REPORT

Lake Whatcom Watershed Baseline Survey Findings

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INTRODUCTION

Lake Whatcom serves as the primary source of drinking water for more than 100,000 people living in Whatcom County, yet the health of the resource is threatened by low dissolved oxygen levels and fecal coliform contamination. To reduce these impacts, a joint Lake Whatcom management team with representatives from the City of Bellingham, Whatcom County, and the Lake Whatcom Water and Sewer District, was formed in 2000 to develop and implement a comprehensive work plan. In 2017, the City of Bellingham and Whatcom County submitted a water quality improvement plan to the Department of Ecology that required evaluation of watershed resident practices, knowledge, and attitudes related to lake water quality.

Many of the issues impacting Lake Whatcom stem from landscape changes that occurred over the last 170 years in the surrounding watershed. Native forests were replaced with residential development and impervious surfaces that increase polluted runoff reaching the lake. While capital improvement projects such as stormwater treatment and government policies such as limiting seasonal construction in the watershed can be instrumental in reducing some of the impacts, the presence over 7,000 households in the Lake Whatcom watershed can have a large impact on the health of Lake Whatcom.

The practices of Lake Whatcom watershed residents were the focus of the study undertaken by the management team in the spring of 2018. The research was deemed necessary in order to accurately provide a progress report to the City and County Councils on the measures included in the watershed's comprehensive work plan and to the Department of Ecology on the tasks included in the water quality improvement plan. Watershed resident stewardship practices have been a topic of study for decades, but this is the first study undertaken that is intended to address so many aspects of the comprehensive work plan. The intent of the management team is to repeat the research every five years to track change in residents' practices and the effectiveness of outreach to watershed residents.

SURVEY DEVELOPMENT PROCESS

Human behavior is known to impact the natural world, and as such, the study of human behavior has intersected with ecological planning and decision-making for many years. Research on human behavior has demonstrated that there are several phases to people's decision making. In broad strokes, they are:

1. Awareness – having knowledge of an issue or subject
2. Contemplation – consideration of taking action that has bearing on the issue or subject

3. Action – using knowledge and experience to change a behavior or practice

Change theories have been in use in health fields for a long time (smoking cessation being one of the most robust, but hand washing to prevent the spread of illness and helping women avoid alcohol during pregnancy are other well-known topics). Their application to environmental issues has proven very fruitful in helping to deter or promote a variety of ecologically beneficial practices, such as recycling, having septic systems inspected, and properly disposing of used motor oil.

The Lake Whatcom management team along with other stakeholders from the City, County, Whatcom Conservation District, Watershed Advisory Board, WSU Extension, and Sudden Valley Community Association began by identifying 30 beneficial practices that watershed residents could implement to reduce impacts on Lake Whatcom. Those practices were prioritized based upon guiding documents including the watershed comprehensive work plan and the 2017 water quality improvement plan, the management team's understanding of the overall impact that the practices might have on the current condition of the lake, and consideration of residents' likely willingness to engage in the practices.[1] The final tally included 17 beneficial practices to be included in the initial survey (see Figure 1).

Figure 1. Prioritized beneficial practices in the Lake Whatcom watershed (sorted according to their appearance in this report)

- Check for and repair leaks in cars and boats
- Pick up pet waste at home and on walks and dispose in trash
- Wash cars at car wash or on pervious surfaces
- Reduce or eliminate fertilizer use; if using fertilizer, use fertilizer with 0% phosphorus
- Replace lawn with native landscaping and preserve native vegetation and trees
- Reduce or eliminate pesticide use
- Compost grass clippings offsite
- Control erosion on property
- Dispose of hazardous materials properly
- Report illicit discharges
- Use trails appropriately to minimize erosion
- Comply with stewardship expectations on preserved property
- Do construction only during work window

[1] More information about the process of selecting beneficial practices and associated survey questions is available by request in the supplemental Excel spreadsheet titled "Lake Whatcom Watershed Survey Topic Selection 2018."

- Comply with development rules and codes prior to making changes on property
- Ensure boat is permitted and inspected before launch
- Conserve water
- Use alternative transportation

Survey items were constructed combining the prioritized practices with the team's knowledge of residents' likelihood to be either aware, contemplating, or acting on a decision to participate in the practice. We know that people are generally willing to contemplate engaging in beneficial practices once they fully understand the rationale and benefits, but willingness is tempered by the cost and convenience of engaging in the practice. As a result, asking questions about practices that may be particularly costly or inconvenient can be problematic. With an eye to sensitive or complex issues, the management team worked through a series of drafted survey items and settled on a collection of items that asks about practices in some cases and awareness or knowledge of the topics in others.

Measuring awareness and knowledge poses a challenge of its own in survey research. It is important to avoid giving the respondent a feeling that they are being tested. It is also important that any items measuring awareness or knowledge be easily understood by a broad audience. As a result, items measuring awareness and knowledge tend to be focused on topics that are likely very accessible to the audience being surveyed. Technical and scientific topics are generally avoided, unless there has been a concerted effort to create mainstream understanding of the topics. We use the convention of asking people about their familiarity with a topic, saying, "How much have you heard or read about *topic*?" The benefit of this format is that it avoids putting responsibility on the respondent for knowing about a topic, and instead focuses on the success of outreach efforts in making them aware of the issue or information.

Finally, four questions about attitudes or beliefs were included in the survey. They included:

- Rating overall water quality in Lake Whatcom (from excellent to poor)
- Rating how much water quality in the lake has changed (improved/become worse)
- How much residents think what they do on their property can affect water quality in the lake (a great deal to not at all)
- Residents' sense of urgency about cleaning up and protecting Lake Whatcom (extremely to not at all)

Belief and attitudinal measures like these are good barometers of overall awareness, culture, and norms. In the survey analysis, it can also be useful to see how attitudes

about the lake's health connect to personal actions or awareness of the specific topics; the more they go together, the more outreach can tie attitudes and practices together. When they don't correspond, other more effective approaches may be used to enable people to engage in beneficial actions.

The purpose of the resulting survey was to set a baseline around these specific topics about residents' knowledge or behavior, and to collect information that may be useful for program development and outreach. Ultimately, the survey included 65 questions about people's relevant practices and awareness as well as their attitudes or beliefs about the lake and demographic characteristics (see the full text of the survey in Appendix B).

RESEARCH METHODS

Following a pilot of 400 households, an additional 5,000 watershed households received survey invitations signed by the Whatcom County Executive, Bellingham Mayor, and the Water and Sewer District's Interim Director. The expected response rate was 10% or about 500 completed surveys. Invitations included a link to the survey, which was programmed for online administration (see Appendix A for the full text of the invitation). Reminder postcards were sent after one week. The survey was available online October 8 through November 18, 2018.[2] A total of 596 respondents completed the survey, an 11% response rate, providing an overall margin of error of ±3.8%.[3]

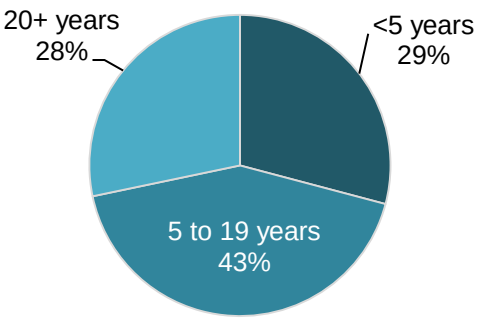
Respondent characteristics

Respondents reported an average of 14 years at their current address (median=11). Figure 2 shows that 29% said they have lived at their address less than five years, and a similar proportion (28%) have lived there longer than 20 years.

[2] Pilot data collection occurred September 10 through September 30, 2018

[3] The research methods included experimentation with sending a large-format full color post card or a first-class standard envelope with the invitation on full-color letterhead. Initial returns (separate links were used to protect the anonymity of the respondents) showed that more recipients of the standard envelope responded to the invitation. However, the survey fielding included dates coinciding with a very active election season where many candidates and causes were using postcard mailings. The postcard may have been overlooked because of the volume of postcards being received during this time.

Figure 2. For how many years have you lived at this address?



n=567 respondents

Most respondents (96%) described their home as a free-standing, one-family residence. This is higher than the 89% expected, perhaps because the questions were more germane to these types of structures compared to an apartment or multi-plex. Most were not on the shoreline of the lake (81%), and 69% were outside of the city limits – less than the 77% expected. Additional demographics are presented in Figure 4 below.[4]

Figure 3. Property descriptions

	%
A free-standing one-family residence	96
Not on shoreline	81
Outside of the city limits	69

n=593 respondents

Figure 4. Respondent characteristics

	%
Age (n=567)	
18-34	5
35-49	23
50-64	34
65-79	35
80 or older	4
Education (n=574)	
High school	3
Vocational school	3
Some college	14

[4] An estimation of Lake Whatcom watershed demographic information determined using 2016 Census block data is available by request in the supplemental Excel spreadsheet titled "Lake Whatcom Watershed Demographic Info 2016."

College degree	40
Graduate/professional school	40
Income (n=435)	
Less than $49,999	13
$50,000 to $99,999	33
$100,000 to $149,999	29
$150,000 to $199,999	14
$200,000 or more	12
Children under 18 in the home (n=590)	
Yes	24
Gender (n=527)	
Male	61
Female	39

FINDINGS

This section describes how the respondents answered survey questions using both text and graphic format. This report uses the convention of *italicizing* verbatim response options to survey questions. We use the term "beneficial" to describe the desired practices.

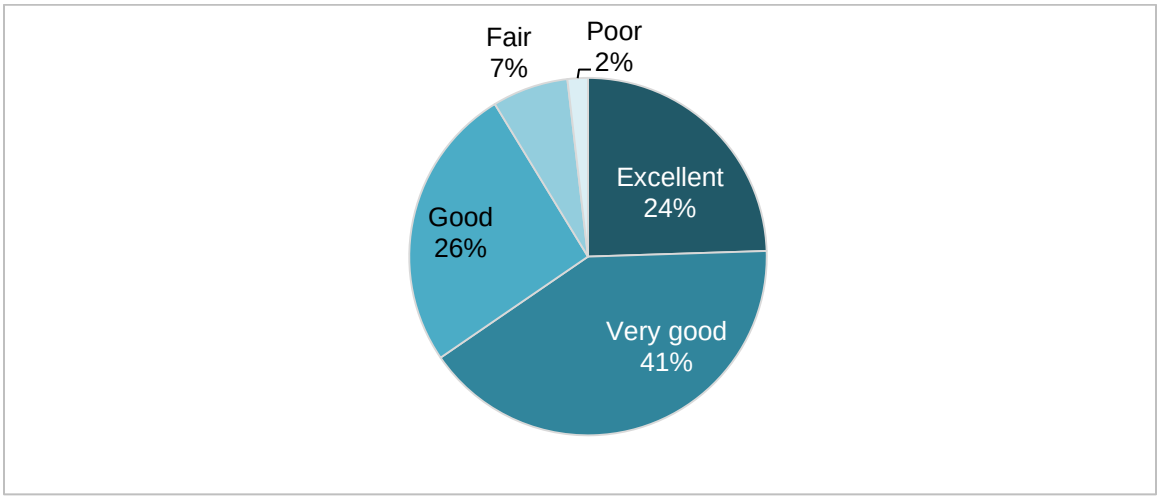
ATTITUDES TOWARDS LAKE WHATCOM WATERSHED

Respondents were asked several questions about their attitudes toward the Lake Whatcom watershed, including their opinions of:

- Overall water quality in Lake Whatcom,
- How much water quality in the lake has changed,
- How much they think what they do on their property can affect water quality in the lake, and
- Their sense of urgency about cleaning up and protecting Lake Whatcom.

When asked how they would rate the water quality in Lake Whatcom, Figure 2 shows that 65% of respondents rated the water quality as *very good* or *excellent.*

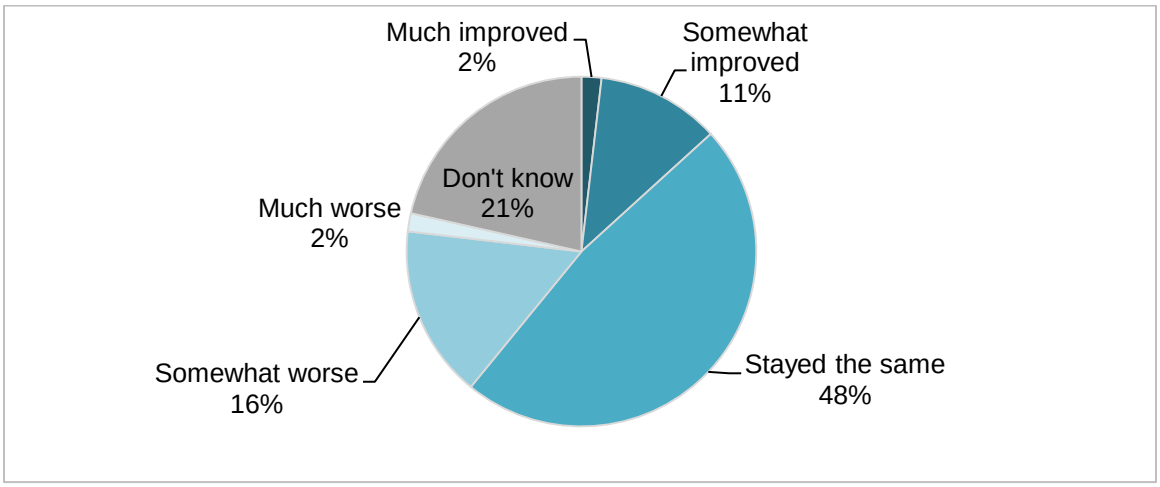
Figure 5. Overall, how would you rate the water quality in Lake Whatcom?



n=596

When asked about change in water quality, just under half of respondents (48%) said they think the water quality has *stayed the same* over the past five years. Thirteen percent (13%) said it is *much* or *somewhat improved* while 18% said it is *much* or *somewhat worse*. Roughly one-fifth (21%) said they *don't know* how the water quality has changed.

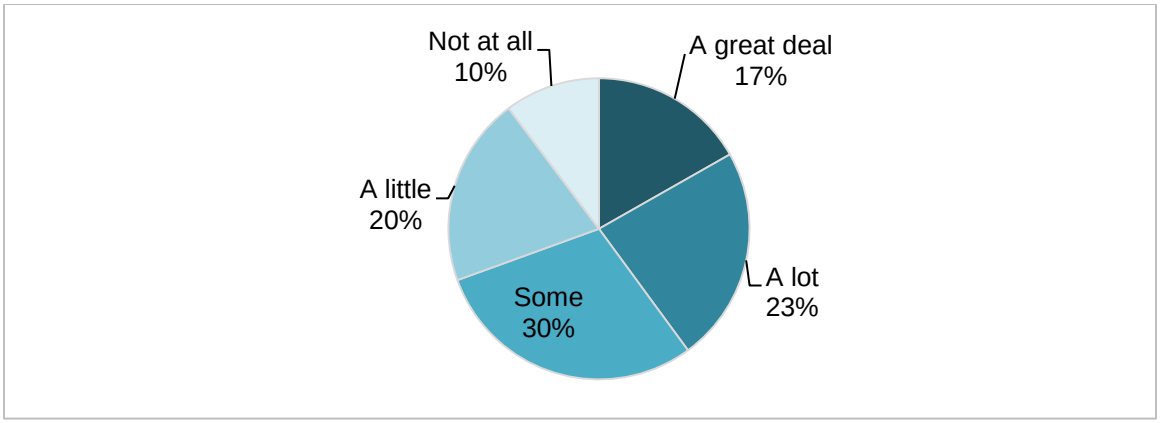
Figure 6. Based on what you know, how much do you think that the water quality in Lake Whatcom has changed over the past five years?



n=596

When asked, 40% of respondents said they think that what they do on their property can affect water quality in Lake Whatcom *a lot* or *a great deal*.

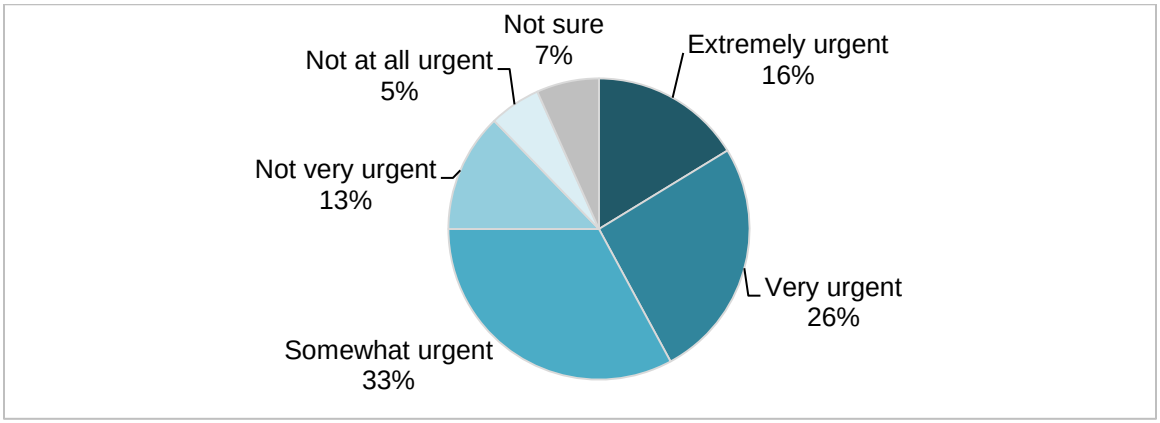
Figure 7. How much do you think what you do on your property can affect water quality in Lake Whatcom?



n=596

Just under half (42%) of respondents feel it is *very* or *extremely urgent* to clean up and protect Lake Whatcom.

Figure 8. How urgent is the need to clean up and protect Lake Whatcom?



n=596

Multivariate analysis

Each of the four attitudinal items were analyzed together, as well as looking at respondents' demographic characteristics.

Water quality ratings

Water quality ratings of *excellent* or *very good* were higher among those with higher incomes (≥$100K, 70%) compared to those with lower incomes (<$100K, 60%). Males tended to rate the water quality higher as well (29% versus 20% of females).

Changes in water quality

Respondent groups were mixed in their assessments of change in water quality. Though there were some significant findings, no pattern was discernable. For example, 64% of those under age 50 said the water quality had *stayed the same*, while 51% of those 50-64 gave the same assessment. If age varied systematically with this attitude, we would expect respondents ages 65 and higher to have reported the same or lower levels of belief that water quality had *stayed the same*. However, 68% of respondents age 65 or more said they thought water quality had *stayed the same*. A similar high-low-high patter was seen with regard to education as well.

Personal property impacts

People who thought their practices could impact water quality *a great deal* or *a lot* were more likely to be shoreline property owners (51% versus 37% of those living off the shoreline), and less likely to have children in the home (43% versus 30% of those with children). They were also more likely to have at least a college education (43% versus

31% of those without a college degree). Females were also more likely to think their actions could impact lake water quality compared to males (50% versus 35% respectively).

Urgency to clean and protect

People who felt it was *extremely* or *very urgent* to clean up and protect Lake Whatcom were more likely to live off the shoreline (48% compared to 33% of shoreline owners). They were more likely to have no children in the home (48% compared to 35% of those with children) and to be female (53% versus 43% of males). Urgency increased as income declined.

Inter-related attitudes

Higher ratings of water quality also accompanied a lack of a sense of urgency about cleaning up and protecting the lake, as well as a sense that water quality hadn't changed or had improved over the past five years. Water quality ratings were higher among people who felt that what they do on their property has less impact on water quality. So, respondents who felt water quality was lower had more of a sense of urgency, were more likely to think practices on their property would impact water quality and also that water quality has gotten worse over the past five years.

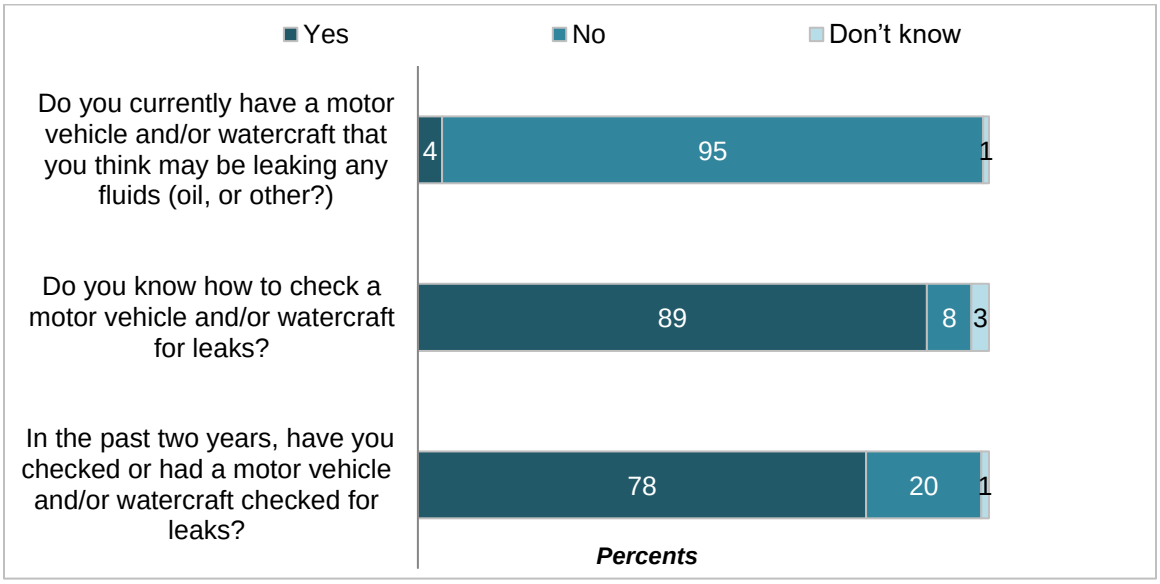
STORMWATER PROGRAM

The survey included eight behavior categories of direct relevance to the Stormwater Program: vehicle leaks, pet waste disposal, car washing, fertilizer use, pesticide use, additions of native plants, disposal of grass clippings, and exposed soil/erosion on private property.

Check for and repair leaks in cars and boats

All but six respondents surveyed (99%) own a vehicle (car, truck, motorcycles, and/or motorized boats). Vehicle owners were asked about their experience with vehicle leaks. Figure 9 shows that the vast majority of vehicle owners (95%) did not think that they had a vehicle leak at the time of the survey. A slightly smaller proportion said they know how to check for leaks (89%). Over three-quarters have checked their vehicle(s) in the past two years (78%).

Figure 9. Recent experience with leaks in motor vehicles and watercraft

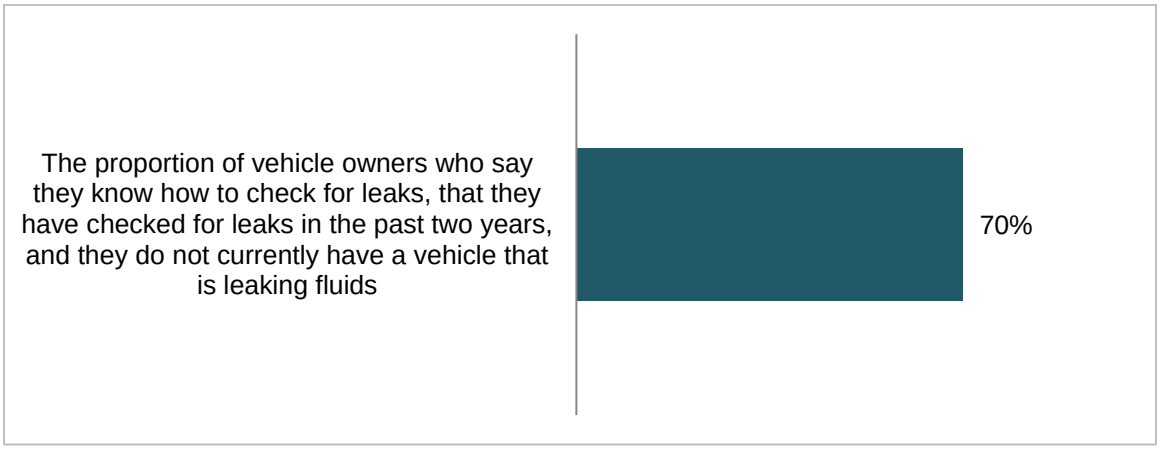


n=590 motor vehicle owners (rounding error may prevent all rows from totaling 100%)

Stormwater Program - Key Metric: Check for and repair leaks in cars and boats

Figure 10 illustrates the key metric associated with checking for leaks.

Figure 10. Stormwater Program Key Metric: Check for and repair leaks in cars and boats



n=590 motor vehicle owners

Multivariate analysis

Analysis found a relationship between this metric and the following characteristics, summarized here with a specification of the segment with the higher proportion:

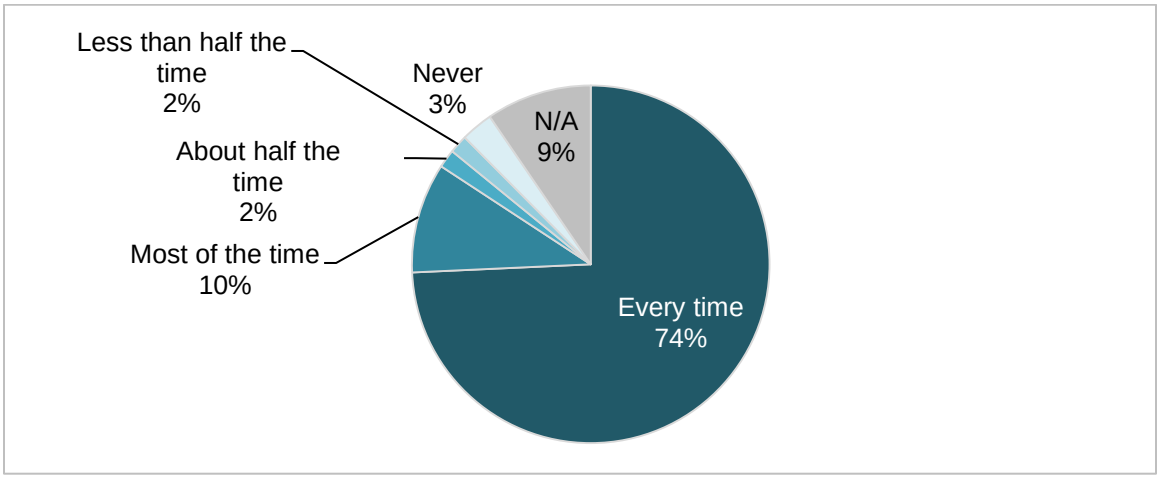
- How long they have lived at the property (77%, 20+ years)
- Gender (74%, male)

Pick up pet waste

Forty percent (40%) of respondents said they have a dog (241 respondents). These respondents were asked about how often they pick up dog waste and how they dispose of it both at home and on walks.

Seventy-four percent (74%) of dog owners said that when they are out for a walk, they pick up dog waste *every time*.

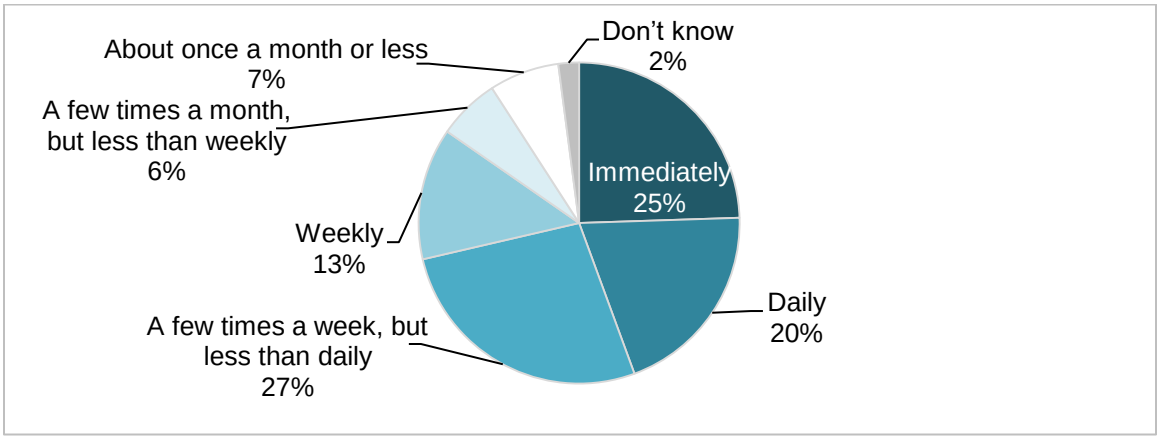
Figure 11. In the past two months, when the dog was out for a walk around the neighborhood or in nearby parks, how often was the dog's waste typically picked up?



n=241 dog owners

Forty-five percent (45%) of dog owners said that dog waste is picked up at home *daily* or more frequently (*immediately*). Eighty-six percent (86%) said they pick up dog waste at least *weekly*.

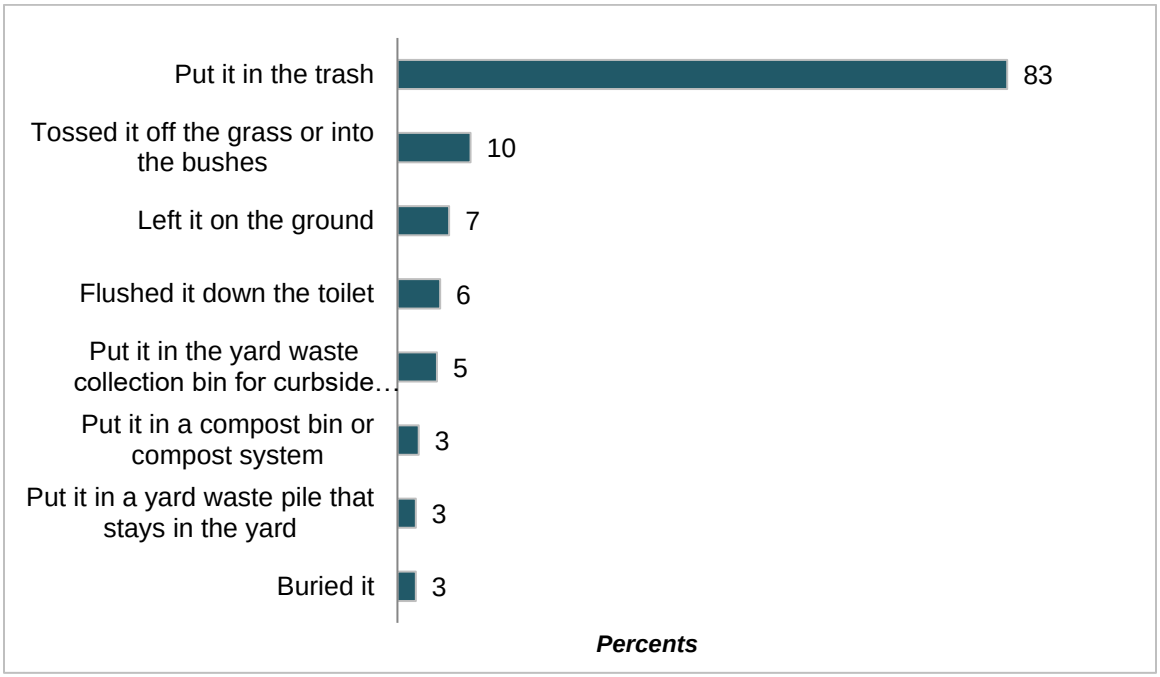
Figure 12. Thinking about the past two months, typically, how often was the dog's waste picked up at home?



n=241 dog owners

Dog owners were asked about how they dispose of the dog waste. A solid majority (83%) said that they put it in the trash. However, a small portion of those respondents also used another less beneficial method.

Figure 13. Below are several different methods people use to dispose of dog waste at home. Which of these did you use in the past two months?

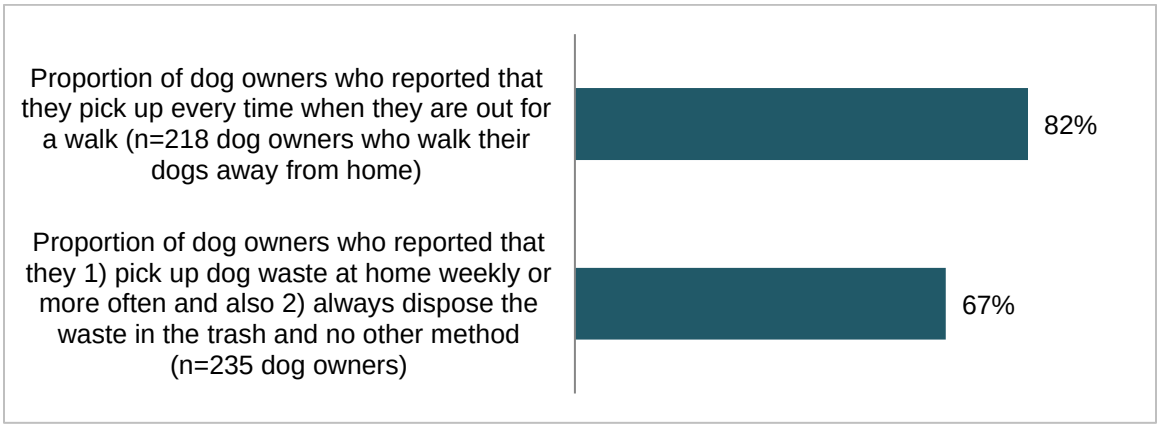


n=240 dog owners; multiple responses were possible, may total more than 100%

Stormwater Program - Key Metrics: Pick up pet waste

Figure 14 illustrates two key metrics associated with pet waste.

Figure 14. Stormwater Program Key Metrics: Pick up pet waste[5]



[5] Dog owners responding *don't know* to any item were not included in the key metric.

Multivariate analysis

Analysis found a relationship between these metrics and the following characteristics, summarized here with a specification of the segment with the higher proportion:

Pick up every time when they are out for a walk

- No significant differences between segments of interest

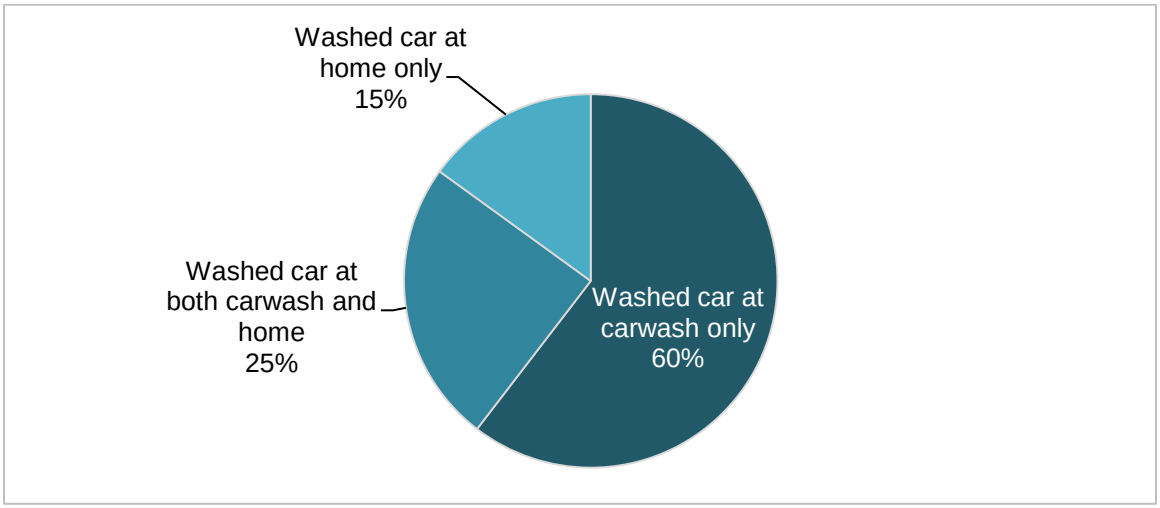
Pick up dog waste at home weekly or more often and also always dispose the waste in the trash and no other method

- Age (79%, age 65+)
- Water quality (83%, fair/poor; 66%, excellent)

Wash cars at car wash or on pervious surfaces

Respondents were asked about where they washed their car in the past year. Sixty percent (60%) used a carwash exclusively, while another quarter (25%) said they washed their car both at home and at a carwash. The remainder (15%) only washed their car at home.

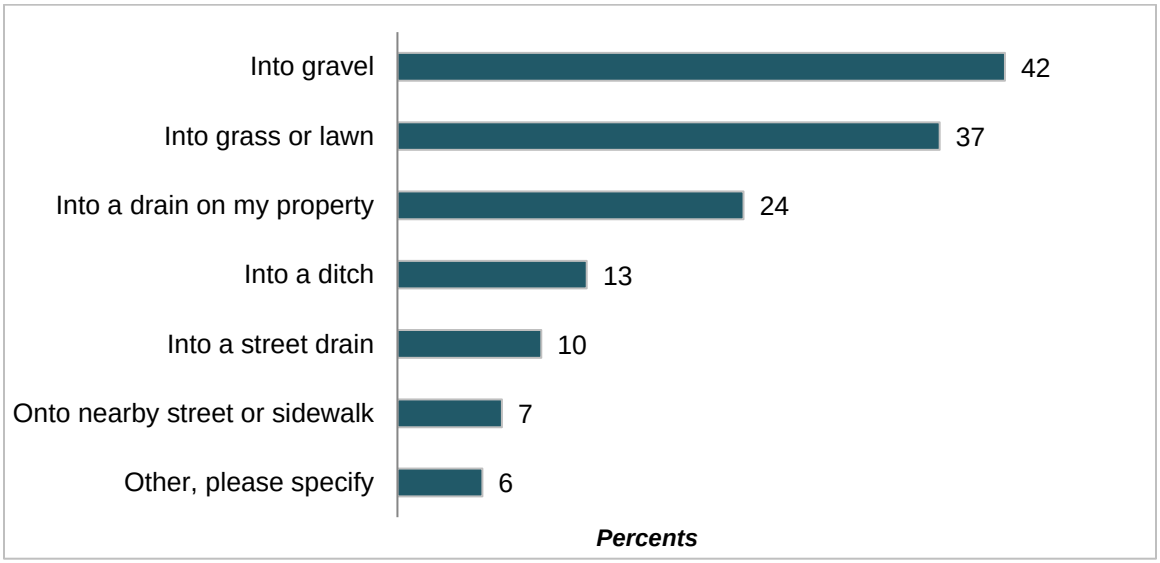
Figure 15. Where has your car or truck been washed in the past year?



n=566 car and/or truck owners who wash their vehicle(s)

Respondents who have washed a car at home in the past year were asked where the water flowed. Figure 16 shows that the most common responses were gravel (42%) and grass or lawn (37%).

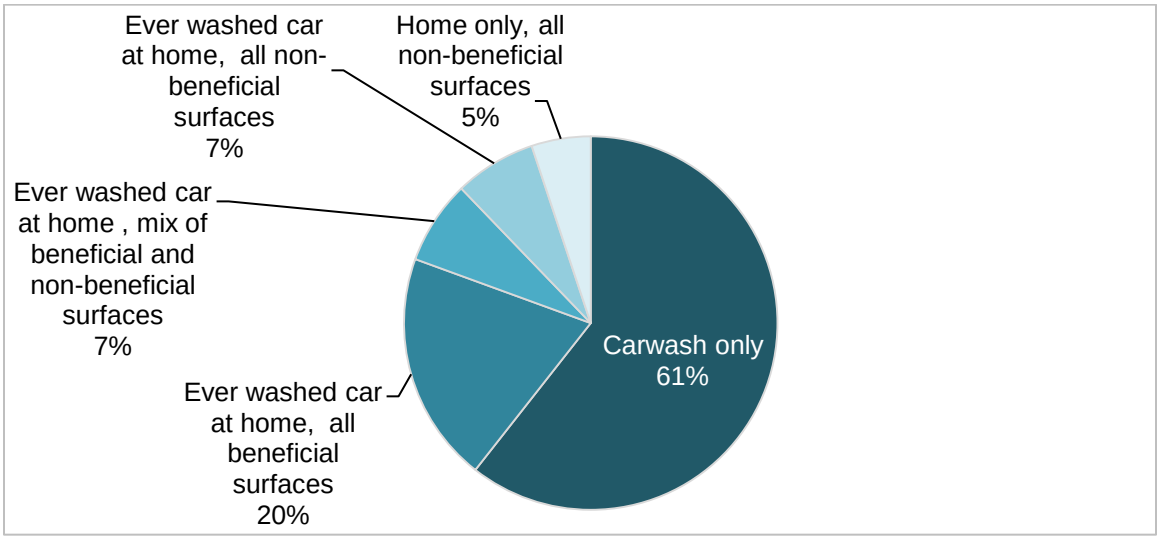
Figure 16. When your car was washed at home, where did the water go?



n=224 car and/or truck owners who washed their vehicle(s) at home in the past year; multiple responses were possible, may total more than 100%

Analysis assigned each response shown in Figure 16 to a category of “beneficial” (used a car wash or washed at home with water draining to grass, lawn, gravel, or other pervious surfaces) or “non-beneficial” (home car wash water draining to a drain, ditch, street or other impervious surface). Figure 17 below shows that 81% of vehicle owners either washed their car exclusively at a carwash or when they washed their car at home, they did so over a beneficial surface only.

Figure 17. Carwash water disposal

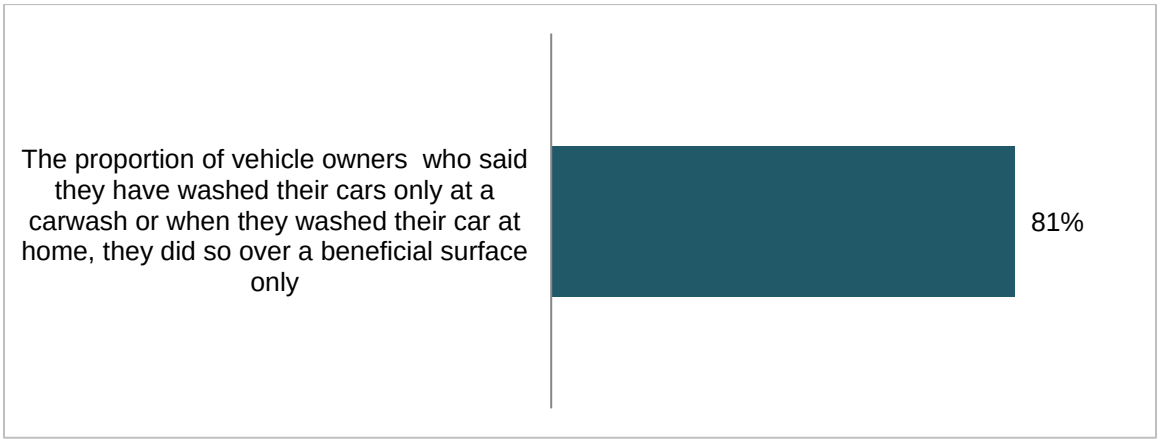


n=566 car and/or truck owners who wash their vehicles

Stormwater Program – Key Metric: Wash vehicles at car wash on pervious surfaces

Figure 18 illustrates the key metric associated with the water disposal from washing vehicles.

Figure 18. Stormwater Program Key Metric: Wash vehicles at car wash or on pervious surfaces



n=566 car and/or truck owners who wash their vehicles

Multivariate analysis

Analysis found a relationship between this metric and the following characteristics, summarized here.

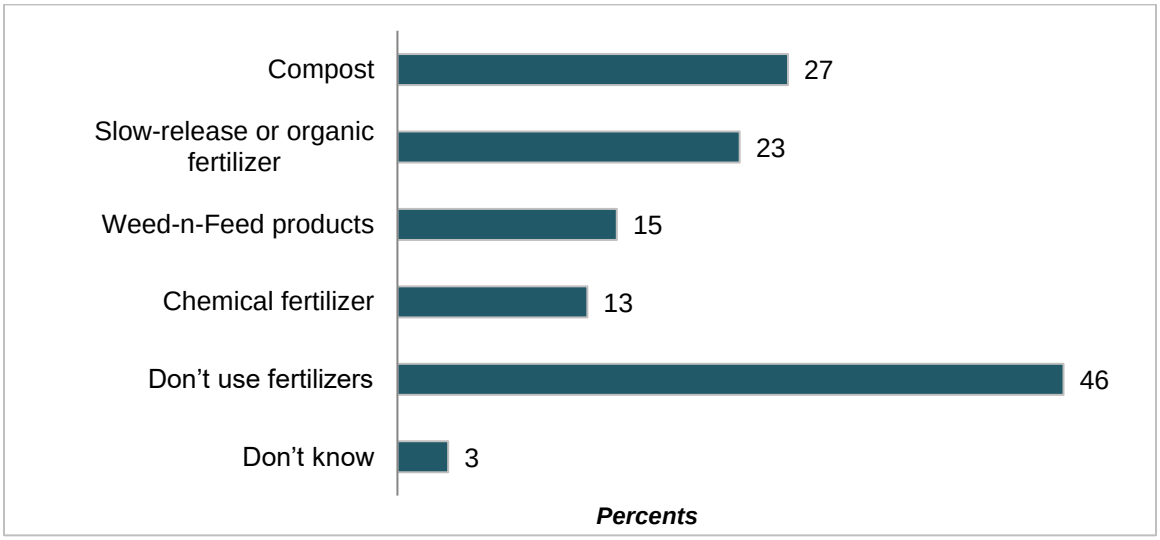
- Shoreline residents (89% vs 79%)
- Attitude that what you do on your property can affect water quality in Lake Whatcom (*A lot or a great deal,* 85%; little/nothing at all 73%)
- Water quality ratings (fair/poor, 90%; excellent 73%)

Reduce or eliminate fertilizer use; if using fertilizer, use fertilizer with 0% phosphorus

Most respondents said that either someone in their household (74%), or someone they hire (12%) or a combination of the two (6%) typically has responsibility for yard and lawn care (92% total). The other eight percent either did not have yard care needs or said that their landlord or property manager had that responsibility.

Respondents who had responsibility for yard care were asked about fertilizer products used in the past two years. The most common products used were *compost* (27%) and *slow-release or organic fertilizer* (23%). Forty six percent (46%) said they *don't use fertilizers* at all.

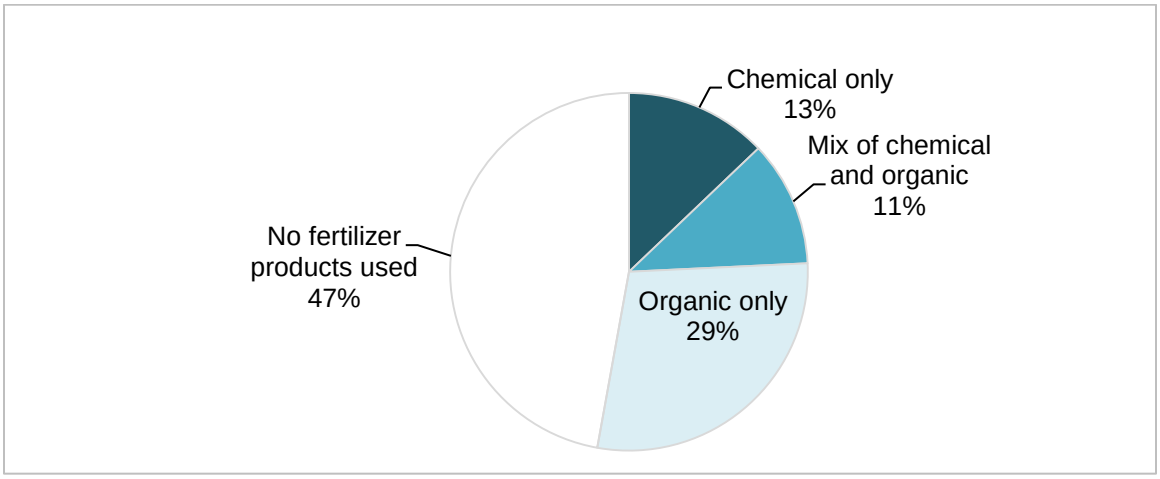
Figure 19. Which of the following best describes the fertilizer products used for your lawn and garden care during the past two years?



n=547 people who hire out or do yard and lawn care; multiple responses were possible, may total more than 100%

Some respondents used multiple types of fertilizer products. Analysis combined the response options to compile Figure 20 below. Respondents who did not know about the fertilizer types were excluded from calculations. Twenty-nine percent (29%) said they only use *organic or slow release fertilizers*. A slightly smaller proportion, 24%, said they used a *chemical fertilizer*, either exclusively or in combination with organic fertilizers and/or compost.

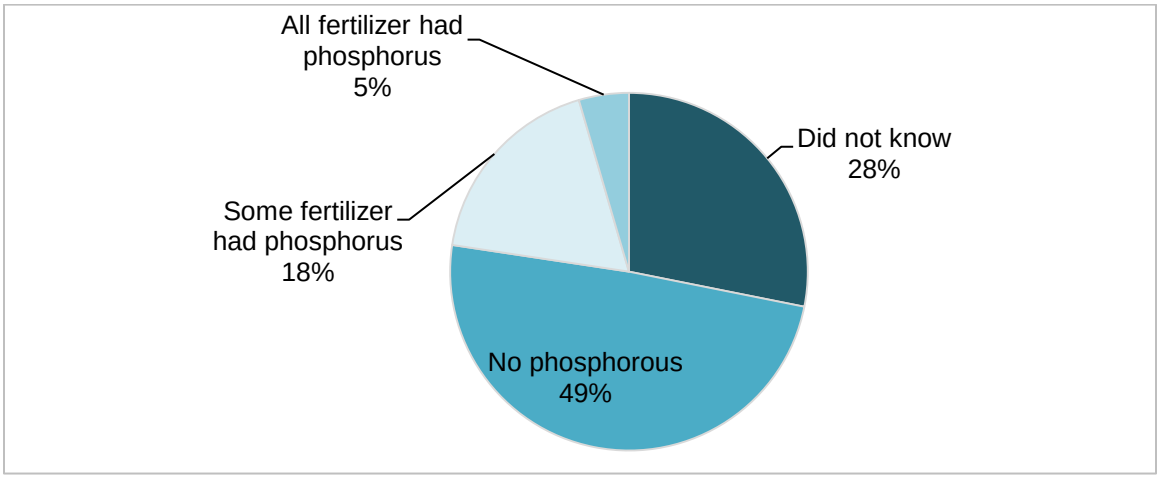
Figure 20. Proportion of organic vs chemical fertilizers



n=528 respondents who hire out or do yard and lawn care and know what fertilizer was used, if any.

Respondents who used any type of fertilizer[6] were asked if they knew the phosphorus content of the fertilizer used. Roughly half said the fertilizer they used had 0% phosphorus. The remainder was roughly split between those who said *some* or *all* of their fertilizer contained phosphorus (23%) or *didn't know* (28%).

Figure 21. What was the phosphorus content of the fertilizer(s) used?



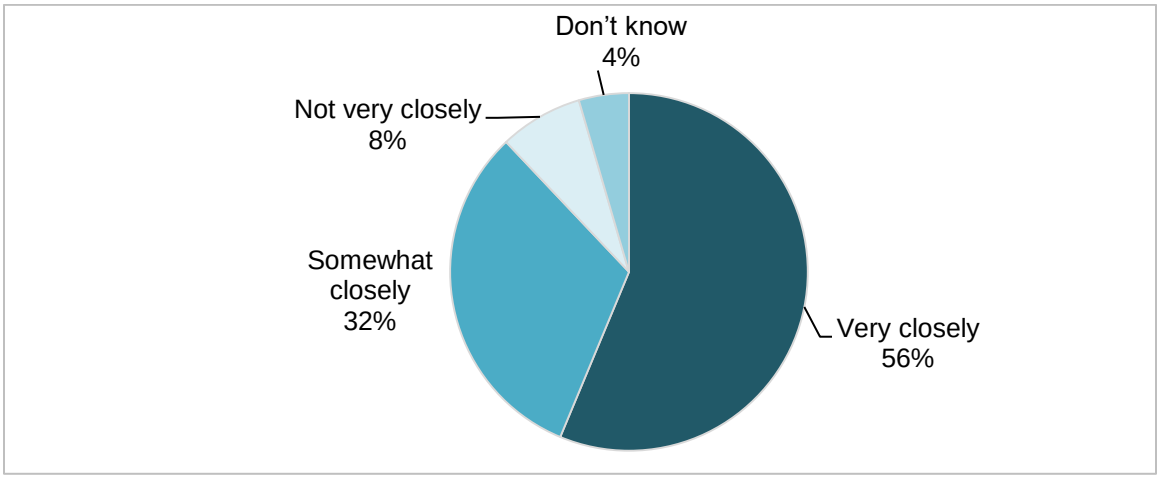
n=199 respondents who hire out or do yard and lawn care and used fertilizer(s)

Analysis found no relationship between the type of fertilizer (chemical or organic) and the knowledge of phosphorus levels, or the reported level of phosphorus.

[6] Chemical fertilizer, weed-n-feed products, or organic/slow-release fertilizers

Respondents who used fertilizers were asked how closely they read the manufacturer's instructions. Figure 22 shows that 56% said that they read the manufacturer's directions *very closely*.

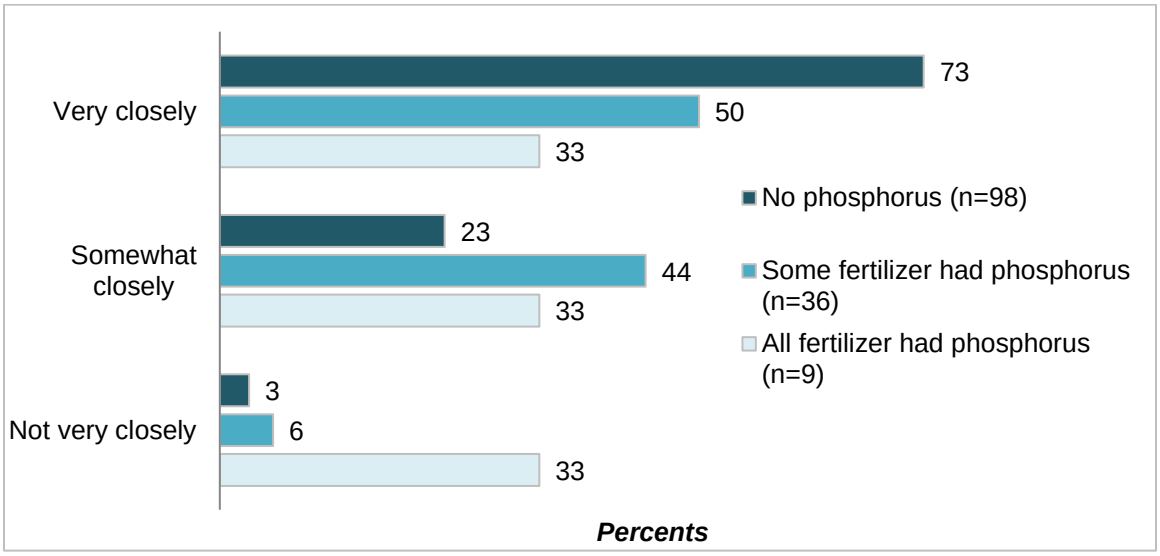
Figure 22. When fertilizer was used, how closely did you read the manufacturer's directions?



n=199 respondents who hire out or do lawn and yard care and who use fertilizer

Analysis found that respondents who were using only 0% phosphorus fertilizers were more likely to say they were reading the manufacturer's directions *very closely* (73% vs. 47% of respondents using fertilizers with any phosphorus).

Figure 23. How closely did you read the manufacturer's directions by phosphorus level[7]

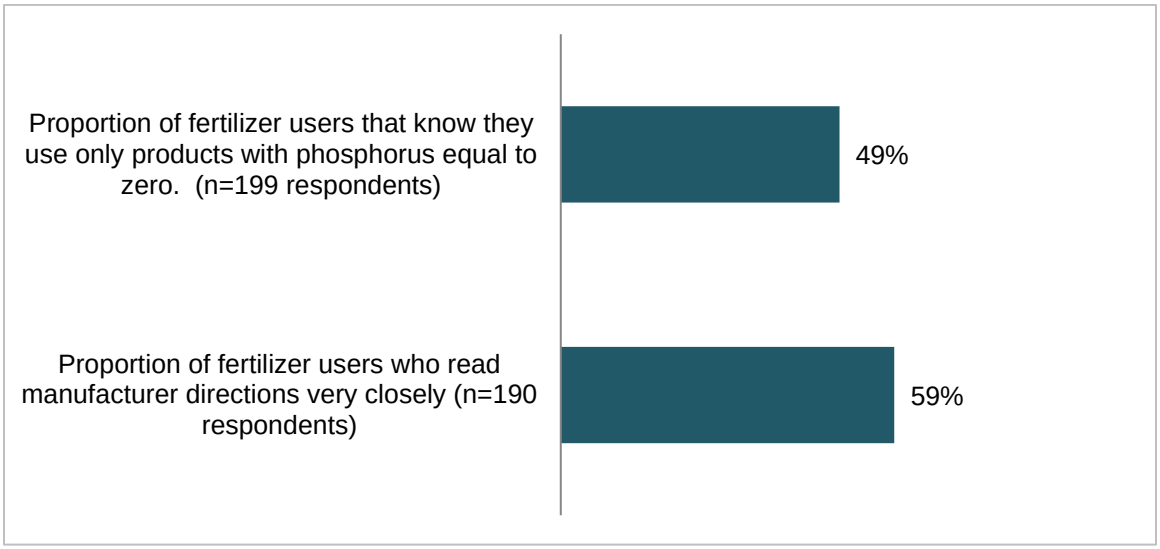


[7] Respondents who knew the phosphorus content of their fertilizer were included in this graphic. Fifty-six respondents (28% of those who used fertilizer) did not know the phosphorus content.

Stormwater Program – Key Metrics: Reduce or eliminate fertilizer use

Figure 24 illustrates the key metrics associated with fertilizer usage.

Figure 24. Stormwater Program Key Metrics: If using fertilizer, use fertilizer with 0% phosphorus; Read manufacturer directions *very closely*



Multivariate analysis

Analysis found a relationship between these metrics and the following characteristics, summarized here with a specification of the segment with the higher proportion:

Proportion of fertilizer users who know the level of phosphorus in their fertilizer

- Gender (Male, 78%)

Proportion of fertilizer users that use only products with phosphorus equal to zero

- No significant differences between segments of interest

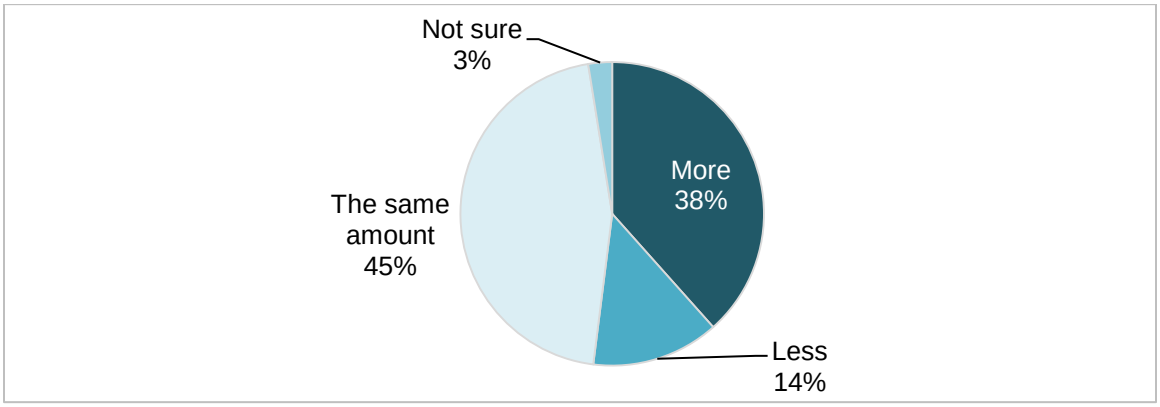
Proportion of fertilizer users who say they read the manufacturer directions very closely

- Attitudes about urgency to clean up and protect Lake Whatcom – this is a bimodal distribution with 72% of respondents saying *extremely urgent,* and 70% saying *not at all/not very urgent.* In between are those who feel it is *very urgent* (63%) and those who think it is *somewhat urgent* (46%).

Replace lawn with native landscaping

Respondents who had responsibility for yard care were asked about the quantity of vegetation on their property. Forty-five percent (45%) reported that there was *the same amount* of vegetation as five years ago, and a slightly smaller proportion (38%) said that the vegetation has increased.

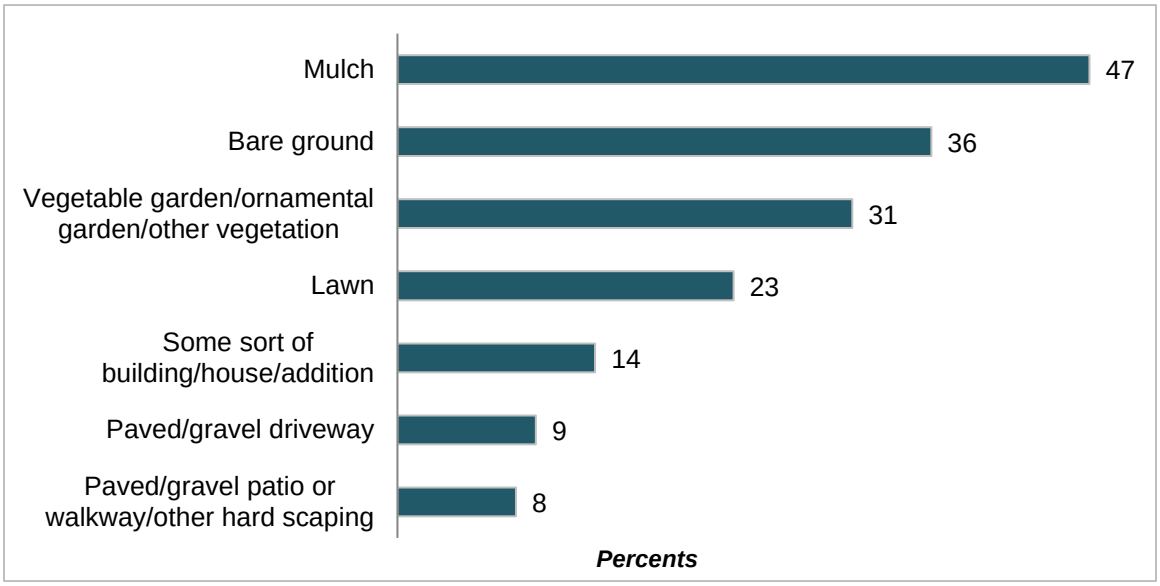
Figure 25. Compared to five years ago, is there more, less, or the same amount of trees, bushes, groundcovers, or other low-growing plants (other than lawn) on your property?



n=552 respondents who hire out or do their own yard and lawn care

Respondents who had less vegetation on their property compared to five years ago were asked to identify what replaced that vegetation. Nearly half (47%) said the vegetation has been replaced by *mulch*. Just over one-third (36%) said it was replaced by *bare ground*.

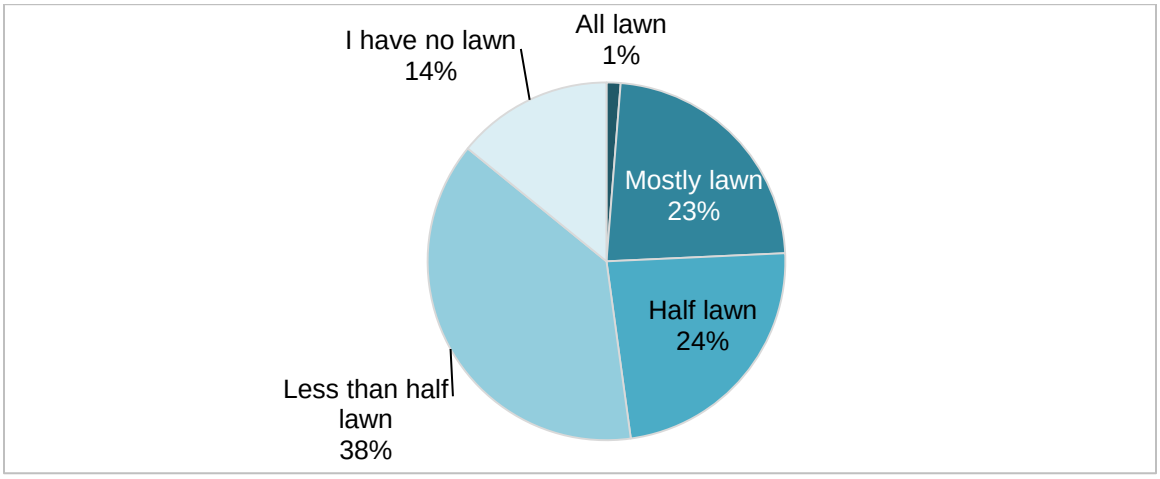
Figure 26. Which of the following best describes what replaced the vegetation?



n=74 respondents with *less* vegetation than five y ears ago; multiple responses were possible, may total more than 100%

Respondents were asked about how much of their lawn is covered by grass lawn. Figure 27 shows how the respondents answered this question.

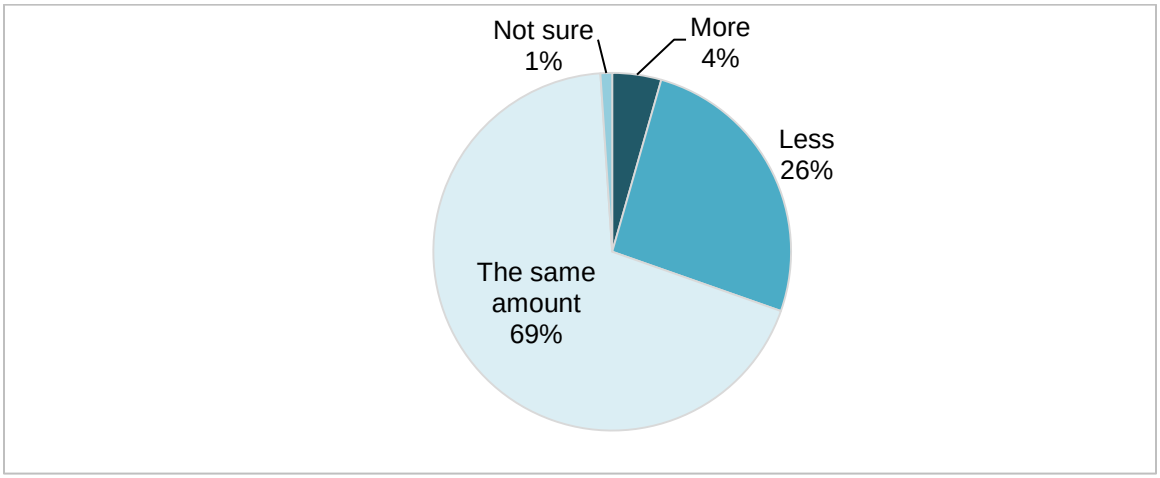
Figure 27. About how much of your yard is covered by a grass lawn?



n=552 respondents who hire out or do their own yard and lawn care

Respondents who had responsibility for yard care were asked about any changes in the quantity of lawn compared to five years ago. Just over two thirds (69%) said their property has the *same amount* of lawn, but roughly one quarter (26%) said that their property has *less* lawn now than five years ago. A small portion (4%) said their lawn size had increased.

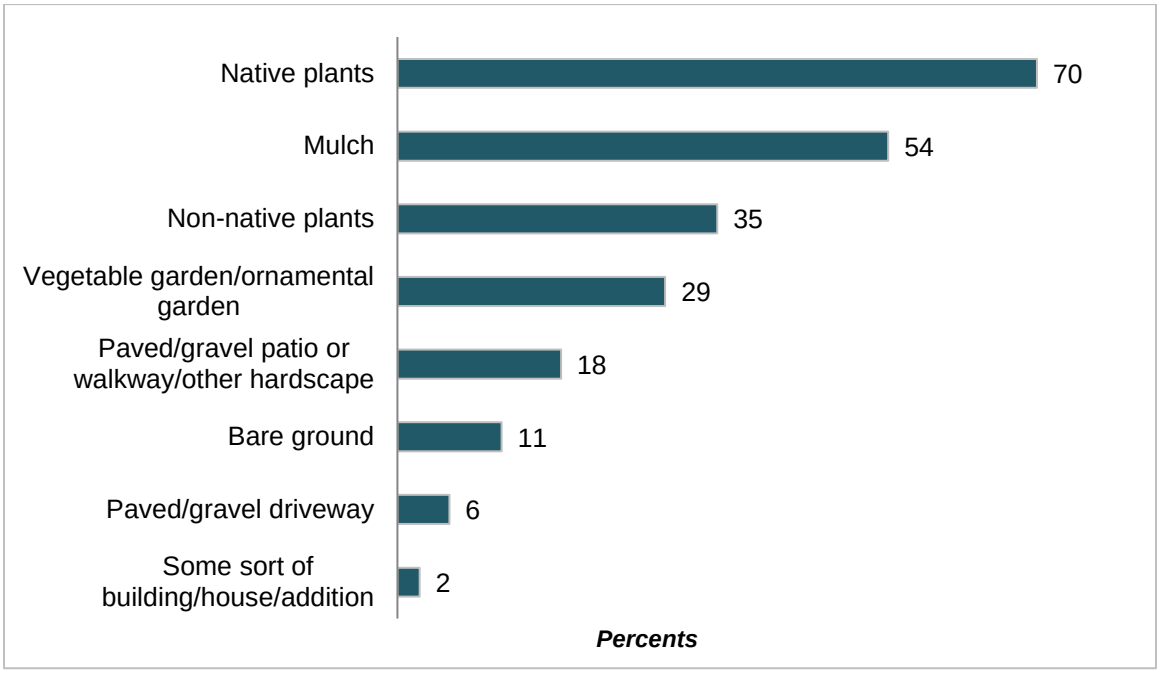
Figure 28. Compared to five years ago, is there more, less or the same amount of lawn on your property?



n=474 respondents with a lawn who hire out or care for their yard and lawn

Respondents who had responsibility for yard care were asked what replaced the lawn. Figure 29 shows that the top mention was native plants (70%), followed by mulch (54%). Respondents typically replaced the lawn with items from more than one category.

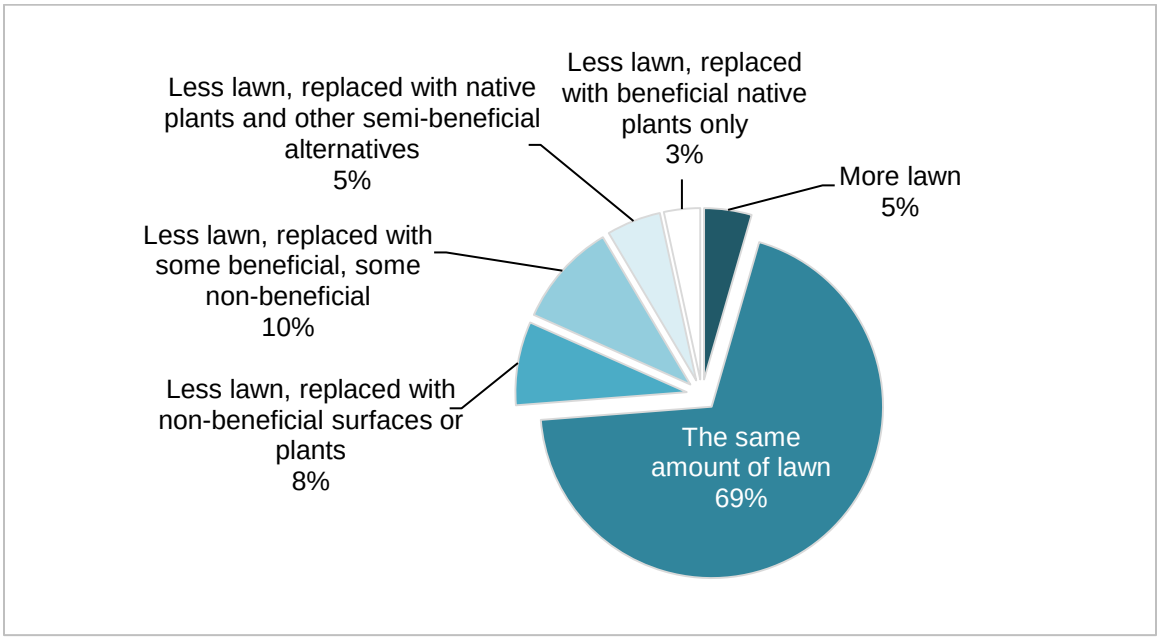
Figure 29. Which of the following best describes what replaced the lawn?



n=123 who have *less* lawn than five years ago; multiple responses were possible, may total more than 100%

Analysis assigned each response shown in Figure 29 to a category of “beneficial” (native plants), “semi-beneficial” (mulch or non-native plants) or “non-beneficial” (vegetable gardens, paved or gravel surfaces, bare ground, and buildings). Figure 30 below shows that altogether 8% of respondents with yard care responsibility have replaced lawn with native plants or other semi-beneficial alternatives to lawn.

Figure 30. Lawn replacement

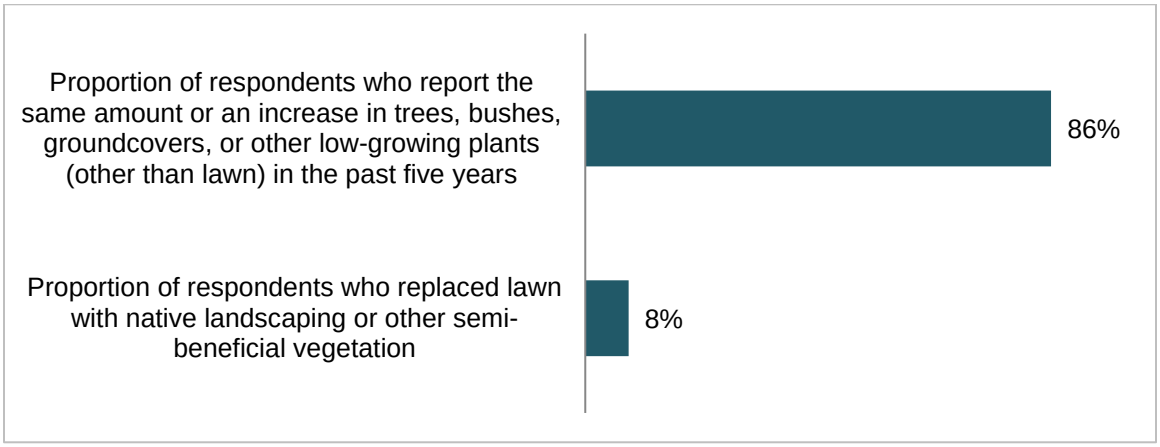


n=469 respondents with lawn, who hire out or do their own yard work

Stormwater Program Key Metrics: Replace lawn with native landscaping:

Figure 31 illustrates the key metrics associated with native landscaping.

Figure 31. Stormwater Program - Key Metrics: Replace lawn with native landscaping



N=469 respondents with lawn who hire out or do their own yard work

Multivariate analysis

Several respondent characteristics coincided with these beneficial practices:

Reported same amount or an increase in vegetation in past five years

- Shoreline property (93% versus 85% of off-shoreline)

- Years at the address (91%, 20+ years; 78%, 5 years or less)
- Children in household (80% yes; 88% no)
- Age (79% under 50; 91% 50-64)
- Urgency to clean up Lake Whatcom (82%, very/extremely; 89% somewhat/not very/not at all)

Replaced lawn with native landscaping or other semi-beneficial vegetation

- Urgency to clean up Lake Whatcom (12%, very/extremely; 6% somewhat/not very/not at all)

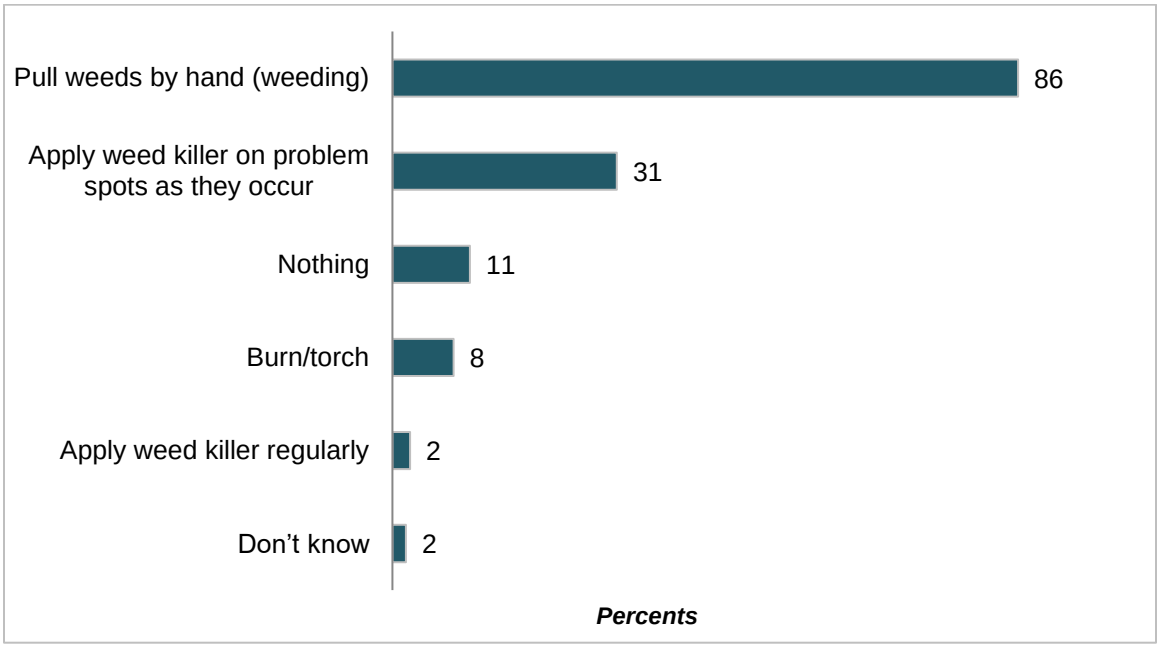
Reduce or eliminate pesticide use

Respondents who had responsibility for yard care were asked

- How weeds had been managed;
- How much they heard or read about alternatives to chemical weed killers;
- How pests had been managed; and
- How much they had heard or read about alternatives to chemical bug killers.

Figure 32 shows that the vast majority said they *pull weeds by hand* (86%) over the past two years.

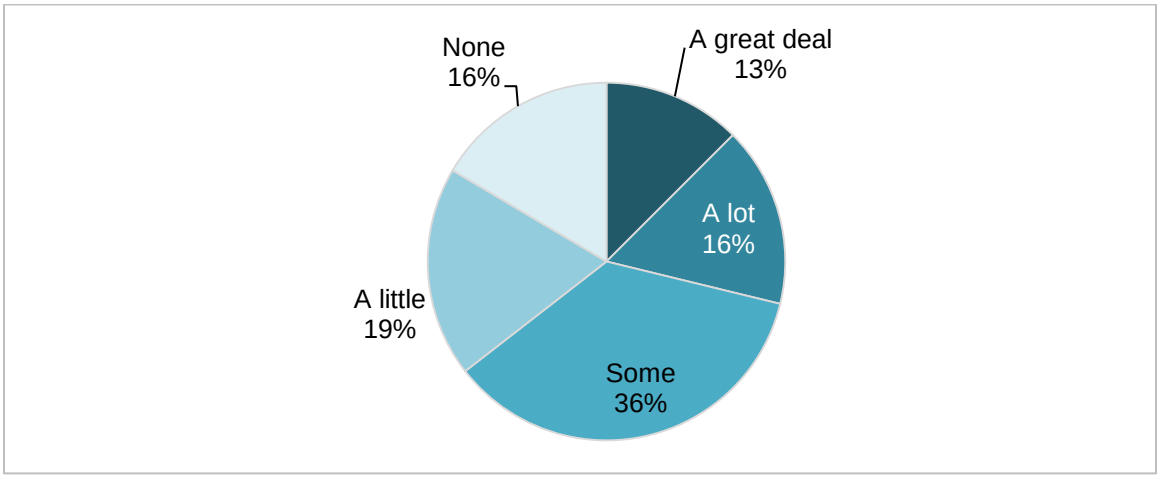
Figure 32. How has your household (or hired professional) typically managed weeds over the past two years?



n=552 respondents who hire out or do their own yard work; multiple responses were possible, may total more than 100%

Nearly two-thirds (65%) of these respondents said they have heard at least *some* about alternatives to chemical weed killers (Figure 33).

Figure 33. How much have you heard or read about alternatives to chemical weed killers?

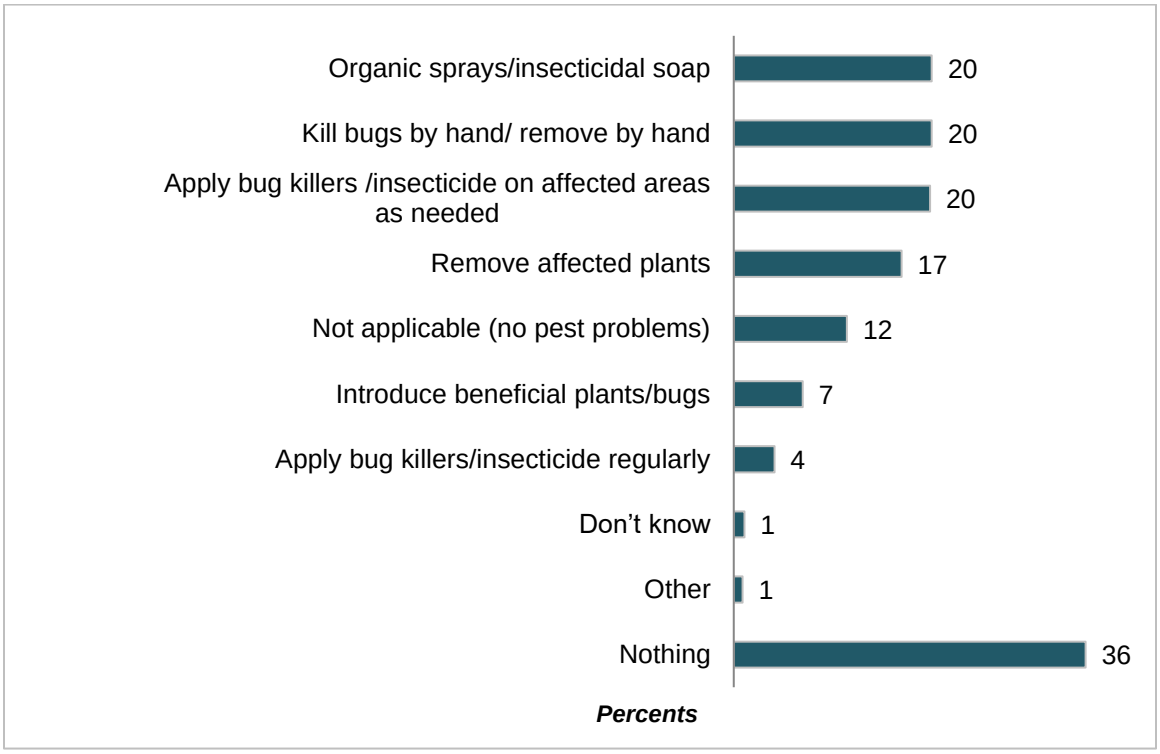


n=552

Analysis found some relationships between the methods of managing weeds and knowledge of alternatives to chemical weed killers. Respondents who *applied weed killers regularly* (n=13) were especially likely to say they have not heard or read anything about alternatives to chemical weed killers (54%, 7 respondents). Respondents who *pulled weeds by hand* were more likely to say they have read or heard about alternatives to weed killers (when compared to those who do not weed by hand).

Figure 34 shows how households have managed pests and bugs over the past two years. The most common response was “nothing” (36%). However, one-fifth (20%) said they use *organic sprays or insecticidal soaps*, and the same proportion said they *kill or remove bugs by hand*. The same proportion said they *apply bug killers/insecticides to affected areas as needed*. Only 4% said that they *apply insecticide regularly*.

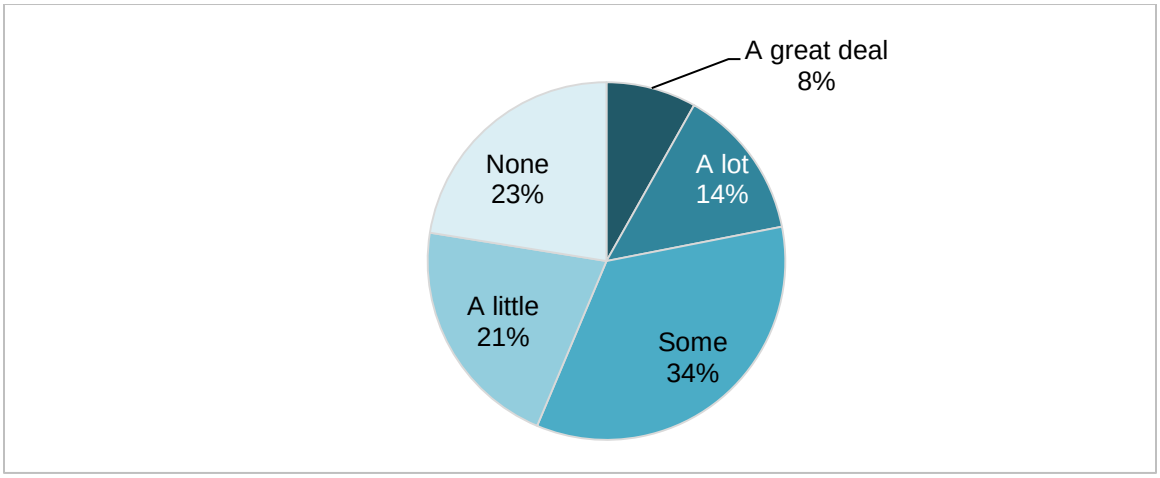
Figure 34. How has your household (or hired professional) typically managed pests/bugs in your garden or yard over the past two years?



n=552 respondents who hire out or do their own yard work; multiple responses were possible, may total more than 100%

Over half (56%) of respondents have heard or read at least *some* about alternatives to chemical bug killers (Figure 35).

Figure 35. How much have you heard or read about alternatives to chemical bug killers?



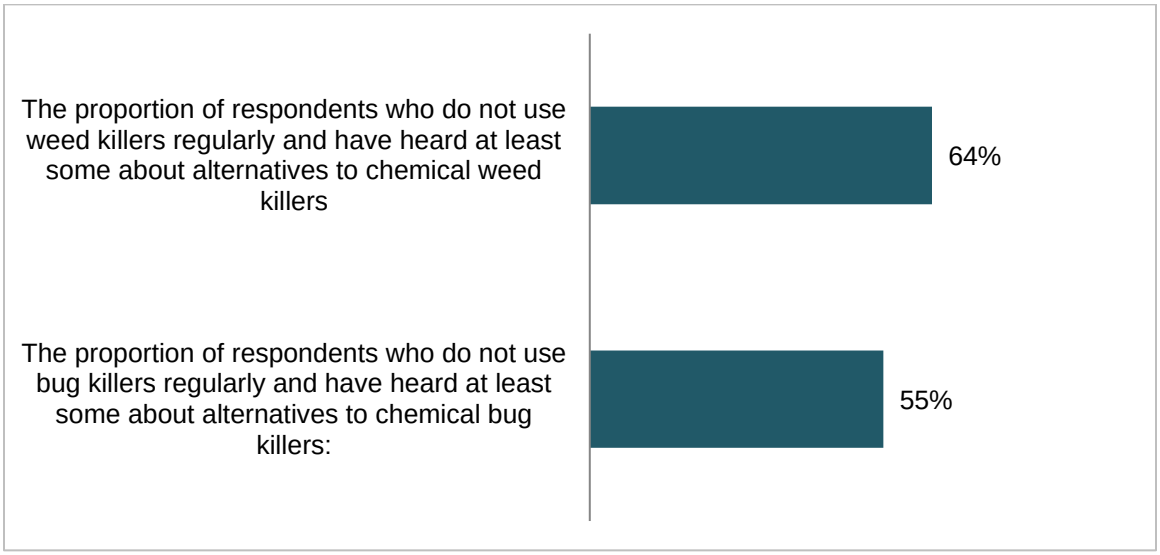
n=552 respondents who hire out or do their own yard work

Respondents who used organic sprays were more likely to say they have heard or read more about alternatives to chemical bug killers.

Stormwater Program – Key Metrics: Reduce or eliminate pesticide use

Figure 36 illustrates the key metrics associated with usage of pesticides and insecticides.

Figure 36. Stormwater Program Key Metrics: Reduce or eliminate pesticide use



n=552 respondents who hire out or do their own yard work

Multivariate analysis

Analysis showed that attitudes are a strong concomitant factor with regard to these key metrics.

Proportion of respondents who do not use weed killers regularly and have heard at least something about alternatives

- Attitude that what I do on my property affects Lake Whatcom (*a great deal*, 82%, *a little/not at all,* 58%)
- Attitudes about urgent need to clean up and protect Lake Whatcom (*extremely/very* 69%*; somewhat/not very/not at all,* 60%)

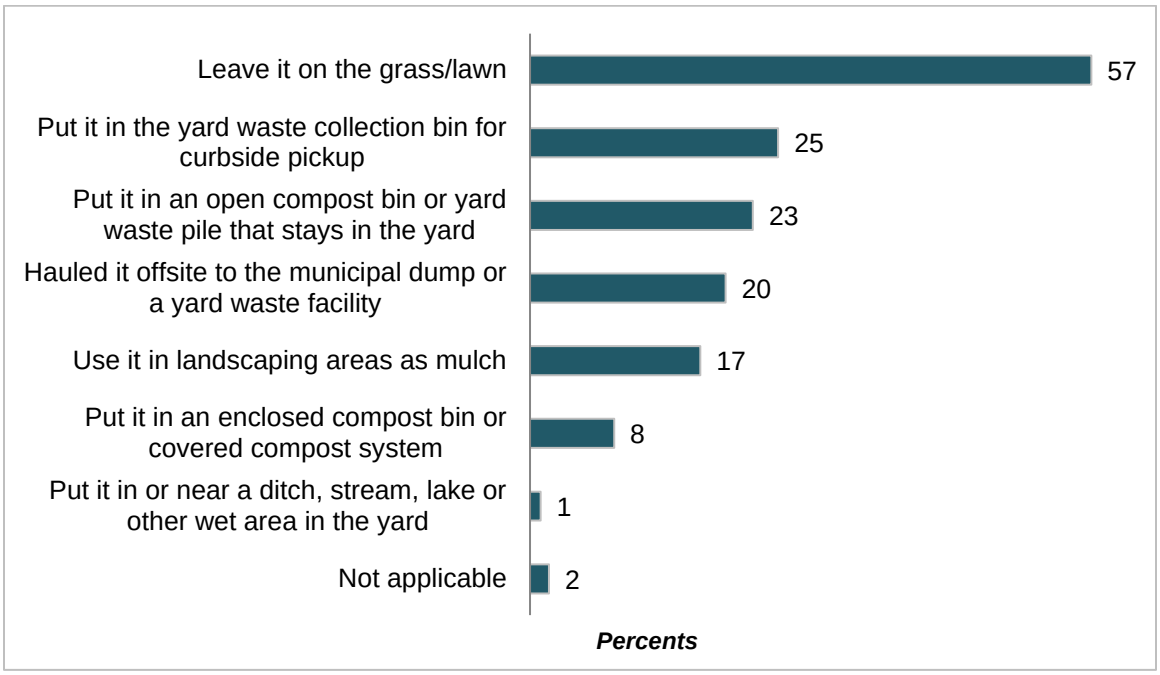
Proportion of respondents who do not use bug killers regularly and have heard at least something about alternatives

- Length of time at current address – bimodal with 60% of those <5 and 60% of those 20+ years, 48% of those with 5-19 years.
- Attitude that what I do on my property affects Lake Whatcom (*a great deal*, 71%, *a little/not at all,* 48%)
- Attitudes about urgent need to clean up and protect Lake Whatcom (*extremely/very* 62%*; somewhat/not very/not at all,* 49%)

Compost grass clippings off site

Respondents who indicated they have any lawn were asked about how they dispose of grass clippings.

Figure 37. Below are several different methods people use to dispose of grass clippings. Which of these methods have you used in the past six months?



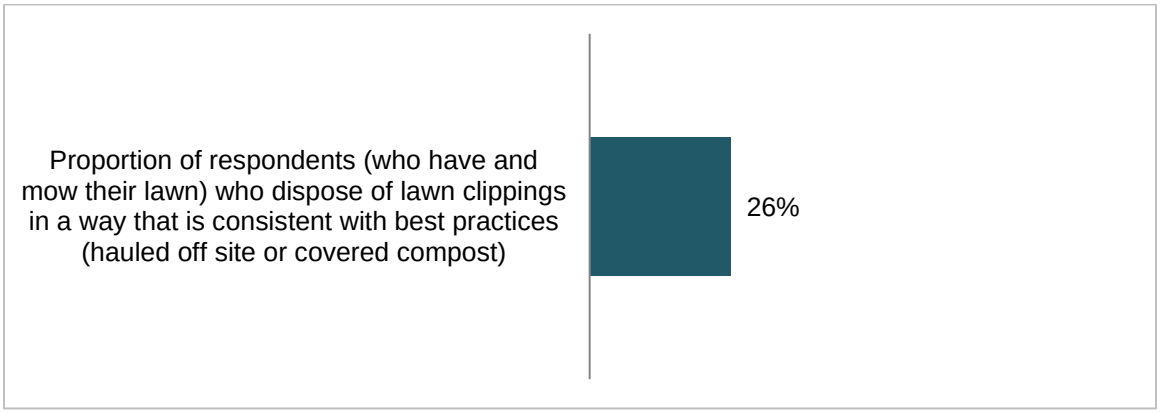
n=471; respondents with lawns who hire out or do their own yard work; multiple responses were possible, may total more than 100%

The methods of disposing of grass clippings were assessed as either beneficial (put in yard waste bin for curbside pickup, hauled offsite or put in an enclosed bin or system) or non-beneficial (all others that leave the grass in the yard and open to rain). Just over one quarter (26%) indicated using a beneficial method exclusively. See Figure 38.

Stormwater Program – Key Metric: Use beneficial practices with grass clippings

Figure 38 illustrates the key metric associated with disposal of lawn clippings.

Figure 38. Stormwater Program Key Metric: Use beneficial grass clipping practices



N=471 respondents with lawns who hire out or do their own yard work

Multivariate analysis

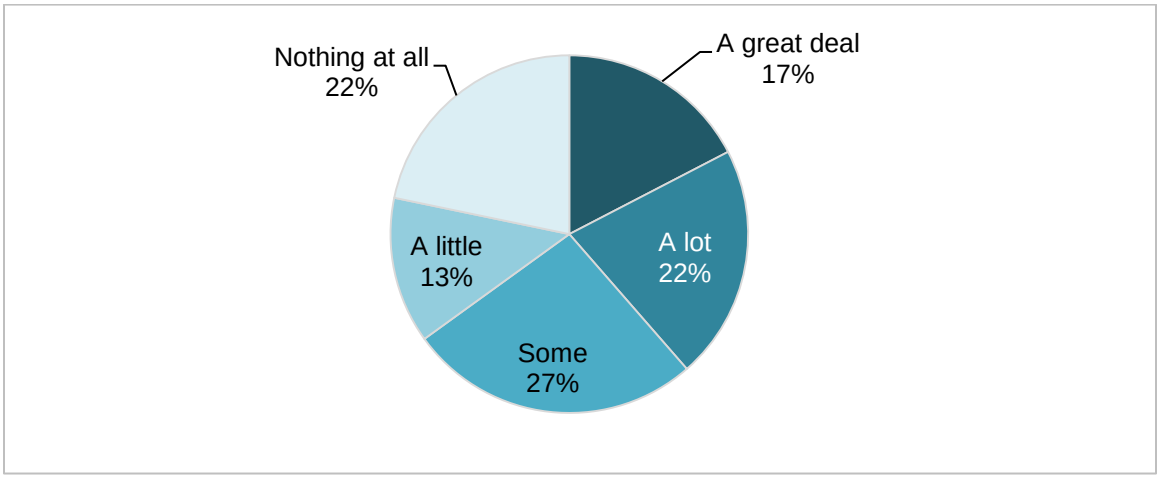
Respondents who were more likely to engage in beneficial practices around grass clippings were:

- Shoreline property residents (39% vs. 23% of those living off the shoreline)
- Older residents (33% of those 65+ compared to 22% of others)

Control erosion on property

Respondents were asked how much they have heard about exposed soil and its impact on Lake Whatcom. Nearly two-thirds (65%) said they have heard at least *some*. Thirty-nine percent (39%) have heard *a lot* or *a great deal*.

Figure 39. How much have you heard or read about exposed soil and its impact on Lake Whatcom?

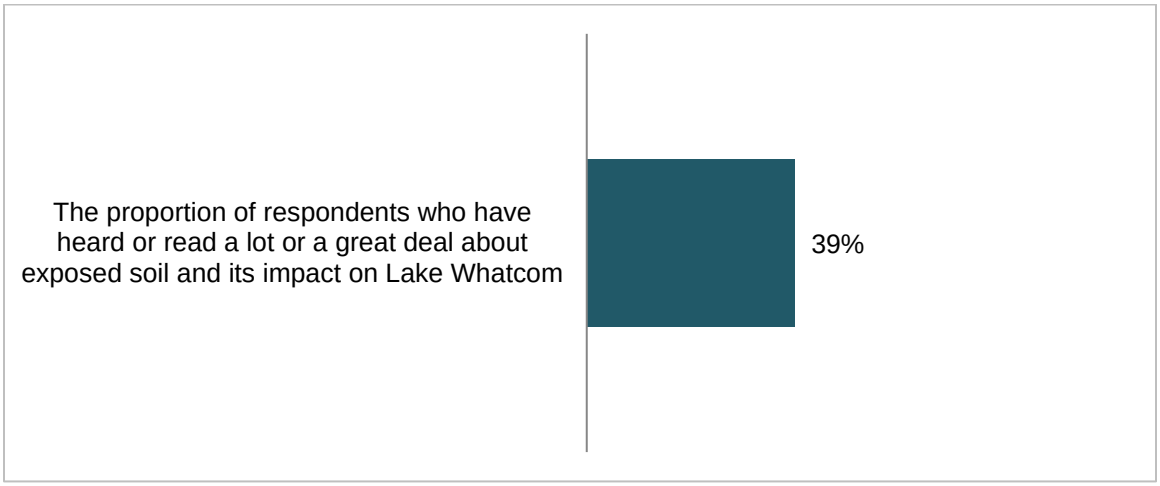


n=552 respondents who hire out or do their own yard work

Stormwater Program Key Metric: Control erosion on property

Figure 40 illustrates the key metrics associated with exposed soil and its role in erosion control.

Figure 40. Stormwater Program Key Metric: Control erosion on property



n=552 respondents who hire out or do their own yard work

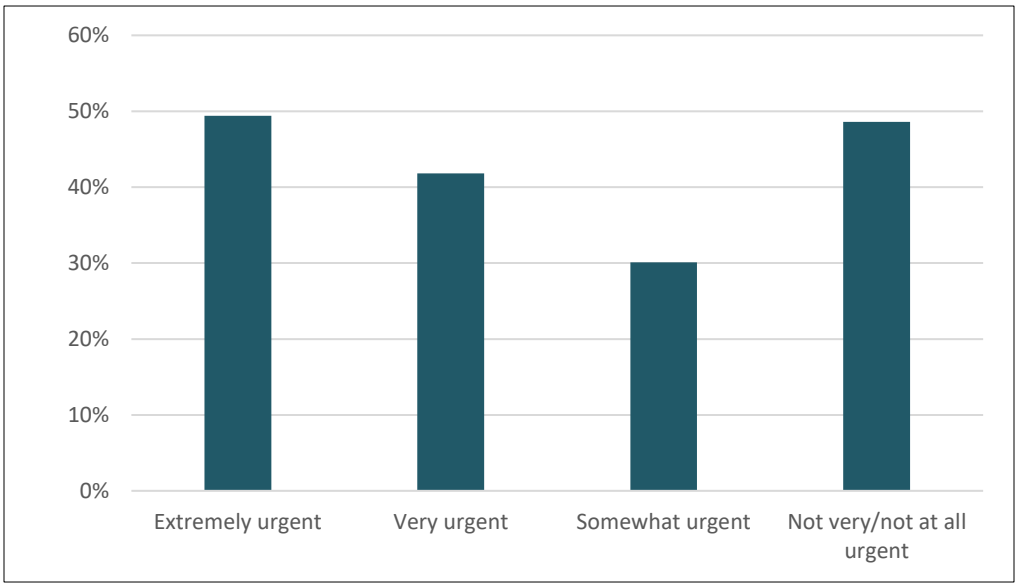
Multivariate analysis

Respondents who were more aware of exposed soil and its impact on Lake Whatcom were more likely to be:

- Shoreline residents (54% vs 39% of off shoreline residents)
- Long term residents (50% of those with 20+ years at the address versus 34% of others)
- Older residents (42% of those 50 and older versus 29% of those under 50)

In addition, respondents who thought what they do on their property can affect Lake Whatcom *a great deal* were more likely to be aware of the problems of exposed soil (58% compared to 33% of those who responded *some* or *not at all*). Other attitudes coincided with this metric as well, but the relationship was not as clear. Those who felt cleaning up and protecting the lake was *extremely urgent* were just as likely as those who felt it was *not at all urgent* to know about exposed soils (49%). However those with middling urgency were less aware (42%, *very urgent*, 30%, *somewhat urgent*).

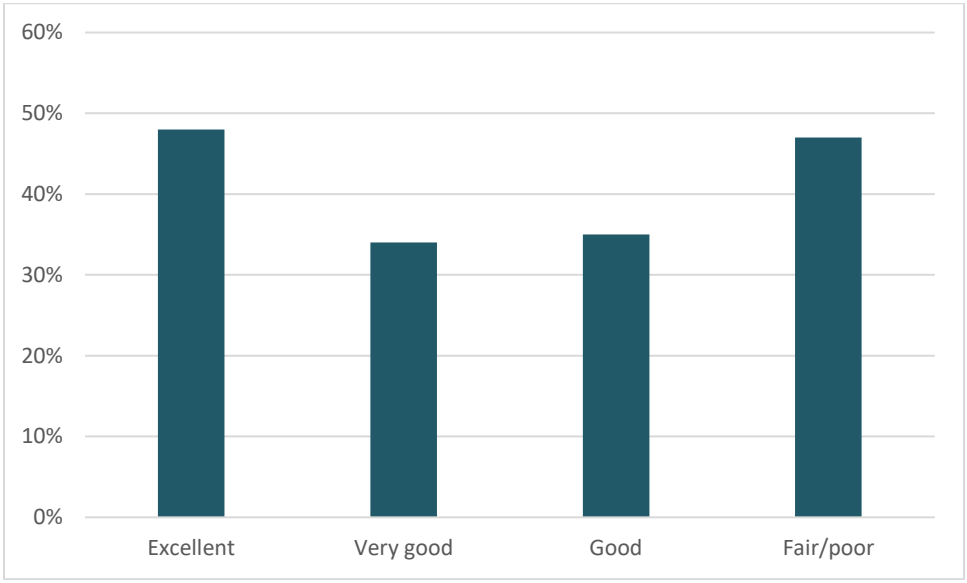
Figure 41. Percent who have heard or read *a lot* or *a great deal* about exposed soil and its impact on Lake Whatcom: How urgent is it to clean up and protect the lake



N=556 n=552 respondents who hire out or do their own yard work

A similar bimodal pattern is seen with attitudes about water quality; 48% and 47% of respondents with highest and lowest ratings of water quality knew about exposed soil, but only 34% of those with middling ratings of water quality knew (Figure 42).

Figure 42. Percent who have heard or read *a lot* or *a great deal* about exposed soil and its impact on Lake Whatcom: water quality in Lake Whatcom

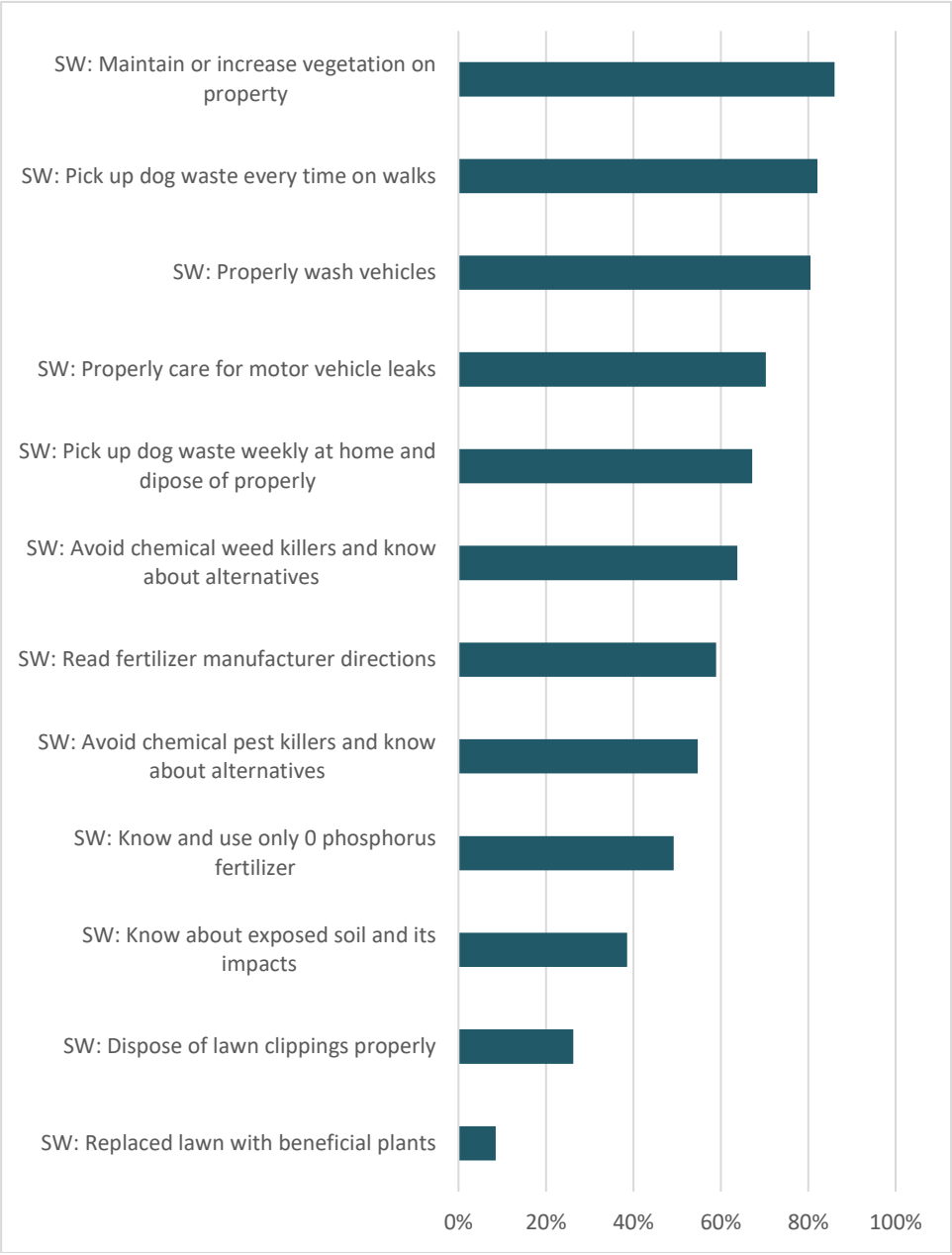


N=596

Stormwater Program Key Metrics summary

Examining all of the Stormwater Program-related Key Metrics helps identify which are most prevalent and which are less so. Figure 43 shows that maintaining or increasing vegetation is the most common practice, while replacing lawn with beneficial plants is least common.

Figure 43. Stormwater Program Key Metrics by prevalence[8]

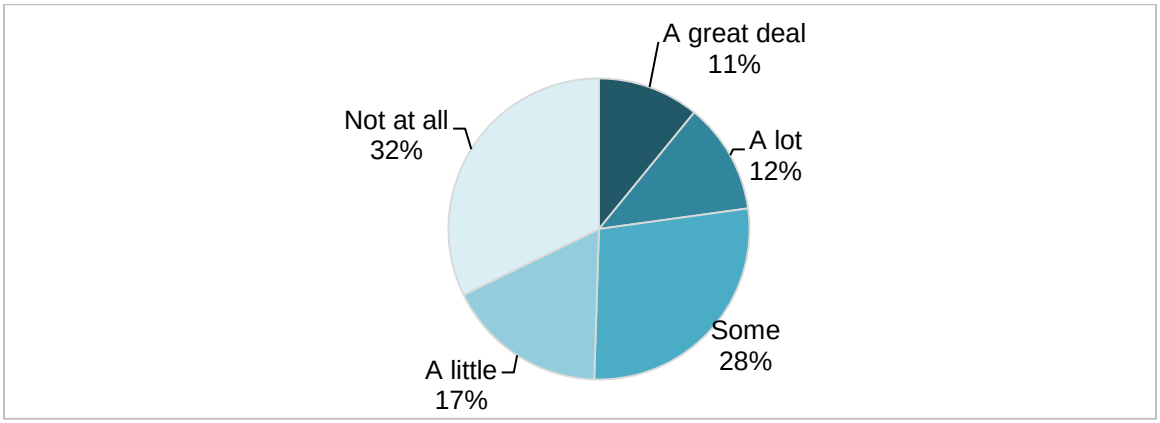


[8] Please note that metric titles have been abbreviated for presentation.

CAPITAL PROJECT AWARENESS

In addition to the specific program areas, the survey also explored the familiarity with the City of Bellingham and Whatcom County's construction projects that filter and clean polluted runoff around the lake. Just over half of respondents (51%) said they have heard at least *some* about this, and 23% said they have heard *a lot* or *a great deal*.

Figure 44. How much have you heard or read about the City of Bellingham and Whatcom County's construction projects that filter and clean polluted runoff around the lake?

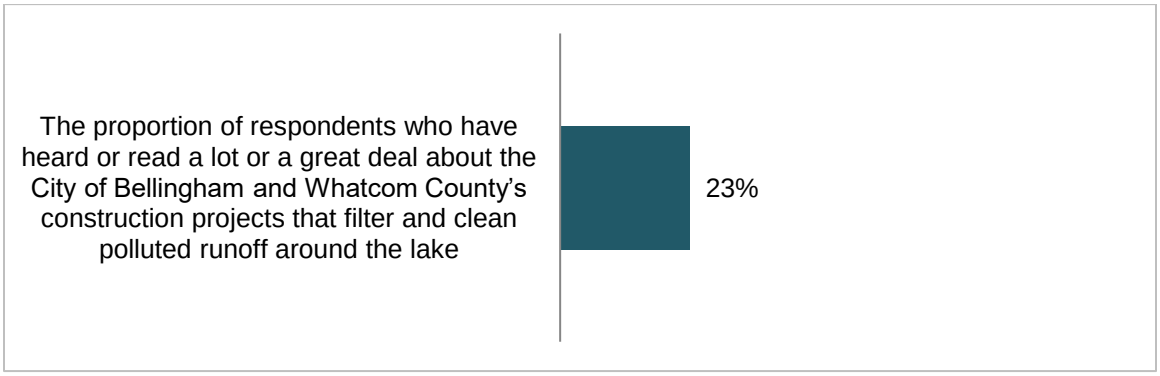


n=596

Key Metric: Capital project awareness

Figure 45 illustrates the key metric associated with the City and County construction projects to clean Lake Whatcom.

Figure 45. Key Metric: Capital project awareness



n=596

Multivariate analysis

Shoreline residents were more likely to be aware of capital projects (34% vs. 20% of non-shoreline residents), as were those with more years at their current address (30%, 20+ years vs. 15% <5 years). Males were also more aware than females (27% vs. 17%).

Attitudes varied significantly with awareness of the capital projects, but not consistently. People who thought water quality had improved were more aware (39% versus 24% of those who did not think it had improved), as were those who felt less urgency to clean up and protect the lake (36% vs. 22% of others). But a bimodal distribution showed up again with ratings of water quality, with *excellent* and *fair/poor* ratings going with higher awareness (34% and 33% respectively) while those who gave middling ratings of *very good* or *good* having lower awareness (17% and 18% respectively).

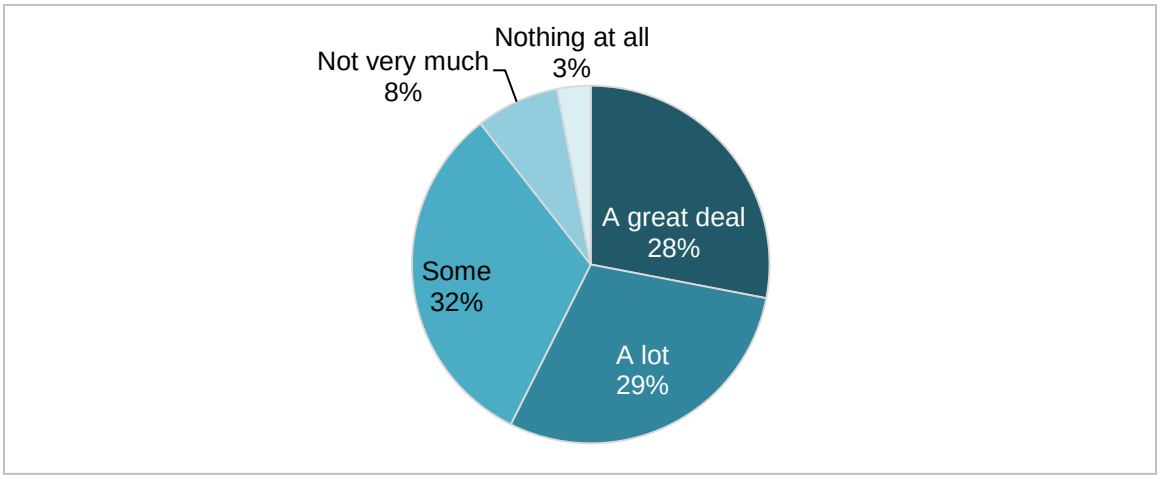
HAZARDOUS MATERIALS PROGRAM

The survey included two topics of direct relevance to the Hazardous Materials Program: the disposal of hazardous materials and the reporting of illicit discharges.

Dispose of hazardous materials properly

Respondents were asked how much they have heard or read about how to dispose of hazardous materials. Fifty-seven percent (57%) said they have heard *a lot* or *a great deal.*

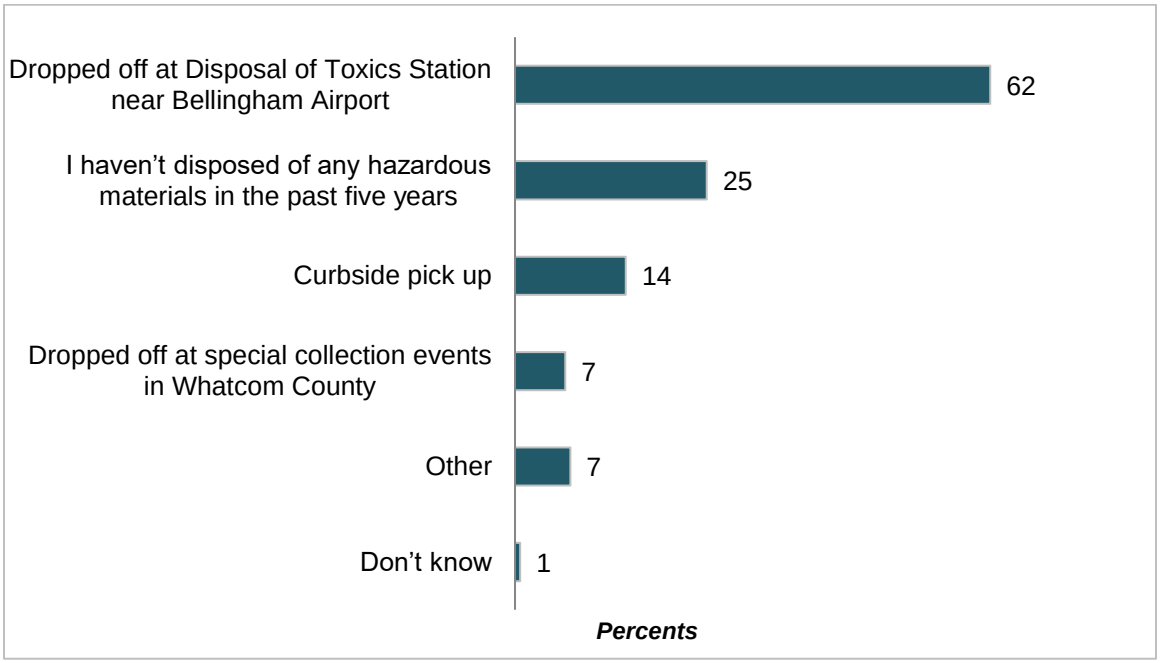
Figure 46. How much have you heard or read about how to dispose of hazardous materials like pesticides, oil-bases paints, solvents, motor oil and gasoline?



n=596

The Disposal of Toxics Station near the airport was most likely to be mentioned as a location for disposal of hazardous materials in the past five years. One-quarter (25%) said they have not disposed of any materials.

Figure 47. How have you disposed of hazardous materials in the past five years?

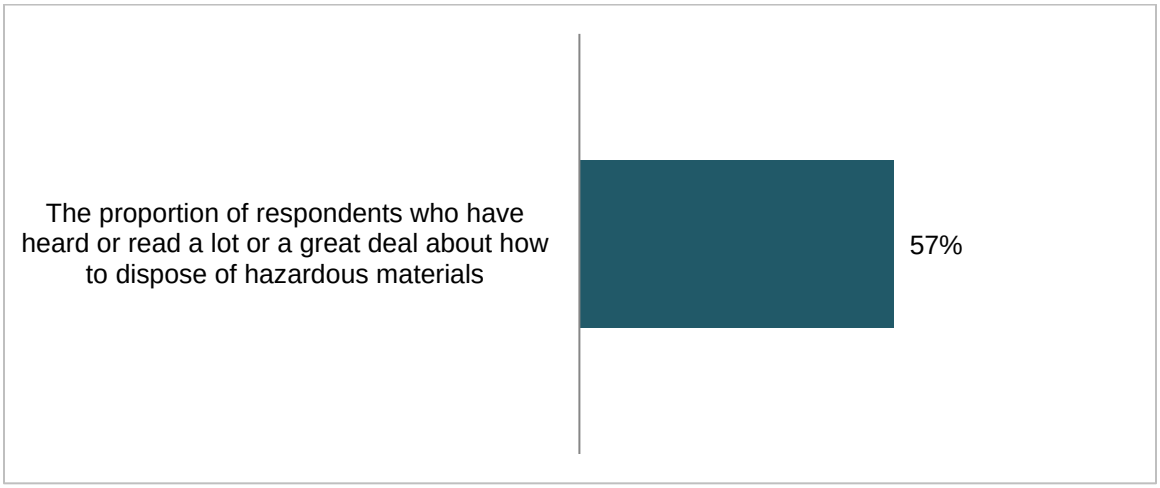


n=596; multiple responses were possible, may total more than 100%

Hazardous Materials Program Key Metric: Dispose of hazardous materials properly

Figure 48 illustrates the key metrics associated disposal of hazardous materials.

Figure 48. Hazardous Materials Program Key Metric: Dispose of hazardous materials properly



n=596

Multivariate analysis

Awareness of how to dispose of hazardous materials tended to be higher among:

- Those who had lived longer in the watershed (71%, 20+ years)

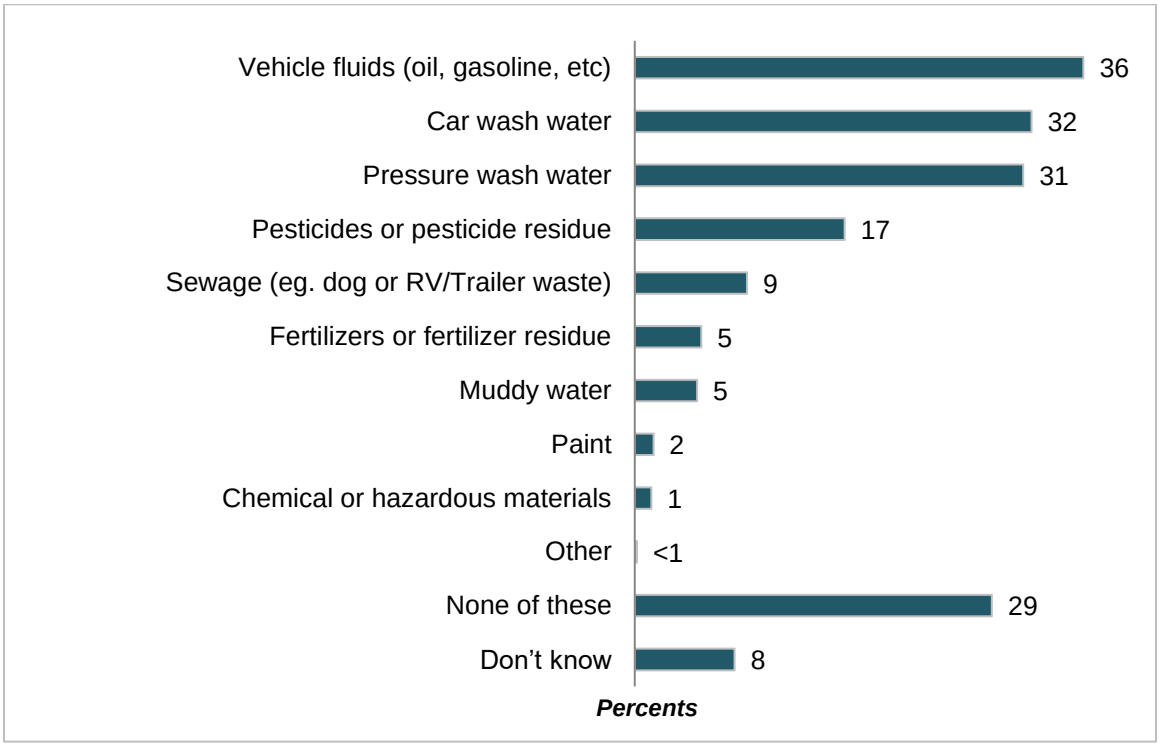
- Those with no children in the household (62% vs. 43% of others)
- Older respondents (64%, 50 and older)
- Those who think what they do on their property affects Lake Whatcom (68%, *a great deal, a lot*)
- Those who think water quality in the lake has improved (75%)

Overall ratings of water quality produced a bimodal distribution with higher rates of awareness about how to dispose of hazardous materials among those giving the lake both very high and very low ratings (65% and 69% respectively).

Report illicit discharges

Respondents were asked to report what kinds of substances they have seen flowing into waterways directly or through drains, ditches or pipes. Altogether, 63% of respondents reported seeing something (any substance, not including *none* or *don't know*). Just over one-third (36%) reported seeing *vehicle fluids* (like oil or gasoline) and a similar, slightly smaller proportion reported seeing *car wash water* (32%) or *pressure wash water* (31%).

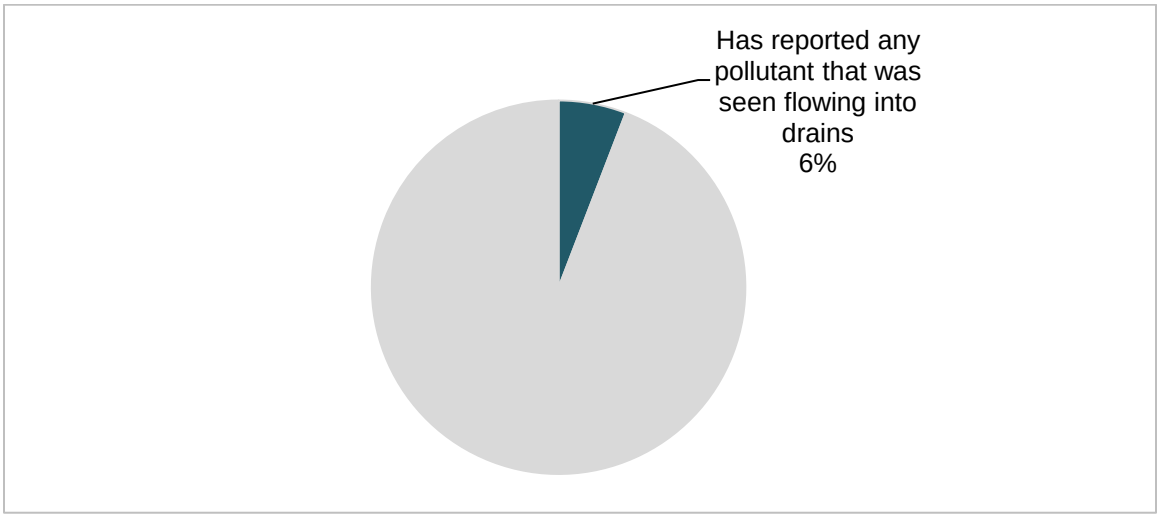
Figure 49. In the past two years, have you seen any of the following substances flowing into any drains, ditches, pipes, or waterways?



n=596; multiple responses were possible, may total more than 100%

Respondents who witnessed pollution flowing into drains, ditches, pipes or waterways were also asked whether they reported the specific substances that they saw. Analysis tabulated the responses to each specific substance (respondents could have reported multiple). Figure 50 shows that 6% of the respondents who witnessed storm water pollution reported it.

Figure 50. Reported storm water pollutant

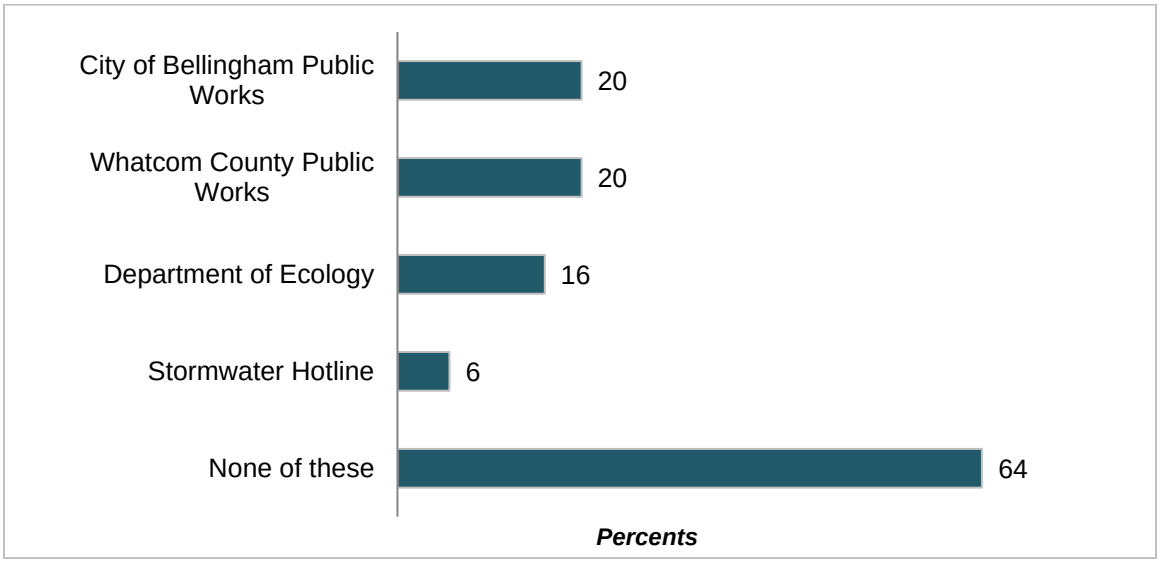


n= 376 respondents who saw any illicit discharge

The individual pollutant associated with the highest rate of reporting was sewage (9%, or 5 out of the 54 respondents who saw sewage going into waterways). This was followed by vehicle fluids (7%, 7 out of 101 respondents) and pesticides (7%, 2 out of 30 respondents).

Respondents were also asked which venues they have heard about for reporting pollution flowing into drains. Nearly two-thirds (64%) said they didn't know about any of the listed avenues for reporting pollution. Only 6% had heard about the storm water hotline.

Figure 51. Which of the following have you heard about for reporting pollution flowing into drains, ditches, pipes, or waterways?

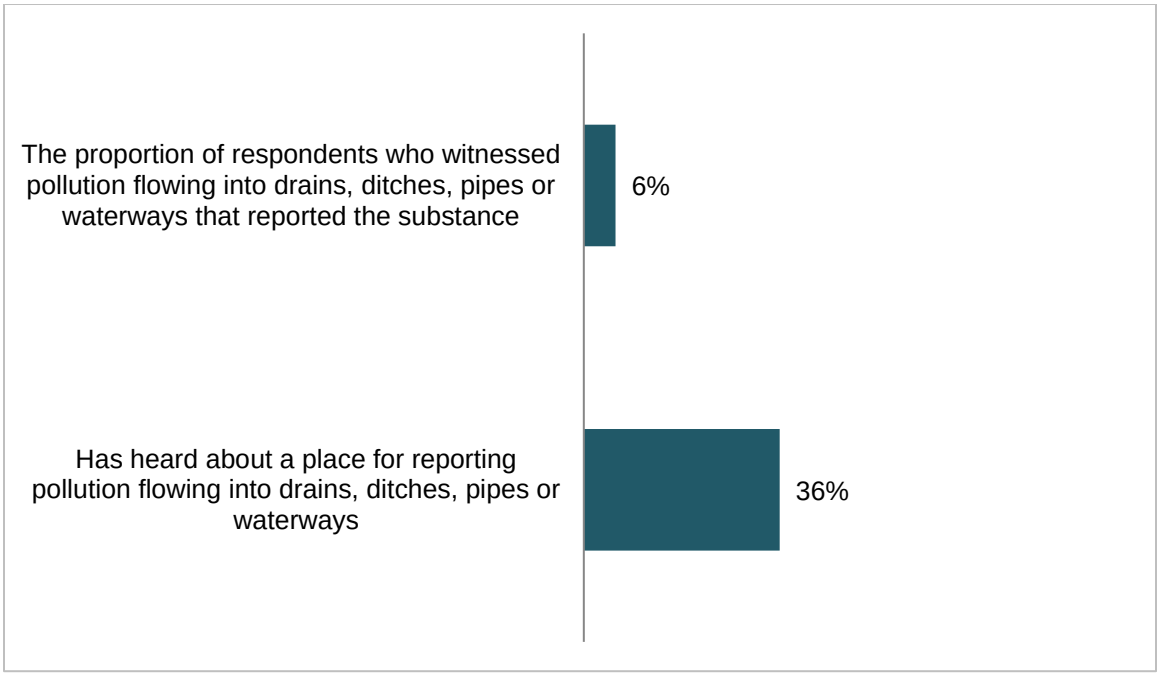


n=596

Hazardous Materials Program Key Metrics: Report illicit discharges

Figure 52 illustrates the key metrics associated reporting illicit discharge that is witnessed.

Figure 52. Hazardous Materials Program - Key Metrics: Report elicit discharges



Multivariate Analysis

Respondents who reported illicit discharges that they saw were more likely to:

- Be shoreline residents (13%)
- Have lived longer at their address (11%, 20+ years)
- Believe that what they do on their property affects the lake (16%, *a great deal)*
- Believe the need to clean up and protect the lake is urgent (15%, *extremely*)
- Rate water quality in the lake *fair/poor* (18%)

Those who were aware of where to report illicit discharges were more often:

- Longer at their address (48%, 20+ years)
- Male (41%)
- Having a low sense of urgency about cleaning and protecting the lake (51%, *not very/not at all urgent*)

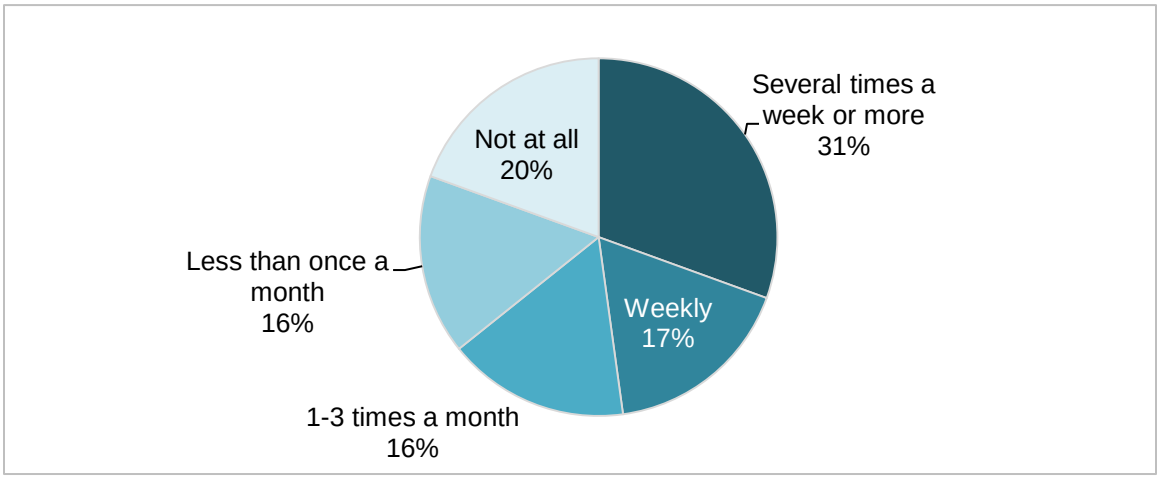
RECREATION PROGRAM

The survey included questions about erosion from unmarked trails. Findings are relevant to the Recreation Program.

Use trails appropriately to reduce erosion

Respondents were asked how often they have used trails for recreation in the watershed. Nearly half (48%) reported weekly usage or more.

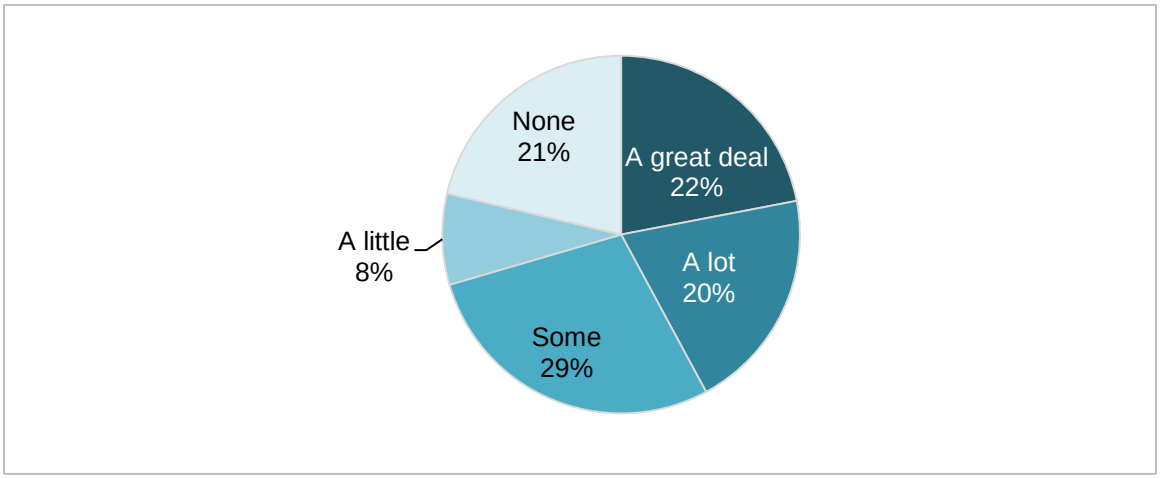
Figure 53. In the past two months, how often did you use trails for recreation in the Lake Whatcom watershed/close to your neighborhood?



n=596

Most respondents (71%) have heard at least *some* about how using unmarked trails can cause erosion, but just over one-fifth (21%) said they had heard nothing.

Figure 54. How much have you heard or read about how using unmarked trails and shortcuts from designated trails can cause erosion?



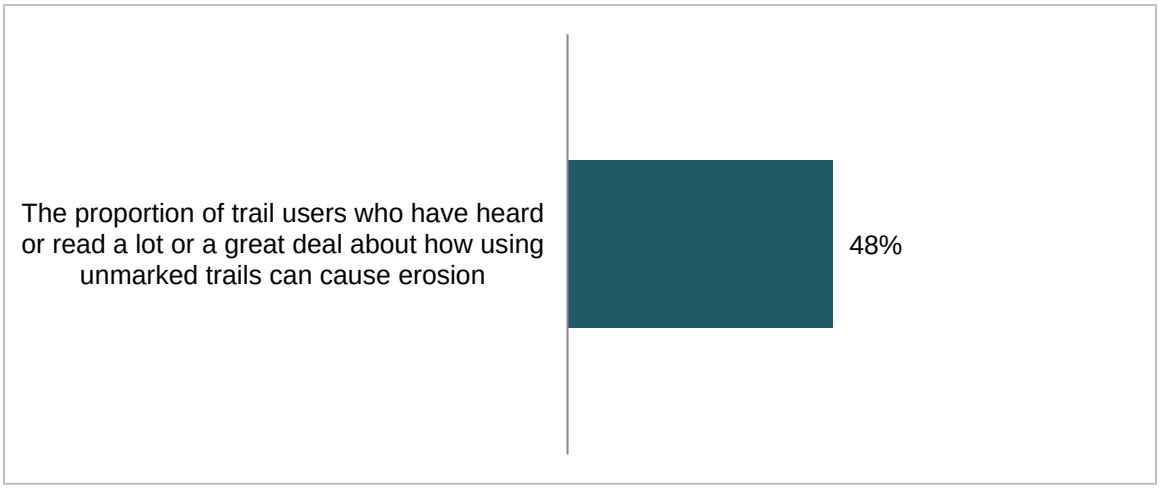
n=596

Analysis found that the respondents who use the trails with greater frequency were more likely to have heard something. About half of the respondents who used trails with some regularity (monthly or more often) said they have heard *a lot* or *a great deal* about the concerns with using unmarked trails (51%). This was significantly lower (27%) among respondents who said they use trails with less frequency.

Recreation Program Key Metric – Use trails appropriately to reduce erosion

Figure 55 illustrates the key metrics associated with recreational use of trails.

Figure 55. Recreation Program Key Metric: Use trails appropriately to reduce erosion



n=480 respondents who used trails in the watershed over the past two months

Multivariate analysis

This metric had no associations with any demographics. However, it was related to two of the attitudinal measures:

- What you do on your property can affect water quality in the lake (65%, *a great deal/a lot*)
- How urgent is the need to clean up and protect the lake (*extremely/very*, 62%)

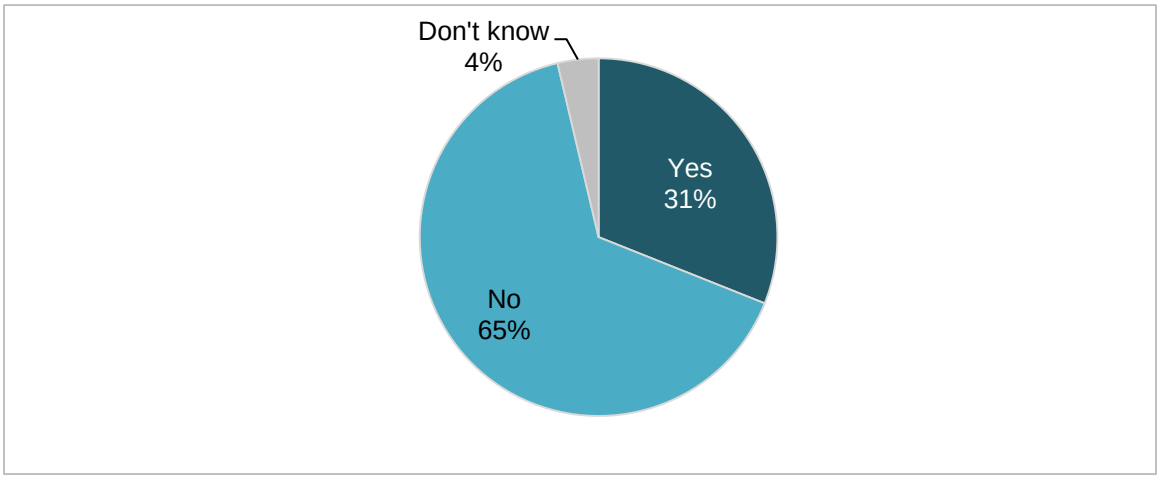
LAND PRESERVATION PROGRAM:

The survey included questions about stewardship expectations on preserved property. Findings are relevant to the Land Preservation Program.

Comply with stewardship expectations on preserved property

Figure 56 shows that nearly one-third or respondents (31%) reported that the property they live on borders some form of public land.

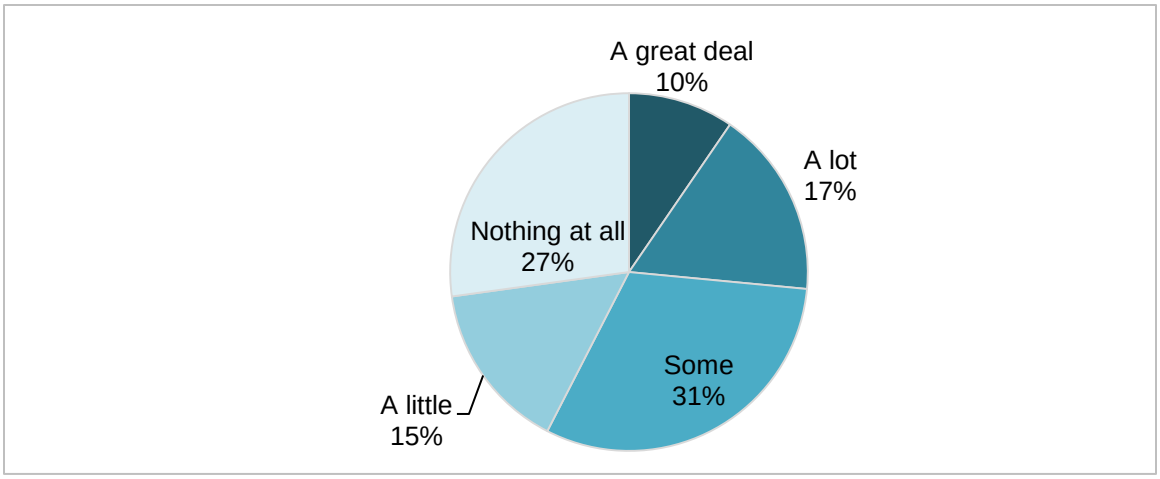
Figure 56. Does the property where you live border any publicly-owned protected land (like a park, preserve, or greenway)?



n=596

Over half of respondents (58%) said they have heard at least some about activities that are prohibited on public land.

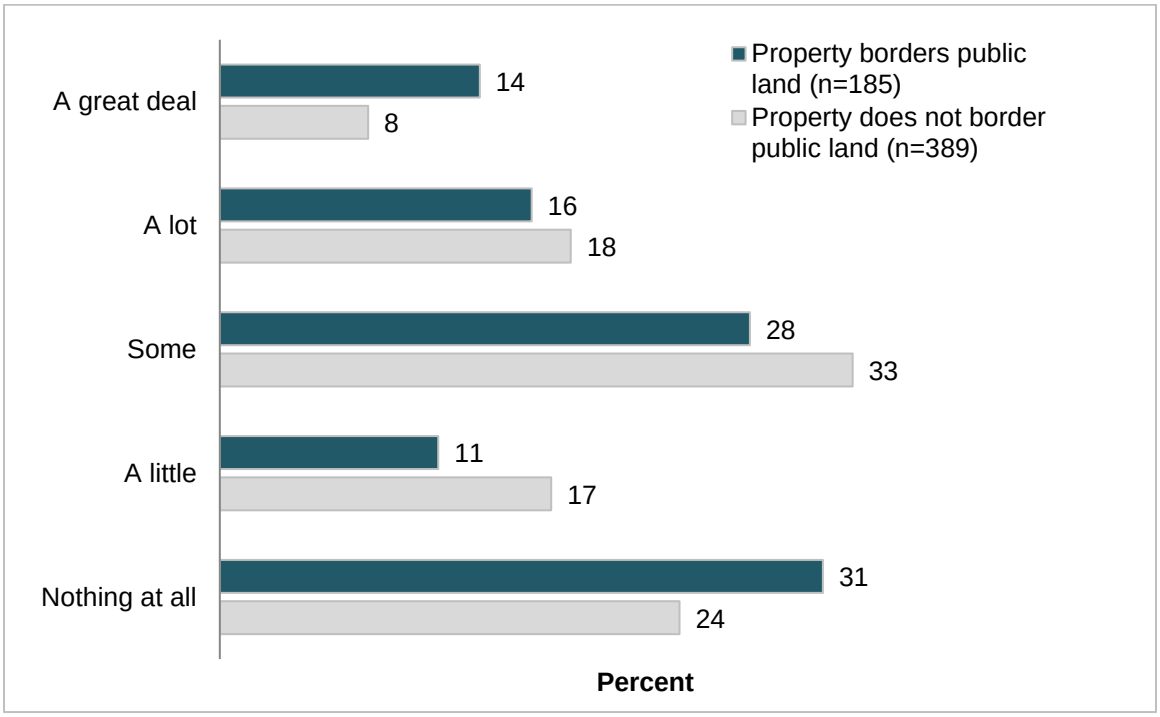
Figure 57. How much have you read or heard about activities that are prohibited on publicly-owned protected land (like a park, preserve, or greenway)?



n=596

Analysis found that respondents who live on property that borders public land were more likely to have heard a *great deal* about what activities are prohibited on public land (14% vs. 8% among other respondents). However, there were a sizable proportion of these respondents who said they have heard *nothing at all* (31% vs 24%).

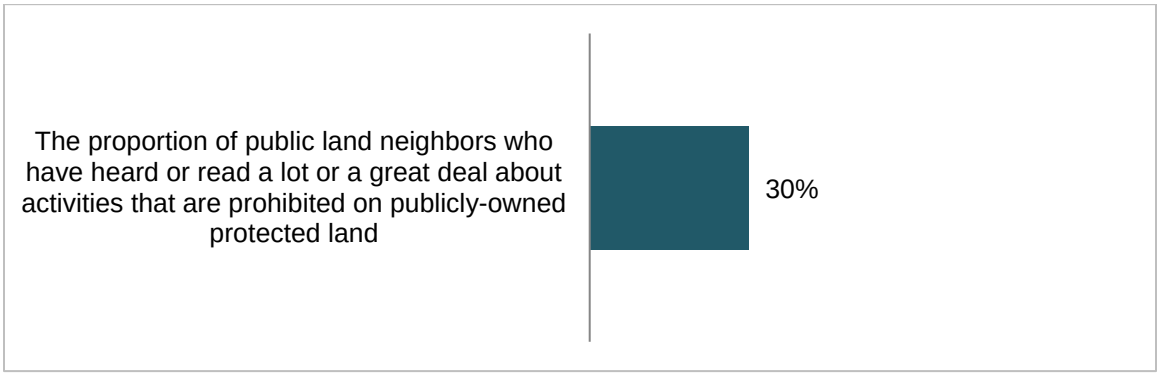
Figure 58. Familiarity with prohibited activities among bordering properties vs. non-bordering properties



Land Preservation Program Key Metric: Comply with stewardship expectations on preserved property

Figure 59 illustrates the key metric associated with stewardship of public lands.

Figure 59. Land Preservation Program - Key Metric: Comply with stewardship expectations on preserved property



n=185 respondents who live adjacent to public land

Multivariate analysis

One attitude was associated with this key metric; those who were aware of stewardship expectations on preserved property were more likely to think what they did on their property could affect Lake Whatcom (39%, *a great deal/a lot*).

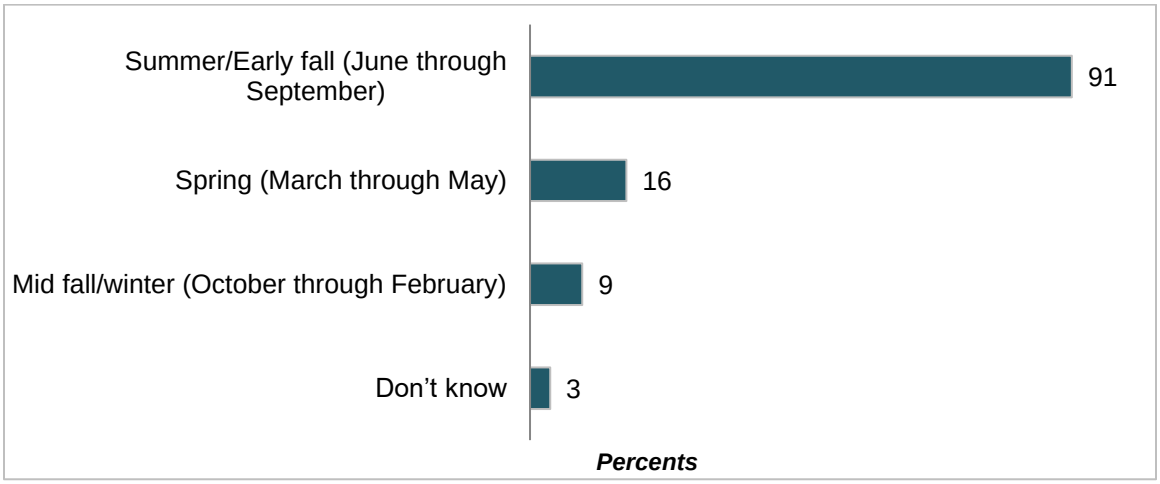
LAND USE PROGRAM

The survey included questions about construction regulations. Findings are relevant to the Land Use Program.

Do construction only during work window

Most respondents said they own the property where they live (96%). Twenty-six percent (26%) of those homeowners said that there has been some construction or other projects, other than gardening, done on their property that involved digging, disrupting and moving soil in the past five years. These respondents were asked to identify the time of year that the projects occurred. Figure 60 shows that 91% of the homeowners who have engaged in construction projects said that they did that work during the construction window (summer and early fall).

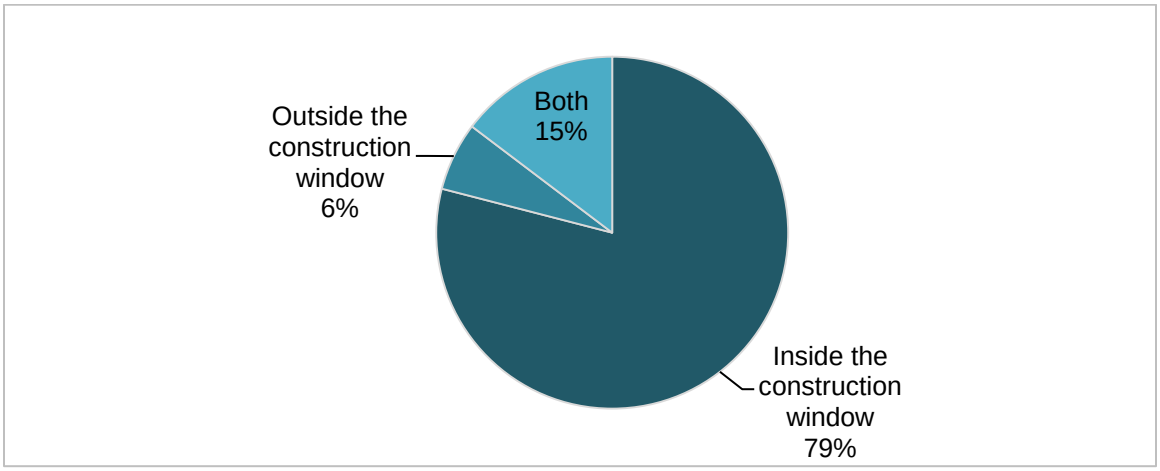
Figure 60. What time of year did the project(s) occur?



n=148 property owners with construction projects in the past five years; multiple responses were possible, may total more than 100%

While most of the homeowners who did some construction said that they did their projects in the summer or early fall (91%), analysis found that a subset of those respondents also did construction projects outside of the work window. Figure 61 below shows that 79% of the homeowners who implemented some sort of project did so exclusively in the work window.

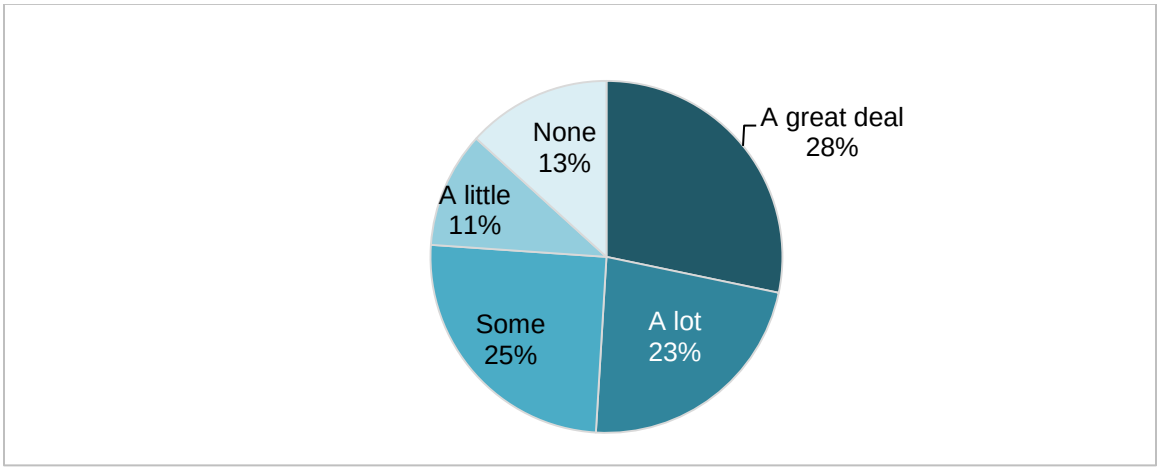
Figure 61. Construction relative to the designated work window



n=143 property owners with construction projects in the past five years

All homeowners were asked about how much they had heard or read about regulations that apply to the seasonal timing of construction or other projects that involve "excavation, moving soil, or leaving soil uncovered and exposed to rain." Just over half (51%) said they have heard *a lot* or *a great deal*. Thirteen percent (13%) said they have heard nothing.

Figure 62. How much have you heard or read about regulations that apply to the seasonal timing of construction or other projects that involve excavation, moving soil, or leaving soil uncovered and exposed to rain?



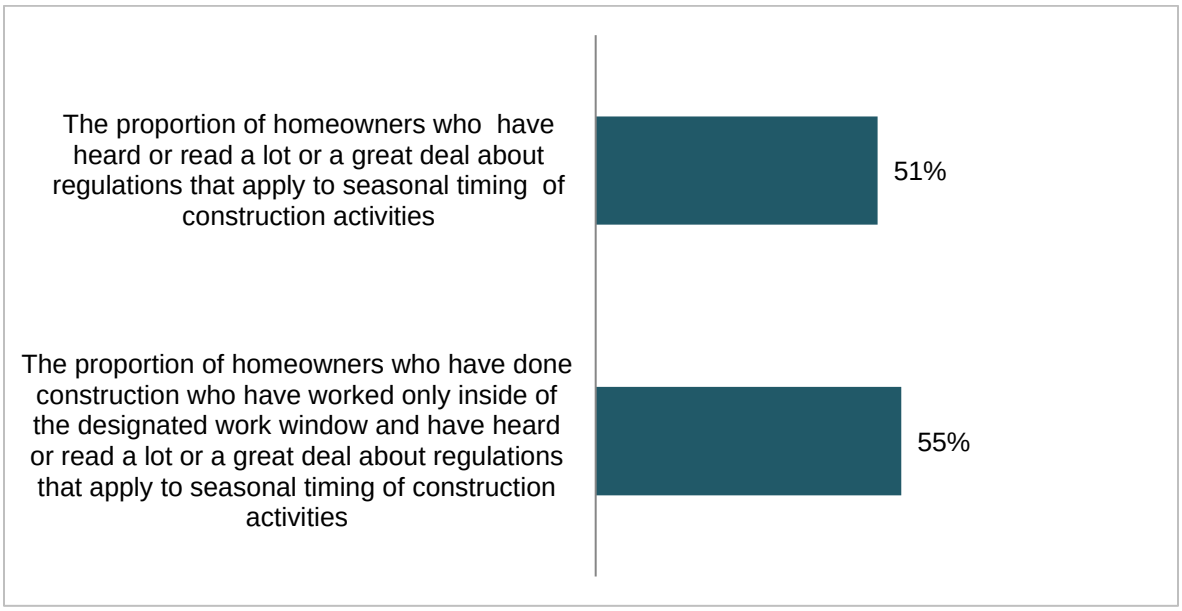
n=573 property owners

Analysis found that respondents who did their work exclusively within the designated work window reported higher rates of hearing about regulations that apply to the seasonal timing of construction (68% vs 40% among those who worked outside of the work window).

Land Use Program – Key Metrics: Do construction only during work window

Figure 63 illustrates the key metrics associated with seasonal timing of construction.

Figure 63. Land Use Program Key Metrics: Do construction only during work window

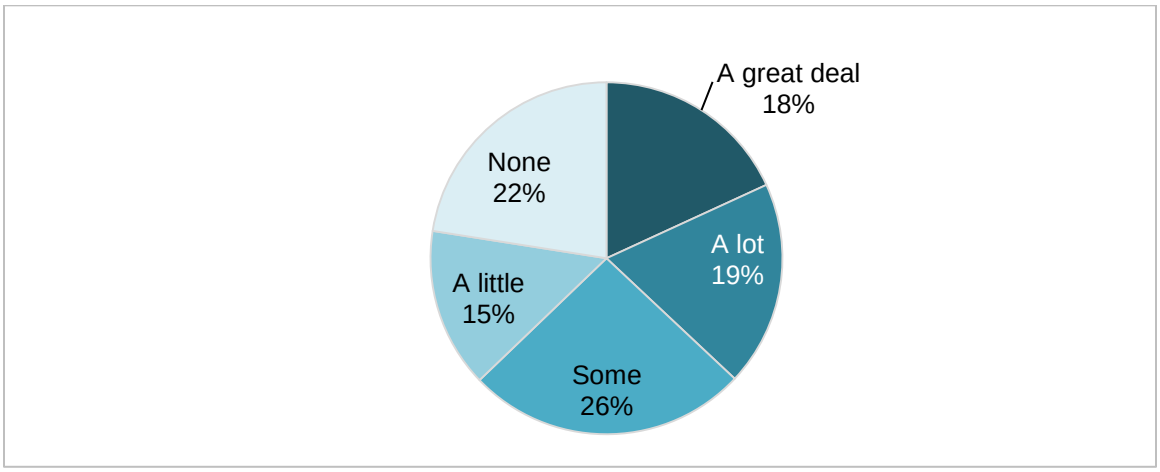


n=143 property owners with construction projects in the past five years

Compliance with development rules and codes

Homeowners were asked about how much they have heard about special development regulations in the Lake Whatcom Watershed. Just over one-third (37%) said they have heard or read a *lot* or *a great deal.* Just over a fifth (22%) said they have heard nothing.

Figure 64. How much have you heard or read about special regulations that apply to activities such as building a deck or patio, adding a walkway, increasing driveway size, or landscaping/gardening within the Lake Whatcom Watershed?

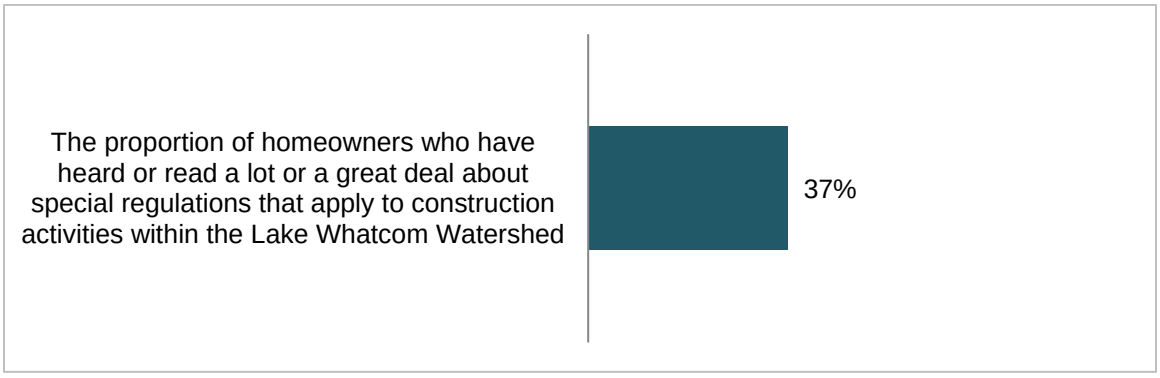


n=573 property owners

Land Use Program – Key Metric: Compliance with development rules and codes

Figure 65 illustrates the key metrics associated with development rules.

Figure 65. Land Use Program Key Metric: Compliance with development rules and codes



n=573 property owners

Multivariate analysis

Respondents who were likely to be aware of development rules were more likely to:

- Be shoreline residents (57%)

- Have higher incomes (50%, $150K+)
- Believe what they do on their property affects water quality in the lake (49%, *a great deal*)
- Give higher ratings to water quality in the lake (47%, *excellent*)

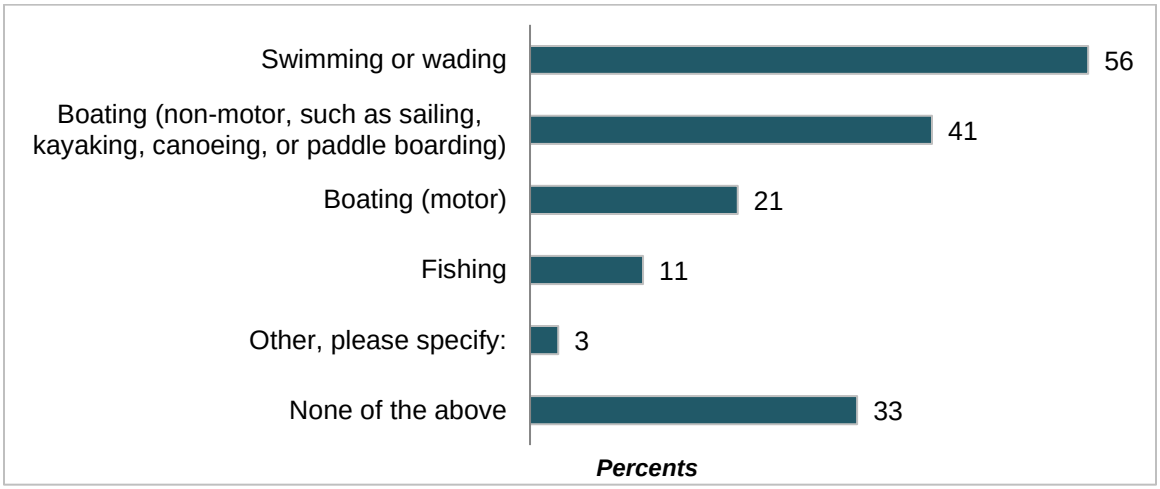
AIS PROGRAM

The survey included a series of questions relevant to the Aquatic Invasive Species program.

Ensure boat permitted and inspected before launch

Over half of the respondents said that they used Lake Whatcom in the past year for swimming or wading (56%). Non-motor boating was also prominent, with 41% saying they have been out on a non-motorized boat on the lake in the past year. One-third (33%) said they did not engage in any activities with the lake.

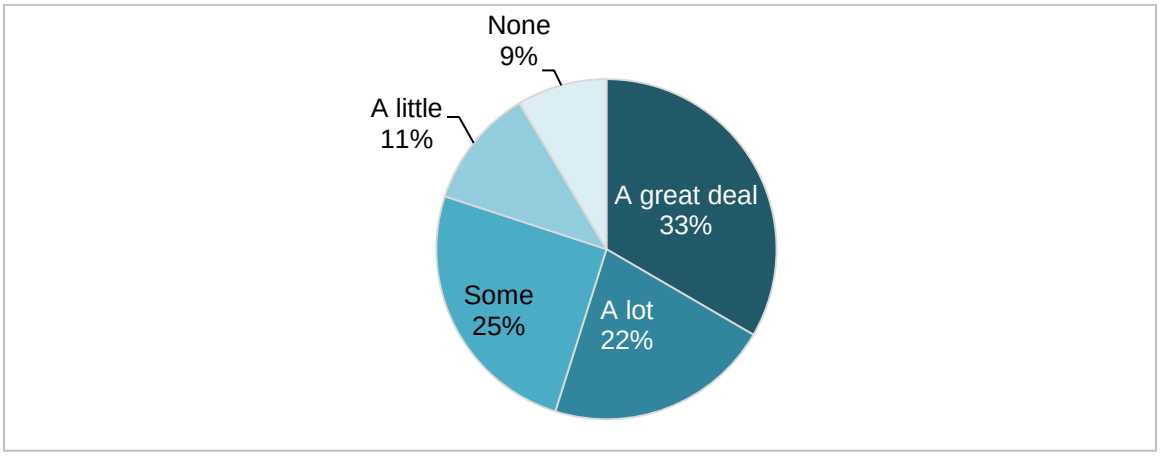
Figure 66. In the past year have you used Lake Whatcom for any of the following activities?



n=596; multiple responses were possible, may total more than 100%

Over half of the respondents (55%) said they have heard *a lot* or *a great deal* about AIS concerns.

Figure 67. How much have you heard about Aquatic Invasive Species (AIS) concerns in regards to Lake Whatcom?



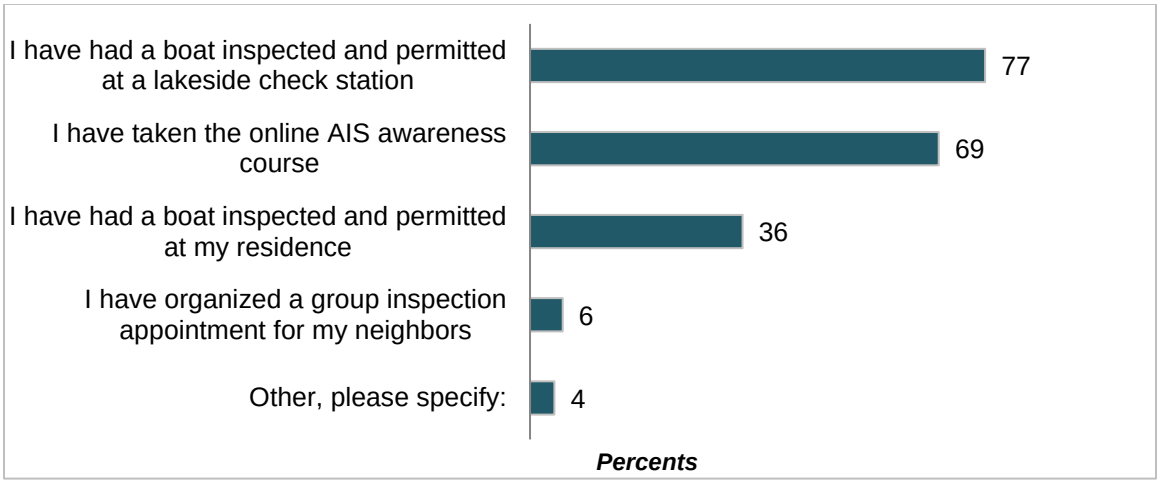
n=596

Analysis found that respondents who have used Lake Whatcom for boating (either motorized or non-motorized) were far more likely to have heard *a great deal* about AIS concerns than other respondents who have not been boating recently. Respondents who have property along the shoreline of Lake Whatcom were also especially likely to be more familiar with AIS concerns.

Thirty-seven percent (37%) of respondents said that have participated in the Aquatic Invasive Species (AIS) boat inspection program. This was much higher among respondents who have been boating on Lake Whatcom in the past year, especially among those who have been boating in the past year and also own their own motorized boat (98%).

Respondents who have participated in the AIS program were asked to identify how they participated. Figure 68 shows that 77% of the program participants said that they have had a boat inspected and permitted at a lakeside check station.

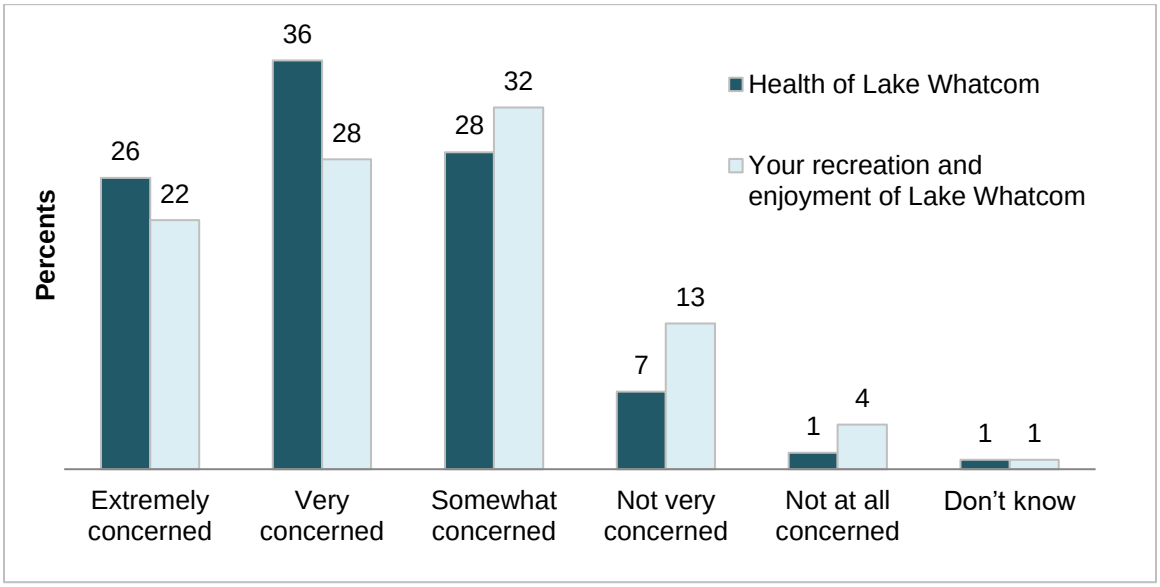
Figure 68. In which of the following ways have you participated in the AIS boat inspection program?



n=218 respondents who ever participated in the AIS boat inspection program; multiple responses were possible, may total more than 100%

Respondents who said they have some awareness of AIS concerns were asked about how concerned they are regarding the impacts of AIS on both the lake and their own recreational enjoyment of the lake. Figure 69 shows that respondents replied similarly to both questions, indicating a slightly greater concern around the general health of the lake over their own usage of it.

Figure 69. How concerned are you about the potential impact of Aquatic Invasive Species on the health of Lake Whatcom? On your own recreation and enjoyment of Lake Whatcom?



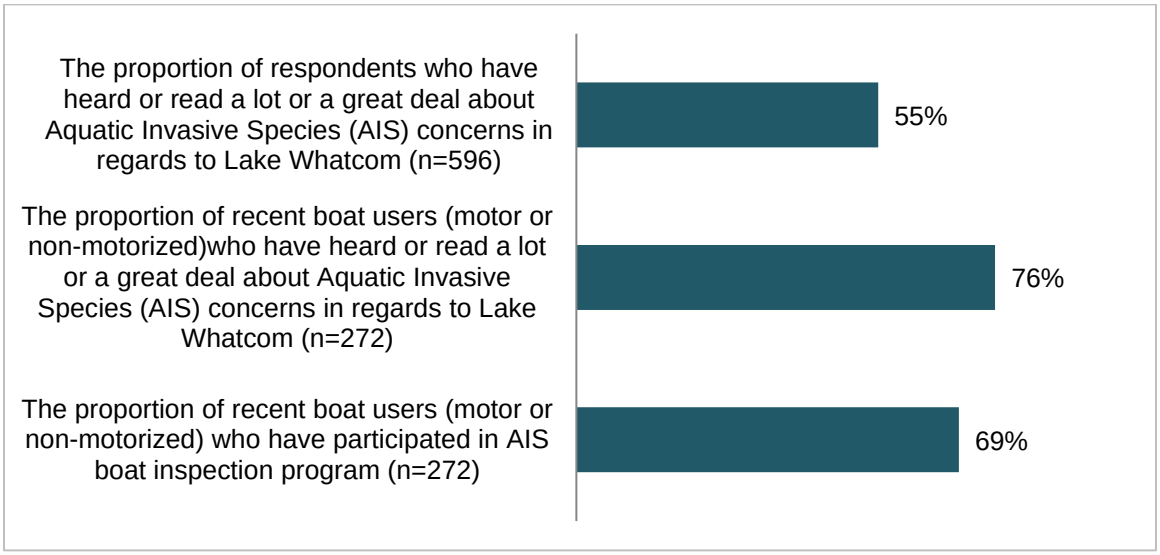
n=596

Analysis found that respondents who had greater familiarity with the AIS concerns showed greater concern for both the health of Lake Whatcom and greater concern for their own enjoyment of the lake.

AIS Program Key Metrics: Ensure boats are permitted and inspected before launch

Figure 70 illustrates the key metrics associated with AIS concerns.

Figure 70. AIS Program Key Metrics: Ensure boats are permitted and inspected before launch



Multivariate analysis

Awareness of AIS concerns tended to be more prominent among:

- Shoreline residents (78%)
- Those with more years at their address (64%, 20+ years)
- Respondents with higher education (64%, professional/graduate school)
- Respondents with higher incomes (66%, $150K+)
- Those with beliefs that what they do on their property can affect water quality (65%, *a great deal/a lot*)
- Respondents giving higher ratings of current water quality (66%, *excellent*)

Recent boaters showed similar patterns of awareness for income (87% $150K+) and water quality ratings (81%, *excellent* or *very good*)

Those who have participated in the AIS program were:

- Less likely to think it is urgent to clean up the lake (78%, *somewhat, not very* or *not at all*)
- More often male (74%)
- More likely to have higher incomes (78% $150K+)
- More likely to have lower education (82% less than a college degree)
- More often shoreline residents (80%)
- More likely to have lived longer at their address (79%, 20+ years)

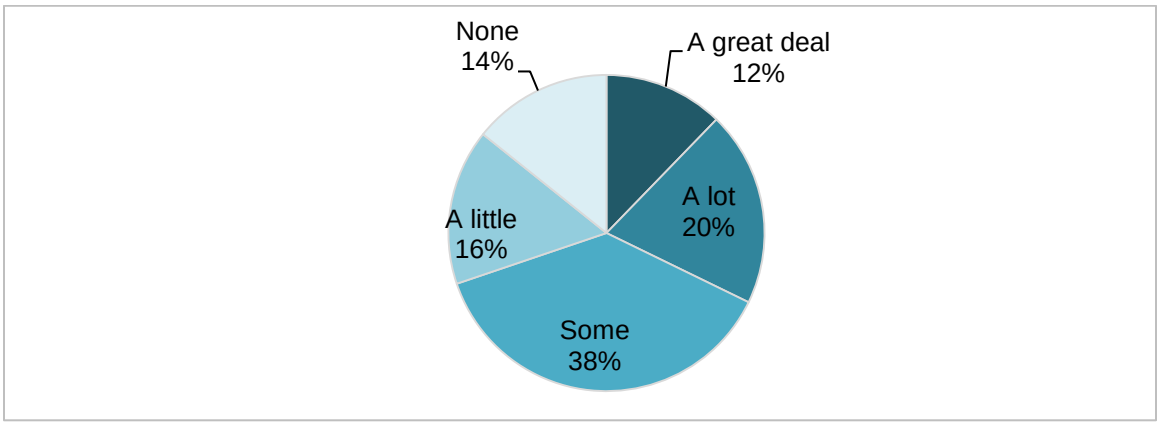
UTILITIES AND TRANSPORTATION PROGRAM

Two areas were explored under the Utilities and Transportation Program: water conservation and alternative transportation.

Conserve water

Respondents were asked how much they have heard about water conservation concerns in regard to the water supply from Lake Whatcom. Roughly one-third (32%) said they have heard *a lot* or *a great deal*. Fourteen percent (14%) said they have heard nothing.

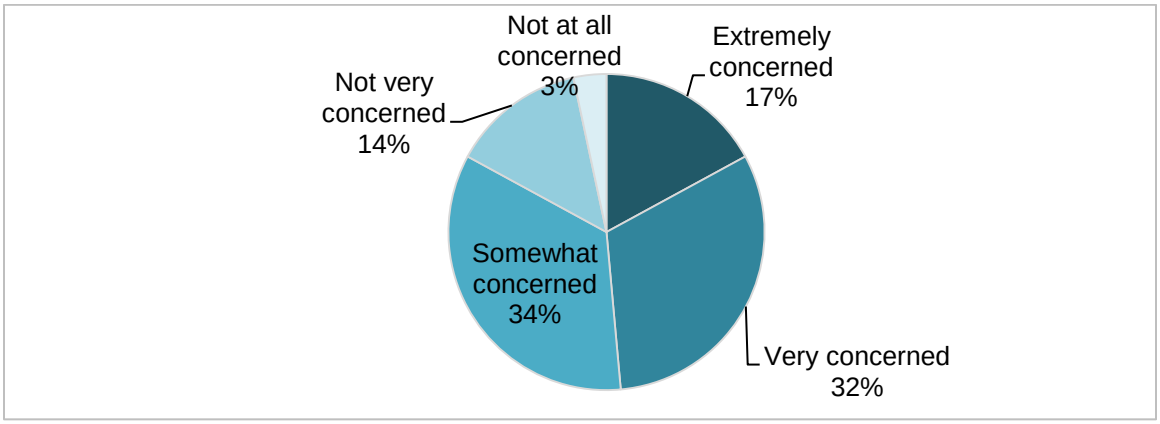
Figure 71. How much have you heard or read about water conservation concerns in regard to the water supply from Lake Whatcom?



n=596

Respondents who have heard *some* or more about water conservation concerns were asked how concerned they feel about conserving water from Lake Whatcom. Almost half (49%) said they feel *very* or *extremely concerned.*

Figure 72. How concerned are you about conserving water from Lake Whatcom?



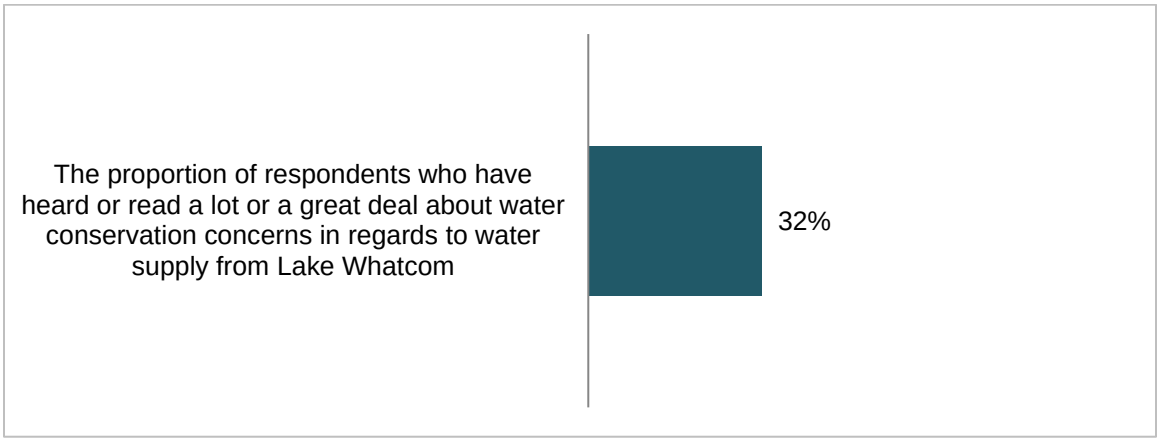
n=596

Analysis found that the respondents who have heard more about water conservation expressed the highest levels of concern about conserving water.

Utilities and Transportation Program Key Metric: Conserve water

Figure 73 illustrates the key metrics associated with water conservation.

Figure 73. Utilities and Transportation Program Key Metrics: Conserve water



n=596

Multivariate analysis

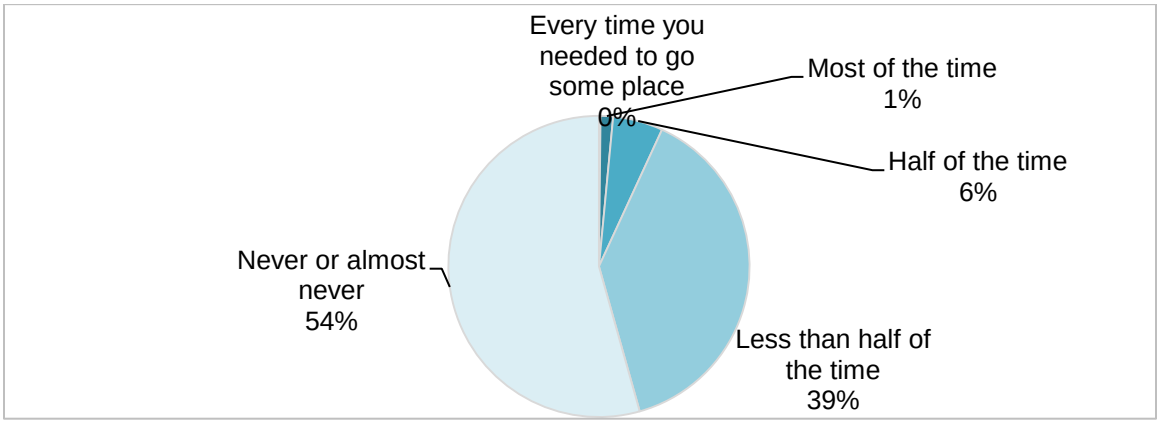
Respondents who were more aware of water conservation concerns were more likely to:

- Have lived longer at their address (45%, 20+ years)
- Be older (36%, 50+ years)
- Believe that what they do on their property can affect water quality in the lake (45%, *a great deal*)
- Rate water quality in the lake as *excellent* (41%)

Use alternative transportation

Respondents were asked how often they used an alternative method of transportation in the past year. Seven percent (7%) said they used alternative transportation *half of the time* or more often. Just over half (54%) said they *never* or *almost never* use alternative transportation.

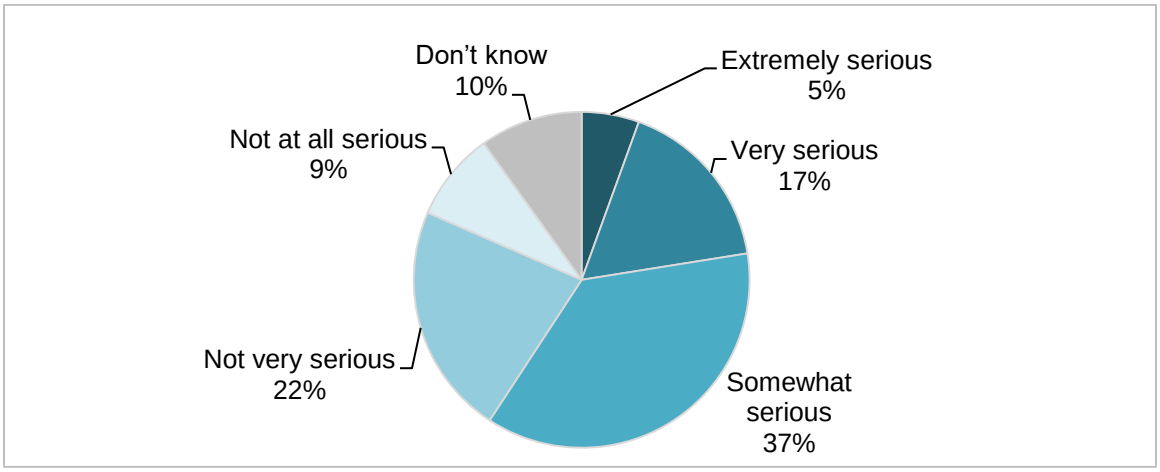
Figure 74. In the past year, how often did you use an alternative method of transportation (like bus, bike or walk) to get from your home to other places you needed to go?



n=596

Respondents were asked to rate the threat of pollution from personal vehicles. Twenty-three percent (23%) described the threat as *very* or *extremely serious*. Ten percent said they did not know, and a similar proportion (9%) called it *not at all serious*.

Figure 75. In your opinion, how serious is the threat of pollution from personal vehicle use to the water quality in Lake Whatcom?



n=596

Analysis found that respondents who use alternative methods of transportation more often were more likely to consider the threat of pollution from personal vehicles to be a serious threat to water quality.

Utilities & Transportation Program Key Metrics: Use alternative transportation

Figure 76 illustrates the key metrics associated with alternative methods of transportation.

Figure 76. Utilities & Transportation Program Key Metric: Use alternative transportation

n=596

Multivariate analysis

Multivariate analysis showed the respondents living within the city limits of Bellingham were more likely to have used alternative transportation (58%). They were also more likely to have higher levels of education (57% *professional/graduate school*).

In addition, all of the attitudinal measures correlated to this activity.

- What you do on your property can affect water quality (53%, *a great deal/a lot*)
- How urgent is the need to clean up and protect the lake (51%, *extremely/very*)
- How would you rate water quality in the lake (56%, *fair/poor*)
- How much do you think water quality in the lake has changed (54%, *improved*)

CONCLUSION

Analysis of the baseline survey items showed that there is a wide range of prevalence among the different measures, and a good deal of variability in prevalence, depending on the characteristics of the respondents. Shoreline residents and those with a longer history in the watershed were more likely to be aware of issues related to water quality or to be engaged in specific beneficial practices. It can be useful to engage such folks to communicate what they know to peer groups. Making sure that non-shoreline residents and newer arrivals to the watershed are reached is critical, especially given their larger numbers.

One of the strongest predictors of key metric prevalence was the beliefs or attitudes that the respondents held. At least one of the four attitudes measured in the survey coincided with almost every key metric; in a few cases attitudes were the only covariate with the metric. Within them, the most consistently predictive attitude was the residents' belief that what they do on their property can affect water quality in the lake. Program managers should work to make compelling connections between specific personal practices and their water quality impacts.

In some cases attitudes proved to be complex, producing bimodal distributions for the key metrics. For example, some metrics showed high prevalence among those who rated water quality in the lake as *excellent,* but also showed high prevalence among those who rated it *fair* or *poor.* These distributions suggest that strong opinions, on either end of the spectrum, are either motivating residents to learn about or engage in watershed-friendly practices, or the residents engagement is producing their attitudes. It is not clear which comes first – the attitude or the engagement. In either case, care should be used in communicating with watershed residents to not dissuade people from engaging in their positive practices.

Interestingly, there were no significant differences between residents living within the Bellingham City limits and those living outside the city other than the likelihood to have used alternative transportation.

The full suite of key metrics is presented on the following page in Figure 77 in rank order from least prevalent to most prevalent. Program associations are included in the labels as follows:

- SW=Stormwater Program
- HM=Hazardous Materials Program
- LU=Land Use Program

- LP=Land Preservation Program
- UT=Utilities and Transportation Program
- AIS=Aquatic Invasive Species Program
- RP=Recreation Program

Figure 77. Key metrics, sorted (part 1).

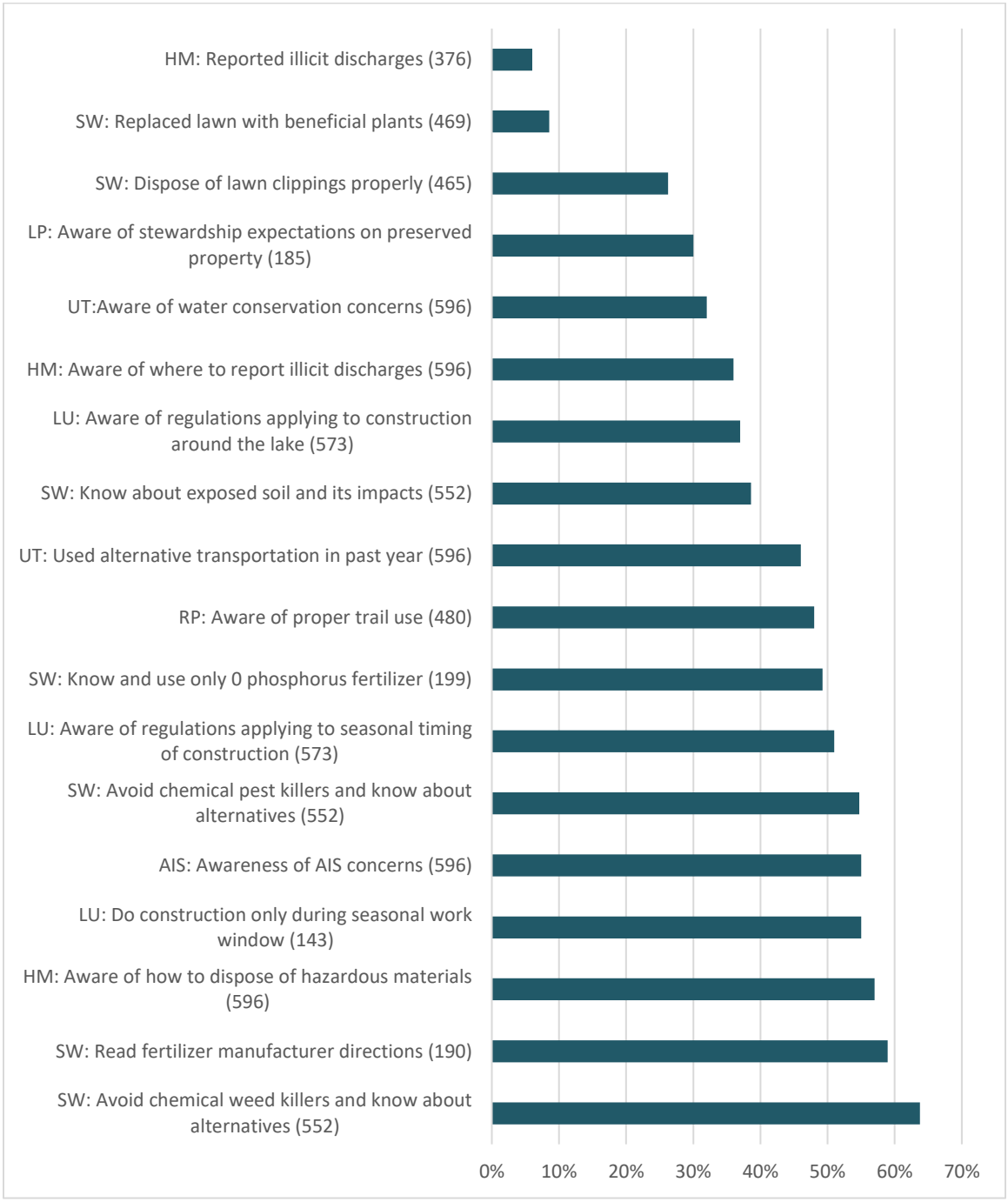
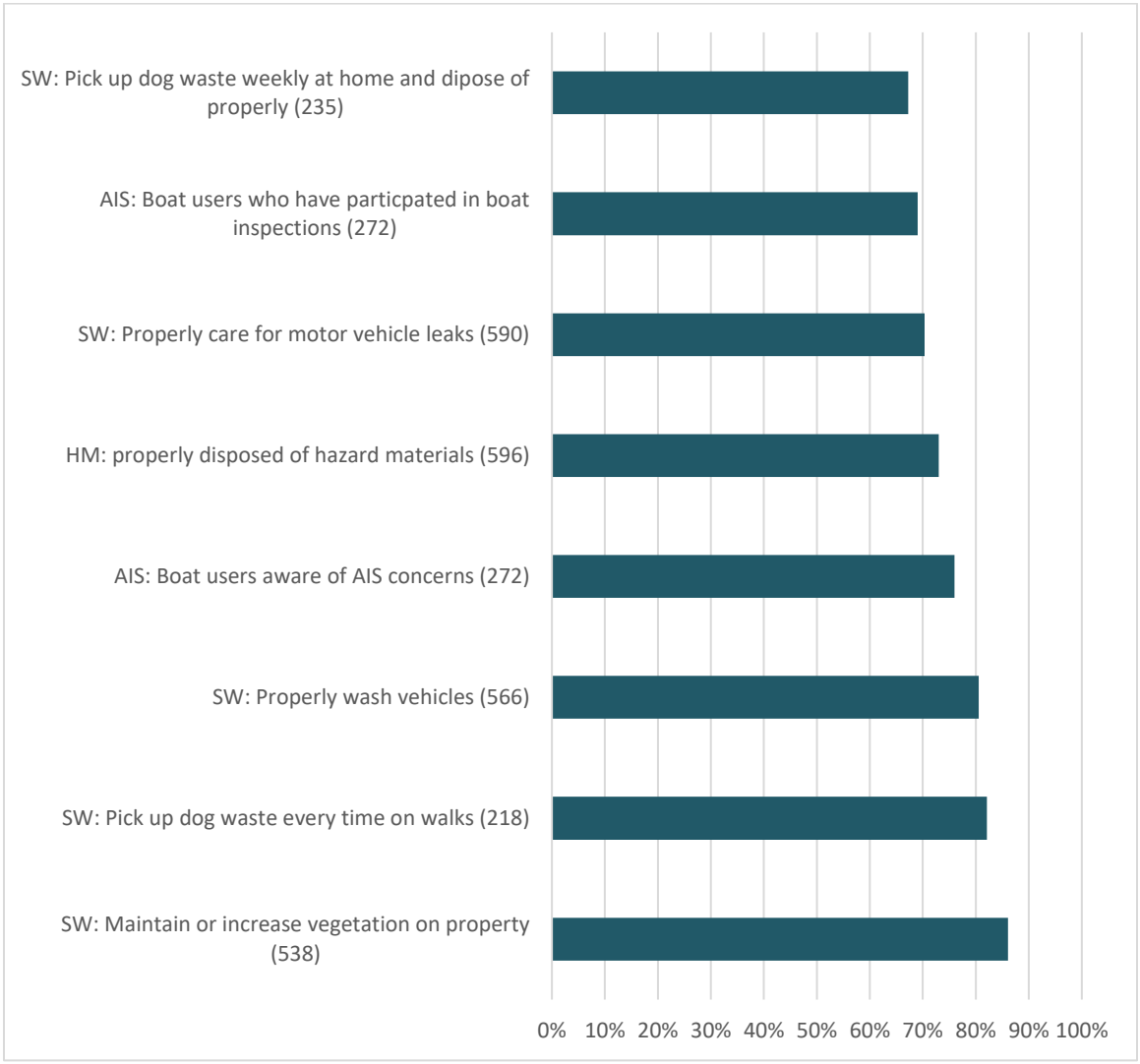


Figure 77. Key metrics, sorted (part 2) .



There remains a question of what level of prevalence for each of these metrics is desirable. Program managers will need to discuss these findings and make their own recommendations, setting thresholds for the various measures and determining which items to prioritize in their subsequent work.

APPENDIX A: INVITATION

October 4, 2018

RECIPIENT address

Dear RECIPIENT,

The City of Bellingham, Whatcom County, and Lake Whatcom Water and Sewer District are working to improve services in your neighborhood. As someone living in the Lake Whatcom area, your insights are particularly important.

We would like to know more about your experiences as a Lake Whatcom area resident and/or property owner, as well as your opinions and concerns. In order to collect this information, we asked Applied Research Northwest, a local, independent research firm, to conduct a survey. The results of this survey will be used to better understand the perspectives of lake residents and improve our outreach efforts.

In order to get a representative sample, please be sure that only one adult from your house completes the survey.

Your participation is completely voluntary and anonymous. Survey responses will be tabulated and the results will be reported as a group without any identifying information. The final report will be available online at the City of Bellingham and Lake Whatcom Management Program websites. We really value your opinion.

The survey is being conducted online. To begin, please type the following URL into the address bar of your internet web browser:

http://survey.arnorthwest.com/whatcom

If you have any questions about the purpose of this survey, please contact City of Bellingham Public Works at 360-778-7711 or email cmay@cob.org.

If you need technical support with the online survey, please contact Applied Research Northwest at 360-647-6067 or email rachel.williams@arnorthwest.com.

Thank you for your participation,

Kelli Linville, Mayor
City of Bellingham

Jack Louws, Executive
Whatcom County

Bill Hunter, Interim General Manager
Lake Whatcom Water & Sewer District

APPENDIX B: SURVEY INSTRUMENT

Lake Whatcom Watershed Resident Survey
This survey was designed to be filled out online. This copy of the survey was adapted for print.

Introduction
The City of Bellingham & Whatcom County in cooperation with other Lake Whatcom Management Program partners are working to improve services in your neighborhood. As someone living in the Lake Whatcom area, your household's insights are particularly important, and we greatly appreciate your participation in this online survey.

In order to get a representative sample, please be sure that only one adult in your household (18 years or older) completes the survey.

We encourage you to be candid in your responses. All surveys will be analyzed together, and no individual responses will be identified in any way. Your name will not be used in any report. It should only take you about 10 minutes to complete. Your participation in this survey is very important to ensure we understand the needs and interests of the local community.

If you have any questions about the content of this survey, please contact City of Bellingham Public Works at cmay@cob.org or call 360-778-7711. If you have technical difficulty with the survey, please contact arn@arnorthwest.com or call 360-647-6067.

Thank you.

1. Overall, how would you rate the water quality in Lake Whatcom?
   - ❒ Excellent
   - ❒ Very good
   - ❒ Good
   - ❒ Fair
   - ❒ Poor

2. Based on what you know, how much do you think that the water quality in Lake Whatcom has changed over the past five years?
   - ❒ Much improved
   - ❒ Somewhat improved
   - ❒ Stayed the same
   - ❒ Somewhat worse
   - ❒ Much worse
   - ❒ Don't know

3. Do you have a dog?
   - ❑ Yes
   - ❑ No **→Skip to #7**

4. In the past two months, when the dog was out for a walk around the neighborhood or in nearby parks, how often was the dog's waste typically picked up?
   - ❑ Every time
   - ❑ Most of the time
   - ❑ About half the time
   - ❑ Less than half the time
   - ❑ Never
   - ❑ N/A (Dog didn't go for walks around the neighborhood or in nearby parks in the past two months)

5. Thinking about the past two months, typically, how often was the dog's waste picked up at home?
   - ❑ Immediately
   - ❑ Daily
   - ❑ A few times a week, but less than daily
   - ❑ Weekly
   - ❑ A few times a month, but less than weekly
   - ❑ About once a month or less
   - ❑ Don't know

6. Below are several different methods people use to dispose of dog waste at home. Which of these did you use in the past two months? *Check all that apply*.
   - ❑ Left it on the ground
   - ❑ Put it in the trash
   - ❑ Put it in the yard waste collection bin for curbside pickup
   - ❑ Put it in a yard waste pile that stays in the yard
   - ❑ Put it in a compost bin or compost system
   - ❑ Tossed it off the grass or into the bushes
   - ❑ Buried it
   - ❑ Flushed it down the toilet
   - ❑ Any other method, please specify:_____

7. Which of the following motor vehicles and/or watercraft do you own? *Check all that apply*.
   - ❑ Car or truck
   - ❑ Motorcycle
   - ❑ Motorized boat
   - ❑ None of these **→Skip to #13**

8. Do you currently have a motor vehicle and/or watercraft that you think may be leaking any fluids (oil, or other?)
   - ❑ Yes
   - ❑ No
   - ❑ Don't know

9. Do you know how to check a motor vehicle and/or watercraft for leaks?
   - ❑ Yes
   - ❑ No
   - ❑ Don't know

10. In the past two years, have you checked or had a motor vehicle and/or watercraft checked for leaks?
    - ❑ Yes
    - ❑ No
    - ❑ Don't know

11. Where has your car or truck been washed in the past year? *Check all that apply*.
    - ❑ Home
    - ❑ Car wash **→Skip to #13**
    - ❑ Not applicable (I don't have a car/don't wash my car) **→Skip to #13**

12. When your car was washed at home, where did the water go? *Check all that apply*
    - ❑ Into a drain on my property
    - ❑ Into a street drain
    - ❑ Onto nearby street or sidewalk
    - ❑ Into grass or lawn
    - ❑ Into gravel
    - ❑ Into a ditch
    - ❑ Other (please describe):_____
    - ❑ Not sure

13. How much have you heard or read about how to dispose of hazardous materials like pesticides, oil-based paints, solvents, motor oil and gasoline?
    - ❒ A great deal
    - ❒ A lot
    - ❒ Some
    - ❒ Not very much
    - ❒ Nothing at all

14. How have you disposed of hazardous materials in the past five years? *Check all that apply*.
    - ❒ Dropped off at Disposal of Toxics Station near Bellingham Airport
    - ❒ Dropped off at special collection events in Whatcom County
    - ❒ Curbside pick up
    - ❒ Other, please specify:
    - ❒ I haven't disposed of any hazardous materials in the past five years
    - ❒ Don't know

15. In the past two years, have you seen any of the following substances flowing into any drains, ditches, pipes, or waterways? *Check all that apply*.
    - ❒ Vehicle fluids (oil, gasoline, etc)
    - ❒ Pressure wash water
    - ❒ Car wash water
    - ❒ Pesticides or pesticide residue
    - ❒ Fertilizers or fertilizer residue
    - ❒ Sewage (such as dog waste or RV/Trailer waste)
    - ❒ Muddy water
    - ❒ Paint
    - ❒ Chemical or hazardous materials
    - ❒ Other, please specify:_____
    - ❒ None of these → **Skip to #17**
    - ❒ Don't know →**Skip to #17**

16. When you saw these substances flowing into drains, ditches, pipes, or waterways, did you report any of the substances to anyone? *Check all that apply.*
    - ❒ Vehicle fluids (oil, gasoline, etc.)
    - ❒ Pressure wash water
    - ❒ Car wash water
    - ❒ Pesticides or pesticide residue
    - ❒ Fertilizers or fertilizer residue
    - ❒ Sewage (such as dog waste or RV/Trailer waste)
    - ❒ Muddy water
    - ❒ Paint
    - ❒ Chemical or hazardous materials
    - ❒ Other, please specify:_____
    - ❒ None /I didn't report any

17. Which of the following have you heard about for reporting pollution flowing into drains, ditches, pipes, or waterways? *Check all that apply*.
    - ❒ Stormwater Hotline
    - ❒ City of Bellingham Public Works
    - ❒ Whatcom County Public Works
    - ❒ Department of Ecology
    - ❒ None of these

18. In the past two months, how often did you use trails for recreation in the Lake Whatcom watershed/close to your neighborhood?
    - ❒ Several times a week or more
    - ❒ Weekly
    - ❒ 1-3 times a month
    - ❒ Less than once a month
    - ❒ Not at all

19. How much have you heard or read about how using unmarked trails and shortcuts from designated trails can cause erosion?
    - ❒ A great deal
    - ❒ A lot
    - ❒ Some
    - ❒ A little
    - ❒ None

20. Does the property where you live border any publicly-owned protected land (like a park, preserve or greenway)?
    - ❒ Yes
    - ❒ No
    - ❒ Don't know

21. How much have you read or heard about activities that are prohibited on publicly-owned protected land (like a park, preserve or greenway)?
    - ❒ A great deal
    - ❒ A lot
    - ❒ Some
    - ❒ A little
    - ❒ Nothing at all

23. When it comes to your yard and lawn care, who typically does that type of work?
    - ❒ Someone from my household
    - ❒ Someone I hire
    - ❒ A landlord or property manager → **Skip to #38**
    - ❒ Someone the landlord or property manager hires → **Skip to #38**
    - ❒ A combination of the above options
    - ❒ Don't know
    - ❒ Not applicable- No yard or lawn care is needed → **Skip to #38**

24. Which of the following best describes the fertilizer products used for your lawn and garden care during the past two years? *Check all that apply.*
    - ❒ Chemical fertilizer
    - ❒ Weed-n-Feed products
    - ❒ Slow-release or organic fertilizer
    - ❒ Compost → **skip to next section if no other fertilizer chosen**
    - ❒ Don't use fertilizers → **Skip to #27**
    - ❒ Don't know → **Skip to #27**
    - ❒ Other, please specify:_____

25. Do you know the phosphorus content of any of the fertilizer(s) used?
    - ❒ Yes
    - ❒ No → **Skip to #26**

25b. What was the phosphorus content of the fertilizer(s) used?
    - ❒ It was 0% phosphorus
    - ❒ Some fertilizer was 0% phosphorus and some fertilizer had phosphorus content
    - ❒ Each fertilizer used had some phosphorus content

26. When fertilizer was used, how closely did you read the manufacturer's directions?
    - ❒ Very closely
    - ❒ Somewhat closely
    - ❒ Not very closely
    - ❒ Don't know

27. Compared to five years ago, is there more, less, or the same amount of trees, bushes, groundcovers, or other low-growing plants (other than lawn) on your property?
    - ❒ More → **Skip to #29**
    - ❒ Less
    - ❒ The same amount → **Skip to #29**
    - ❒ Not sure → **Skip to #29**

28. Which of the following best describes what replaced the vegetation? *Check all that apply.*
    - ❒ Lawn
    - ❒ Mulch
    - ❒ Bare ground
    - ❒ Paved/gravel driveway
    - ❒ Paved/gravel patio or walkway
    - ❒ Vegetable garden/ornamental garden
    - ❒ Some sort of building/house/addition
    - ❒ Other, please specify:_____

29. About how much of your yard is covered by a grass lawn?
    - ❒ All lawn
    - ❒ Mostly lawn
    - ❒ Half lawn
    - ❒ Less than half lawn
    - ❒ I have no lawn → **Skip to #32**

30. Compared to five years ago, is there more, less or the same amount of lawn on your property?
    - ❒ More → **Skip to #32**
    - ❒ Less
    - ❒ The same amount → **Skip to #32**
    - ❒ Not sure → **Skip to #32**

31. Which of the following best describes what replaced the lawn? *Check all that apply*
    - ❒ Native plants
    - ❒ Non-native plants
    - ❒ Mulch
    - ❒ Bare ground
    - ❒ Paved/gravel driveway
    - ❒ Paved/gravel patio or walkway
    - ❒ Vegetable garden/ornamental garden
    - ❒ Some sort of building/house/addition
    - ❒ Other, please specify:_____

32. How has your household (or hired professional) typically managed weeds over the past two years? *Check all that apply.*
    - ❒ Apply weed killer regularly
    - ❒ Apply weed killer on problem spots as they occur
    - ❒ Pull weeds by hand (weeding)
    - ❒ Burn/Torch
    - ❒ Nothing
    - ❒ Other, please specify:_____
    - ❒ Don't know
    - ❒ Not applicable (no weed problems)

33. How much have you heard or read about ***alternatives*** to chemical weed killers?
    - ❒ A great deal
    - ❒ A lot
    - ❒ Some
    - ❒ A little
    - ❒ None

34. How has your household (or hired professional) typically managed pests/bugs in your garden or yard over the past two years? *Check all that apply.*
    - ❒ Apply bug killers/insecticide regularly
    - ❒ Apply bug killers /insecticide on affected areas as needed
    - ❒ Organic sprays/Insecticidal soap
    - ❒ Introduce beneficial plants/bugs
    - ❒ Kill bugs by hand
    - ❒ Remove affected plants
    - ❒ Nothing
    - ❒ Other, please specify:
    - ❒ Don't know
    - ❒ Not applicable (no pest or insect problems)

35. How much have you heard or read about **alternatives** to chemical bug killers? A great deal
    - ❒ A lot
    - ❒ Some
    - ❒ A little
    - ❒ None

36. Below are several different methods people use to dispose of grass clippings. Which of these methods have you used in the past six months? *Check all that apply.*
    - ❒ Leave it on the grass/lawn
    - ❒ Use it in landscaping areas as mulch
    - ❒ Put it in the yard waste collection bin for curbside pickup
    - ❒ Put it in an enclosed compost bin or covered compost system
    - ❒ Put it in an open compost bin or yard waste pile that stays in the yard
    - ❒ Put it in or near a ditch, stream, lake or other wet area in the yard
    - ❒ Hauled it offsite to the municipal dump or a yard waste facility
    - ❒ Any other method, please specify:_____
    - ❒ Not applicable

37. How much have you heard or read about exposed soil and its impact on Lake Whatcom?
    - ❑ A great deal
    - ❑ A lot
    - ❑ Some
    - ❑ A little
    - ❑ Nothing at all

38. Do you own or rent the property where you live?
    - ❒ Own
    - ❒ Rent→ **Skip to #43**
    - ❒ Neither/Other→ **Skip to #43**

39. Has there been any construction or other projects, other than gardening, done on your property that involved digging, disrupting and moving soil in the past five years?
    - ❒ Yes
    - ❒ No → **Skip to #41**
    - ❒ Don't know → **Skip to #41**

40. What time of year did the project(s) occur? *Check all that apply.*
    - ❒ Summer/Early fall (June through September)
    - ❒ Mid fall/winter (October through February)
    - ❒ Spring (March through May)
    - ❒ Don't know

41. How much have you heard or read about regulations that apply to the seasonal timing of construction or other projects that involve excavation, moving soil, or leaving soil uncovered and exposed to rain?
    - ❒ A great deal
    - ❒ A lot
    - ❒ Some
    - ❒ A little
    - ❒ None

42. How much have you heard or read about special regulations that apply to activities such as building a deck or patio, adding a walkway, increasing driveway size, or landscaping/gardening within the Lake Whatcom Watershed?
    - ❒ A great deal
    - ❒ A lot
    - ❒ Some
    - ❒ A little
    - ❒ None

43. In the past year, have you used Lake Whatcom for any of the following activities?
    - ❒ Boating (motor)
    - ❒ Boating (non-motor, such as sailing, kayaking, canoeing, or paddle boarding)
    - ❒ Swimming or wading
    - ❒ Fishing
    - ❒ Other, please specify:_____
    - ❒ None of the above

44. How much have you heard about Aquatic Invasive Species (AIS) concerns in regards to Lake Whatcom?
    - ❒ A great deal
    - ❒ A lot
    - ❒ Some
    - ❒ A little
    - ❒ None

45. Have you ever participated in the Aquatic Invasive Species (AIS) boat inspection program?
    - ❒ Yes
    - ❒ No → **Skip to #46**
    - ❒ Don't Know→ **Skip to #46**

45b. In which of the following ways have you participated in the AIS boat inspection program?

Check all that apply

- ❒ I have taken the online AIS awareness course
- ❒ I have had a boat inspected and permitted at my residence
- ❒ I have had a boat inspected and permitted at a lakeside check station
- ❒ I have organized a group inspection appointment for my neighbors
- ❒ Other

46. How concerned are you about the potential impact of Aquatic Invasive Species on the health of Lake Whatcom?
    - ❒ Extremely concerned
    - ❒ Very concerned
    - ❒ Somewhat concerned
    - ❒ Not very concerned
    - ❒ Not at all concerned
    - ❒ Don't know

47. How concerned are you about the potential impact of Aquatic Invasive Species on your recreation and enjoyment of Lake Whatcom?
    - ❒ Extremely concerned
    - ❒ Very concerned
    - ❒ Somewhat concerned
    - ❒ Not very concerned
    - ❒ Not at all concerned
    - ❒ Don't know

48. How much have you heard or read about water conservation concerns in regards to the water supply from Lake Whatcom?
    - ❒ A great deal
    - ❒ A lot
    - ❒ Some
    - ❒ A little → **Skip to #50**
    - ❒ None → **Skip to #50**

49. How concerned are you about conserving water from Lake Whatcom?
    - ❒ Extremely concerned
    - ❒ Very concerned
    - ❒ Somewhat concerned
    - ❒ Not very concerned
    - ❒ Not at all concerned
    - ❒ Don't know

50. In the past year, how often did you use an alternative method of transportation (like bus, bike or walk) to get from your home to other places you needed to go?
    - ❒ Every time you needed to go some place
    - ❒ Most of the time
    - ❒ Half of the time
    - ❒ Less than half of the time
    - ❒ Never or almost never

51. In your opinion, how serious is the threat of pollution from personal vehicle use to the water quality in Lake Whatcom?
    - ❒ Extremely serious
    - ❒ Very serious
    - ❒ Somewhat serious
    - ❒ Not very serious
    - ❒ Not at all serious
    - ❒ Don't know

52. How much do you think what you do on your property can affect water quality in Lake Whatcom?
    - ❒ A great deal
    - ❒ A lot
    - ❒ Some
    - ❒ A little
    - ❒ Not at all

53. How urgent is the need to clean up and protect Lake Whatcom?
    - ❒ Extremely urgent
    - ❒ Very urgent
    - ❒ Somewhat urgent
    - ❒ Not very urgent
    - ❒ Not at all urgent
    - ❒ Not sure

54. How much have you heard or read about the City of Bellingham and Whatcom County's construction projects that filter and clean polluted runoff around the lake?
    - ❒ A great deal
    - ❒ A lot
    - ❒ Some
    - ❒ A little
    - ❒ Not at all

55. Is your property on the shoreline of Lake Whatcom?
    - ❑ Yes
    - ❑ No
    - ❑ Don't know

56. Before participating in this survey, did you consider your home to be a part of the Lake Whatcom Watershed?
    - ❑ Yes
    - ❑ No
    - ❑ Don't know

57. For how many years have you lived at this address? _____ years

58. Is your home within the city limits of Bellingham?
    - ❑ Yes
    - ❑ No
    - ❑ Don't know

59. Is your home:
    - ❑ A free-standing one-family residence, or
    - ❑ Part of a multi-family residence (duplex, triplex or larger)

60. Do you have children under the age of 18 living in your household?
    - ❒ Yes
    - ❒ No
    - ❒ Don't know

61. How old are you?
    - ❒ 18-34
    - ❒ 35-49
    - ❒ 50-64
    - ❒ 65-79
    - ❒ 80 or older
    - ❒ Prefer not to say

62. What is the last year of schooling you completed?
    - ❒ Less than high school
    - ❒ High school
    - ❒ Vocational school
    - ❒ Some college
    - ❒ College degree
    - ❒ Graduate/professional school
    - ❒ Prefer not to say

63. What is your approximate total household income?
- ❒ Less than $49,999
- ❒ $50,000 to $99,999
- ❒ $100,000 to $149,999
- ❒ $150,000 to $199,999
- ❒ $200,000 or more
- ❒ Prefer not to say

64. Are you…
- ❒ Male
- ❒ Female
- ❒ Other
- ❒ Prefer not to say

Thanks for taking this survey. If you have any concluding comments, please use this space: