regard to Priority trends, the 2015 results showed that while no other statements changed priority statuses entirely, many of the statements saw a decreased number of correct responses within the same priority category. In addition, the overall average correct proportions in all three priority issues indicate decreasing public knowledge on stormwater education as compared to that of 2013. The average proportion giving the correct response within Priority I issues, Priority II issues and Priority III issues decreased by 7.9%, 10.5% and 1.7% points, respectively. This is a negative sign in an effort to increase public knowledge and concern about their potential behavior for stormwater pollution, raising the desire to act responsibly and bringing about improper behavioral change. This indicated that the city's current educational program, marketing campaigns and stewardship activities have not effectively addressed any Priorities issues. In addition, the 2015 data showed that 61% of respondents reported that they have not heard of or participated in any stewardship activities when asked: "Which of the following stewardship activities have you heard of within the last year?" Of those who reported "heard of or participated in stewardship activities of the city within the last year," 21 % reported they have heard of or participated in "Healthy Earth" while 23% reported they have heard or participated in "Duwamish Alive!" Only 6% reported that they have heard of or participated in "Healthy 5K". This indicated that the current communication works are not effectively enough in raising public awareness about the current educational program, marketing campaigns and stewardship activities and the city also facing the challenges of engaging the target residents with those programs.

With the goal remains to achieve a fully informed public and bring a behavioral change, besides the future educational program and marketing campaigns should increase the degree of emphasis on these issues to target audience by increasing both level of frequency and media coverage. The city should have the right approaches in order to increase the public reach and engagement level.

For Priority III category, though the relatively high percent of respondents who gave the correct responses in this category suggests that high behavioral compliance continues to take place. In order to maintain and increase positive behaviors, it remains advisable to continue educating the public on these issues and maintain the properly degree of emphasis on these issues to make sure no changes from the Priority III issues to Priority I or II happen. While some statements saw an increased number of correct responses, others saw a slightly decreased number of correct responses within the Priority III, the following statement saw a significantly decreased number of correct responses from 76.44% in 2013 to 58% in 2015 as below: *“Scrubbing oil and grease spots on outdoor concrete or asphalt with soap and hosing it off is a good way to prevent polluting stormwater runoff.”* it should be a high priority in the future marketing and social campaigns.

Lastly, of the three new questions added into the 2015 survey, two were classified into Priority I issues. The statements are given below:

- *Green rooftops reduce the amount of stormwater runoff*
- *Impervious surfaces and streets are better for managing runoff than porous ones*

While the remaining was classified into the Priority II issue as below:

- *All automotive chemicals and cleaning supplies, can be stored and disposed of in the same manner*

3) The proportion of Tukwila residents who know which agency to report an illicit discharge increased up to 34.8% this year. This is a highest correct percentage recorded among the 4 year surveys. This is an encouraging sign that progress is being made in the effort to improve the public’s knowledge regarding which agency to report an illicit discharge. However, the correct percentage is about one third (34.8%) so there is still more room for the city of Tukwila to improve the level of residents’ knowledge regarding which agency to report an illicit discharge and communications on this topic should continue to be a priority.

- 4) Males (97.56%) were more likely to correctly respond that “My family stores all containers holding oil or antifreeze under a roof or cover” as compared to females (85.42%). Hence, in order to improve the overall knowledge regarding to the issue, the future educational program and marketing campaigns should target on female audience.
- 5) In addition, the following stormwater knowledge issues statements saw a decreased number of correct responses over 20% as compare to that of 2013. Hence, it should be a priority for the future communication in order to improve the overall knowledge:
- *Pollution in our rivers, wetlands and lakes is more the result of commercial discharge practices than individual human activity. D*
 - *The best place to dispose of water from cleaning a Latex paint brush is in a sink inside, not outdoors. A*
 - *Chemical treatments to kill moss on roofs pose little risk for polluting stormwater. D*
 - *Carpet shampoo wastewater can be safely added to a stormwater drain. D*

TUKWILA - Stormwater Community Survey Questionnaire

Hello, this is _____ from Hebert Research, on behalf of the City of Tukwila. We are asking residents about important storm water issues and we would like to include your opinions. All your answers are strictly confidential and will not be connected to your name.

1. My first question is about the water in Tukwila. I'd like you to rate your perception of the overall quality of the water in our rivers, wetlands and lakes. By "quality of water" I mean how absent it is from pollution. Rate it on a 0 to 10 scale where "0" means the water is "extremely polluted" and 10 means the water is "extremely clean." **[RECORD NUMBER]**

[READ]

I will be reading a number of statements regarding stormwater. The responses for each question are as follows:

1. Agree
2. Disagree
3. Need more information
4. Uncertain, Don't Know
5. Refused
6. Doesn't Apply

2. Drains on city streets for stormwater are connected to the same sanitary or sewage system for waste.

3. Non-Point stormwater runoff is the leading cause of pollution in rivers, wetlands and lakes.

4. Pollution in our rivers, wetlands and lakes is more the result of commercial discharge practices than individual human activity.

5. All water going into stormwater drains on the street is treated before being discharged into the surface and ground water.

[ROTATE Q6-Q33] [NOTE: These questions will be asked in a random order to prevent sequencing bias.]

6. Impervious surfaces such as roads and driveways are not significant sources of pollution to stormwater. .

7. The best way to clean up spilled oil on the driveway is to fully absorb it using kitty litter or paper towels and deposit this waste in a garbage can.

8. Scrubbing oil and grease spots on outdoor concrete or asphalt with soap and hosing it off is a good way to prevent polluting stormwater runoff.
9. All of my family's vehicle parts with oil or grease on them are kept away from the weather.
10. My household recycles all used motor oil.
11. My family stores all containers holding oil or antifreeze under a roof or cover.
12. The runoff from washing a car with biodegradable soap is safe in stormwater drains.
13. When I wash a motor vehicle at home, the soapy water ends up in a ditch or on the street.
14. Washing a vehicle at a commercial car wash causes less pollution than washing a vehicle on the street using a biodegradable soap.
15. The best place to dispose of water from cleaning a Latex paint brush is in a sink inside, not outdoors.
16. Grass clippings and leaves are not regarded as harmful in stormwater.
17. Chemical treatments to kill moss on roofs pose little risk for polluting stormwater.
18. Sediment or dirt in stormwater is natural and not regarded as pollution.
19. The downspouts at my home convey the water to an area where it is absorbed by the ground.
20. Using a mulching lawnmower reduces the need to fertilize a lawn.
21. My household stores all yard fertilizers and pesticides inside a building or in a covered area out of the rain.
22. I'm careful not to exceed the recommended amount of insecticide or weed killer than the directions say to use.
23. I'm careful not to exceed the recommended amount of fertilizer than the directions say to use.
24. Carpet shampoo wastewater can be safely added to a stormwater drain.

25. Bricks or pavers offer no advantage for reducing runoff over concrete or asphalt pavement.

26. An *illicit or unlawful stormwater discharge* is primarily defined as anything that enters a storm drain system that is not made up entirely of stormwater.

27. If you witnessed someone pouring a gallon of used paint thinner into a stormwater drain, which agency would you call first to report it: **[READ 1-5]**

1. The Washington Department of Ecology
2. The police department
3. The city Public Works Department
4. 911
5. Need more information
6. I would not report it
7. Don't Know
8. Refused

28. Which of the following stewardship activities have you heard of or participated in within the last year? **[Select all that apply]**

- Healthy Earth
- Healthy 5K
- Duwamish Alive!

29. Green rooftops reduce the amount of stormwater runoff

30. Impervious surfaces and streets are better for managing runoff than porous ones

31. All automotive chemicals and cleaning supplies, can be stored and disposed of in the same manner

That concludes our survey. I want to thank you very much for your time and cooperation. You have been very helpful. Have a good day!

Thank them and ask if they would like to be included in the panel in the future

POSTCODE GENDER:

1. MALE
2. FEMALE

DATE: _____ Research

Assistant:
