SNOHOMISH COUNTY
Conservation & Natural Resources

Surface Water Management

Snohomish County
Conservation and Natural Resources
3000 Rockefeller Avenue
Everett, WA 98201

INTEGRATED AQUATIC VEGETATION MANAGEMENT PLAN

Lake Roesiger

TETRA TECH

ESA

December 2021

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Lake Roesiger

September 2021

PRESENTED TO

Snohomish County
Surface Water Management
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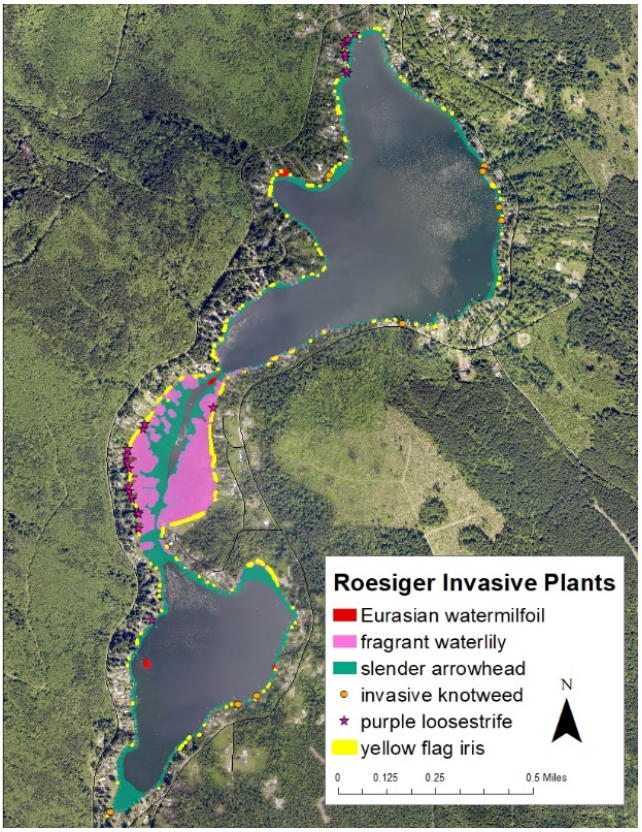
EXECUTIVE SUMMARY

THE PROBLEM

Lake Roesiger is a 348-acre lake located 7 miles east of Lake Stevens. The lake is a significant regional resource for fishing, swimming, boating, water skiing and aesthetic enjoyment. Unfortunately, multiple invasive plants have infested the lake, threatening its health, recreational suitability and it puts other nearby lakes at a higher risk for a future infestation.



Unlike beneficial native plants, invasive plants have no natural controls. They decrease lake oxygen levels when they decompose and increase nutrient recycling leading to more harmful algal blooms. Overly dense plant stands pose hazards for swimmers and diminish enjoyment for paddling, boating, and waterskiing. Invasive plants also speed up lake sedimentation, especially threating navigation in the already shallow middle basin of Lake Roesiger. Collectively, these factors have the potential to harm lake resident property values

MAKING A PLAN

In 2021, Snohomish County Surface Water Management (SWM) obtained grant funding from the Department of Ecology to develop the Lake Roesiger Integrated Aquatic Vegetation Management Plan (IAVMP). The plan provides a roadmap for the community to reduce the impact of invasive aquatic plants. The plan includes the most effective control options that are economically viable for each target invasive plant as well as a timeline for implementation. It is intended to be adaptable over time.

The project was initiated by and completed in partnership with the Lake Roesiger Community and Boat Club. The Club created a steering committee of 12 volunteers, with representatives from each basin to develop the draft plan. Snohomish County contracted with professional lake scientists at Tetra Tech, Inc. and ESA to facilitate the plan development and provide technical expertise. Finally, extensive outreach including mailers, emails and social media posts were used to advertise the draft plan and include community members in a plan survey and vote.

PROBLEM PLANTS & CURRENT EXTENT

A plant survey was completed in July 2021. Six priority invasive plants were mapped that are designated as noxious weeds by the state's Noxious Weed Control Board (Table 1). Each plant is designated by the control board as a class A, B or C noxious weed with class A being the highest priority for control. There were no class A noxious weeds discovered at Lake Roesiger. More details and maps can be found in Section 6 of the plan and online.

Table -1 Noxious Weed Designations

In-Lake Plants	Class	Distribution	Shoreline Plants	Class	Distribution
Eurasian watermilfoil	B	Scattered patches	Invasive Knotweed	B	11 properties
Slender arrowhead	B	39.8 acres[1]	Purple Loosestrife	B	24 properties
Fragrant waterlily	C	30.1 acres	Yellow-flag iris	C	Widespread

[1]THE 39.8 ACRES ARE AREAS OF DENSE COVERAGE WITH AN ADDITIONAL 5.5 ACRES OF SPARSE COVERAGE

PLAN GOALS

The first step in creating the plan was for the steering committee to establish management goals which were agreed upon as follows:

1. Reduce the distribution and density of invasive plants in Lake Roesiger to improve:
    - recreational safety, usability, and navigability of the lake
    - water quality and overall lake health
    - habitat for fish and other aquatic species
2. Prevent the spread of invasive species to and from Lake Roesiger
3. Develop a comprehensive education and outreach plan on prevention and effective control methods

After identifying the overarching plan goals, the steering committee also identified plant-specific control goals and prioritized them, with eradication of milfoil as the highest priority. These goals are described in the context of the recommended control options in the following section.

PLANT MANAGEMENT GOALS & CONTROL METHODS

The next step was to review all available invasive plant control strategies to identify their efficacy for various plant species, environmental impacts, and potential costs. Examples of strategies are listed below, and a full list with explanations and pros/cons of each control method can be found in Section 8.0 of the plan. Due to community concerns over chemical control, additional research regarding herbicides and adjuvants was completed and summarized in Tables 8-2 and 8-3 of the plan.

- Manual/bottom barriers – hand pulling, cutting, bottom barriers, diver assisted suction harvesting (DASH)
- Mechanical/Dredging– harvesters, rotovation, weed cutters, hydraulic dredging, hydrorakes
- Chemical – aquatic herbicides
- Biological – grass carp, insects

Based on a review of all available control options, the steering committee was provided recommendations to consider for each plant species as appropriate to Lake Roesiger and the plant specific management goals. The committee then provided feedback to further refine the recommended control methods for each plant

The final recommendations were shared with the community in a draft plan and summary with an online survey. Using the survey results, the control options were further reduced to a final set of control options. In the final vote the plan was approved by 64% of all respondents (includes lake users), 70% among lake area residents and 74% of among Lake Roesiger Community and Boat Club members. The approved plan's control methods and expected outcomes of the plan for each invasive plant are described in the following section.

Priority 1 – Eurasian Watermilfoil (Class B Noxious Weed)

Milfoil forms dense mats that Limits swimming,

Eurasian watermilfoil (milfoil) presents a high risk to the lake as it can significantly alter aquatic ecosystems and impair recreation. It creates large stands in up to 15 feet of water with vegetation creating a tangled mat up to the lake surface. The current low levels of this plant in Lake Roesiger are a result of many years of diver hand-pulling by the County and Community Club. With limited funding, the current diving effort is minimal with 2-3 days of diving every other year which covers about half the lake. The lake is at high risk for rapid spread of milfoil.

Management Goal: Eradicate small infestations and monitor to ensure early detection of new infestations

Control Method: To achieve the desired goal of eradication, the control method is to continue with diver hand-pulling and/or Diver Assisted Suction Harvesting (DASH) but increase the frequency to include a whole-lake annual survey until plants are not detected, followed by annual monitoring. If the milfoil infestation dramatically increased, a chemical option, ProcellaCOR, would be used. ProcellaCOR has been highly effective in selectively treating milfoil at area lakes, is cost effective, and has a highly favorable human health and environmental toxicity profile, meaning the impacts to human and environmental health are very low (See Section 8.3.1 for full details).

Priority 2 - Fragrant Water Lily (Class C Noxious Weed)

fragrant waterlily decay is causing the lake to

The lake's most visible infestation includes 30 acres of this invasive ornamental lily introduced to the lake decades ago. Concentrated in the middle basin, dense pads have made navigation to and from homes nearly impossible and has caused rapid lake sedimentation, increased nutrient cycling, and caused the formation of mud islands. Left unchecked, the middle basin will continue to evolve into a shallow wetland cutting off navigation between the north and south basins.

Management Goal: Full eradication is the desired goal of many in the community yet may be difficult to achieve given the size and longevity of the infestation. Incremental goals towards eradication include:

- Prevent further spread of invasive lilies within the lake
- Improve navigation between basins and keep main navigation channels open
- Open navigation paths to lake residences
- Significantly reduce the coverage of fragrant waterlilies and slow new sediment buildup
- Reduce historic sediment buildup

Control Options: Control of fragrant waterlily is challenging both because of the scale of the problem and the dense network of underground rhizomes that are difficult to remove. The issue is further complicated by the diversity of opinions on the appropriate management goal for Lake Roesiger. In response, the draft plan included four different scenarios with different control methods and management goals for Fragrant waterlily (Section 9). The community survey on the draft plan showed that of the 149 respondents 63% supported chemical control, 50% mechanical harvesting, 23% hydraulic dredging and 19% status quo or no action. When asked which Scenario is the best option, Chemical control was the most popular with 55% support followed by Mechanical Harvesting (17%) Hydraulic Dredging (14%) and Status Quo (16%).

The survey results led to the inclusion of chemical control as the primary option that was approved by the community. Imazapyr and Imazamox are the specific proposed chemicals as they have a highly favorable toxicological profile with little to no known human health and environmental risks, have a small impact to lake use (some irrigation restrictions) and have been effective locally in several King County lakes (Section 8.2 in the plan). Because of the favorable support, mechanical harvesting is included as an additional future tool, especially if it

becomes less costly. Harvester use is limited to those lake areas deeper than 2-3 feet that are free of woody debris. Finally, individual landowners can supplement these strategies by continuing repeated hand-cutting or bottom barriers.

In the first five years, there will be an estimated 40 to 50% lily reduction (12-15 acres) in the middle basin and eradication in the north and south basins. Efforts would maintain navigation between the basins, slow the rate of sediment accumulation and clear some navigation channels in the middle basin.

Priority 3 Invasive Species Prevention

In addition to invasive plant control, the steering committee recognized that outreach and education to lake users is important to prevent new invasive species from entering Lake Roesiger. The following strategies were identified to educate lake users:

- Volunteer outreach - Community members visit the boat launch on heavy use days and provide education about cleaning, draining, drying boats.
- Lake resident outreach - Develop and implement an outreach campaign for residents to prevent introduction from their boats. Outreach materials would be distributed via mailers, email, and social media.

Priority 4 – Invasive Shoreline Plants

The Lake Roesiger shoreline has three shoreline plants classified as noxious weeds and include: invasive knotweed, purple loosestrife and yellow flag iris. These invasive plants are highly aggressive and can quickly crowd out native vegetation and reduce habitat for wildlife.

Management Goal: Prevent further spread, reduce current coverage and, if possible, eradicate small areas of invasive knotweed and purple loosestrife. Educate landowners on ways to manage or remove shoreline species on their property.

Control Method: The control method is to have individual landowners control plants on their properties which would be supported by education on plant identification and control methods. Education would include landowner workshops and outreach materials distributed via mailers, email, and social media.

Priority 5 – Slender Arrowhead

This spikey-leaved plant dominates over 40 acres of the lake's shallow areas. It creates large monocultures where no other native plants can survive, harming important habitat and accelerating lake aging. While it has changed the lake ecosystem, the long-term impacts are largely unknown as Roesiger is one of only five lakes in WA with this largely unresearched plant. Because it is lower growing and does not normally reach the lake surface, it does not have as great of an impact on lake recreation.

Management Goal: Prevent spread to other waterbodies and reduce current coverage; educate landowners on ways they can control to allow for native plant growth, if desired.

Control Method: Diver Assisted Suction Harvesting (DASH) was identified as the most effective control strategy for this shallow-rooted plant. Private landowners could also hand-pull this plant in shallow areas if plant material is disposed of or composted away from the lake. An initial target of 20% per year was put forward, but as a lower priority plant, this effort could be scaled up or down based on available funding. A Lake Roesiger resident has also developed a personal DASH system which may increase viability of this strategy.

CONTROL METHOD SUMMARY AND COSTS

The control methods are summarized in the table below with detailed preliminary cost estimates for the first five years. The following assumptions were made when estimating costs:

- Cost estimates were calculated in 2021 dollars and do not include inflation.
- Costs were estimated for the first five years, but continued investment will be needed beyond five years.
- Per parcel totals were calculated based on 463 lake shoreline parcels. The per parcel cost is for illustration purposes only.
- Per parcel with grant totals assume a full Aquatic Invasive Plant Implementation Grant award of $75,000 from the Department of Ecology is received and split evenly over the first two years of implementation (earliest potential funding in July 2022).

FUNDING OPTIONS

Implementation of the plan will require a long-term financial investment by the Lake Roesiger community. Grant funding could help to alleviate the initial financial burden. The Washington State Department of Ecology Aquatic Invasive Plants Management Implementation Grant provides a two-year grant award of up to $100,000 of which 25% is the required local match. For longer term funding, the community can choose to continue voluntary local fund collection through the Lake Roesiger Community Club. Another option is to establishing a more formal funding structure by forming a Lake Management District (RCW 36.61) or creating a Surface Water Management Service Charge (See Snohomish County Code 25.20.050 for example).

Both formal funding mechanisms require a legislative process through the Snohomish County Council and would require broad community support. View Section 11 and the online presentation for more information regarding funding options and the process by which they are established.

Approved Invasive Plant Control Methods

Target Plant	Action	Expected Outcomes	Estimated Cost for First 5 Years of Control					
			Year 1	Year 2	Year 3	Year 4	Year 5	Total
Eurasian watermilfoil	Diver hand-pulling; chemical control only if needed	Eradication within 5 years followed by annual monitoring	$22K	$22K	$22K	$22K	$22K	$110K
Fragrant waterlily - Middle Basin[1]	Chemical treatment (imazapyr/imazamox)	40-50% reduction in lily coverage (12-15 acres)	$34K	$34K	$34K	$17K	$17K	$136K
Fragrant waterlily -North & South Basin[1]	Chemical treatment (imazapyr/imazamox)	Eradication of existing patches	$3.3K	$3.3K	$1.1K	$1.1K	$1.1K	$9.9K
Invasive Shoreline Plants[2]	Workshops & outreach on plant ID and control methods	Prevention of new areas; reduce existing areas	$15K	$15K	-	-	-	$30K
Slender Arrowhead[3]	Incremental removal by DASH	20% removal per year[4]	$22K	$22K	$22K	$22K	$22K	$110K
Invasive Species Prevention	Outreach to lake users & residents	Lower risk of spread & intro of new invasive species	$3.5K	$3.5K	-	-	-	$7K
		Total	$99.8K	$99.8K	$79.1K	$62.1K	$62.1K	$402.9K
		Cost Per Parcel	$216	$216	$171	$134	$134	$870
		Cost per Parcel with Grant	$135	$135	$171	$134	$134	$708

[1]Costs do not include supplemental efforts by landowner for control in private dock and swimming areas through pulling, repeated hand cutting and/or bottom barriers.

[2]Costs are for education and outreach only; control work and associated costs will be the responsibility of individual landowners.

[3] Slender arrowhead efforts could be scaled up or down based on available funding

1.0 INTRODUCTION

1.1 PROBLEM PLANTS IN LAKE ROESIGER

Invasive and non-native aquatic weeds (also referred to as aquatic noxious weeds and aquatic invasive species) threaten the health of lake as they displace the native plant community, negatively impact fish and aquatic habitat, and can harm water quality. Invasive plants also can interfere with recreation including swimming, boating, and fishing.

Lake Roesiger suffers from infestations of six priority noxious weeds that are affecting the health of Lake Roesiger and pose a threat to other area lakes. The noxious weeds are as follows:

- *Myriophyllum spicatum* (Eurasian watermilfoil or EWM)
- *Nymphaea odorata* (Fragrant waterlily)
- *Sagittaria graminea* (Slender arrowhead)
- *Fallopia* sp. (Invasive Knotweed)
- *Lythrum salicaria* (Purple Loosestrife)
- *Iris pseudacorus* (Yellow flag iris)

Figure 1-1 provides an overview showing the extent of the invasive plants in Lake Roesiger. A full discussion of the aquatic plant community in Lake Roesiger and the threat they pose is provided in Section 6. More detailed maps showing each basin can also be found in Section 6.

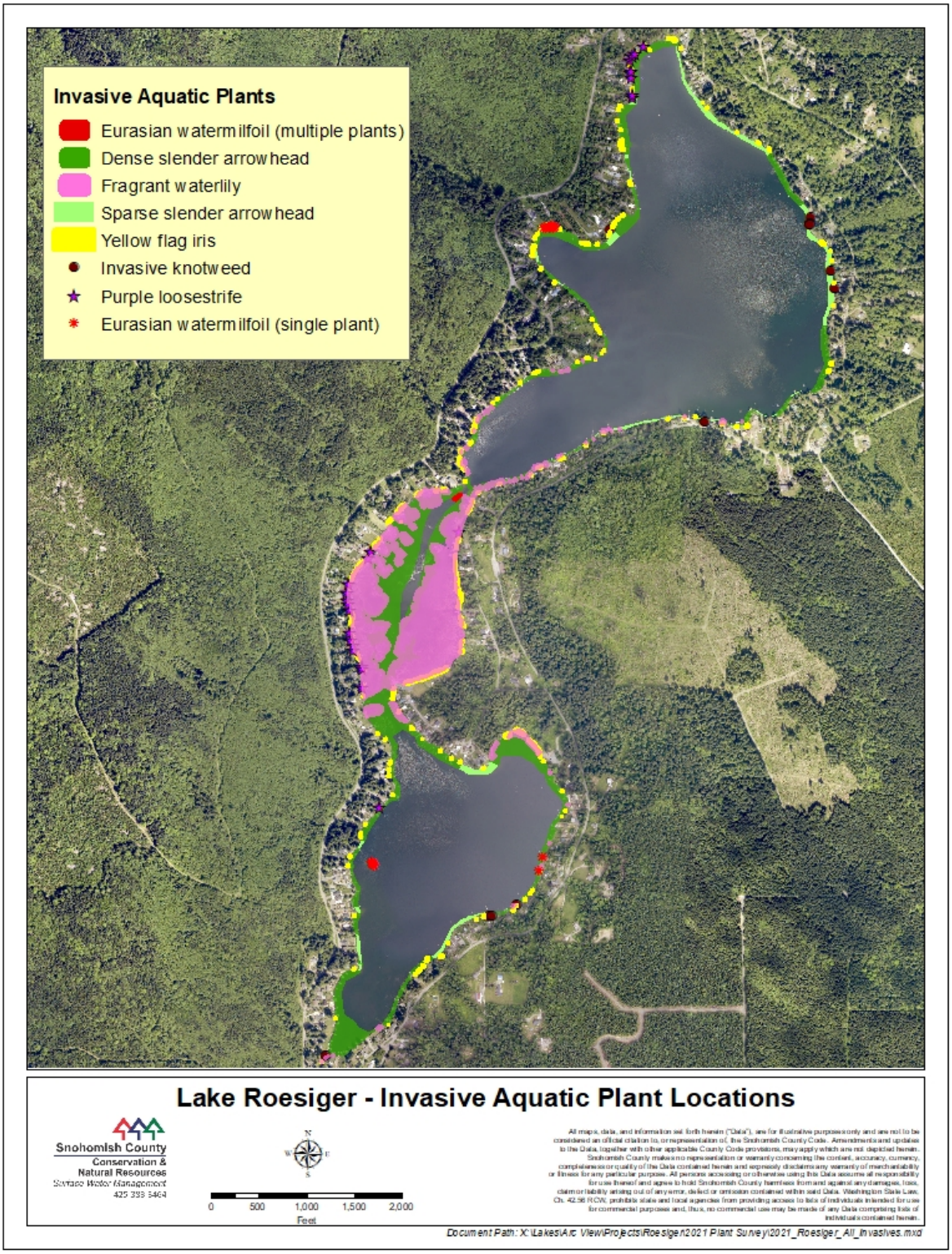


Figure 1-1. Overview of invasive aquatic plants in Lake Roesiger, July 2021.

1.2 BENEFICIAL USES DISRUPTED BY PROBLEM PLANTS

Dense growth of invasive aquatic plants significantly disrupts several beneficial uses in Lake Roesiger including swimming; recreational fishing; the use of motorized boats and non-motorized vessels; aesthetic value; resident fish spawning and rearing and overall aquatic habitat.

1.3 PROBLEM STATEMENT

Dense invasive aquatic vegetation has negatively impacted navigation, aesthetics, recreational activities, water quality and aquatic habitat in Lake Roesiger. Over time, the decay of vegetation has also led to sediment accretion or buildup of “muck”. The build-up is especially pronounced in the shallow, middle portion of the lake. This dense aquatic vegetation and corresponding buildup of “muck” has contributed to navigational issues and safety concerns, as well as inhibited boating, swimming, kayaking, canoeing, and paddling in many areas of the lake.

The overly dense growth of non-native aquatic plants also greatly impairs habitat for fish and other aquatic species. Non-native plants displace native species which provide a critical food source and cover for fish and other aquatic life. The rapid growth and then decay of invasive plants negatively impacts water quality by increasing nutrient recycling and lowering dissolved oxygen. Overall, the excessive growth s and will continue to diminish lake aesthetics, impair beneficial uses, and lower property values.

An aquatic plant survey in July 2021 found that the non-native invasive species slender arrowhead and fragrant water lily dominate the open water vegetation community in Lake Roesiger. The aquatic plant survey in 2021 also found small patches of Eurasian watermilfoil (*Myriophyllum spicatum)*. The survey found patches of the native species, water bulrush (*Scirpus subterminalis*), slender elodea (Elodea canadensis and Elodea nuttallii), bladderwort (Utricularia vulgaris), pondweeds (Potamogeton sp.) and yellow waterlily (*Nuphar polysepala*).

Several non-native invasive shoreline species were identified during a July 2021 survey the survey in July 2021 including yellow flag iris, purple loosestrife), and invasive knotweed species. These species aggressively spread creating large monocultures. They displace native plants and disrupt critical shoreline edge habitat for amphibians, waterfowl and other aquatic life.

Adaptive management of non-native invasive plant species will bring back a balanced plant community that improves navigation, aquatic habitat, recreational activities, and the overall water quality and health of the lake.

2.0 COMMUNITY INVOLVEMENT

2.1 ORGANIZATIONS INVOLVED IN LAKE MANAGEMENT

Organizations and entities that have been involved in the management of Lake Roesiger include the WA Department of Ecology (Ecology), Snohomish County Surface Water Management (County), and the Lake Roesiger Community and Boat Club (Community Club). From 1998-2017, the County controlled Eurasian watermilfoil through diver surveying and hand-pulling. Initial funding was provided, in part, by an early infestation grant from Ecology. The county then funded this program until 2017 when funding for this project was cut due to budget shortfalls.

2.2 LAKE AND COMMUNITY RESIDENTS

The Community Club and individual residents have been highly active in lake management. First, after County funding was cut, they raised funds to conduct diver hand-pulling of milfoil in 2019 and 2021. The Community Club has held several community meetings and established a lake health committee which, in part, was tasked with researching and supporting feasible invasive lily control methods. They purchased tools for homeowners to control lilies on their property. Finally, the obtained a permit and placed bottom barriers to suppress lily growth and improve channel navigation.

Individual community members have also been highly active in pursuing lily control through hand cutting, cutting with the use of small mowers and the placement of bottom barriers in dock and swimming areas. One landowner is also in the in process of developing a diver suction dredge. Previously, some landowners attempted to work together to conduct an herbicide treatment. This effort failed due to a mistake in the permitting notifications by the contracted herbicide applicator.

While the efforts of both the Community Club and individual members were a start, many felt the magnitude of the invasive plant problem (particularly the fragrant waterlily) was too great for individuals or small groups to address and a broader approach was needed. Members of the community approached County leaders and requested county assistance in applying for grants to fund control work. Subsequently, the County applied to Ecology for a grant to develop an Integrated Aquatic Vegetation Management Plan (Plan), the first step to obtaining a grant to help fund control efforts.

Upon receipt of funding, the Community Club assembled a steering committee to help guide the plan development. The steering committee includes 12 members appointed by the Community Club with representation from each lake basin.

2.3 STEERING COMMITTEE MEETINGS

The Lake Roesiger Steering Committee met virtually on August 9, 2021 and on September 9, 2021. At these meetings, the group discussed management goals, priority target areas, and preferred control options. The first meeting focused on the 2021 plant survey findings, key invasive plant species found and all potential management options for each plant. The steering committee provided input to identify the problem statement and attainable and measurable goals for the plan. They also voiced concerns over potential management options. After the first meeting, the committee took an online survey to formalize management goals and prioritize the invasive plant species.

The second steering committee meeting included clarification of plant-specific goals, a review of all applicable management options, proposal of management alternatives for all target invasive species, and methods to prevent new invasive species. The steering committee voted on potential management options to recommend to the Lake Roesiger community. The steering committee agreed upon several management goals and approaches but was largely divided on the options to address fragrant waterlily.

The steering committee meetings were recorded and posted on the project website along with the presentations from the meetings for all interested community members to view.

2.4 PUBLIC INVOLVEMENT

The committee feedback was used to develop the draft plan. The draft plan included a single recommended management goal and control approach for each of the following:

- Eurasian watermilfoil
- Invasive species prevention
- Shoreline invasive plants (invasive knotweed, purple loosestrife and yellow-flag iris)
- Slender-leaf arrowhead

For fragrant waterlily control, the draft Plan provided four different scenarios with their associated costs.

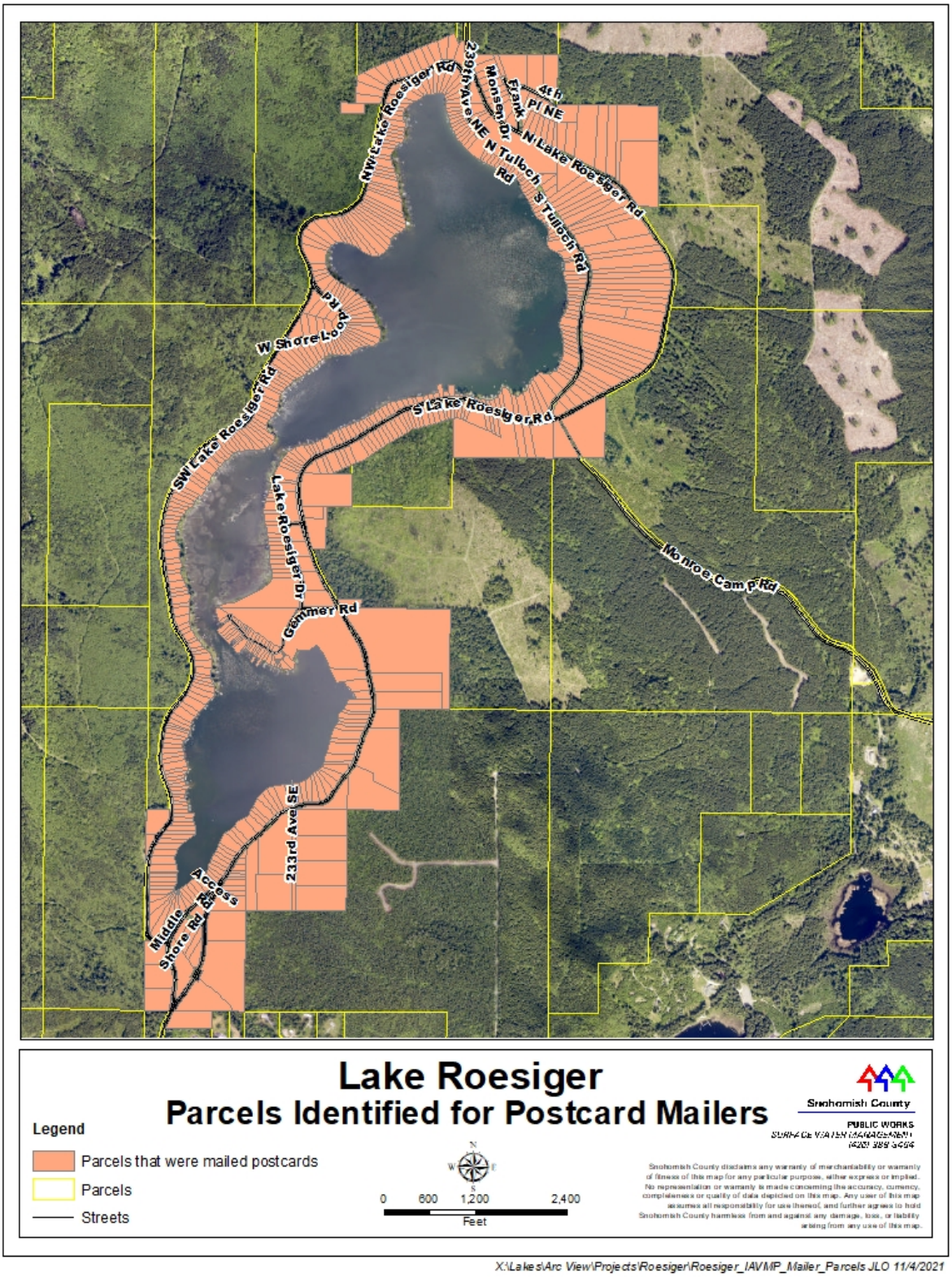
2.4.1 Draft Plan & Online Survey

The draft plan was then provided to the lake community along with a draft executive summary and an online presentation explaining the plan. In addition, a survey was sent with the plan so interested community members could provide their input. The survey results are further discussed in Section 9.2

The draft plan and online survey were advertised as follows:

- **Project webpage** – the project webpage was updated with the draft plan, executive summary, online presentation and link to the online survey for all stakeholders to access.
- **Postcard mailers** – two mailers were sent (October 1 and October 15, 2021) to parcels along the shoreline, and all parcels on N Lake Roesiger Rd, Frank Monson Dr, 4th Place NE, S Lake Roesiger Rd, N Tulloch Rd, S Tulloch Rd, Monroe Camp Rd, Lake Roesiger Dr., Gemmer Rd, 233rd Ave SE, Middle Shore Rd, 239th Ave NE, Lois Ln, NW Lake Roesiger Rd, SW Lake Roesiger Rd, Paradise Ln, and West Shore Loop Rd (Figure 2-1). The addresses were extracted from the Snohomish County Assessor's database and the taxpayer address was used as the mailing address. There were several reports of mail delays and other post office issues a second mailer (Oct 15) was sent and the deadline to respond to the survey was extended a week.
- **NextDoor** – two posts were made by the County to the Roesiger area neighborhoods
- **Email** – multiple announcements were sent to 135 residents who have subscribed to the Lake Roesiger update list through GovDelivery, an email subscription management service used by Snohomish County. Access to sign up to receive emails is available on the project webpage and was advertised in all project mailers.
- **Lake Roesiger Community and Boat Club**
    - Multiple emails were sent to membership
    - Facebook post
    - Website updated with link to survey

Figure 2-1 Lake Roesiger parcels identified for postcard mailers



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2.4.2 Community Meeting

A public meeting was held as an online Zoom call the evening of Tuesday, October 26, 2021. The meeting was advertised on the same postcard mailers as well as through additional email and NextDoor posts. At the community meeting, a presentation was given to discuss the following:

- background and history of invasive aquatic plants at Lake Roesiger
- descriptions of the target invasive species
- all control methods considered in the plan
- best control options for Lake Roesiger
- community survey results on control options
- potential funding options and next steps for the community

After the presentation, there was a community discussion on the proposed control options for Lake Roesiger. The community meeting was recorded and is available to view on the project website. Using feedback from the online survey and the meeting, the plan was revised to include only one option for fragrant waterlily control. The initial and final options are further discussed in Sections 8.0 and 9.0.

2.4.3 Final Online Vote

The steering committee and Community Club board requested that a final vote be held so everyone could vote as not all residents would be able to attend the community meeting. The vote was conducted via an online survey and was open from October 28 – November 10, 2021. The community was provided with a revised executive summary as well as the survey results and were requested to review the materials before voting. Per feedback at the community meeting, there was one vote allowed per parcel and participants were subsequently asked to provide their address and/or parcel numbers. While all members of the public could vote, participants were asked if they lived on one of the lake basins, near the lake or were lake users to allow for an understanding of the views of each stakeholder group. The survey also included questions regarding options for funding the plan.

The community was notified of the final vote as follows:

- Mailer (Nov 1) – sent to same recipients as previous mailers. While it was intended to be sent Oct 28th it was delated due to a printer issue
- Email – 3 emails sent
- NextDoor – 3 posts

The final vote was tabulated and provided to the Roesiger Board, posted to the project website and sent out to all of the survey participants who requested results. The final results are further discussed in Section 9.3.

3.0 MANAGEMENT GOALS

3.1 MANAGEMENT AREA

In Lake Roesiger, management of aquatic invasive plant species will prioritize shorelines and the shallow areas (out to approximately 10 to 12 feet deep) where non-native species have been mapped and are growing relatively densely. This will prioritize most of the 44 acres within the middle basin and the connecting channels to the north and south basin. This will also prioritize most residential swimming and boat areas in the north and south basin as well as the public swimming areas at the Lake Roesiger County Park.

3.2 MANAGEMENT GOALS

The overall project goal is to reduce the distribution and density of invasive aquatic and shoreline plants in Lake Roesiger to support beneficial uses.

1. Reduce the distribution and density of invasive plants in Lake Roesiger to improve:
    - recreational safety, usability, and navigability of the lake
    - water quality and overall lake health
    - habitat for fish and other aquatic species
2. Develop a comprehensive education and outreach plan on prevention & effective control methods

The Lake Roesiger steering committee also identified the following plant-specific management goals in order of priority as established by the community survey results:

Priority 1 - Eurasian watermilfoil: Eradicate remaining small infestations and continue monitoring efforts to identify any new infestations within the lake

Priority 2 - Fragrant waterlily: Full eradication of the non-native lily is the desired goal of many in the community, yet this goal may be difficult to achieve given the size and longevity of the infestation. Incremental goals towards eradication include:

- Prevent further spread of invasive lilies within the lake
- Improve navigation between basins and keep main navigation channels open
- Open navigation paths to end of lake residence docks
- Significantly reduce the coverage of fragrant waterlilies and slow new sediment buildup
- Reduce historic sediment buildup
- Educate landowners on available control options for fragrant waterlilies that they can individually implement near their shorelines to complement and support the overall community plan

Priority 3 - Invasive Species Prevention: Prevent the spread of invasive species to and from lake Roesiger

Priority 4 - Shoreline Invasive plants (invasive knotweed, yellow flag iris, purple loosestrife): Prevent further spread and reduce current coverage. If possible, eradicate small areas of invasive knotweed and purple loosestrife infestations along the lake shoreline; educate landowners on ways to control shoreline species on their property

Priority 5: Slender arrowhead: Prevent spread to other waterbodies and reduce current coverage; educate landowners on ways they can control to allow for native plant growth, if desired

4.0 WATERSHED AND WATERBODY CHARACTERISTICS

4.1 LAKE ROESIGER WATERSHED

Lake Roesiger is located in the foothills of the Cascade Mountains in eastern Snohomish County and is part of the upper Woods Creek watershed. The lake is at approximately 500 feet elevation and is surrounded by hills up to around 1,000 feet of elevation. In total, the Lake Roesiger watershed drains 2,228 acres (Figure 4-1). The watershed is relatively small as it is only 5.4 times the size of the lake area.

4.1.1 Land Use Activities in Watershed

The Lake Roesiger watershed has a long history of logging. Starting in the 1890's early settlers cleared land to build their homesteads around the lake (KCM, 1989). Commercial logging began shortly thereafter and persists today with most of the watershed acreage still designated as commercial harvest land. The remainder of the lake watershed is residential with dense development along the lake shoreline. Residential parcels consist of both permanent homes and seasonal cabins.

4.1.2 Streams and Wetlands in Watershed

There are 18 seasonal streams that feed into Lake Roesiger (Figure 4-1). One outlet stream at the southern tip, Roesiger Creek, drains the lake. Roesiger Creek flows into Woods Creek, a salmon bearing stream, and eventually to the Skykomish River.

The Lake Roesiger watershed is steep with surrounding mountains, so wetlands are relatively small and localized. Wetlands in the watershed include areas in the Lake Roesiger County Park and at the outlet stream of Roesiger Creek in the south basin.

4.1.3 Non-Point Nutrient Sources in Watershed

The residential development near the lake is a potential source of non-point source nutrient pollution. Sources of pollution include pet and animal waste, fertilizers, and sediment. Runoff is greater in areas with high levels of impervious surfaces including roads, driveways and parking areas and roofs and patios. In addition, homeowners have on-site septic systems to handle waste management. Poorly maintained systems may also contribute nutrient and bacteria pollution to the lake. Finally, forested land may also contribute sediment and nutrient pollution when trees are commercially harvested. Snohomish County offers assistance to homeowners on ways to reduce residential pollution through its LakeWise program. Visit www.lakewise.info for more information.

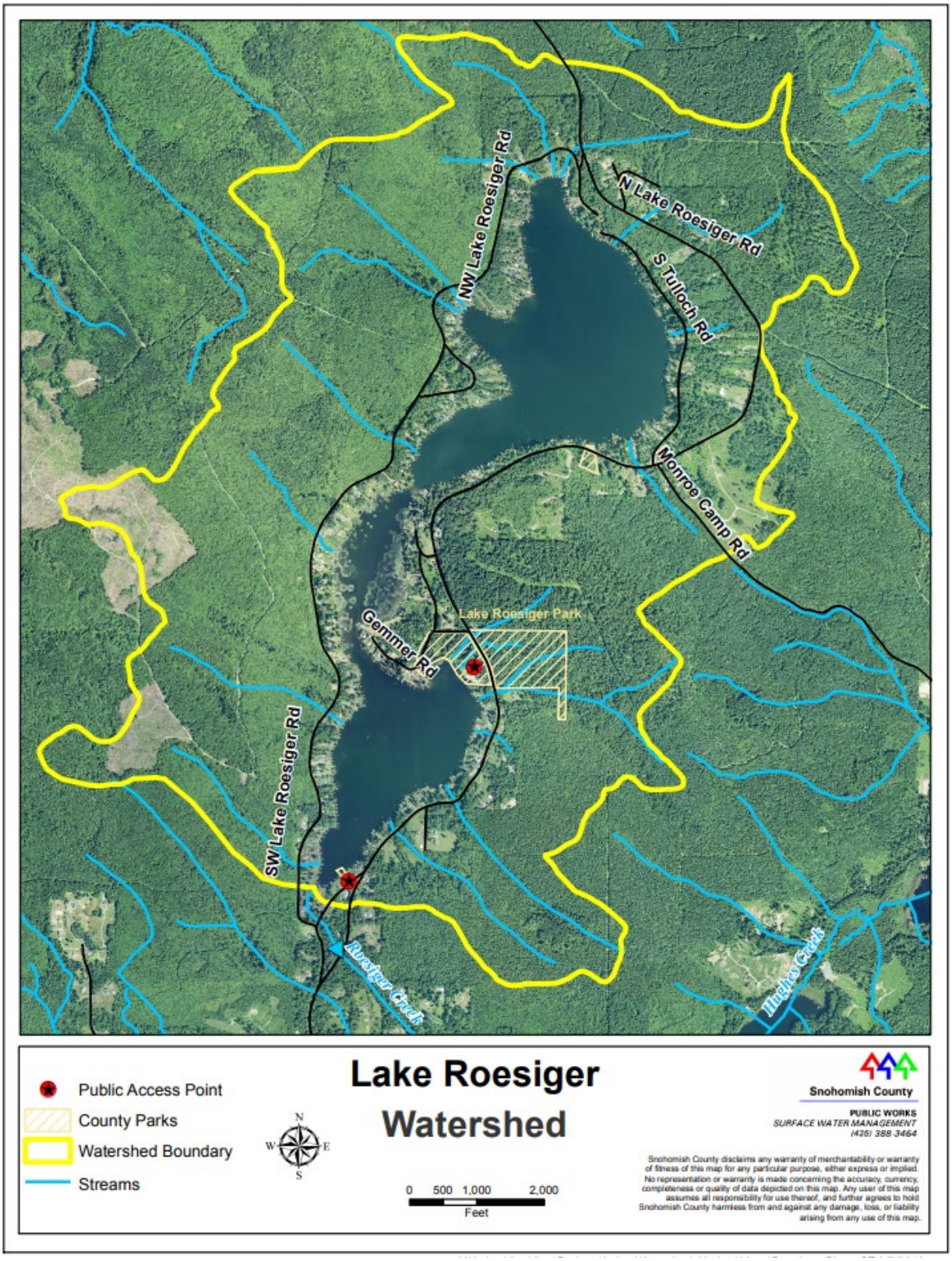


Figure 4-1. Lake Roesiger Watershed.

4.2 LAKE ROESIGER

Lake Roesiger has a surface area of approximately 348 acres (Figure 4-2). The lake has three basins referred to as the north, middle, and south basins. The sizes of the basins will vary as there are not set boundaries, but the north basin of the lake covers roughly 200 acres and has a maximum depth of 33 meters (108 feet). The south basin covers 104 acres and has a maximum depth of 21 meters (69 feet). The middle basin is about 44 acres in size with a maximum depth of only 3.7 meters (12 feet) (Figure 4-2). The volume of the lake is approximately 12,858 acre-feet.

The perimeter of the lake is approximately 33,004 linear feet or 6.25 miles. The shoreline is divided into 463 parcels (Table 4-1). Most parcels (92%) are developed with single family residences, manufactured homes, vacation cabins or non-residential structures. The remaining parcels are largely classified as undeveloped or recreational.

Table 4-1. Lake Roesiger Land Use Classifications by Parcel as of August, 2021

Land Use Classification Code and Description	Number of Parcels	Parcel Acres
111 Single Family Residence - Detached	332	141.67
112 2 Single Family Residences	5	11.75
118 Manufactured Home (Owned Site)	9	4.68
183 Non-Residential Structure	13	9.59
198 Vacation Cabins	63	20.43
672 Protective Functions & Related Activities	1	2.77
761 Parks - General Recreation	2	37.51
910 Undeveloped (Vacant) Land	34	16.76
912 No Perk Undeveloped Land	1	0.37
913 Recreational Lot	3	1.09
Grand Total	**463**	**247.79**

According to a 1999 survey by Washington Department of Fish and Wildlife (WDFW, 2001), the sediment in Lake Roesiger is highly humic. The littoral substrate of the north and south basins consists of silt, sand and cobble with the north basin also having gravel. The middle basin is largely silt and sand with large flocculent mud deposits. The mud deposits are likely the result of years of decaying fragrant waterlily biomass.

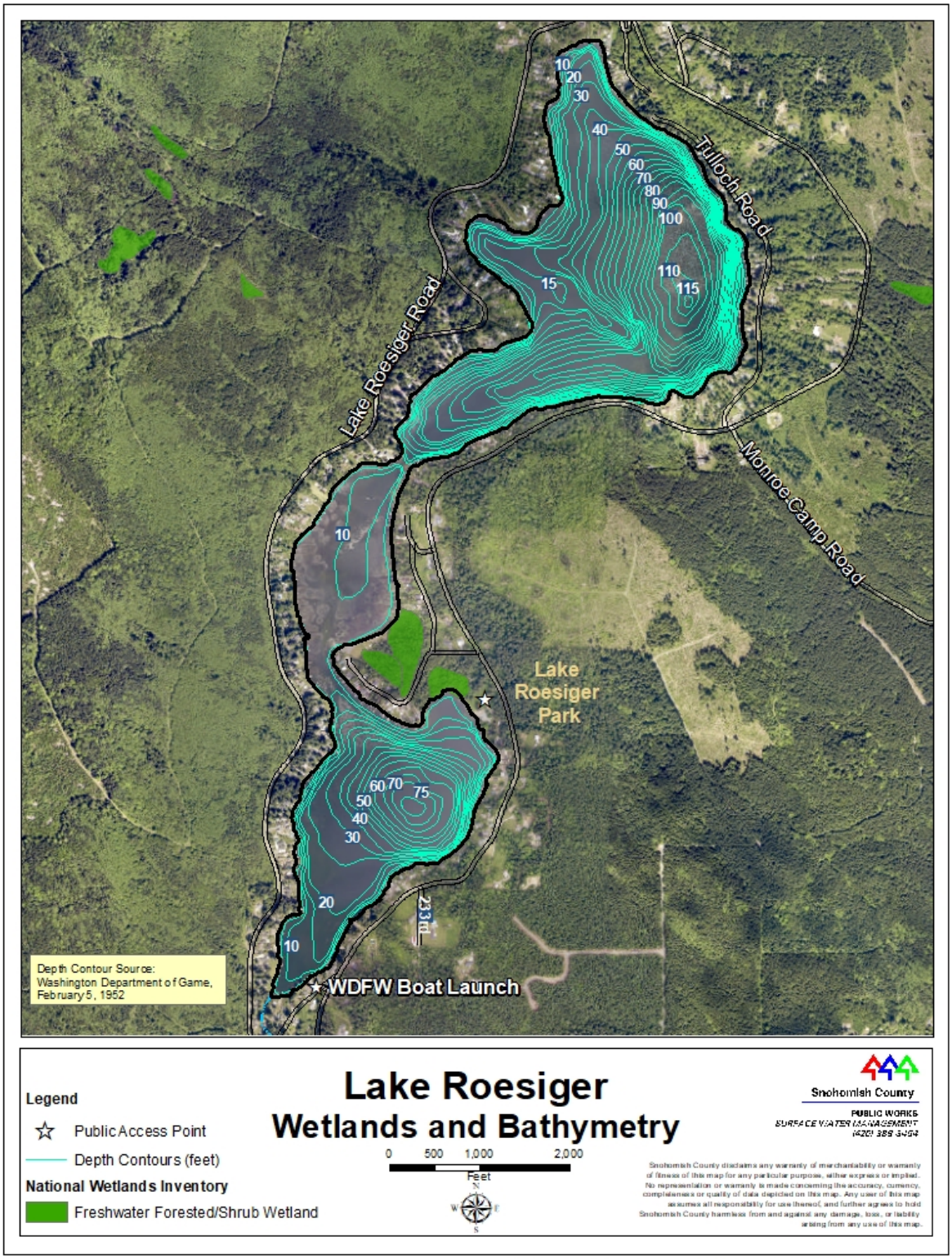


Figure 4-2. Lake Roesiger Overview and Bathymetric Contours.

4.2.1 Hydrology of Lake Roesiger

A hydrologic budget was developed for Lake Roesiger in the Lake Roesiger Phase 1 Assessment Study (KCM, 1989). The study found that groundwater and interflow (shallow groundwater flow) were the largest annual contributors to the lake. The outlet stream was the largest outflow from the lake each year. The annual residence time (the time water stays in the lake) is approximately 0.8 years (KCM, 1989).

Table 4-2. Lake Roesiger Water Budget (June 1988 – May 1989).

Inflow		Outflow	
Groundwater	38.7	Outlet Stream	82.7
Interflow	27.1	Evapotranspiration	16.9
Inlet Streams	20.8	Change in storage	0.4
Precipitation	9.0		
Overland Flow	4.4		

4.2.2 Water Quality in Lake Roesiger

Lake Roesiger has a long history of volunteer lake water quality monitoring. From 1991 through 2001, volunteers participated in the State Department of Ecology's volunteer lake monitoring program. In 2002, the state program dissolved, and the Roesiger community began participating in Snohomish County's volunteer lake monitoring program.

Water quality monitoring is conducted by volunteers or County staff every two weeks from May through October. Monitoring stations are located in the deep points of the north and south basin. A brief summary of conditions for key water quality parameters is provided in the following sections. Refer to the 2021 Lake Roesiger Health Report Card or the 2017 State of the Lake report produced by Snohomish County for a more in-depth discussion of current and historic water quality conditions (www.snohomishcountywa.gov/5385).

4.2.2.1 Temperature and Dissolved Oxygen

Temperatures in the epilimnion (upper waters) of Lake Roesiger range from 41 degrees Fahrenheit (°F) in the winter to 77 °F in the summer. Temperatures in the hypolimnion (bottom waters) stay consistent throughout the year at 41-42 °F. The lake undergoes thermal stratification in the spring and remains stratified through late fall. During this time, dissolved oxygen concentrations in the epilimnion range from 8.2 to 10.2 milligrams per liter (mg/L), while dissolved oxygen concentrations in the hypolimnion can be as low as 0.5 mg/L (Snohomish County, 2017).

4.2.2.2 Phosphorus and Nitrogen

Total phosphorus concentrations in the epilimnion are low with a long-term summer average of 7 micrograms per litter (µg/L) in the north basin and 8 µg/L in the south basin. There had been little year-to-year variation until recent years when a statistically significant increasing trend was identified in the north basin. There are no trends in the south basin, although algae levels are increasing over time.

Summertime phosphorus averages in the hypolimnion are also low with a long-term summer average of 30 µg/L in the north basin and 23 µg/L in the south basin. However, there has been statistically significant increasing trends in phosphorus concentrations in the bottom waters in both the north and south basins.

Snohomish County began monitoring for Total Nitrogen in the epilimnion in 2014. Lake Roesiger has low levels of total nitrogen, with a summer average or 329 µg/L in the north basin and 280 µg/L in the south basin.

4.2.2.3 Algae

Chlorophyll *a* values show low to moderate levels of algae in both basins of the lake. The long-term summer average is 2.5 µg/L in the north basin and 2.8 µg/L in the south basin. In recent years, a statistically significant increasing trend in chlorophyll a has been identified in the south basin.

The County has received a couple of reports of a blue-green algae bloom from Lake Roesiger residents. One was reported to the County in June 2014, but no toxins were detected. The lake was also posted in June 2016 for 24 days to caution lake users and residents that a blue-green algae bloom had been reported but no sample was able to be collected for toxin analysis.

4.2.2.4 Trophic State

Based on the long-term monitoring data, both the north and south basins of Lake Roesiger may be classified as oligo-mesotrophic, with high water clarity, low phosphorus, low to moderate algae and low to moderate productivity of plants and algae. The shallow middle basin is more eutrophic and supports dense growths of aquatic plants.

4.2.3 Aquatic plants in lake roesiger

In July 2021, county staff conducted an aquatic plant survey. The plant species found are as follows:

In-lake (littoral) aquatic plants

- Nuttal's elodea/waterweed (*Elodea nuttallii*)
- Common elodea/waterweed (*Elodea canadensis)*
- Quillwort (*Isoetes* sp.)
- Eurasian watermilfoil (*Myriophyllum spicatum*) – Class B noxious weed
- Brittlewort (*Nitella* sp.)
- Yellow waterlily (*Nuphar polysepala*)
- Fragrant waterlily (*Nymphaea odorata*) – Class C noxious weed
- Ribbonleaf pondweed (*Potamogeton epihydrus*)
- Unidentified pondweed (*Potamogeton sp.*)
- Slender or grass-leaved arrowhead (*Sagittaria graminea*) - Class B noxious weed
- Water bulrush (*Scirpus subterminalis*)
- Common bladderwort (*Utricularia vulgaris*)
- Water Celery (*Vallisneria americana*) – Non-native

Shoreline emergent plants:

- Slough sedge (*Carex obnupta*)
- Purple marsh cinquefoil *Comarum palustre (*syn *Potentilla palustris)*
- Three-way sedge *(Dulichium arundinaceum*)
- Spike rush (*Eleocharis* sp.*)*
- Invasive knotweed (*Fallopia* sp.*)* - Class B noxious weed
- Yellow flag iris *(Iris pseudacorus)* - Class C noxious weed
- Rush (*Juncus sp.)*
- Water purslane (*Ludwigia palustris*)
- Purple loosestrife (*Lythrum salicaria)* - Class B noxious weed

- Common forget-me-not (*Myosotis scorpioides*)
- Reed canarygrass (*Phalaris arundinacea)* - Class C noxious weed
- Pickerel weed (*Pontederia cordata)* - Non-native
- Arrowhead (*Sagittaria sp.*)
- Bulrushes (*Schoenoplectus sp.*)
- Woolgrass (*Scirpus cyperinus*) Non-native
- Small-fruited bulrush (*Scirpus microcarpus)*
- Hardhack (*Spiraea douglasii*)
- Cattails (*Typha spp.*)

Previous plant surveys include those by Ecology in 1994, 1995, and 1998 and Snohomish County in 2001. The results of these surveys can be found in Ecology's online Lakes environmental database (Ecology, 2021a). Most species identified in the 2021 survey were also identified in these past surveys. Ecology identified two species not found in the 2021 survey – Slender pondweed (*Potamogeton pusillus)* and one-way sedge (*Carex unilateralis*). The former was likely the unidentified pondweed in 2021. The foliage was similar in form to slender pondweed but could not be positively identified due to lack of a flower or fruit.

Previously unreported species that were found in the 2021 survey were all shoreline plants and include: spike rush, rush, arrowhead, woolgrass, common forget-me-not and pickerel weed. These were likely identified in 2021 due to a more intensive shoreline survey effort. The one exception is the non-native pickerel weed. It was only found in one location and was likely recently planted by a shoreline landowner as an ornamental plant.

4.2.3.1 Rare Plants in Lake Roesiger

According to the Washington Department of Natural Resources Natural Heritage Program, there are no records of state endangered, threatened or sensitive plant or animal species in Lake Roesiger or the vicinity (W. Fertig, pers. comm. ()

4.2.4 Water Uses in Vicinity of Lake Roesiger

Lake Roesiger is not believed to be a primary water drinking water source for lake residents. However, 50 lake residents have active legal water rights to use Lake Roesiger as a source of water for domestic use or irrigation. These water rights range from quantities of 0.01-0.02 cubic feet per second (cfs) and annual quantities of 0.5-1.0 acre-feet for a combined total of 0.68 cfs and 49 acre-feet per year (Ecology, 2021b). Details on the active certificates for these water rights are provided in Appendix A.

4.2.5 Wetlands Adjoining Lake Roesiger

According to the U.S. Fish and Wildlife Service National Wetland Inventory, there is one small pocket of freshwater forested/shrub wetland adjacent to the eastern middle and southern basin (Figure 4-2). (USFWS, 2021). In addition, the lake itself including the lake shoreline edge is classified as a lacustrine limnetic system with the north and middle basins having unconsolidated bottom that is permanently flooded (Code L1UBH) and the middle basin having an aquatic bed that is permanently flooded (Code L1ABH) (USFWS, 2021).

4.2.5.1 Fish in Lake Roesiger

Lake Roesiger does not support anadromous fish species. There is a waterfall located approximately 7 miles downstream of the lake that serves as a physical barrier to fish migration (WDFW, 2001). However, Lake Roesiger has a long history of recreational fishing and fisheries management on the lake. Reports

from the 1880s indicate that the lake was home to cutthroat trout (*Oncorhynchus clarkii*), rainbow trout (*Oncorhynchus mykiss*) and bullhead (*Ameiurus* sp.) (WDFW, 2001). In the 1920's largemouth bass (*Micropterus salmoides*) were likely introduced lake followed by other warmwater fish introductions. According to angler reports in 1952 and gill netting in 1953, the lake supported several species including kokanee (*Oncorhynchus nerka),* largemouth bass, yellow perch (*Perca flavescens*), cutthroat trout, rainbow trout, crappie (*Pomoxis* sp.) and pumpkinseed (*Lepomis gibbosus*) (WDFW, 2001).

The state managed the lake as a trout fishery with three treatments to remove yellow perch, pumpkinseed and largemouth bass (1955, 1961 and 1966). Since 1986, the lake has been managed as a mixed species fishery and is annually stocked with kokanee and rainbow trout. According to a 1999 survey, the species present in the lake are similar to those in the 1950's except no bullhead species were found and sculpin (*Cottus* sp.*)* were identified (WDFW, 2001).

4.2.5.2 Other Aquatic Life

Roesiger is home to an abundance of other aquatic life. During the 2021 plant survey, native freshwater mussels, western floater (*Anodonta kennerlyi)*, were found in the north basin. The freshwater bryozoan, *Pectinatella magnifica*, was observed in the south basin near the boat launch. This species is not native to the Pacific Northwest though the impacts on the lake ecology are largely unknown. Invasive Chinese mystery snails (*Cipangopaludina chinensis malleata*) were also found in several locations throughout the lake. In 2018, lake volunteers found the non-native signal crayfish (*Pacifastacus leniusculus*). The amphibian population of the lake is largely unknown though invasive bullfrogs (*Rana catesbeiana)* have been documented by county staff.

4.2.5.3 Waterfowl Use of Lake Roesiger

A variety of waterfowl have been observed in the vicinity of Lake Roesiger. Volunteer lake monitors have identified bald eagles (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus)*, blue herons (*Ardea herodias*), Canada geese (*Branta canadensis*) and several duck species.

4.2.5.4 Wildlife Use of Lake Roesiger

Beavers (*Castor candensis*), otters (*Lontra canadensis*) and muskrats (Ondatra zibethicus) have been observed using Lake Roesiger for habitat and foraging. There have also been reports of nutria (Myocastor coypus) being present on the lake, though these sightings could not be confirmed.

4.2.5.5 Endangered Species in Lake Roesiger

Lake Roesiger is not home to endangered fish species. Anadromous fish cannot reach the lake due to a downstream waterfall (WDFW, 2001).

5.0 BENEFICIAL USES AND IDENTIFIED PROBLEMS

Beneficial uses are derived from the federal Clean Water Act to define uses of the lake that should be protected against water quality degradation. The state defines designated uses and include things like water supply, power generation, recreation, boating etc. The beneficial uses identified for Lake Roesiger include are shown below with a short description of how they are impacted by invasive plants:

- Primary contact recreation
    - Swimming occurs at private residences and at the public swimming beach at Lake Roesiger Park (Figure 5-1).
    - Dense growth of aquatic plants in nearshore areas makes swimming unpleasant, cumbersome, and potentially unsafe, as limbs may get tangled in plant growth.
    - Accumulated muck primarily in the middle basin lake bottom makes swimming and wading unpleasant and potentially unsafe
- Boating
    - The whole lake is open to motorized and non-motorized boats.
    - Boats access the lake from the public boat launch along southern shore as well as from private residential docks.
    - There is also a designated public water ski course in both the south and north basins (Figure 5-1).
    - Aquatic plants impede navigation by motorized and non-motorized boats and watercraft.
- Other recreation
    - The lake can be accessed by lake residents and from the Lake Roesiger Park which abuts the eastern shore of the south basin of the lake.
    - Fishing lines get tangled in dense mats of invasive aquatic plants and quality can be reduced if fish habitat is impacted.
- Aesthetic values
    - Decaying aquatic plants reduce water clarity and generate unpleasant odors
    - Dense coverage of aquatic plants limits the aesthetic quality of the lake
- Aquatic habitat
    - Invasive nuisance weeds reduce native biodiversity and habitat diversity for aquatic species
- Resident fish spawning and rearing (see Section 4.2.5.1)
    - Dense growth of aquatic plants negatively impacts fish habitat
    - Water quality is degraded in areas of dense growth
    - In general, dense growth of nuisance aquatic plants is known to disrupt temperature, pH and dissolved oxygen that these species rely upon (Frodge et al. 1990) and direct impacts to rainbow trout spawning and rearing has not been documented.
    - Warmwater fish such as largemouth bass, yellow perch, and black crappie have self-sustaining populations that are unlikely dramatically impacted by dense growth of submersed plants. Coldwater fish such as Kokanee and rainbow trout, retreat to deeper and colder water during the summer. In general, dense growth of nuisance aquatic plants is known to cause changes in temperature, pH and dissolved oxygen negatively impacting these species (Frodge et al. 1990).

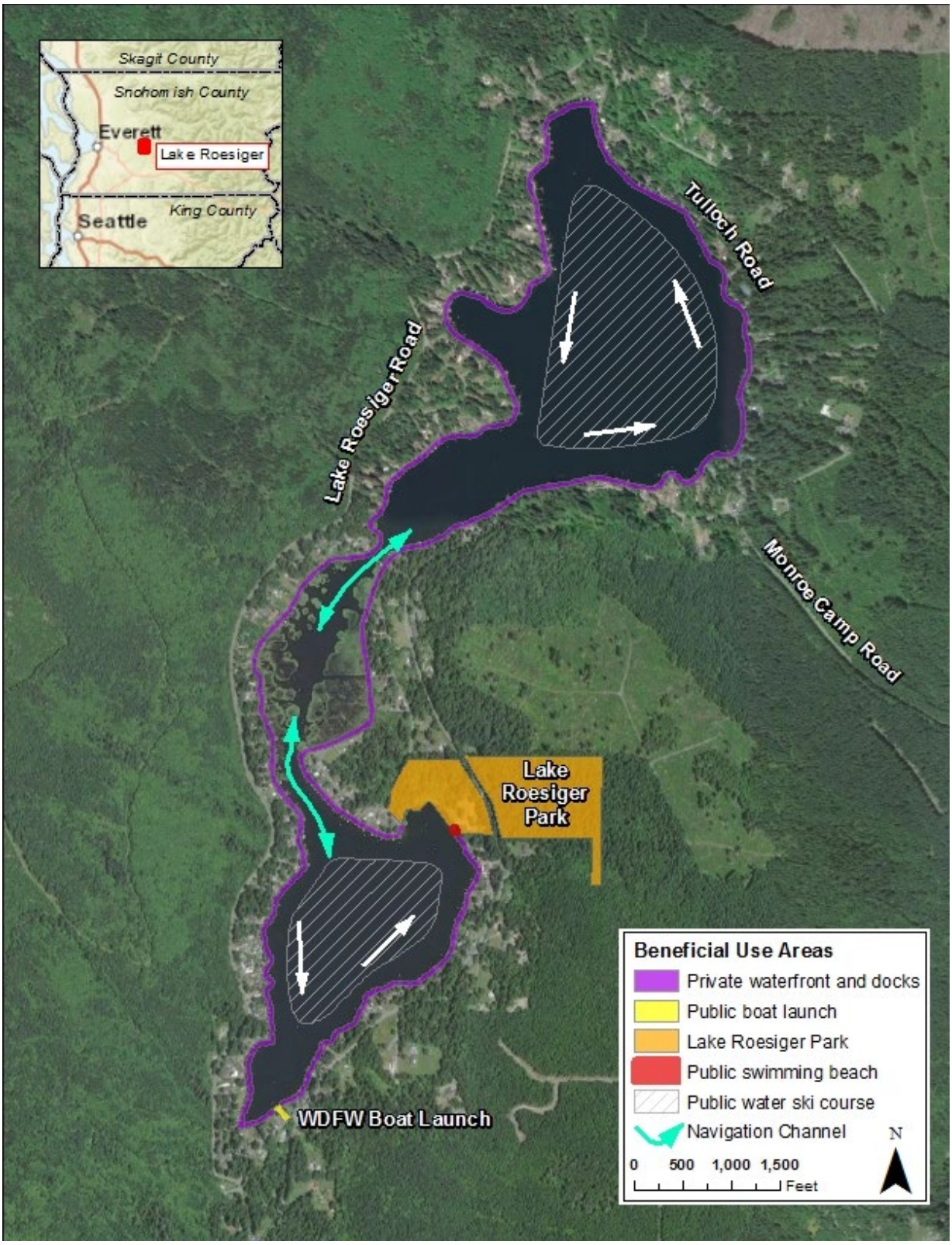


Figure 5-1. Beneficial use areas in Lake Roesiger.

6.0 AQUATIC PLANT COMMUNITY

County staff conducted an aquatic plant survey of Lake Roesiger in July of 2021. The survey began at the public boat launch near the southeast corner of the lake and proceeded in a clockwise direction around the edge of the lake. The plant survey was based on Ecology's Aquatic Plant Sampling Protocols (Parsons, 2001) and consisted of visual identification of the presence, speciation, and percent coverage of aquatic plants. In most areas, high water clarity allowed for visual identification of plants from the boat. However, frequent rake tosses were conducted in both near-shore areas and in deeper water to ensure all plants were being identified. Aquatic plants that were submerged, floating-rooted or floating were mapped. Shoreline plants were identified and noted; however, only the noxious weeds were mapped. Plant samples that could not be easily identified in the field were collected and later identified with the use of a dissection microscope.

In addition to the County's plant survey, the Community Club hired Seascapes, Inc. to survey and hand-pull Eurasian watermilfoil. They conducted a survey of the south and middle basin in 2019 and middle and north basin in June 2021. Their findings are incorporated into the following description and map of aquatic plants.

6.1 IN-LAKE (LITTORAL) AQUATIC PLANT COMMUNITY

The County's July 2021 survey found 13 species of submerged or floating-leaved plants as shown in (Table 6-1). Most of the shoreline had dense growth of aquatic out to 7- or 8-feet water depth. A few locations had vegetation extending out deeper to 10 to 12 feet deep. An interactive map of the surveyed plants is available on the Lake Roesiger Invasive Plant Control Project website[1].

The north basin had the lowest overall plant density as there are large stretches of the basin with a steep drop off and rocky sediments that are less conducive to littoral plant growth. The south basin has some areas with low plant density, but the shallow areas had dense aquatic plant growth. In both the north and south basins, the dominant plant was the invasive, slender arrowhead (*Sagittaria graminea*). This plant was found in high densities throughout much of the lake and extending from about 2 to 8 feet deep (Table 6-1;Figure 6-1).

The native macroalgae, brittlewort (*Nitella* sp.), was often found growing on the outer edges of the slender arrowhead growth. In most places, slender arrowhead growth was so thick it excluded all other native species from growing beyond a few scattered plants such as the ribbonleaf pondweed. There were a few areas where non-invasive plant species were able to grow in denser patches and included water celery, elodea and bladderwort (*Utricularia vulgaris*). Invasive fragrant waterlilies (*Nymphaea odorata)* were also present in both the north and south basins. Most patches were found near the middle basin with the exception of a large stand by the Lake Roesiger Park.

The middle basin has dense aquatic plant growth covering most of the basin with only a small band of deeper water with little to no plant growth. Fragrant waterlily was growing in extremely dense monocultures from the shoreline out to about 5 to 7 feet of water (Figure 6-1). Despite this, in some areas there were large dense patches of native water bulrush (*Scirpus subterminalis*) and bladderwort growing in the breaks between water lilies or, in some cases, even between the waterlilies. There were only a few patches of the native yellow waterlily (*Nuphar polysepala*). In deeper areas, the lilies are replaced by

[1] An interactive online map is also available on the Lake Roesiger Invasive Plant Control Project website https://snohomishcountywa.gov/5822. .

dense stands of slender arrowhead, which was a near monoculture in most areas. Dense stands of bladderwort were observed in deeper water, particularly towards the center of the basin.

There were a few patches of Eurasian watermilfoil detected by divers and hand-pulled in the middle and north basins in June of 2021 (Figure 6-2 and Figure 6-3). Snohomish County did not observe any invasive milfoil in either of these basins. However, a few scattered plants were found in the south basin (Figure 6-4). They align with the locations of diver hand-pulling in 2019.

Table 6-1. Distribution and density of in-lake aquatic plant community.

Scientific Name	Common Name	Type	Distribution Values (DV)[1]		
			North	Middle	South
Elodea canadensis[2]	Common waterweed	Native	3	1	3
Elodea nuttallii[2]	Nuttall's waterweed	Native	9	9	9
Isoetes sp.	Quillwort	Native	2	-	2
Myriophyllum spicatum	Eurasian watermilfoil	Invasive (Class B)	1	1	1
Nitella sp.	Brittlewort	Native	3	2	3
Nuphar polysepala	Yellow waterlily	Native	-	2	-
Nymphaea odorata	Fragrant waterlily	Invasive (Class C)	3	4	3
Potamogeton epihydrus	Ribbonleaf pondweed	Native	1	-	-
Potamogeton sp [1]	Pondweed[1]*	Native	-	1	-
Sagittaria graminea	Slender arrowhead	Invasive (Class B)	3	4	4
Scirpus subterminalis	Water bulrush	Native	-	3	-
Utricularia vulgaris	Common bladderwort	Native	2	3	2
Vallisneria americana	Water celery; tapegrass	Non-native	3	1	3

[1] Distribution values (DV) are defined by Ecology in their plant monitoring database as follows: **1** - few plants in only 1 or a few locations; **2** - few plants, but with a wide patchy distribution; **3** - plants growing in large patches, codominant with other plants; **4** - plants in nearly monospecific patches, dominant; **5** - thick growth covering the substrate at the exclusion of other species; **9** - plant species present, but not assigned an index value (https://apps.ecology.wa.gov/coastalatlas/tools/LakeDetail.aspx)

[2] Difficult to distinguish between elodea species. DV values assigned to *E. canadensis* are representative of all elodea species.

[3] Plant is likely *Potamogeton pusillus* based on vegetative features and past identification in lake, but no flowers or fruit present.

6.2 IN-LAKE NOXIOUS WEED SPECIES

There were three aquatic noxious weeds identified in the littoral area: Fragrant water lily (*Nymphaea odorata*), Eurasian watermilfoil (*Myriophyllum spicatum*), and slender arrowhead (*Sagittaria graminea)* (Figure 6-2, Figure 6-3, and Figure 6-4). The acreages of each plant are shown in Table 6-2. Both slender arrowhead and Eurasian watermilfoil are Class B noxious weeds (NWCB 2021). Class B noxious weeds are widespread in some areas but not in all areas. The State or County Noxious Weed Control boards have the option to designate a plant for mandatory control of Class B plants. Snohomish County has designated Eurasian watermilfoil for control but not slender arrowhead (SCNWCB, 2021). Finally, fragrant water lily is a Class C noxious weed (NWCB 2021). Class C weeds are already widespread, so control is

typically not mandatory. Snohomish County encourages control and provides education and technical support for removal of these weeds.

Table 6-2. Approximate acreages of noxious weeds species in Lake Roesiger (July 2021).

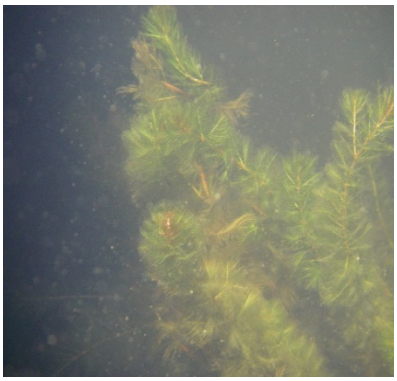
Scientific Name	Common Name	Acreage
Myriophyllum spicatum	Eurasian watermilfoil	Scattered locations
Nymphaea odorata[1]	fragrant waterlily	30.1
Sagittaria graminea (dense)	grass-leaved or slender arrowhead	39.8
Sagittaria graminea (sparse)	grass-leaved or slender arrowhead	5.5

[1] Fragrant waterlily acreage per basin: north basin 0.7 acres, middle basin 28.88 acres, south basin 0.55 acres

Figure 6-1. Submerged Invasive Plants in Lake Roesiger

Slender arrowhead (invasive) with native water bulrush

Fragrant water lily growing in middle basin



Eurasian watermilfoil

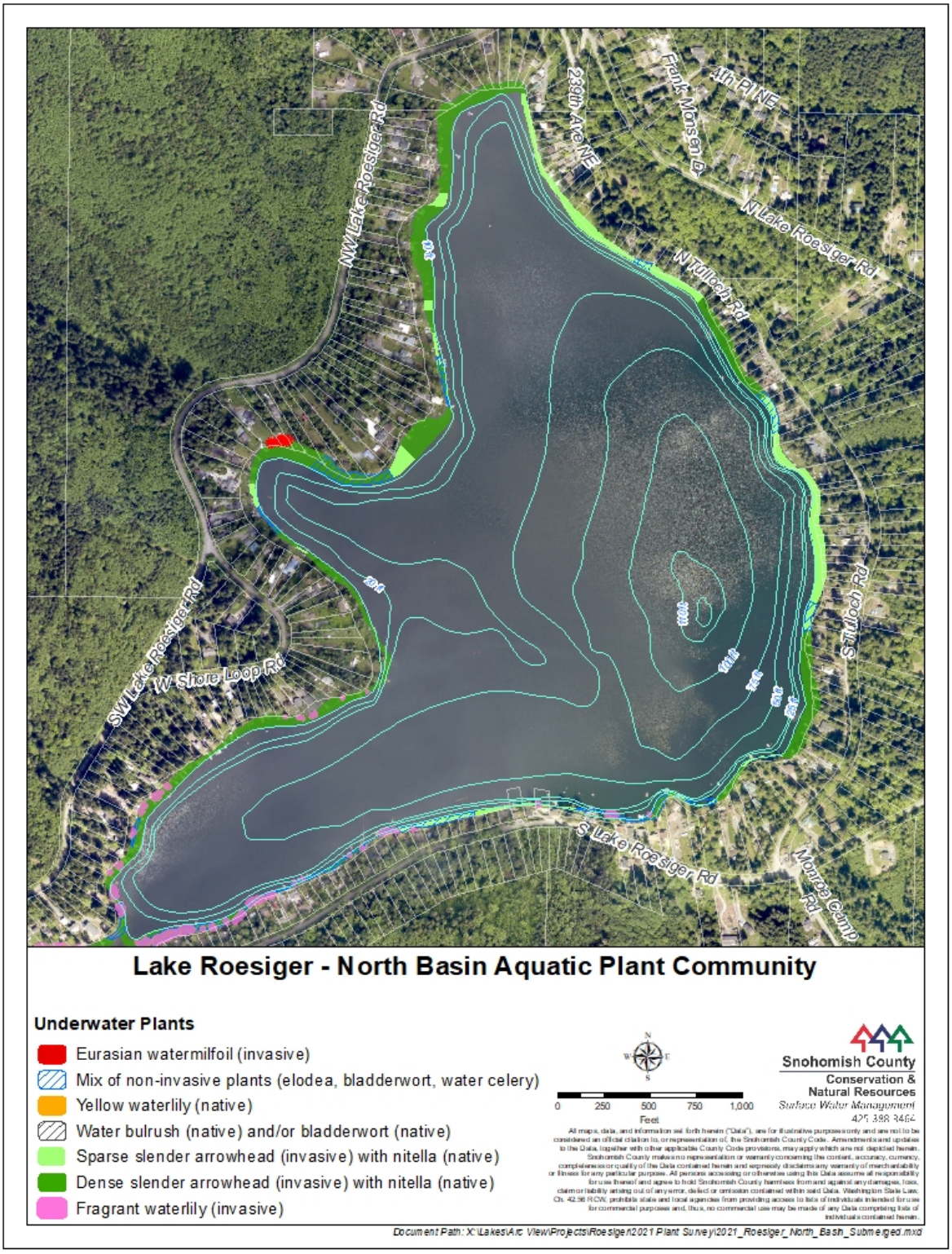


Figure 6-2 Lake Roesiger North Basin Aquatic Plant Community Map

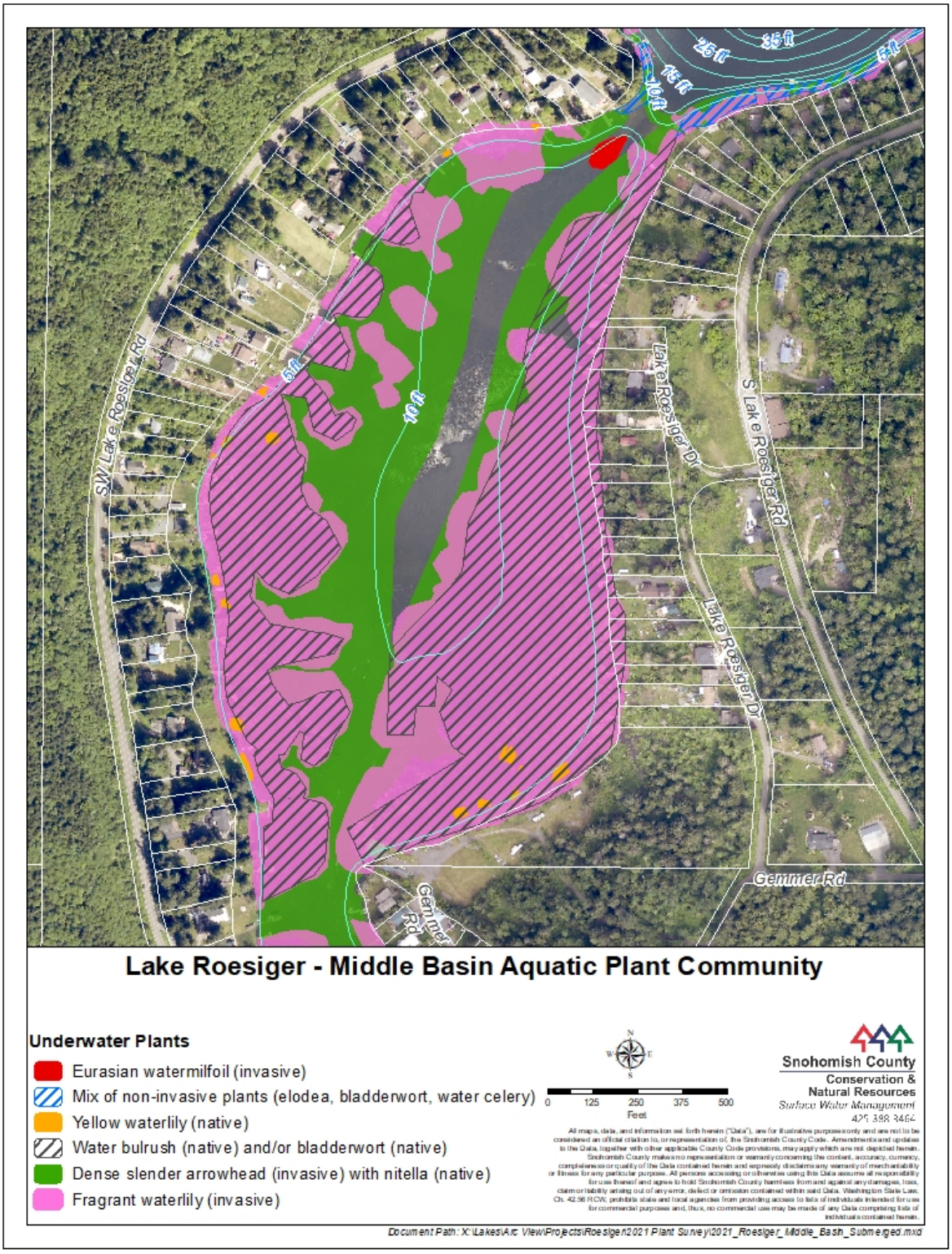


Figure 6-3 Lake Roesiger Middle Basin Aquatic Plant Community Map

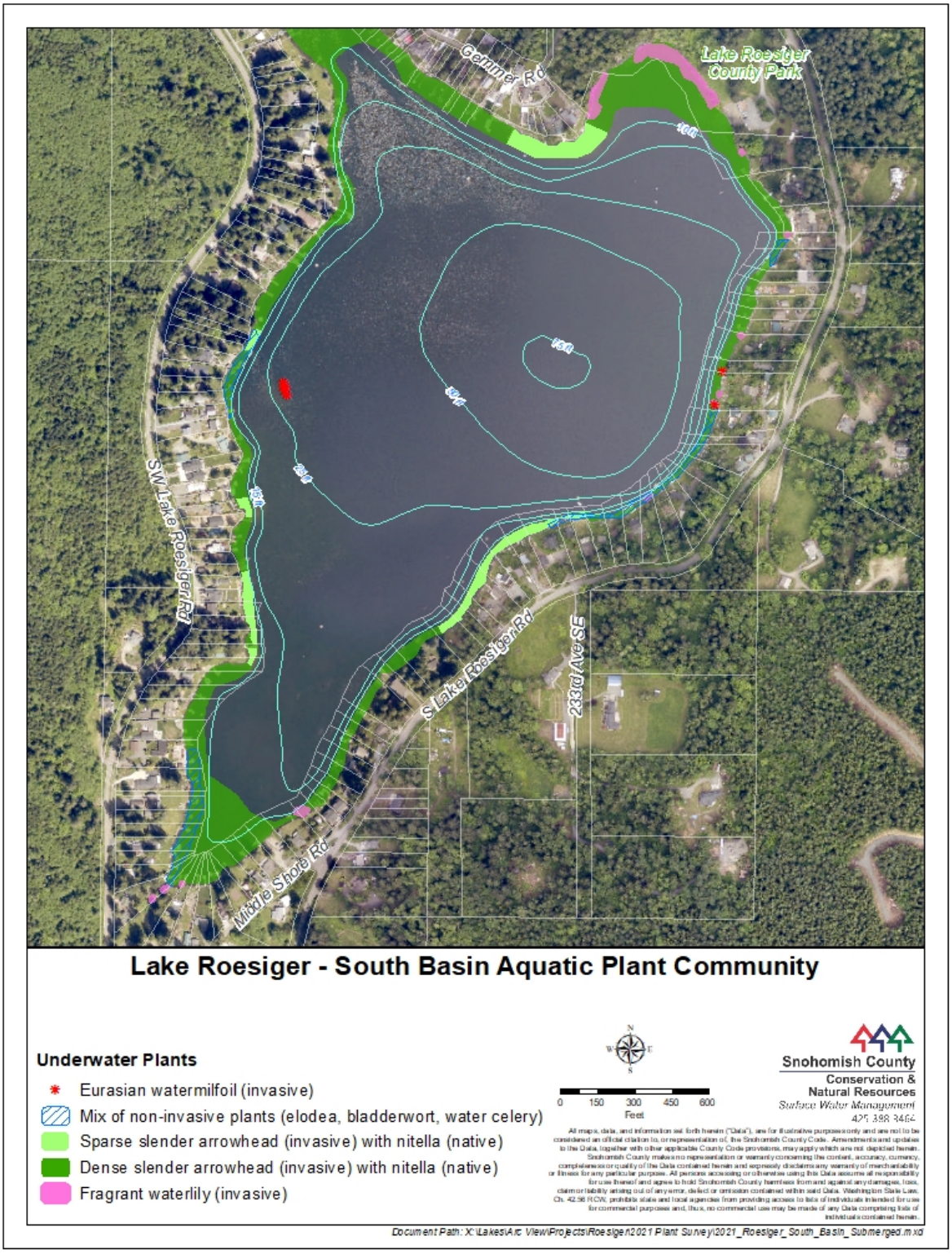


Figure 6-4 Lake Roesiger South Basin Aquatic Plant Community Map

6.3 SHORELINE PLANT COMMUNITY

In total there were 18 species of emergent shoreline plants found at Lake Roesiger. The survey was focused on the lower growing riparian plants and did not include the larger trees and shrubs found along the shoreline except for the hardhack (*Spiraea douglasii*) which was included to be consistent with previous surveys.

Lake Roesiger has over 33,000 linear feet of lake shoreline. The shoreline is mostly developed with large stretches having lawn or hardened services lacking any riparian vegetation. Some of the developed areas have thin bands of shoreline vegetation that are mostly dominated by invasive yellow-flag iris and reed canary grass or native sedges and rushes. There were pockets of undeveloped shoreline or areas where landowners had preserved shoreline vegetation. In these areas, hardhack was often observed with a mix of native rushes, sedges and cinquefoil. There were a few large stands of bulrush, rushes and spike rush that extended far out into the water and appeared to be protecting the lake shoreline.

6.4 SHORELINE NOXIOUS WEEDS

There were three priority aquatic noxious weeds identified as shoreline emergent plants: invasive knotweed (*Fallopia* sp.), purple loosestrife and yellow-flag iris (Figure 6-5, Figure 6-6, Figure 6-7, Figure 6-8). The knotweed was only found in a few scattered locations (11 parcels) in the north and south basin. The loosestrife was more prevalent in the middle basin though scattered in the others (24 parcels). The yellow-flag iris was the most common and was found in all three basins. Each area was too small to accurately identify acreage of these plants. There were other noxious weed identified as well such as reed canary grass, English ivy and Himalayan blackberry. Because they are so locally prevalent, their specific locations were not mapped.

Invasive knotweeds and purple loosestrife are designated as Class B Noxious Weeds by the state (NWCB 2021). In addition, Snohomish County has designated them for control meaning control is required by landowners (SCNWCB, 2021). Yellow flag iris is designated as a Class C noxious weed (NWCB 2021). Snohomish County encourages control and provides education and technical support for removal of these weeds.

Table 6-3. Distribution and density of shoreline emergent plants in Lake Roesiger (July 2021).

Scientific Name	Common Name	Type	Density Values		
			North	Middle	South
Carex obnupta	slough sedge	Native	2	2	2
Comarum palustre (syn *Potentilla palustris)*	purple marsh cinquefoil	Native	2		
Dulichium arundinaceum	three-way sedge	Native			1
Eleocharis sp.	spike rush	Native	2	2	2
Fallopia sp. (syn *Polygonum* sp.)	invasive knotweed	Invasive (Class B)	1		1
Iris pseudacorus	yellow flag iris	Invasive (Class C)	3	3	3
Juncus sp.	rush	Native	2		
Ludwigia palustris	Water-purslane	Native			1
Lythrum salicaria	purple loosestrife	Invasive (Class B)	1	2	1
Myosotis scorpioides	common forget-me-not	Native	1		
Phalaris arundinacea	reed canarygrass	Native	9	9	9
Pontederia cordata	pickerel weed	Non-native	1		
Sagittaria sp.	arrowhead	Native		1	
Schoenoplectus sp.	bulrush	Native	2	2	2
Scirpus cyperinus	woolgrass	Non-native			1
Scirpus microcarpus	smallfruited bulrush	Native	2	2	2
Spiraea douglasii	hardhack	Native	2	3	2
Typha sp.	cattails	Native	1		1

Figure 6-5 Invasive Shoreline Plants at Lake Roesiger

Invasive knotweed

Purple loosestrife

Yellow flag iris

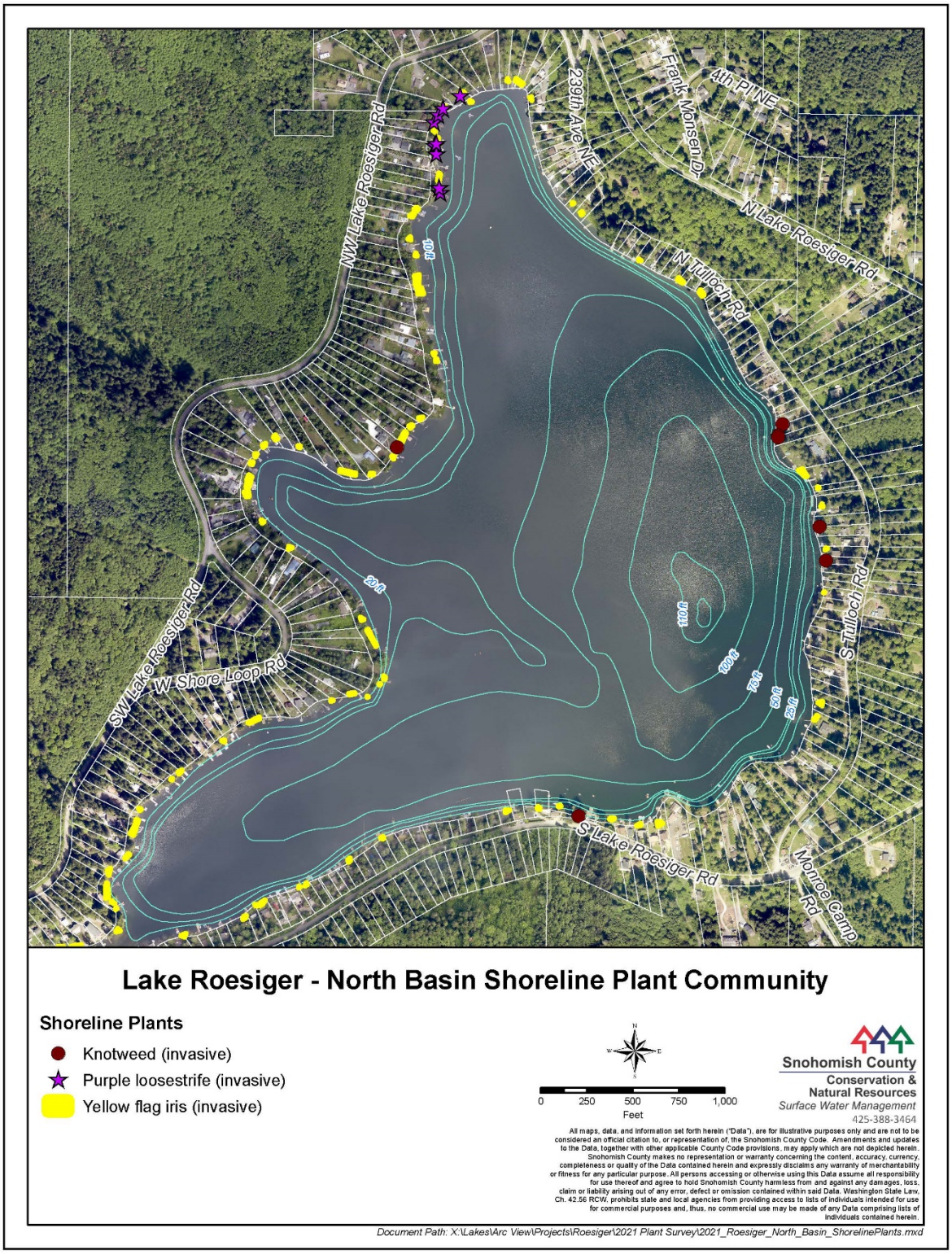


Figure 6-6 Lake Roesiger North Basin Shoreline Plant Community Map

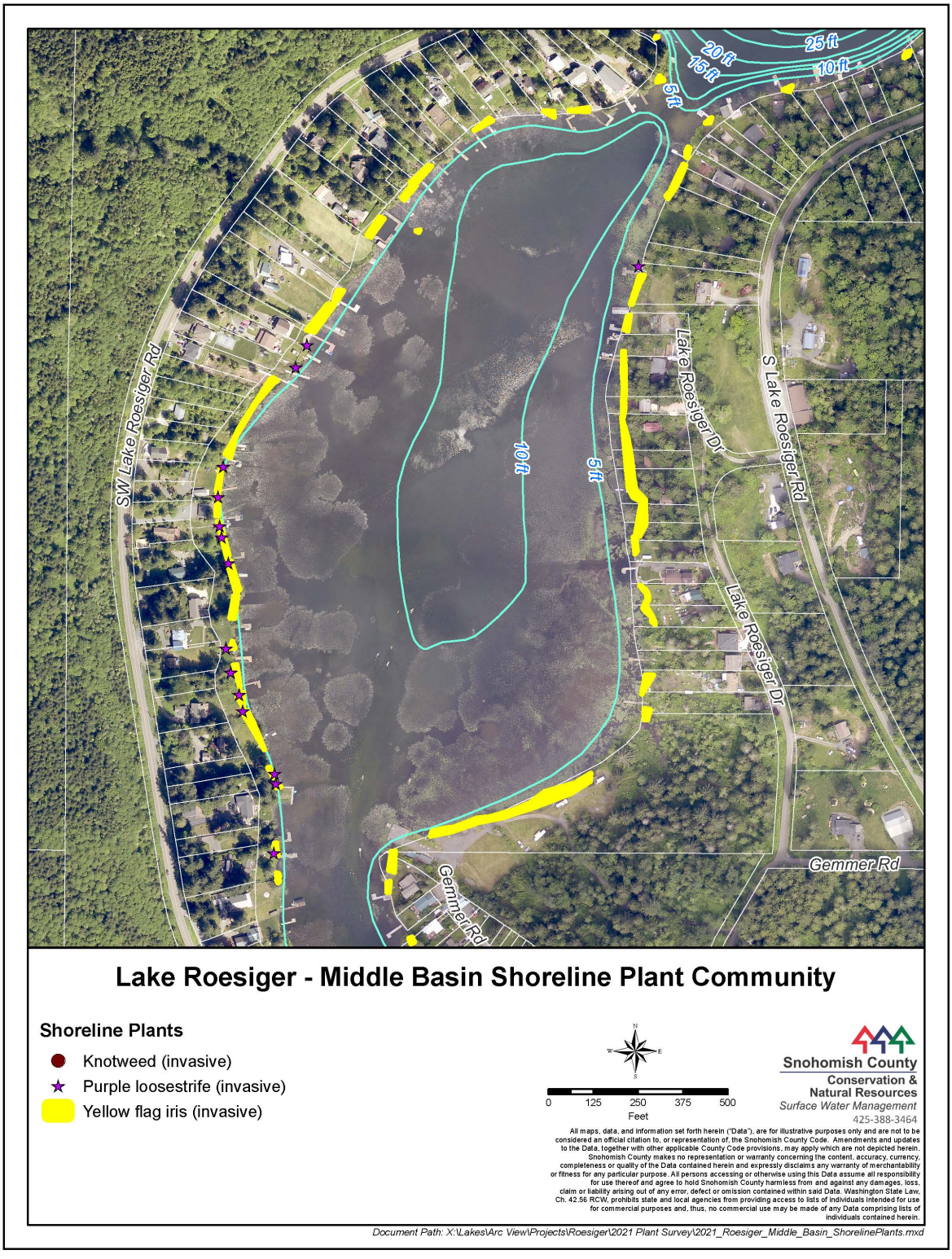


Figure 6-7 Lake Roesiger Middle Basin Shoreline Plant Community Map

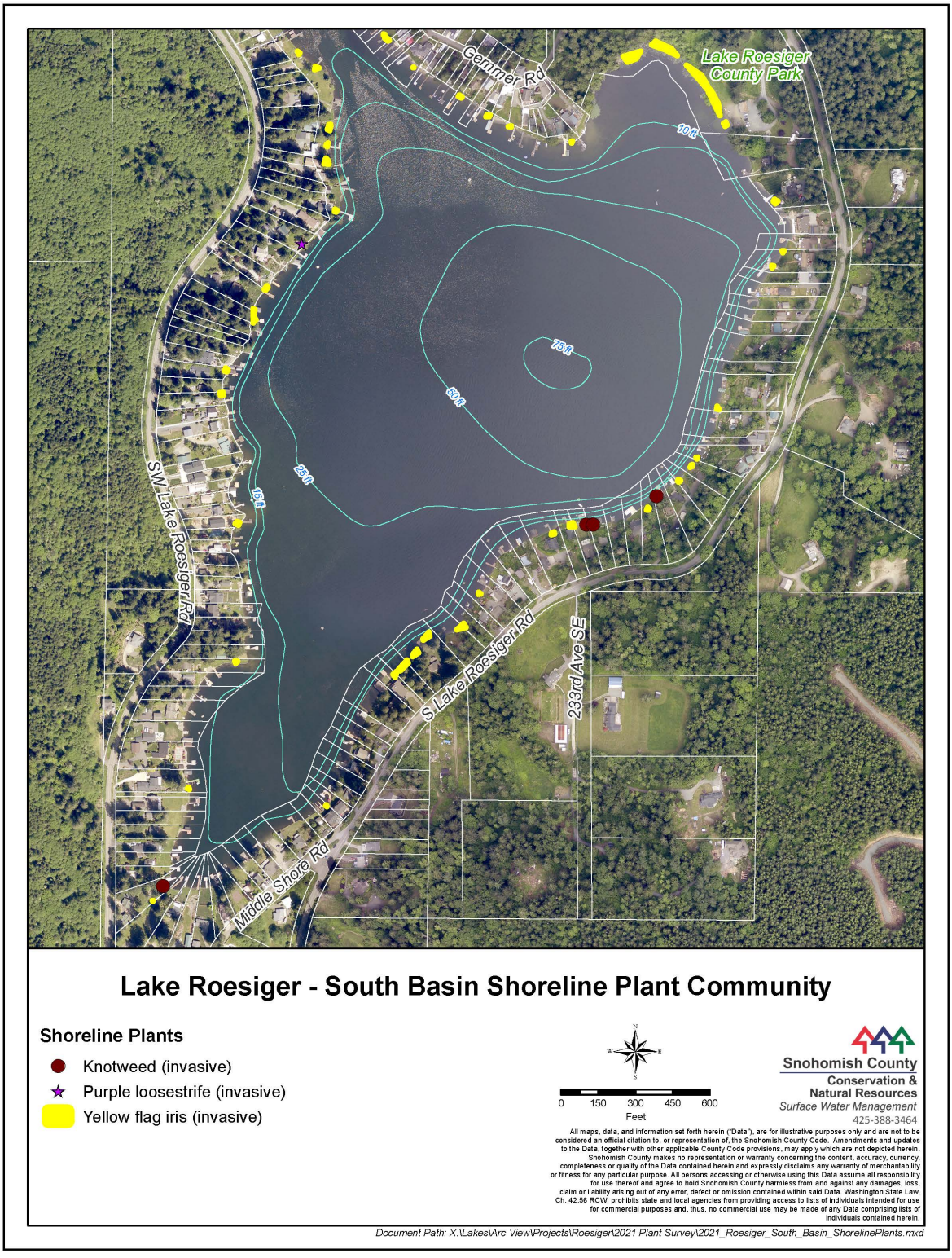


Figure 6-8 Lake Roesiger South Basin Shoreline Plant Community Map

6.5 TARGETED PLANT DESCRIPTIONS

6.5.1 Plants Targeted for Control in Lake Roesiger

Under this Plan, both in-lake and shoreline plants will be targeted for control. In-lake plants targeted for control are Eurasian watermilfoil, fragrant water lily, and slender arrowhead. Shoreline plants targeted for control are invasive knotweed, purple loosestrife, and yellow flag iris. These plants are described below.

Eurasian watermilfoil

Eurasian watermilfoil (Figure 6-3) is a Class B noxious weed in Washington. In Snohomish County, this designation requires control. It was introduced to the United States as an ornamental species in the 1940s. The stems of Eurasian watermilfoil range in color from reddish-brown to whitish-pink. The stems branch and can grow throughout the water column in depths of up to 20 feet but is typically found at depths of 1.5 to 10 feet. Submersed leaves are 2-4 cm in length and have more than 14 feather-like segments. Along the stem, the leaves are typically arranged in whorls of 4. It can grow at a wide range of velocities, salinities, and temperatures, making it successful in many aquatic environments. Its ability to tolerate a wide range of temperatures allows it to overwinter in lakes and ponds, even when they freeze. Eurasian watermilfoil spreads primarily by regrowth of plant fragments. Fragmentation typically occurs naturally and because of disturbance by boat props. Once dispersed, the plant grows rapidly and can form dense mats that shade out native plants and disrupt lake recreation. Information sources: University of Florida, 2021; Ecology, 2021c.

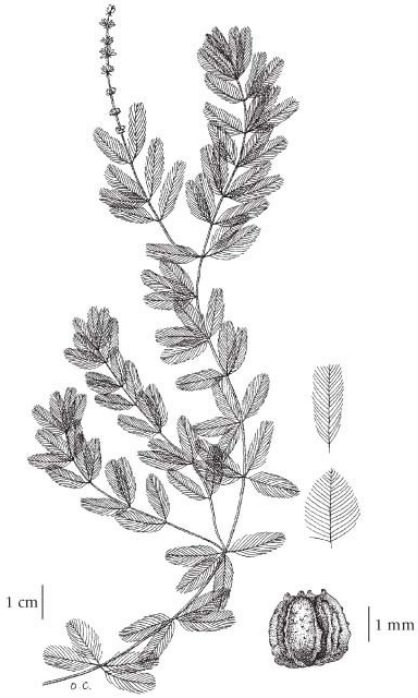


Figure 6-9. Eurasian watermilfoil.
Source: **E-Flora BC, 2020a.**

Fragrant water lily

In Washington State, fragrant water lily is designated as a Class C noxious weed. Fragrant water lily (Figure 6-4). is native in the eastern United States and was likely introduced in Washington State in the late 1800s. It is favored as a decorative aquatic plant due to the large white or pink flowers that grow on lily pads on the water surface. The lily pad leaves grow from underwater stalks, which extend to the lake surface (Figure 6-6). It can grow to depths of 10 feet in slow-moving waters with silty sediments. Fragrant water lily spreads through horizontally branching rhizomes, seed dispersal, and rhizome fragmentation. It is capable of aggressive growth and substantially altering ambient water quality conditions. Over years, the decay of the plant leads to a build-up of organic matter. Information sources: Frodge et al. 1990; NWCB, 2021.

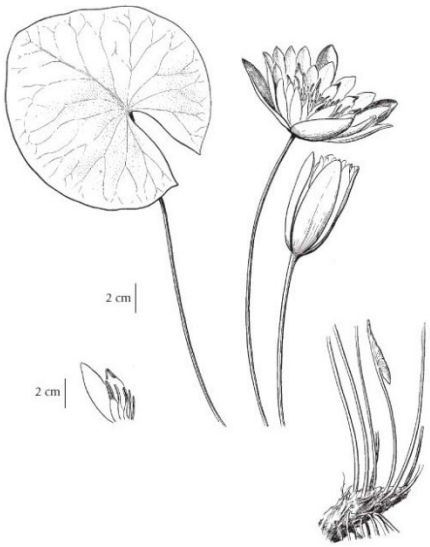


Figure 6-10. Fragrant water lily.
Source: **E-Flora BC, 2020b.**

Slender arrowhead

In Washington State, slender arrowhead, also called grass-leaved arrowhead, is designated as a Class B noxious weed. This species is not designated for control in Snohomish County meaning control is not required but is highly encouraged. Slender arrowhead is native to eastern and central North America and has only been observed in a few lakes in Washington. It was first confirmed in Lake Roesiger in 1995, although it was likely present in the 1970s (NWCB, 2004). The plant has both emergent and underwater leaves. Emergent leaves are linear or oval and grow up to 10 inches long, while submerged leaves are strap-shaped and up to 20 inches long (**Figure 6-5**). It grows best in shallow water up to 7 feet deep in static or slow-moving freshwater with stems growing to about 3 feet tall. Slender arrowhead reproduces mainly by rhizomes, but it also produces flowers and seeds. Outside of its native range, slender arrowhead is a densely growing invasive plant known to form extensive infestations in shallow waterways, restricting water flow and increasing sedimentation.
Information sources: NWCB, 2004; NWCB, 2021.

Figure 6-11. Slender arrowhead. *Source:* University of Florida, 2021.

Invasive knotweed

In the Pacific Northwest, there are four similar species of invasive knotweed that are difficult to tell apart and share similar habitat, impacts and control methods. All four of these invasive knotweed species are designated as Class B noxious weeds in Washington State. Snohomish County has designated them for control meaning it is required in Snohomish County. A distinguishing characteristic of knotweed is its swollen nodes where the leaves meet the stems. Leaves are typically 4-12 inches long, lance-shaped or oval, with small whitish flowers (Figure 6-6). Knotweeds are emersed plants that reproduce mainly by rhizomes as well as seed and create dense colonies that exclude native vegetation.
Information sources: NWCB, 2021; King County, 2021.

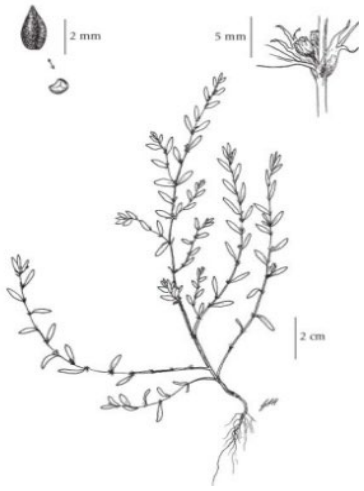


Figure 6-12. Invasive knotweed. *Source:* E-Flora BC, 2020c.

Purple loosestrife

In Washington State, purple loosestrife is a Class B noxious weed. Snohomish County has designated this weed for control in Snohomish County meaning control is required. Purple loosestrife can reach up to 10 feet tall and 5 feet wide with a persistent, perennial tap root and spreading rootstock. The magenta flowers are densely clustered on a 4-16 inch terminal flowering spike (Figure 6-7). Purple loosestrife reproduces by seed and vegetatively by stem fragments in favorable conditions and is a vigorous competitor that can quickly dominate a site and adapt to environmental changes.
Information sources: NWCB, 2021; Ecology, 2021c.

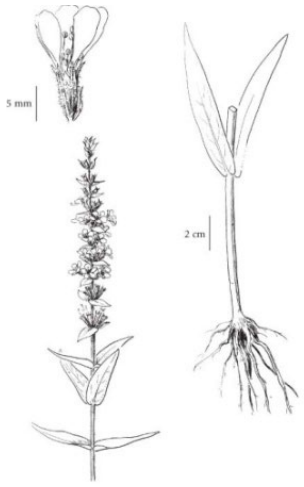


Figure 6-13. Purple loosestrife.
***Source:* E-Flora BC, 2020d.**

Yellow flag iris

In Washington State, yellow flag iris is designated as a Class C noxious weed, meaning control is not required but is encouraged. It was introduced to North America as an ornamental species in the early 1900s and was first collected in Washington in 1948. Yellow flag iris grows along the edge of water and in wetlands in water to 0.25 meters deep. The plant, including flower stalk, is up to 1.5 m tall, with leaves that clasp the stem in a fan-lake fashion (Figure 6-8) and showy yellow flowers that occur in late spring or early summer. The plants grow tightly bunched together and spread by rhizomes and seeds.
Information sources: NWCB, 2021.

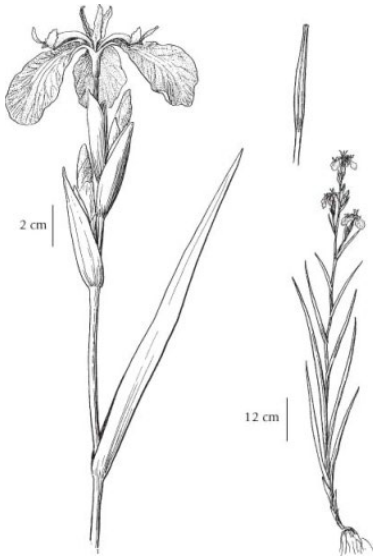


Figure 6-14. Yellow flag iris.
Source: E-Flora BC, 2020e.

6.5.2 Species Identified as a Potential Threat to Lake Roesiger

The plant that is likely the highest risk for introduction to Lake Roesiger is Brazilian elodea (*Egeria densa*). The only lake in Snohomish County with a known infestation of Brazilian elodea is Swartz Lake, located approximately eight miles south of Lake Roesiger. Since it is a private lake, the risk of introduction to Roesiger is low. However, since Roesiger is a motorized lake, it is at risk from transfer of Brazilian elodea from neighboring King County which has infestations in the Lake Sammamish and the Sammamish River. Lake Roesiger may also be at risk for infestation of the New Zealand mud snail which has been found in the Snohomish estuary as well as a few stream locations in King County.

7.0 PAST MANAGEMENT EFFORTS

A summary of the available information on previous efforts to control aquatic plants in Lake Roesiger is provided in Table 7-1. Snohomish County and lake residents have coordinated all lake management efforts since 1998 and have primarily used manual and mechanical control methods to control aquatic vegetation in Lake Roesiger.

Table 7-1. Summary of control methods previously employed in Lake Roesiger.

Control Method	Used in Lake Roesiger?	Additional Information
Manual Control Methods		
Diver or shoreline hand pulling/raking	Yes	**Eurasian Watermilfoil:** Snohomish County had managed diver hand-pulling of Eurasian watermilfoil since milfoil was first identified in the lake in 1998, with level of effort varying due to budgeting limitations and in response to milfoil density. In 2019, the Lake Roesiger Community and Boat Club took over managing and funding diving efforts. A summary of diver hand-pulling activities from 1998-2021 is provided below: • 1998-2004: diver hand-pulling for 5-7 days each summer • 2006-2010: diver hand-pulling for 2-3 days annually • 2011-2017: diver hand-pulling for 1 day annually • 2018: no diver hand-pulling due to budget shortfall • 2019: diver hand-pulling in the south and middle basins • 2021: diver hand-pulling in the north basin Note that individuals should not rake or hand-pull milfoil as the plant can easily fragment spreading plants and making the problem worse. **Fragrant water lily:** Individual property owners have been hand-pulling invasive fragrant water lily. Some landowners engaged in hand-removal by removing all rhizomes. The Community Club purchased hooks and other hand removal tools that could be used for removal. Others began regular cutting of pads to work towards eventual depletion of starch stores in rhizomes. These efforts require intensive efforts and repeated cuttings. Therefore, efforts are are limited to small areas within docks and swimming areas and in boating lanes to private docks.
Bottom barriers	Yes	The Community Club's lake health committee led an effort to obtain a community-wide Hydraulic Permit Approval (HPA) from the Washington Department of Fish and Wildlife (WDFW) for the use of burlap bottom barriers. To ensure clear navigation in the middle lake basin, the Community Club with the use of volunteers installed approximately 1,100 square feet of burlap barriers over two years, plus 240 square feet of poly framed barriers which were removed at the end of year one and not replaced. In addition, barriers have been installed in residential swimming/boating areas on an estimated 9 properties (around 7 by private contractor and 2 by homeowners).

Control Method	Used in Lake Roesiger?	Additional Information
Diver dredging	No	In 2020, a private Lake Roesiger landowner began developing a Diver Assisted Suction Harvest (DASH) system. In 2021, he began testing his system to clear small areas in front of his property.
Environmental Manipulation Methods		
Water level drawdown	No	The level of Lake Roesiger is not regulated as there is no structure in place to manipulate lake levels. Therefore, no water level drawdowns have been conducted. A continuous lake level gage was installed in February 2021, collecting hourly lake level data. A water level drawdown would impede recreational use of the lake, especially in the shallow middle basin.
Mechanical Methods		
Mechanical cutting and/or harvesting and/or rotovation	Yes	No large-scale mechanical cutting, harvesting, or rotovation has been conducted. Two lake residents have purchased mowers to clear small boating lanes. One also developed a system to collect invasive and then collect the fragrant fragments (see video). The system uses a small electric mower designed to attach to the back of a boat. It is mounted to a pvc frame which also supports a mesh basket to collect lilies. The Community Club received second boat-mounted mower as a donation which may be used to develop a similar cutting/collection system.
Sediment agitation devices such as weed rollers	No	These devices are not known to have been used in Lake Roesiger.
Biological Control Methods		
Biological control methods, such as triploid grass carp	No	Grass carp have not been used in Lake Roesiger.
Chemical Control Methods		
Chemical control methods, such as herbicides, algaecides, or alum treatments	No	Chemical control methods have not been used in Lake Roesiger.

8.0 AQUATIC PLANT CONTROL ALTERNATIVES

8.1 AQUATIC PLANT CONTROL ALTERNATIVES CONSIDERED FOR LAKE ROESIGER

Table 8-1 provides a summary of aquatic plant control alternatives that were considered for Lake Roesiger. The types of controls are divided into the following categories: chemical, manual, bottom barrier, mechanical, dredging, and biological methods. One or more control methods are commonly employed in an integrated approach, depending on several factors such as the target plant species, density of its growth, presence of desirable native plants, and location in the waterbody. Additional information on potential aquatic herbicides is summarized in Table 8-2. A summary of potential health and environmental risks of herbicides that could potentially be used at Lake Roesiger is summarized in Table 8-3. And lastly, the control strategies considered for the Lake Roesiger IAVMP are provided in Section 8.3 and summarized in Table 8-4 through Table 8-8.

Table 8-1. Summary of aquatic plant control alternatives considered for Lake Roesiger.

Type of Control	Method	Description	Advantages	Disadvantages	Cost[1]	Target Plants
None	No Action	No management strategy implemented to control and reduce aquatic plant growth	• No Cost	• No plant control • Does not maintain or improve beneficial uses	$0	None
Chemical	Aquatic Herbicides (for more details regarding potential herbicides see Section 8.2). **Cannot be done without permit and may only be performed by licensed applicator using Ecology-approved aquatic herbicides.	Chemicals applied directly to plants or lake sediments to inhibit or restrict plant growth or to kill existing plants	• Cost effective • High level of control • Specific herbicides for specific situations • Easily adaptable	• Some herbicides have ecological impacts and concerns • Potential damage to non-target plants • Permit required	$800 to $2,000 per acre	All plants, although less is known about treatment options for slender arrowhead
Manual	Hand-pulling	Plants are removed by hand (must remove roots)	• No equipment costs except collection bins and proper disposal • Can be done by trained volunteers or lake residents	• Small infestations only • Time consuming • Must capture all pieces of the plant and root system • Limited depth of removal	Market labor cost for contractor	Generally, submersed, some loosely rooted emergent plants
	Diver Assisted Suction Harvesting (DASH)	Extraction of plants using a diver, suction tube, a unique set of pumps mounted on a boat and a bagging or filtration system	• Entire plant and root system removed • Target specific species • Eradication possible with small and moderate infestations • Plants can be removed around submerged obstacles (i.e., logs)	• High costs • Slow – 0.25 to 0.5 acres removed per day depending on species & density • Must capture all pieces of the plant and root system for proper disposal • As sediments are disturbed, harder to distinguish target species	$45K to $88K per acre for fragrant water lily; may be less for other species	All plants

Type of Control	Method	Description	Advantages	Disadvantages	Cost[1]	Target Plants
Manual	Raking	Plants are raked from the shore, dock, or boat using a rake attached to a rope or long pole; Requires multiple times per year	• Low equipment cost • Easy for homeowners to implement	• Effective for control in small areas only • Plant regrowth and drift • Safety • For EWM, generates fragments that spread distribution • Affects non-target plants	Market labor cost for contractor	Shallow-rooted plants where no milfoil is present
	Cutting	Plants are cut by hand from shore, dock or boat using cutting implement; stems, flower and seed may be cut and removed from lake; Requires multiple times per year	• Low equipment cost • Easy for homeowners to implement • Can selectively cut target plants	• Effective for control in small areas only • Plant regrowth and drift • Safety • For EWM, generates fragments that spread distribution	Market labor cost for contractor	All plants, but easier with floating or emergent species
Bottom Barrier	Burlap	Burlap material installed on the lake bottom anchored by burlap covered sandbags or rocks. Compresses existing plants while blocking light to prevent further growth	• Very effective for rooted plants in small areas around docks • Can be installed by homeowners • Gas permeable	• Moderate costs • Must be monitored and plants growing on top of barriers removed by hand-pulling • Decompose every 4 years • Permitting difficult for large areas; installation under WDFW pamphlet limited to 50% or less of property per year for lake residents • Non-biodegradable materials must be removed after two years unless approved by WDFW	$22,000 per acre (assumes material and diver install needed due to depth) Costs for homeowner installation in shallow areas would be cost of barrier material	All Plants

Type of Control	Method	Description	Advantages	Disadvantages	Cost[1]	Target Plants
	Geotextiles/Plastic	Geotextile fabric or plastic installed on the lake bottom anchored by burlap covered sandbags or rocks. Compresses existing plants while blocking light to prevent further growth	• Very effective for rooted plants in small areas around docks • Can be installed by homeowners	• High costs • Must be removed every year or every 2 years if not 100% biodegradable, including weights used to keep in place • Not gas permeable • Not sustainable	$28,000 per acre (assumes material and diver install needed due to depth)	All Plants
Mechanical	Harvesters	Plants are cut several feet beneath the water surface and collected using a large barge-mounted machine, typically outfitted with a conveyor. Harvested plants are disposed off-site.	• Collects plants • Clears boating and swimming lanes easily	• High costs • Fragment drift if not properly collected • Depth limitations • Difficult to maneuver around submersed obstacles (e.g., logs) • Plant Regrowth • Increase the distribution and density of plants that spread by fragments	$150,000 to 250,000 initial purchase $33,000 to $100,000 annual operations depending on area	All plants
	Rotovation	Aquatic rotovators have underwater rototiller-like blades to uproot aquatic plants	• Clears boating and swimming lanes easily • Disrupts rhizomes and additional plant growth	• Floating plant material must be gathered • Only feasible if submersed logs not significant	$200,000 to $275,000 initial $40,000 to $100,000 annual operations Additional costs for plant retrieval $20,000 to $30,000	All plants
	Weed Cutters	Plants are cut several feet beneath the water surface using a hand-held machine or tool with no plant collection	• Low Costs • Could be implemented by homeowner • Clears boating and swimming lanes	• No plant collection • Plant and fragment drift • Depth limitation • Plant regrowth	$200 initial (hand-cutters)	Submersed or emergent

Type of Control	Method	Description	Advantages	Disadvantages	Cost[1]	Target Plants
Mechanical				• Increase the distribution and density of plants that spread by fragments	Market labor cost for contractor for frequent cutting	
Dredging	Mechanical Dredging	Sediment and plant material from the lake bottom are removed using large dredging equipment (e.g., backhoe)	• Deepens lake • Removes sediment, plants, nutrients, roots, and seeds from the system	• Very high costs • Sediment disposal • Permitting • Requires trucks for offsite disposal • Inefficient removal as water-saturated sediment will require multiple pulls	$200 to $400 per cubic yard $1.2M to $2M per acre (including sediment disposal)	All plants
	Hydraulic Dredging	Sediment and plant material from the lake bottom are removed using large dredging equipment	• Deepens lake • Removes sediment, plants, nutrients, roots, and seeds from the system • Removes slurry and transfers offsite via a closed system pipe (reduced turbidity)	• Very high costs • Sediment disposal • Permitting • Cannot be used in areas with large, submersed objects (e.g., rocks and logs) • Removes a significant amount of water • Requires large disposal and dewatering area	$165 to $200 per cubic yard $800,000 to $1.0M per acre (including sediment disposal)	All plants
	Hydro-rake	Clears unconsolidated bottom muck and vegetation	• Slightly less intrusive compared to mechanical dredging • Operates at wide range of depths	• Less sediment removal compared to hydraulic dredging • Due to size of cutter and rate of removal activity, it would be expected to take longer than hydraulic dredging	Estimated at approximately $150 per cubic yard	All plants

Type of Control	Method	Description	Advantages	Disadvantages	Cost[1]	Target Plants
Dredging	Diver Dredging	Divers (SCUBA) use a hose attached to a suction device to remove plants from the sediment underwater	• Removes entire plant including roots • Eradication possible with small and moderate infestations	• High costs • Not feasible for large infestation areas	Highly variable; $2,250 to $3,750 per day (½ acre per day)	Submersed
Biological Methods	Grass Carp	Sterile triploid carp introduced to a waterbody that consume plants	• Moderate costs • Successful in other WA lakes	• Permitting • Prefers to consume native species before target species • Requires containment to prevent escape • May not control lilies • As bottom feeders, they tend to increase turbidity	$20 to $200 per acre	Submersed
	Insects	Use of a natural enemy insect to consume varies plant parts (e.g., stems, leaves)	• Moderate costs • Successful in other WA lakes • Generally favorable public perception	• Plants are not eradicated as the biocontrol agent is dependent upon the target plant • Not effective in areas with sparse populations of target plants	Approximately $2.00 per milfoil weevil with minimum of 10,000 needed. Costs for loosestrife beetle are unknown	Available for Purple loosestrife and EWM; in development for invasive knotweed

[1]Cost estimates are based on best professional judgement and information from recent relevant projects in WA. Costs presented here are indented to illustrate a range or estimate and is not intended to represent all potential expenses as these can vary widely for some control approaches, for example, travel time, disposal fees, permitting, or monitoring requirements.

8.2 DETAILS ON CHEMICAL CONTROL OPTIONS

Given the high number of target species at Lake Roesiger and the history of concern about chemical herbicides, there was an extensive review of the chemical control options for Lake Roesiger both in terms of the efficacy of potential herbicides, their potential restrictions that may limit lake use, and their safety for both the environment and human health.

The first step in the review was to identify all potential herbicides that could be effectively used for the target plants in Lake Roesiger. Table 8-2 provides a summary of those findings along with the associated use restrictions and limitations for each chemical. Herbicides listed in bold text in Table 8-2 are those herbicides selected for potential use in Lake Roesiger.

The second step was to review the data and scientific research on the safety of each potential product. To be approved for use in water, products first go through an extensive review by the United States Environmental Protection Agency. In addition, the state Department of Ecology conducts an additional review which examines many factors including ". . . target efficacy, non-target effects, human health and ecological hazard or risk, short- and long-term toxicity, potential effects to endangered plant and animal species as well as their habitats, label restrictions, mitigation requirements, the need for post-treatment monitoring, and other key factors." (Ecology, 2017). A summary of the various human health and environmental risks from Ecology's review is provided in Table 8-3. The table is an attempt to highlight the key findings, but for further details, the full text may be viewed online[2,3]. It should be noted that for some products, Ecology has imposed restrictions/advisories (e.g., swimming) beyond those listed on the label developed as part of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFA).

Finally, some herbicide products applied to emergent, floating, or shoreline target species require the use of an adjuvant or surfactant. Adjuvant is a broad term that describes an additive than enhances herbicidal activity. Surfactants are a type of adjuvant that can accentuate the dispersal of the herbicide. For example, adjuvants may reduce the surface tension of water permitting the herbicide to improve penetration of the waxy leaf cuticle or may allow subsurface applications to sink more deeply which increases effectiveness for floating-leaved plants.

In Washington, adjuvants and surfactants must be registered for aquatic use by the Washington State Department of Agriculture (WSDA) (Appendix E). Not all adjuvants are registered for use in Washington due to known toxicity to non-target species such as juvenile mussels. Ecology also specifies adjuvants allowable under their Aquatic Plant and Algae General Permit (Appendix E in the permit document). Ecology does not allow the use of adjuvants with some herbicides registered for aquatic applications. Conversely, some adjuvants cannot be used without a significant reduction in efficacy, especially on some emergent or floating-leaved plants.

For the Lake Roesiger control, adjuvants would only be used for those herbicide applications that require an adjuvant to be effective. Additionally, the only adjuvants that will be used for the treatment are those that are classified as "practically non-toxic" in the table of adjuvants approved by Washington State Department of Agriculture that are also on Ecology's approved list in the Aquatic Plant and Algae General Permit.

[2] The 2017 Final Supplemental Environmental Impact Statement: https://snohomishcountywa.gov/836/Native-Plants; &

[3] 2000 Final Supplemental Environmental Impact Statement for Aquatic Plant management - https://apps.ecology.wa.gov/publications/SummaryPages/0010040.html

Table 8-2 Summary of potential herbicide options for treating problem plants in Lake Roesiger

Herbicide[1]	Description	Target Plants
2, 4-D Ester	Systemic herbicide that targets broadleaf (dicots) plants	Eurasian watermilfoil
Endothall (dipotassium salt)	Selective contact herbicide; damages plants at site of contact but does not impact roots or tubers	Eurasian watermilfoil Slender arrowhead (potentially, no known evaluations in the US)
Florpyrauxifen-benzyl (ProcellaCOR)[1]	**Relatively fast-acting selective systemic herbicide**	**Eurasian watermilfoil** Slender arrowhead (potentially, no known evaluations in the US)
Fluridone	Slow-acting systemic herbicide, may be applied as pellet or liquid. Moves from submersed foliage to roots or emergent foliage	Eurasian watermilfoil Fragrant waterlily
Glyphosate	Non-selective broad-spectrum herbicide. Applied as a liquid to leaves. Good applicator can be somewhat selective to remove target plants by focusing spray/application	Fragrant waterlily Invasive knotweed Purple loosestrife Yellow Flag Iris
Imazamox	**Broad spectrum systemic herbicide. Requires use of Ecology-approved adjuvant for emergent, floating or shoreline target species**	**Slender arrowhead (potentially)** **Invasive knotweed**
Imazapyr	**Broad spectrum systemic herbicide. Requires use of Ecology-approved adjuvant for emergent, floating or shoreline target species**	**Fragrant waterlily** **Invasive Knotweed** **Purple Loosestrife** **Yellow Flag Iris**
Triclopyr	Triclopyr TEA registered for aquatic use. Can be applied as liquid or granular form. Fast-acting systemic, selective herbicide. Most commonly used for Eurasian watermilfoil control.	Eurasian watermilfoil Fragrant waterlily Purple loosestrife Invasive Knotweed

[1] Products recommended for use in Lake Roesiger are in **Bold Print**

[2] Florpyrauxifen-benzyl is currently only available within the United States under the product name ProcellaCOR.

Table 8-3. Summary of potential health and environmental risks of herbicide application.

Note: The information provided in this table was compiled from the Supplemental Environmental Impact Statement for State of Washington Aquatic Plant and Algae Management (Ecology, 2017) and does not represent the opinions of Snohomish County, Tetra Tech, or ESA.

Human Health Risks	Environmental Risks	Treatment Limitation or Other Specific Restrictions
2, 4-D Ester		
In 2015, the International Agency for Research on Cancer (IARC), classified 2,4-D as "possibly carcinogenic to humans" based on inadequate evidence in humans and limited evidence in experimental animals. There is strong evidence that 2,4-D induces oxidative stress, a mechanism that also occurs in humans, and moderate evidence that 2,4-D causes immunosuppression, based on both in vivo and in vitro studies. However, epidemiological studies did not find consistent increases in risk of cancers in relation to 2,4-D exposure (IARC, 2015 in Ecology, 2017).	2,4-D Ester has shown acute toxicity to fish, particularly to rainbow trout fry and fathead minnow fingerlings (CSI 2001 in Ecology, 2017). However, field studies have indicated that the use of 2,4-D BEE granular pellets has no direct impact on fish populations (Shearer and Halter, 1980), presumably due to the insolubility of these granular materials. Thus, as long as label specifications are followed, field data have indicated that use of 2,4-D aquatic use products should be safe to aquatic biota at label-specified use rates (Ecology, 2017).	• Fish timing window applicable to avoid potential fish impacts. • Swimming restriction during treatment, and for 24 hours post-treatment (in the treated area). • See label, irrigation restrictions apply and testing may be required.
Endothall (dipotassium salt)		
The main adverse health effect of endothall appears to be associated with irritation potential. Endothall falls under FIFRA (Federal Insecticide, Fungicide and Rodenticide Act) Toxicity Category I as causing severe irreversible eye damage. Irritation effects to the gastrointestinal tract were also noted in some animals in the mid and high dose test groups in the endothall sub-chronic and chronic oral dosing and feeding studies. Label directed use of the endothall products for aquatic weed control, and dilution and degradation of the chemical following application, reduces the potential for overexposure (Ecology, 2001)	It is recommended that exposure of wild fisheries to endothall should be avoided, although toxicity testing have suggested that the most common forms of endothall, including the dipotassium and mono salts, will not cause acute or chronic harm to non-target aquatic animals when label specifications are followed (Ecology, 2017).	• Swimming advisory in the treated area during treatment, and for 24-hours post-treatment for protection against mild eye irritation • A 24-hour boating advisory is recommended for boaters entering areas of treatment for protection against mild eye irritation due to aerial drift . • Fish timing window applicable to avoid potential fish impacts. Further seasonal restrictions for endothall treatments may be advisable to protect both the fisheries and human health when recreational or commercial fishing seasons are active. • No application within 400 ft of an outlet stream if there is an outflow.
Florpyrauxifen-benzyl (ProcellaCOR)		
Based on the current understanding of available environmental fate, chemistry, toxicological, and other data, there is little to no cause for concern to human health or ecotoxicity for acute, chronic, or subchronic exposures to	ProcellaCOR™ has undergone extensive ecotoxicological testing. No toxicity was observed for avian, fish, or other species exposed to the herbicide in acute and long-term studies (Ecology, 2017).	• Irrigation restrictions during treatment are recommended to prevent undesired spread to terrestrial plants.

Human Health Risks	Environmental Risks	Treatment Limitation or Other Specific Restrictions
ProcellaCOR™ formulations (Ecology, 2017).		
Fluridone		
Fluridone has been found to be non-teratogenic, mutagenic, or carcinogenic to humans (Ecology, 2000). There are no label restrictions against drinking, swimming, or fishing in water treated with fluridone (Ecology, 2017).	Fluridone is not expected to have adverse effects on fish or aquatic invertebrates based on a range of aquatic species tested (Hamelink et al. 1986 in Ecology, 2017).	• Fish timing window applicable to avoid potential fish impacts. • Monitoring of impacts to native/desirable aquatic plant species (e.g., bladderwort, elodea, pondweeds, water celery, some shoreline grasses) is recommended with mitigation measures implemented as needed. • Fluridone application limited to no more than 40% of the littoral zone as per Ecology guidance.
Glyphosate		
Glyphosate is classified as "probably carcinogenic" to humans by the IARC based on evidence in experimental animals. However, the levels of anticipated glyphosate exposure experienced by humans, through current use patterns, are not expected to be carcinogenic (IARC/WHO, 2016 in Ecology, 2017).	Glyphosate shows relatively low toxicity to birds and mammals but can impact animals at high doses (Evans and Batty, 1986; Nature Conservancy, 2001 in Ecology, 2017). Glyphosate could present a potential hazard to non-target, native plant species or terrestrial plants through the use of contaminated irrigation water. Overapplication of glyphosate can result in oxygen depletion and potential fish kills. .	• Irrigation restrictions during treatment are recommended to prevent undesired spread to terrestrial plants. • Fish timing window applicable to avoid potential fish impacts. • Only one-third to one-half of the water body is to be treated at any one time to prevent oxygen depletion and resultant fish kills.
Imazamox		
Imazamox targets an enzyme found only in plants and microorganisms, and therefore does not present a human health risk. Standard toxicity studies involving oral, dermal, ocular, or inhalation exposure have reported no remarkable signs of toxicity. No signs of carcinogenicity have been reported in mammals, and Imazamox is classified as "not likely to be a human carcinogen" by the EPA (USDA, 2010).	Extensive toxicity testing (as summarized by Durkin (2010), Schumacher (2014), and Ecology (2012) show that imazamox is practically non-toxic to fish, birds, mammals, and invertebrates, including insects such as honey bees (taken from Ecology, 2017). Imazamox could present a potential hazard to non-target, native plant species (e.g., cattail, pondweeds, bulrushes) or terrestrial plants through the use of contaminated irrigation water.	• Irrigation restrictions during treatment are recommended to prevent undesired spread to terrestrial plants. • Monitoring of impacts to native/desirable aquatic plants species (e.g., cattail, pondweeds, bulrushes) is recommended, and potential mitigation measures may be implemented as needed.
Imazapyr		

Human Health Risks	Environmental Risks	Treatment Limitation or Other Specific Restrictions
Imazapyr targets an enzyme not found in animals and mammalian toxicity studies indicate low and essentially undetectable toxicity for imazapyr. Based on numerous, consistent studies, Imazapyr is classified by the EPA with "evidence of non-carcinogenicity" (Ecology, 2017; USDA, 2011).	A human health and ecological risk assessment for imazapyr (WSDA, 2009) found that the mechanism for phytotoxicity, interruption of plant protein synthesis used by this herbicide, is generally not relevant or harmful to animal species such as birds, mammals, fish, or invertebrates (taken from Ecology, 2017). Imazapyr could present a potential hazard to non-target, native plant species or terrestrial plants through the use of contaminated irrigation water.	• Irrigation restrictions during treatment are recommended to prevent undesired spread to terrestrial plants. • Monitoring of impacts to native/desirable aquatic plants species (e.g., cattail, pondweeds, bulrushes) is recommended, and potential mitigation measures may be implemented as needed.
Triclopyr		
An overview of the toxicology information indicates that triclopyr shows only a low degree of systemic toxicity based on findings from a variety of acute, subchronic, and chronic toxicology studies. The main adverse health effect appears to be associated with eye contact with concentrated triclopyr which can result in severe eye irritation and damage (Ecology, 2017).	Toxicity studies indicate that triclopyr and its products used as aquatic herbicides do not pose a significant acute or chronic risk to wild birds or terrestrial mammals. Most species of fish are tolerant of triclopyr TEA and it is considered to have very low toxicity to environmentally relevant fish and aquatic invertebrates (Ecology, 2004).	• Swimming advisory during treatment and for 12-hours post-treatment in treated area. • Regarding mitigation for aerial drift, irrigation, surface water, fish, and other wildlife, potable water, and fishing or consumption of fish or shellfish, Ecology (2004) stipulates that following label directions for triclopyr TEA should be adequate for avoiding adverse environmental impacts. • Fish timing window applicable to avoid potential fish impacts.

[1] Products recommended for use in Lake Roesiger are in **Bold Print**

8.3 CONTROL STRATEGIES CONSIDERED

Prior to identifying control strategies, the steering committee prioritized the target plants and prevention in order of importance for control from highest to lowest. The community survey affirmed the prioritization with the inclusion of prevention as follows:

1. Eurasian Watermilfoil (EWM)
2. Fragrant Waterlily
3. Prevention of new invasive plants
4. Shoreline invasive plants (invasive knotweed, purple loosestrife and yellow flag iris)
5. Slender Arrowhead

The next step was to identify attainable goals for each plant and the associated suite of control strategies or prevention strategies to reach that goal as shown in Tables 8.4a to 8.4e. The tables also provide preliminary estimated costs for each plant management approach. Finally, the consultants, Tetra Tech & ESA, provided a recommendation based on their technical expertise and experience as to whether the community should consider each suite of control options.

The tables were presented to the community steering committee and their feedback was used to help narrow down the suite of control options to present to the greater community. The results of the steering committee feedback can be found in the last columns of Table 8-4 through Table 8-8. Additional details on the options selected for further consideration are provided in the next section.

8.3.1 Eurasian Watermilfoil (EWM)

8.3.1.1 Management Goals:

EWM was identified by the steering committee as the highest priority for aquatic plant control. Based on aquatic plant surveys in 2019 and 2021, the EWM infestation is currently at the lowest level since the control work began back in the 1990's (Section 6.0). The low levels of EWM make eradication within the next five years a potentially attainable goal. The alternative goal is to decrease the current milfoil and prevent it from spreading further (status quo options) (Table 8-4).

8.3.1.2 Control Methods:

EWM control can be challenging as the plant spreads easily through fragments. When the plant breaks into pieces, fragments as small as one or two inches can grow into a new plant. Therefore, any method that cuts the plant such as mechanical harvesters can make an infestation worse. Instead, manual methods that minimize fragmentation or chemical options are the most effective.

Manual Methods:

Since Lake Roesiger still has low levels of EWM, the recommended option for control is to have divers conduct surveys and use hand-pulling and/or diver-assisted suction harvesting (DASH) to remove any detected plants. DASH is a method whereby divers hand-pull vegetation from the lakebed that is then fed into a suction pipe to the lake surface where it is sorted, water is drained, and plants are bagged for off-site disposal.

Diver hand-pulling typically works well when there are a few scattered plants. However, if patches develop, DASH can be advantageous as groups of plants can be removed more quickly and with less sediment disruption which helps maintain visibility. Diver hand-pulling and DASH have been used successfully for control of scatted EWM plants and small EWM patches at Lake Roesiger, Lake Goodwin, and Lake Shoecraft.

Chemical Methods

If EWM did begin to spread more aggressively or develops into larger patches throughout the lake, the recommended alternative would be the use of aquatic herbicides. While there are several herbicides that can be effective for EWM control, the best option identified at this time is the florpyrauxifen-benzyl which is sold under the trade name ProcellaCOR.

As discussed in Section 8.2, all chemical options were closely reviewed in terms of their efficacy, their human health and environmental safety and the restrictions they may impose on lake users. From this review, florpyrauxifen-benzyl was selected as the recommended herbicide for EWM control at Lake Roesiger should it become necessary. This product is currently only sold under the tradename ProcellaCOR. It was chosen based on the following:

Proven efficacy –

- Efficacy has been demonstrated locally through treatments at Lake Goodwin and Lake Shoecraft by Snohomish County and Lake Ballinger by the City of Edmonds and the City of Mountlake Terrace.
- The Lake Shoecraft treatment resulted in the reduction of 12 acres of milfoil down to one plant found the following year. The Goodwin treatment reduced the milfoil down from 26 acres to 30-40 plants the following year.
- The chemical is highly selective for EWM. The only off-target effects seen at Lakes Goodwin and Shoecraft was a stressing of invasive fragrant waterlily.

- **Few use restrictions** (See additional info in Section 8.2).
  - There are no use restrictions for ProcellaCOR

- **Favorable toxicological profile**
  - US EPA concluded that the profile for florpyrauxifen-benzyl indicates that this compound is of low acute and subchronic toxicity to both humans and terrestrial and aquatic freshwater organisms when applied at recommended label rates (EPA 2017 and included in US EPA docket No. HG-OPP-2016-0560-0065).
  - EPA concluded that the overall profile appeared more favorable when compared to the registered alternatives for the proposed use patterns for noxious species such as invasive watermilfoils, and that the reduction in risk pertaining to human health was the driving factor in this determination (Ecology 2017).

8.3.1.3 Recommended Approach

Tetra Tech and ESA's recommended approach to achieve the goal of eradication is to continue with diver-hand pulling and/or DASH but to significantly increase the frequency so that the entire lake is surveyed annually. This would be an increase from the current effort where the entire lake is surveyed every two to three years. Annual surveys are recommended for the first five years. If plants are no longer detected during these surveys, it is recommended that monitoring surveys continue to be conducted, but at a lower frequency of every 2 to 3 years. This would both ensure eradication has been achieved and help to detect new infestations early so they can be quickly controlled. They also recommended approving ProcellaCOR as a potential tool should conditions worsen rendering manual options ineffective.

The majority (75%) of the steering committee supported the goal of eradication with the recommended method (Table 8-4). The remaining 25% supported continuing with the alternative goal which is to continue trying to reduce coverage in the lake and prevent further spread through the current effort of diving every 2-3 years.

Table 8-4. Management Options at a Glance: Eurasian watermilfoil (gray shading indicates primary control method)

Management Goal	Control Strategy	Preliminary Costs and Assumptions	Estimated 5-Year Cost[1]	Tetra Tech/ESA Recommendation	Steering Committee Voting Results
All Basins					
1. Eradicate remaining small infestations within the lake	Manual, includes annual surveying (diver hand-pulling)	• $12-20K for 3-5 days for entire lake survey and hand-pulling. • Annual surveys should be conducted for at least 5 years post eradication	$60-80K	Recommended for further consideration	75%
	Chemical, Florpyrauxifen-benzyl	• $800 - $1,000 per acre, as needed; • would only be needed if spread to 0.5 acre or more (currently less than 0.2 acres)	$0-5k (if needed)		
2. Reduce current coverage in lake and prevent further spread (status quo)	Containment – diver survey and hand-pulling every 1-3 years	• $4-5K per day; currently 3 days every other year.	$12-15K	Not recommended for further consideration	25%

NOTES:

[1]Costs are estimated for first five years of control. Continued control work will likely be necessary beyond five years.

8.3.2 Fragrant Water Lily

8.3.2.1 Management Goal:

Invasive fragrant waterlily was identified by the steering committee as the second highest priority for aquatic plant control. The fragrant waterlily infestation is extensive as it now covers 29 acres in the middle basin. It has been progressively spreading to the north and south basins and now covers 1.25 acres in these two basins. The magnitude of the infestation presents significant challenges for successful control. The longevity of the infestation also poses challenges as the middle basin has an extensive rhizome network by which lilies can spread and a rich seed bank for new growth following any type of control. In addition, the decades of biomass buildup from lily rhizome decay have led to large accumulations of organic material or “muck”.

Because of these challenges, eradication is not likely achievable. Instead, the steering committee laid out a series of goals that are incremental steps towards eradication, including the following:

- Prevent further spread of invasive lilies within the lake
- Improve navigation between basins and keep main navigation channels open
- Open navigation paths to lake residences (i.e., end of docks)
- Significantly reduce the coverage of fragrant waterlilies and slow new sediment buildup
- Reduce historic sediment buildup within lily pad beds

Table 8-5 lays out the potential management goals along with the suite of control options that would be appropriate to achieve these incremental goals.

8.3.2.2 Control Methods:

Manual Methods – Cutting, Pulling

Manual cutting and pulling can be highly effective for fragrant water lily control but is also labor and time intensive. To dig or pull the plant in shallow areas, weed hooks can be used to remove the rhizomes completely, preventing future growth. A less physically intensive approach is to simply cut the lily pads at the surface. This can be done from a dock or shore with a weed razer or similar tool. Alternatively, pads can be cut by hand via a boat. To be effective, cutting must occur 4-6 times in the growing season and may require multiple years of cutting for complete control. Repeated cutting is needed because of the large amount of starch reserves stored up in the lily rhizomes which can be used for new growth. When cutting lilies, the pads should be collected and allowed to dry away from the lake before disposing or composting. If left in the water, the pads will decay, releasing nutrients and potentially causing localized algal blooms.

Because of the high amount of labor required, cutting and pulling cannot achieve large-scale control and are only a recommended approach for small areas. However, repeated cutting is highly effective when dealing with a new or small infestation of lilies. Looking out for and immediately cutting new pads can prevent the establishment of rhizomes and prevent conditions from worsening. Cutting and pulling can also be used effectively to target high recreational use areas such as by docks, swimming areas, or to clear navigation paths from private docks to open water.

Bottom Barriers

Bottom barriers are sheets of synthetic fabric or burlap that are installed on the lake bottom, anchored by rocks or burlap-covered sandbags. For lily control, they must be left in place for a sufficient time to deplete the rhizome of all starch reserves. They can be highly effective if installed properly, which can be challenging when working with fragrant waterlily. However, they do have off-target impacts to other native

plants (if present) and benthic organisms. Once installed, bottom barriers must be monitored and maintained. Gasses emitted from plant decomposition can unseat the barriers requiring re-anchoring.

Permits are required for bottom barrier installation. Depending on the project size, the permit will either be covered via the Washington Department of Fish and Wildlife's Aquatic Plant handbook or through a Hydraulic Project Approval (HPA). To be protective of lake health, there are limits to the size of bottom barrier coverage. In addition, synthetic barriers must be removed per permit requirements to ensure they don't have long-term harmful effects. Burlap barriers are preferred as they typically degrade within four years. Removal of burlap barriers is not required if covered by the handbook. However, if an HPA is required, removal of burlap barriers may be required by Fish and Wildlife.

The Lake Roesiger Community and Boat Club and private individuals are already successfully using bottom barriers as a control method in strategic areas including navigation channels and high use recreational areas. The Club applied for and received an HPA for interested community members and installed the barriers themselves.

Unfortunately, bottom barrier installation could not be effectively scaled up to address the magnitude of the lily infestation due to the high cost of installation, the off target impacts and the required maintenance on such a large scale. Like hand-cutting, bottom barriers are recommended only to supplement other approaches in small, targeted areas such as by docks, swimming areas, or to clear navigation paths from private docks to open water.

Manual – Diver Assisted Suction Harvesting (DASH)

Another method that was closely looked at for lily control was DASH. This method uses divers to hand-pull vegetation from the lakebed that is fed into a suction pipe to the lake surface where it is sorted, water is drained, and plants are bagged for off-site disposal. The use of DASH for fragrant waterlily control is much more labor intensive than for other species because the rhizome biomass must first be manually cut for removal. However, if implemented, it can be highly effective. It also has the benefit of removing the lily rhizomes which will prevent further re-growth and reduce organic matter buildup that would otherwise occur as the rhizomes decay. Because of the high labor intensity, the area of control that can be reasonably achieved by DASH is limited. In addition, it is difficult to find willing contractors to conduct DASH for lily control and, because it is labor intensive, the number of acres that can be controlled is limited. Therefore, DASH would be most appropriate to control small patches in the north and south basins and in strategic locations in the middle basins such as docks, swimming areas, or to clear navigation paths from private docks to open water.

Mechanical - Harvesters

Aquatic harvesters are commercial machines designed to cut aquatic vegetation and then collect the cut material, which is then disposed of away from the lake. Harvesters can cut large areas of aquatic vegetation but are limited by the need to offload and dispose of the cut vegetation. Similar to hand-cutting, harvesters are most effective with 4 to 6 cuttings per growing season and potentially over multiple seasons to fully deplete the starch reserves in the lily rhizome.

Unfortunately, harvesters are limited in the areas they can be used as they can only operate in deeper water and/or in areas without significant woody debris or underwater obstacles. For Roesiger this means they will be most effective if used in the navigation channel portion of the middle basin. Another disadvantage to harvesters is that all plants in the harvester pathway will be affected. In addition, there is a risk for plant fragments spreading in the cutting process. This would be especially high risk if there was a plant present that spreads by fragments such as Eurasian watermilfoil. It would be essential to ensure that any harvesting work is timed to be after Eurasian watermilfoil surveys and removal. Spreading seeds or rhizomes of lilies from the harvesting is also a risk though there is already a high amount of dispersal with the size of the current infestation.

Mechanical – hydraulic dredging

Hydraulic dredging is a system that uses underwater cutting devices where material is then mixed with the muck and pumped through a floating pipeline for offsite dewatering and disposal. Hydraulic dredging has the potential to not only remove a high amount of the plant biomass but also remove approximately 3 feet of muck. There are limitations on the dredge as it cannot operate in areas with high wood density or other underwater obstacles. The estimated lily reduction that hydraulic dredging could achieve is 80-90% of the lilies in the middle basin. Other methods such as DASH would need to be used in areas with high densities of logs and for the small patches in the north and south basin. There will also need to be follow-up control in dredged areas as lilies will likely re-emerge from any remaining rhizomes or seeds.

While it can be highly effective, feasibility at Lake Roesiger is limited. The permits required are extensive and can be challenging to obtain. It is also extremely expensive due to the high costs of offsite disposal as well as the permitting and mobilization costs. For the 25 surface acres listed in goal 1, the estimated cost is $20 to $25 million for a one-time dredging event.

Chemical Treatment

Chemical treatment is the application of a US EPA- and Ecology-approved aquatic herbicide to reduce the growth of target plants. This approach is considered the most efficient method to control large infestations of aquatic plants and has been widely used throughout Washington state and in Snohomish County for the control of fragrant waterlily. All aquatic herbicides are restricted-use and only licensed aquatic herbicide applicators can purchase and apply these herbicides. Permits are required before applying herbicides in water.

Applications have been shown to substantially reduce biomass within one growing season; however, as with most control measures, repeated treatments are generally necessary to fully kill the rhizomes (horizontal roots) and deplete the seed bank over time. To maximize effectiveness for fragrant water lily, applications are typically conducted in the late summer and early fall when the plant is translocating nutrients to its rhizomes. They are typically conducted via a foliar application where the pads are sprayed from a boat. This process allows some selectivity so invasive plants can be targeted while avoiding patches of native plants.

Because of the extensive infestation and the large amount of lily biomass, herbicide treatments would need to be carefully planned in Lake Roesiger as the treatment will lead to the decay of plants. Too much decay in one area could result in localized drops in dissolved oxygen. Therefore, treatments in one year would need to be spaced out over time to allow for oxygen recovery. Treatments would also need be conducted incrementally over several years to achieve the full target area of control. In addition, a systemic herbicide is preferable as it leads to slower plant decay.

Using a chemical approach, it is estimated that there could be a 40 to 50% reduction of lily coverage in the middle basin plus the eradication of lilies in the north and south basin over five years. This level of treatment would significantly slow the filling of the lake basin, particularly in the main navigation channel. The estimated cost for treatment with the recommended herbicides is on the order of $800 - $2,000 per acre for treatment not including permitting or other costs.

Ongoing efforts through one or more control methods would be needed beyond five years to prevent re-growth in the treated areas and could also continue to reduce the overall lily coverage. Landowners in the north and south basin would also need to be vigilant about re-spreading and immediately cut any new lily pads before significant growth occurs.

Recommended Herbicides

As first introduced in Section 8.2, all chemical options were closely reviewed in terms of their efficacy, human health and environmental safety, and the advisories/restrictions they may impose on lake users.

From this review, imazapyr and imazamox emerged as the two products recommended for fragrant waterlily control at Lake Roesiger. These products were chosen based on the following:

- **Proven efficacy**
  - Efficacy has been demonstrated locally through treatments in King County including Portage Bay, Lake Union (Imazamox), Beaver Lake (Imazapyr) and Shadow Lake (Imazamox).
  - Monitoring data from Shadow Lake resulted in a 78% reduction of the 2.8 acre lily infestation)

- **Few use restrictions**
  - Imazamox and imazapyr have no additional Ecology restrictions/advisories or treatment limitations on recreational use of the lake following application. There are label restrictions on irrigation that may apply to the limited number of landowners with water rights for that use. There are no known potable water intake rights that could result in use restriction.

- **Favorable toxicological profile based on Ecology, 2017**
  - Extensive toxicity testing (as summarized by Durkin (2010), Schumacher (2014), and Ecology (2012)) show that imazamox is practically non-toxic to fish, birds, mammals, and invertebrates, including insects such as honeybees.
  - The Washington State Department of Agriculture (WSDA) evaluated the ecological risk for terrestrial animals, terrestrial plants, and aquatic animals (fish and invertebrates). Results indicated that both terrestrial and aquatic species are not likely to be adversely affected by imazapyr under prescribed conditions.
  - For imazapyr, there is a preponderance of toxicological data that demonstrate no adverse effects are likely in mammals, birds, fish, and terrestrial or aquatic invertebrates (taken from Ecology 2017).
  - For both imazamox and imazapyr, Ecology (2017) concluded that the most ecological impacts could come from direct herbicidal effects to non-target species or indirect effects due to changes in species composition.
  - Adjuvants – both of these chemicals typically require the use of an adjuvant. As discussed in section 8.2, only adjuvants that are listed as “practically non-toxic” by the Washington Department of Agriculture would be considered for use.

8.3.2.3 Recommended Approach for Fragrant Waterlily Control.

The range of management goals and the associated suite of control methods to achieve fragrant waterlily control goals for, first, the middle basin and then the north and south basin are laid out in Table 8-5. Below is a summary of the technical recommendations and committee preferences for each. Overall, there was a diverse range of views for both the best goal and control option. Therefore, it was decided that the community should be presented with several options to choose from to make a final choice.

For the Middle Basin, Tetra Tech and ESA **Recommended** two options for further consideration as follows:

- Management Goal 2 – Option 1 Chemical Treatment – this effort provides the highest degree of control with the greatest cost efficiency. 50% of the steering committee supported this as the best option.

- Management Goal 3 - Harvesting – this effort does not have as widespread control as the cost is much higher per acre than chemical treatment. However, it is the only non-chemical option that meets some of the community's goals for keeping navigation open. The steering committee did not support this as the best option as they either wanted to manage fragrant waterlily to a higher level of control or not control.

Tetra Tech and ESA did **Not Recommend** further consideration of the remaining options as follows:

- Management Goal 1 - Hydraulic dredging – while this option provides a high level of control it was not recommended due to high costs and difficulty in funding and permitting. 16% of the steering committee selected this to be the best option.
- Management Goal 2 Option 2 - DASH – this option was also rejected for further consideration because of the high associated costs and required level of labor. Even if this option was selected, it may be difficult to find a contractor that would be willing to take on a contract of this magnitude. 17% of the steering committee did support this as the best option.
- Management Goal 4 Status Quo – this option was not recommended as no action or status quo will not address the problems identified including the continued rapid sedimentation of the middle basin that harms navigation and recreation. 17% of the steering committee supported the status quo as the best option.

For the North and South Basins fragrant water lily infestations, Tetra Tech and ESA **Recommended** all of the management goals and control options for further consideration. Not considered further was the status quo option of no action. The steering committee was evenly split between Management Goal 1 of eradication with chemical treatment and Management Goal 3 containment using hand cutting.

Table 8-5 Management Option at a Glance: Fragrant Water Lily (gray shading indicates primary control method) by basin

Management Goal	Control Strategy	Preliminary Costs and Assumptions	Estimated 5-Year Cost[1]	Tetra Tech/ESA Recommendation	Steering Committee Voting Results
Middle Basin					
1. Target of 70-80% reduction of lilies (20-22 acres) and up to 3 ft depth of muck reduction. Focus is center navigation channel and channels to residences	Mechanical (hydraulic dredging) for lily control and muck reduction	• $20M - $25M, one-time event	$20M - $25M	Considered but not recommended	16%
	Manual (DASH)	• Post dredging cleanup of any surviving lilies and channel maintenance • $45K - $88K/acre, as needed	$100K		
	Manual (non-diver)	• Channel maintenance • Market labor cost for contractor; or volunteer/landowner	NA[2]		
	Bottom Barrier (diver install)	• Dock/swimming maintenance per discretion of landowner	NA[2]		

Management Goal	Control Strategy	Preliminary Costs and Assumptions	Estimated 5-Year Cost[1]	Tetra Tech/ESA Recommendation	Steering Committee Voting Results
		• Residences only, [add in to cost per property based on community feedback]			
2. Target of 40-50% reduction (12-15 acres) of lilies in center navigation channel and channels to residences	**Option 1 – Chemical, imazamox and/or imazapyr**	• 12-15 acre treatment; Whole area cannot be treated at once and would likely be 2 times per year over 5 years • $24-30K per year, decreasing as infestation decreases	$110-150K	Recommended, considered further	50%
	Manual (DASH)	• Focused efforts on navigation channels as supplement to chemical treatment • $1.6-2K per day for 800 sq. feet	TBD		
	Manual (non-diver)	• Channel maintenance • Market labor cost for contractor; or volunteer/landowner	NA[2]		
	Bottom Barrier (diver install)	• Dock/swimming area maintenance per discretion of landowner • Cost	NA[2]		
2. Target of 40-50% reduction (12-15 acres) of lilies in center navigation channel and channels to residences	**Option 2 - Manual (DASH)**	• $1.6-2K per day for 800 sq feet • May not be feasible pending finding willing contractor for such a large scope project	$900K-1.8M	Considered but not recommended	17%
	Manual (non-diver)	• Channel maintenance, dock/swimming areas • Market labor cost for contractor; or volunteer/landowner	NA[2]		
	Bottom Barrier (diver install)	• Dock/swimming area maintenance per discretion of landowner • Residences only, • Cost	NA[2]		
3. Target of 15-20% reduction (4-6 acres) maintaining center navigation channel and deeper portions of	Mechanical - Harvester	• $1.5-2K per day • Assume 4 days of labor 4X a year including mobilization/demobilization • Unable to operate in shallow areas or where logs are present; • Not specific to invasive water lily; non-target plant impacts	$24-32K	Recommended, considered further	0%

Management Goal	Control Strategy	Preliminary Costs and Assumptions	Estimated 5-Year Cost[1]	Tetra Tech/ESA Recommendation	Steering Committee Voting Results
residential channels					
4. Status quo	Individual actions by landowners; limited bottom barriers by Community Club		?	Not recommended for further consideration	17%
North and South Basins					
1. Eradication of isolated patches (1.25 acres) within 5 years	Option 1 – Chemical, imazamox and/or imazapyr	• 1.25 acre treatment 2 times per year for at least 3 years • $1.2-2.5K per year	$3.6-$7.5K	Recommended, considered further	50%
	Manual (non-diver)	• Maintenance pulling by landowner • Market labor cost for contractor; or volunteer/landowner	NA[2]		
1. Eradication of isolated patches (1.25 acres) within 5 years	Option 2 - Manual (DASH)	• Maximum feasible is about 0.5 acres per year • $1.6-2K per day for 800 sq feet; • May not be feasible pending finding willing contractor	$125K	Recommended, considered further	0%
	Manual (non-diver)	• Maintenance pulling by landowner • Market labor cost for contractor; or volunteer/landowner	NA[2]		
2. Containment	Manual (non-diver)	• Cutting/pulling of plants when spread to new areas; up to individual landowner • Market labor cost for contractor; or volunteer/landowner	NA[2]	Recommended, considered further	50%
3. Status quo	Limited landowner manual control		$0	Not recommended for further consideration	0%

1. Costs are estimated for first five years of control. Continued control work will likely be necessary beyond five years.
2. Costs assumed to be incurred by individual landowner so not included in total
3. Estimated perceived success is a subjective value that describes the level of control at any given time as plants continue growing
4. Diver Assisted Suction Harvesting (DASH)

8.3.3 Invasive Species Prevention

8.3.3.1 Management Goals

The prevention of new invasive species was recognized as a high priority by the steering committee. Preventing the introduction of any new species and having early recognition of species is critical to ensuring the long-term health of the lake. It also cannot be overstated that prevention of new introductions and rapid response to those introductions provide significant cost savings over controlling an invasive species once established. While this plan focuses on invasive plants, the same efforts can also help prevent the introduction of invasive animals such as zebra mussels or New Zealand mudsnails.

The primary vector by which new invasive species can be introduced to the lake is through contaminated boats coming from other lakes into Lake Roesiger. Similarly, boats leaving Lake Roesiger can also carry invasive species such as slender arrowhead to other nearby lakes. Cleaning, draining and drying boats when leaving any lake can help prevent the spread of invasive species. The cleaning includes removing plant fragment from boats, trailers, and other equipment that was in contact with water. Draining includes cleaning any bilge water or other water remaining in the boat hull or live wells. Drying helps to kill any invasive plants or animals that may have been missed which is especially important for preventing the spread of invasive mussels and snails.

8.3.3.2 Control Methods

Outreach and Education:

Outreach and education are the primary methods to prevent the spread of invasive species The target audience for efforts would include both external lake users as well as lake residents that take their boats to other lakes and then return to Lake Roesiger. Methods of outreach may include:

- **Boat Launch Education**: The best method of reaching external lake users is to provide education at the boat launch while launching and leaving the lake. One approach successfully used at other lakes is for community members to volunteer and provide outreach materials to lake users - especially on busy summer weekends. There are many good outreach materials developed by other jurisdictions such as Lake Whatcom that could be adapted for this purpose at a relatively low cost. This effort would require coordination and implementation by the Lake Roesiger Community and Boat Club.
- **Outreach and Education campaign** – To reach Lake Roesiger residents an outreach campaign focused on Cleaning, Draining and Drying boats. Methods to reach residents would include email, social media and mailers. This effort could complement efforts to educate landowners on invasive shoreline plants and control methods.
- **Boat Launch Signage** – A passive method of reaching external lake users would be posting additional signage at the boat launch to encourage Cleaning, Drying and Drying your boat. To be effective, the sign would have to be highly visual and easy to read. However, the Roesiger boat launch already has significant number of signs including the lake rules, cautions about wake and a large, highly visible sign on preventing the spread of Eurasian watermilfoil. Adding more signs without removing any current signs may actually harm messages as lake users may experience sign fatigue.

Boat Washing Station:

An additional approach to reduce the risk of invasive species introduction and spread to other lakes is to install a boat washing station at the boat launch. The goal would be to have boat users wash their boat and thoroughly drain it prior to launching and again after leaving the lake. This method can be highly

effective in preventing invasive aquatic plants from leaving the lake. However, it will not necessarily prevent the spread of some invasive animals like New Zealand mudsnails unless the boat wash includes high temperature water which also poses a safety risk or boat owners follow guidelines to allow boats to fully dry before using in another waterbody.

There are a variety of options for boat washing stations from unmanned self-service stations to full inspection stations staffed with people requiring washing. Traditional water systems require upgrades to the launch to add power and water. They would require long-term investments for utilities, upkeep and potentially staffing.

Recently, new boat washing station models have a waterless model with cleaning tools to dry their boat and wells and clean their hulls. They can be employed without water and have optional solar panels for power. These models do require an annual software description, pumping and upkeep costs. They also avoid issues with stormwater management associated with water-based boat washing stations.

One of the requirements needed for a successful boat wash at the launch is to have a good location to be able to install the launch that does not impede the flow of traffic into and out of the lake. The Roesiger launch is highly restricted in terms of space for maneuvering boats especially on high traffic weekends. Due to these restrictions and the long-term investment in upkeep, a boat washing station is not recommended at this time.

Table 8-6 Management Options at a Glance: Invasive Species Prevention (gray shading indicates primary control method)

Management Goal	Control Strategy	Preliminary Costs and Assumptions[1]	Estimated 5-Year Cost[1]	Tetra Tech/ESA Recommendation	Steering Committee Voting Results
All Basins					
1. Reduced risk of new invasive species infestation	Boat Launch Education through Use of Volunteers	• Assumes volunteer labors • Printing of materials $1K	$1-$2K	Recommended for further consideration	NA
	Outreach campaign to lake residents	• Multi-year outreach campaign $5 to $10K	$5-10K		
	Boat Launch Signage	• Additional sign for Clean/Drain/Dry $1K	NA[2]	Not recommended for further consideration	NA
	Boat Washing Station	• Initial purchase $14K to $36.5K • Requires potential infrastructure upgrade; maintenance; and potentially staffing • Need adequate space for washing that does not disrupt boat traffic	$50K-$1.2M	Not recommended for further consideration	NA
2. Status quo	No action	NA	$0K	Not recommended for further consideration	NA

8.3.4 Invasive Shoreline plants (Knotweed, Purple Loosestrife, and Yellow Flag Iris)

8.3.4.1 Management Goals:

The third highest priority, as identified by the steering committee, is the control of invasive shoreline plants. The lake only had small infestations of invasive knotweed (11 parcels) and purple loosestrife (24 parcels). Yellow flag iris was widespread around the lake.

Table 8-6 presents the management goals and associated control strategies needed to achieve goals. The first goal of eradication within five years is only recommended for knotweed and purple loosestrife as they have a much smaller distribution. The second goal of containing the current infestations and preventing spread is feasible for all three species. The success of achieving either of these goals would hinge on participation of willing landowners and potentially the help of community members who may be able to assist landowners with control. The final potential goal is to maintain status quo and not have a community wide plan to address these plants.

8.3.4.2 Control Methods

The control methods presented below provide a summary of control options for individual landowners to implement. Note that the biological control of purple loosestrife was examined, but not considered further as there was not a high enough density of loosestrife to warrant that approach. More detailed information on the control of each invasive shoreline plant can be found in fact sheets developed by the King County and/or State noxious weed control boards as follows:

- **Invasive knotweed**: https://your.kingcounty.gov/dnrp/library/water-and-land/weeds/BMPs/Knotweed-Control.pdf
- **Purple Loosestrife**: https://your.kingcounty.gov/dnrp/library/water-and-land/weeds/BMPs/purple_loosestrife-control.pdf
- **Yellow flag iris:** https://your.kingcounty.gov/dnrp/library/water-and-land/weeds/BMPs/yellow-flag-iris-control.pdf

Manual Methods

Manual methods for shoreline invasive plant control vary by species. However, small infestations of all three plants can be handled by carefully digging up the plants including the roots or rhizomes. The area should be monitored for regrowth and continued control until no further vegetation is present. Because of their highly invasive nature, plant material should not be composted and instead be disposed of in a municipal landfill.

For yellow flag iris, there has also been demonstrated control success by repeated cutting of the leaves below the water surface to exhaust the plant's rhizomes over time. Cutting flowers and seed pods can also limit spread. Gloves should be worn for yellow flag iris removal as it produces a resin that can irritate some people's skin.

Manual control efforts are most effective if done before the plant has gone to seed to reduce future spread. Yellow flag iris and purple loosestrife are easily identified when they are flowering and can be removed then. If full removal of iris or loosestrife is not feasible, cutting of the flowers and seedpods can be effective in reducing spread of the plant.

Chemical Methods

The application of US EPA- and Washington state-approved aquatic herbicides to shoreline invasive plants can be highly effective at control. However, lake shorelines are sensitive areas and there is a high

risk of overspray into the water. Therefore, special aquatic formulations of herbicides are required for chemical treatment. As previously mentioned, all aquatic herbicides are restricted-use and only licensed aquatic herbicide applicators can purchase and apply these herbicides. As with submersed applications, permits are required before applying herbicides when there is threat of overspray into water. Because of the potential damage that conventional formulations of herbicides can have on aquatic systems, herbicides control is not a feasible option for a private homeowner to apply themselves when overspray into the lake is a possibility. Selective application techniques without overspray may be a viable option for homeowners. This technique works well for invasive knotweed, in particular.

If an aquatic formulation is used and applied by a licensed applicator with appropriate permits, imazamox and/or imazapyr are effective in plant control with favorable toxicological profiles (See Section 8.2 for more details)

Education and Outreach

The shoreline plants are unique in that they are largely on private property and their control will likely fall to the responsibility of the individual landowner. Therefore, it is critical that individual landowners are first able to recognize an invasive species so they can control existing patches and quickly respond to any new invasive plants. Next, it is important that landowners are equipped with the knowledge on the most effective control methods and what methods require permits and/or the assistance of licensed professionals. The most effective strategy to achieve these goals is through rigorous education and outreach.

Based on similar work at other lakes the following are potentially effective outreach strategies that can be implemented:

- **Outreach campaign** – the goals of an outreach and education campaign would be to first raise awareness of the problem, help landowners identify if they have invasive plants, provide information on how to effectively control plants and lastly, encourage them to take control actions. Messaging and materials would need to be developed and then distributed multiple times via email, social media and mailers.

- **Landowner workshops** on plant control – workshops conducted in person or online have been a highly effective method used for other areas, including Lake Ballinger and throughout King County, to empower landowners to conduct invasive control. Workshop topics would include an introduction to each target plant and tips for identification, control methods that they can conduct on own, and control methods that are effective but require professional assistance or permits.

8.3.4.3 Recommended Approach

Tetra Tech and ESA **Recommended** for further consideration two potential options for invasive shoreline plants as follows as shown in Table 8-6:

- Eradication of small infestations of invasive knotweed and purple loosestrife
- Containment of current infestations and preventing future spread for all three shoreline invasive plants

The recommendation to eradicate was supported for invasive knotweed (high support) and purple loosestrife (moderate support). Invasive knotweed is highly aggressive and once established can make manual control extremely difficult. With an eradication goal, annual surveys are also recommended for at least five years to spot errant plants and remove them.

The steering committee reached consensus that control of shoreline plants should be the responsibility of individuals as they were located on private property. In addition, they felt that education and outreach on

control methods should be the primary tool used by the community to both encourage and empower landowners to achieve control.

Given the education approach, 50% of the committee supported the goal of eradication for knotweed and/or purple loosestrife. One committee member felt that professional control should be an option to consider reaching this goal. The remaining committee was evenly split between trying to contain current populations and to maintain the status quo.

Table 8-7 Management Option at a Glance: Shoreline Invasive Plants (invasive knotweed, purple loosestrife and yellow flag iris) (gray shading indicates primary control method)

Management Goal	Control Strategy	Preliminary Costs and Assumptions	Estimated 5-Year Cost[1]	Tetra Tech/ESA Recommendation	Steering Committee Voting Results[3]
All Basins					
1. Eradicate small infestations along lake shoreline (invasive knotweed & purple loosestrife only)	Education (outreach campaign & workshops)	• $5 K per workshop (mailers, speakers etc.) • Multi-year outreach campaign - $15- 20K	$25-30K	Recommended for further consideration	50%
	Manual (hand-pulling, digging, covering)	• Manual control of knotweed is extremely difficult except with small isolated plants • Market labor cost for contractor; or volunteer/resident	NA[2]		
	Chemical, imazapyr or imazamox	• $800 - $1,000 per acre; • Must hire a licensed applicator • Would work best as a community-wide effort • Potential assistance from Snohomish County Noxious Weed Control Board for invasive knotweed	TBD		
2. Reduce current coverage along lake shoreline and prevent further spread; Up to individual landowner (all species)	Manual – as above, prioritizing new or expanding populations	• Market labor cost for contractor; or volunteer/resident; • For Loosestrife - cut flowers prior to going to seed to limit spread • For iris cut flowers before going to seed and/or repeated cutting below water line	NA[2]	Recommended for further consideration	25%
	Chemical, imazapyr or imazamox prioritizing new or expanding populations	• $600 - $800 per acre • Must hire a licensed applicator	TBD		
3. Status quo	No action		$0	Not recommended for further consideration	25%

1. Costs are estimated for first five years of control. Continued control work will likely be necessary beyond five years.
2. Costs assumed to be incurred by individual landowner so not included in total
3. For Yellow Flag iris control, the steering committee voted 58% to reduce spread and 42% for status quo

8.3.5 Slender Arrowhead

8.3.5.1 Management Goals

Slender arrowhead was identified as the lowest priority plant by the steering committee. Given its widespread distribution, eradication of this plant is unlikely. Instead, the first goal shown in Table 8-7 is to incrementally reduce its current coverage which would both allow the native plant population to rebound but also prevent its spread to other lakes. An initial goal of 20% reduction per year was proposed. Other potential goals were to only have control by individual landowners or to keep the status quo which would be no action to reduce coverage of this plant.

8.3.5.2 Control Methods

Manual Methods

Similar to milfoil, the recommended primary option for control is to use diver hand-pulling and/or diver-assisted suction harvesting (DASH). DASH is well-suited to work on slender arrowhead as the plant is shallowly rooted and very easily pulled by divers.

Hand-pulling without the use of divers is also an alternative method that will work for landowners interested in controlling the plant in shallow areas. It is easily hand-pulled. All material pulled should be removed from the lake and dried away from the lake shoreline before being composted. Leaving the material in the lake will allow it to float to new areas and re-establish and could cause localized algal blooms due to the release of nutrients. Bottom barriers may also be effective but are likely more labor intensive to install in shallow area than hand-pulling.

Chemical Methods:

Slender arrowhead has a very limited distribution in Washington and little research has been conducted on the management of this species. Most research trials that include species from the genera *Sagittaria*, which has a number of highly desirable native species, are typically conducted to assess non-target impacts. A limited number of aquatic herbicides are known to be or are likely efficacious against *Sagittaria* species; however, in some instances where species are listed on the product label, information is not specific to *Sagittaria graminea* (slender arrowhead) that occurs in Lake Roesiger. For example, glyphosate is used to control *Sagittaria* species, but is only considered effective for emergent stems. Slender arrowhead produces emergent stems, but the majority of biomass is typically submersed. Slender arrowhead is not listed as a target plant on the ProcellaCOR label; however, one recent study suggests its active ingredient, florpyrauxifen-benzyl, may be effective in controlling this species (Rustom 2020).

Until there is more certainty around which aquatic herbicide is most appropriate for control of slender arrowhead, the use of DASH for control is recommended. Unlike fragrant water lily, slender arrowhead is shallowly rooted, making DASH much more viable for larger-scale infestations.

8.3.5.3 Recommended Approach

Tetra Tech and ESA **Recommended** for further consideration two potential approaches for further consideration by the community as show in Table 8-7:

- Incremental reduction of 20% surface acre each year over a 10-year period with the long-term goal of eradication using DASH
- Individual landowner control on properties using hand-pulling in shallow areas or divers in deeper areas.

The majority of the steering committee (58%) approved the incremental approach while 42% preferred to leave it up to individual landowners. None supported the status quo of no action. There was some discussion that addressing this plant would improve grant funding odds as it is a Class B noxious weed. In addition, control of this plant may be more feasible should the DASH system owned by a resident on the lake be used.

Table 8-8 Management Options at a Glance: Slender Arrowhead (gray shading indicates primary control method)

Management Goal	Control Strategy	Preliminary Costs and Assumptions[1]	Estimated 5-Year Cost[1]	Tetra Tech/ESA Recommendation	Steering Committee Voting Results
All Basins					
1. Incremental reduction of 20% surface acre each year over a 10-year period with the long-term goal of eradication	Manual (DASH)	• $12K for 3 days of diving annually (unsure of progress achievable) • Highly selective – no off-target impacts allowing for re-establishment of native plants	$60K	Recommended for further consideration	58%
	Chemical	Uncertain at this time; Future potential with additional research			
2. Individual landowner control on properties	Manual – hand-pulling (divers in deep areas; landowners in shallow)	Market labor cost for contractor (higher for divers); or volunteer/landowner in shallow areas	NA[2]	Recommended for further consideration	42%
3. Status quo	No action	$0	0%	Not recommended for further consideration	0%

1. Costs are estimated for first five years of control. Continued control work will likely be necessary beyond five years.
2. Costs assumed to be incurred by individual landowner so not included in total

9.0 RECOMMENDED MANAGEMENT APPROACH

Successful management of invasive plants in Lake Roesiger will require a long-term commitment as it will take several years to re-establish a sustainable lake environment with native plant diversity. Ongoing prevention and early detection of invasive species are also needed to prevent future establishment of problem plants. The plan shows the first five years of implementation which are likely be the costliest. However, ongoing investments beyond these five years will be needed to at least maintain initial success and potentially continue improvements.

9.1 INITIAL PROPOSED SCENARIOS

Based on feedback from the steering committee, four potential management scenarios were developed for review by the Lake Roesiger community and are presented in Sections 9.1.3 to 9.1.6. Each scenario has the identical recommended approaches for control of Eurasian watermilfoil, invasive shoreline plants, slender arrowhead as well as invasive species prevention which are and summarized in 9.1.1 below. For fragrant waterlily, three different scenarios were developed with the three levels of impact. A fourth scenario of “status quo” or no additional aquatic plant control options was also included.

9.1.1 Description of Recommended Approaches Included in Proposed Scenarios

Eurasian Watermilfoil

To achieve the desired goal of eradication of Eurasian watermilfoil, the recommended control method is to continue with surveying and diver hand-pulling but increase the frequency from every 2-4 years to annually. Once plants are no longer detected for at least two or three consecutive years, surveys could be reduced to every 2-3 years.

If the milfoil infestation dramatically increased, the chemical option ProcellaCOR is an additional recommendation. ProcellaCOR has been highly effective in selectively treating milfoil at area lakes and has a highly favorable human health and environmental toxicity profile, meaning the impacts to human and environmental health are very low (See Section 8.3.1 for full details).

Recommended Approaches for Fragrant Waterlily

Given the range of initial opinions on the best approach for fragrant waterlily control, three potential scenarios were developed to show the three potential approaches for fragrant waterlily control and their potential impact as follows:

- Scenario 1 (hydraulic dredging): High impact to fragrant waterlily
- Scenario 2 (chemical): Moderate impact to fragrant waterlily
- Scenario 3 (mechanical harvester): Low impact to fragrant waterlily

The scenarios were based on the primary method of control for fragrant waterlily though all would be supplemented by individual landowners through actions such as cutting and bottom barriers. The full details for each scenario are show in Tables

Recommended Approach for Invasive Species Prevention

In addition to aquatic plant control, the steering committee recognized that invasive species prevention through outreach and education to lake users is important to not only prevent new invasive species from entering Lake Roesiger but for transporting invasive species such as slender arrowhead to other lakes (see Section 8.4 for full details).

The following strategies were identified to educate lake users:

- Volunteer outreach - Community members visit the boat launch on heavy use days and provide education about cleaning, draining, drying boats.
- Lake resident outreach - Develop and implement an outreach campaign for residents to prevent introduction from their boats. Outreach materials would be distributed via mailers, email, and social media

Recommended approach for Invasive Shoreline Plants

To prevent further spread, reduce current coverage and, if possible, eradicate small areas of invasive knotweed and purple loosestrife, the steering committee recommends educating landowners on ways to manage or remove shoreline invasive plants on their property. Landowners would be supported by education on plant identification and control methods. Education would include landowner workshops and outreach materials distributed via mailers, email, and social media. (See Sections 8.3.3 for full details)

Recommended Approach for Slender Arrowhead

To prevent spread of slender arrowhead to other waterbodies and reduce current coverage, the steering committee recommends educating landowners on ways they can control to allow for native plant growth, if desired. Diver Assisted Suction Harvesting (DASH) was also a recommended control strategy for this shallow-rooted plant. An initial target of 20% reduction per year was put forward and included in the cost estimates, but as a lower priority plant, this effort could be scaled up or down based on available funding.

9.1.2 Cost Assumptions for scenarios

Successful management of invasive plants in Lake Roesiger will require a long-term commitment as it will take several years to re-establish a sustainable lake environment with native plant diversity. Ongoing prevention and early detection of invasive species are also needed to prevent future establishment of problem plants. The plan shows the first five years of implementation which are likely be the costliest. However, ongoing investments beyond these five years will be needed to at least maintain initial success and potentially continue improvements.

The proposed management scenarios identify control methods and cost estimates for each priority plant. The scenarios are summarized in tables with detailed cost estimates for the first five years. Detailed descriptions of the control methods for each target plant are described in Section 8.0 Aquatic Plant Control Alternatives.

The following assumptions were made when estimating costs for the scenarios:

- Cost estimates were calculated in 2021 dollars and do not include inflation.
- Costs were estimated for the first five years, but continued investment will be needed beyond five years.
- Per parcel totals were calculated based on 463 lake shoreline parcels. The per parcel cost is for illustration purposes showing one potential scenario in which all shoreline landowners contribute equally.
- Per parcel with grant were calculated the same method as the per parcel total. However, it was also assumed that an Aquatic Invasive Plant Implementation Grant award of $75,000 would be obtained and would be split evenly over the first two years of implementation.

9.1.3 Scenario 1 (Hydraulic Dredging): High Impact to Fragrant Waterlily

Scenario 1 includes mechanical hydraulic dredging as the primary control method for fragrant waterlily. It includes dredging approximately 20 to 22 acres of the middle basin to achieve 80-90% reduction in the existing lily biomass along with three feet of sediment. It is the only method by which the legacy sediment will be significantly reduced in the middle basin. It also includes Diver Assisted Suction Harvesting or DASH as a primary method to control re-emerging plants in years 2 to 5. DASH would also be used in areas that hydraulic dredging is not appropriate such as shallow areas with submersed obstacles. While highly effective, this scenario is extremely costly.

Table 9-1. Invasive Plant Control with High Impact to Fragrant Waterlily

Target Plant	Action	Expected Outcomes	Estimated Cost for First 5 Years of Control					
			Year 1	Year 2	Year 3	Year 4	Year 5	Total
Eurasian watermilfoil	Diver hand-pulling; Chemical control only if needed	Eradication within 5 years followed by annual monitoring	$22K	$22K	$22K	$22K	$22K	$110K
Fragrant waterlily - Middle Basin[1]	Hydraulic dredging followed by DASH for maintenance	80-90% lily removal; 3 feet muck reduction	$22M	$88K	$88K	$88K	$88K	$22.3M
Fragrant waterlily - North & South Basin[1]	DASH removal	Eradication of existing patches;	$56K	$56K	$17K	$17K	$17K	$163K
Invasive Shoreline Plants[2]	Workshops & outreach on plant ID and control methods	Prevention of new areas; Reduce existing areas	$15K	$15K	-	-	-	$30K
Slender Arrowhead[3]	Incremental Removal by DASH	20% removal per year	$22K	$22K	$22K	$22K	$22K	$110K
Invasive Species Prevention	Outreach to lake users & residents	Lower risk of spread & intro of new invasive species	$3.5K	$3.5K	-	-	-	$7K
		Total	**$22.1M**	**$206.5K**	**$149K**	**$149K**	**$149K**	**$22.8M**
		Cost Per Parcel for all efforts	**$47,772**	**$446**	**$322**	**$322**	**$322**	**$49,184**
		Cost Per Parcel with Grant	**$47,691**	**$365**	**$322**	**$322**	**$322**	**$49,022**

[1]Costs do not include supplemental efforts by landowner for control in private dock and swimming areas through pulling, repeated hand cutting and/or bottom barriers.

[2]Costs are for education and outreach only; control work and associated costs will be the responsibility of individual landowners.

[3] Slender arrowhead efforts could be scaled up or down based on available funding.

9.1.4 Scenario 2 (Chemical): Moderate Impact To Fragrant Waterlily

This moderate impact scenario will achieve an estimated 40 to 50% lily reduction (12-15 acres) in the middle basin over five years, and eradication in the north and south basins. Chemical treatments are the primary approach. Efforts would maintain navigation between the basins, slow the rate of sediment accumulation and would provide some relief for middle basin residents to reach their homes.

Imazapyr and imazamox were identified as the most appropriate chemical options as they have a highly favorable toxicological profile with little to no known human health and environmental risks, have a small impact to lake use (some irrigation restrictions) and have demonstrated effectiveness locally in several King County lakes (See Plan Section 8.2). This option is the most cost-effective approach as it achieves the highest level of control at the lowest cost.

Table 9-2. Invasive Plant Control with Moderate Impact to Fragrant Waterlily

Target Plants in order of priority	Action	Expected Outcomes	Estimated Cost for First 5 Years of Control					
			Year 1	Year 2	Year 3	Year 4	Year 5	Total
Eurasian watermilfoil	Diver hand-pulling; Chemical control only if needed	Eradication within 5 years followed by monitoring	$22K	$22K	$22K	$22K	$22K	$110K
Fragrant waterlily - Middle Basin[1]	Chemical treatment (imazapyr/imazamox)	40-50%reduction in lily coverage (12-15 acres);	$34K	$34K	$34K	$17K	$17K	$136K
Fragrant waterlily - North & South Basin[1]	Chemical treatment (imazapyr/imazamox)	Eradication of existing patches	$3.3K	$3.3K	$1.1K	$1.1K	$1.1K	$9.9K
Invasive Shoreline Plants[2]	Workshops & outreach on plant ID and control methods	Prevention of new areas; Reduce existing areas	$15K	$15K	-	-	-	$30K
Slender Arrowhead[3]	Incremental Removal by DASH	20% removal per year	$22K	$22K	$22K	$22K	$22K	$110K
Invasive Species Prevention	Outreach to lake users & residents	Lower risk of spread & intro of new invasive species	$3.5K	$3.5K	-	-	-	$7K
		Total	**$99.8K**	**$99.8K**	**$79.1K**	**$62.1K**	**$62.1K**	**$402.9K**
		Cost Per Parcel	**$216**	**$216**	**$171**	**$134**	**$134**	**$870**
		Cost Per Parcel with Grant	**$135**	**$135**	**$171**	**$134**	**$134**	**$708**

[1]Costs do not include supplemental efforts by landowner for control in private dock and swimming areas through pulling, repeated hand cutting and/or bottom barriers.

[2]Costs are for education and outreach only; control work and associated costs will be the responsibility of individual landowners.

[3] Slender arrowhead efforts could be scaled up or down based on available funding

9.1.5 Scenario 3 (Mechanical Harvester): Low Impact To Fragrant Waterlily

This scenario would have a lower impact to the invasive lily with an estimated 15-20% lily reduction in the middle basin over five years. The primary method would be mechanical harvesting (Section 8.3). To maintain this reduction goal, mechanical harvesting would likely require 4-6 cuttings per year, depending on conditions. Cutting would be focused on maintaining a clear navigation channel but would not significantly reduce the overall coverage. There is a small risk that the cutting may increase the spread of lilies to other areas of the lake. This scenario was included as an option due to the desire to have an affordable non-chemical approach to the lily control. However, harvesting is not as cost effective as a chemical approach, meaning the same investment provides a much lower level of lily control. The harvester can also only operate in deeper water that is free of underwater obstacles such as logs.

Table 9-3. Invasive Plant Control with Low Impact to Fragrant Waterlily

Target Plant	Action	Expected Outcomes	Estimated Cost for First 5 Years of Control					
			Year 1	Year 2	Year 3	Year 4	Year 5	Total
Eurasian watermilfoil	Annual Diver hand-pulling; Chemical control only if needed	Eradication within 5 years followed by monitoring	$22K	$22K	$22K	$22K	$22K	$110K
Fragrant waterlily - Middle Basin[1]	Mechanical harvester - center navigation channel and deeper portions of residential channels	15-20% lily reduction (4-6 acres);	$38K	$38K	$38K	$38K	$38K	$190K
Fragrant waterlily - North & South Basin[2]	Workshops and outreach on control methods	Potential continued spread in basin	-	-	-	-	-	-
Invasive Shoreline Plants	Workshops & outreach on plant ID and control methods	Prevention of new areas; Reduce existing areas	$15K	$15K	-	-	-	$30K
Slender Arrowhead[4]	Incremental Removal by DASH	20% removal per year	$22K	$22K	$22K	$22K	$22K	$110K
Invasive Species Prevention	Outreach to lake users & residents	Lower risk of spread & intro of new invasive species	$3.5K	$3.5K	-	-	-	$7K
		Total	**$100.5K**	**$100.5K**	**$82K**	**$82K**	**$82K**	**$447K**
		Cost Per Parcel for all efforts	**$217**	**$217**	**$177**	**$177**	**$177**	**$965**
		Cost Per Parcel with Grant	**$136**	**$136**	**$177**	**$177**	**$177**	**$803**

[1]Costs do not include supplemental efforts by landowner for control in private dock and swimming areas through pulling, repeated hand cutting and/or bottom barriers.
[2]Workshops would be the same as those held for shoreline invasive plants.
[3]Costs are for education and outreach only; control work and associated costs will be the responsibility of individual landowners.

9.1.6 Scenario 4 (Status Quo): Low Level of Eurasian Watermilfoil Control Only

This status quo scenario is to continue existing diver surveys with hand-pulling of Eurasian watermilfoil every other year to maintain low levels of infestation. All other invasive plant control work would be the responsibility of individual landowners. With this scenario, all other invasive plants will continue to spread to new areas within the lake, along shorelines and potentially to other nearby lakes.

Table 9-4. Status Quo - Low Level of Eurasian Watermilfoil Control Only

Target Plant	Action	Expected Outcomes	Estimated Cost for First 5 Years of Control[1]					
			Year 1	Year 2	Year 3	Year 4	Year 5	Total
Eurasian watermilfoil	Diver hand-pulling every 2 years	Maintain milfoil with high risk of greater spread	-	$10K	-	$10K	-	$20K
		Total	-	$10K	-	$10K	-	$20K

[1]Currently paid for by volunteer lake association dues and donations

9.2 COMMUNITY FEEDBACK ON INITIAL MANAGEMENT SCENARIOS

As described in Section 2.4.1, the full draft plan was distributed to the community. The plan was accompanied with a short executive summary as well as an online presentation fully describing the plan and the scenarios. Community members including interested stakeholders such as lake users were then asked to take an online survey to provide feedback on the draft plan and specifically on the preferred scenarios.

The results are fully described in Appendix C and includes a description of how the survey was distributed and the respondent demographics. The key survey takeaways are as follows:

- The respondents confirmed the prioritization of Management Goals presented in Section 3.2.
- There was high level of agreement on the recommended approaches for Eurasian watermilfoil, Invasive Species Prevention, Shoreline Invasives and Slender Arrowhead, though there were comments on how to further improve these recommendations.
- With regards to the approach to fragrant water lily control there were different levels of support for each of the scenarios. Of the 142 respondents, the strongest support was for chemical control with 63% supporting or strongly supporting followed by mechanical harvesting (50%), hydraulic dredging (23%) and status quo (19%). These results indicate that there is a strong opposition to take no action or mechanical harvesting.
- When specifically asked which scenario is the best option, the results were:
    - Chemical control - 55%
    - Mechanical Harvesting - 17%
    - Hydraulic Dredging -14%
    - Status Quo - 16%
- Finally, there was a high willingness to pay for invasive plant control as follows:
    - More than $177 - 25%
    - Between $135 and $177 - 53%
    - Less than $135 – 10%
    - Not amount - 12%

There were many additional survey comments regarding the plan including comments on funding, the need to act now, a preference not to use herbicides as well as appreciation for working on the plan. The full text of comments can be seen in Appendix C.

Following the survey, a community meeting was held to discuss the survey results and decide on next steps. Many of the comments shared in the community meeting reflected those presented in the survey. The full community meeting is recorded and can be viewed on the project webpage at https://snohomishcountywa.gov/5822.

9.3 VOTE ON FINAL MANAGEMENT APPROACH

Based on the feedback on the initial scenarios, the recommended approach selected was scenario 2 as the approach to fragrant waterlily was the preferred approach by 55% of the community with next highest being mechanical harvesting at 17%. Following the survey, the steering committee and Community Club Board requested that a final vote be held so everyone could vote as not all residents would be able to attend the community meeting. Section 2.4.3 describes how the online vote was distributed and counted. The full results can be found in Appendix D.

Overall, the draft plan with Scenario 2 was approved by:

- 64% for all voters which included lake users that do not live near the lake.
- 70% among lake area residents
- 74% among Lake Roesiger Community and Boat Club members.

The final vote also asked if respondents would support the Lake Roesiger community working with Snohomish County to apply for a grant

- 68% for all voters which included lake users that do not live near the lake.
- 72% among lake area residents
- 75% among Lake Roesiger Community and Boat Club members.

Finally, respondents were asked if the plan is approved if they would support the Lake Roesiger area paying an annual fee charged on a per parcel basis to implement the plan. The response percentages below are presented in the order of all voters, lake area residents and Lake Roesiger Community and Boat Club members.

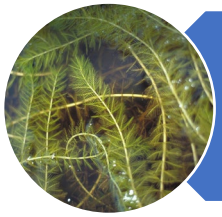
- More than $177 - 17%, 20%, 21%
- Between $135 and $177 – 40%, 44%, 44%
- Less than $135 – 8%, 8%, 9%
- Not amount - 35%, 28%, 26%

The full comments on the survey can be found in Appendix D. However, most of the comments focused on who should fund the plan (43 comments) and opposition to chemical use (7 comments). Another common theme is that there was still wide support for mechanical harvesting and should be included in the plan with the chemical control option.

9.4 FINAL MANAGEMENT APPROACH FOR LAKE ROESIGER

The final management approach approved was Scenario 2 based upon the feedback of the community survey and then the final vote. This scenario was slightly modified to also add the use of Mechanical Harvesting in the middle basin. The final approach and associated costs are shown in Figure 9-1 and Table 9-6.

Figure 9-1: Final Lake Roesiger Management Actions by Priority



Priority 1 – Milfoil

- **5-Year Goal:** Eradication
- **Control Methods:**
  - Annual diver surveys and hand-pulling
  - Chemical treatment with Procellacor (only if greatly increase)

Priority 2 – Fragrant waterlily

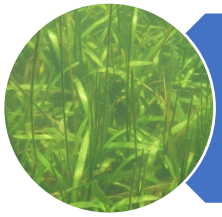
- **5-Year Goal:** North & South - eradication; Middle - 40-50% reduction
- **Control Methods:**
  - Chemical control with use of imazapyr or imazamox
  - Mechanical harvesting - use as possoble especially if costs decrease in future
  - Individual landowners - repeated lily cutting/bottom barriers

Priority 3 – Invasive Species Prevention

- **5-Year Goal:** Prevent spread of new invasives to and from lake
- **Control Methods:**
  - Education campaign to lake residents
  - Volunteer Outreach at Boat Launch

Priority 4 –Knotweed, purple loosestrife, yellow flag iris

- **5-Year Goal:** prevent further spread and reduce coverage
- **Control Methods:**
  - Individual landowner control
  - Workshops on plant identification and control methods
  - Outreach campaign



Priority 5 - Slender Arrowhead

- **5-Year Goal:** prevent further spread and reduce coverage (initial target of 20% per year that would be scaled based on funding)
- **Control Methods:**
  - Diver assisted suction harvesting (DASH)

Table 9-5: Final Management Approach Actions, Management Goals and Costs first 5 Years of Control

Target Plant	Action	Management Goal	Estimated Cost for First 5 Years of Control					
			Year 1	Year 2	Year 3	Year 4	Year 5	Total
Eurasian watermilfoil	Diver hand-pulling; chemical control only if needed	Eradication within 5 years followed by annual monitoring	$22K	$22K	$22K	$22K	$22K	$110K
Fragrant waterlily - Middle Basin[1]	Chemical treatment (imazapyr/imazamox) Mechanical harvesting – additional option for future use	40-50% reduction in lily coverage (12-15 acres)	$34K	$34K	$34K	$17K	$17K	$136K
Fragrant waterlily -North & South Basin[1]	Chemical treatment (imazapyr/imazamox)	Eradication of existing patches	$3.3K	$3.3K	$1.1K	$1.1K	$1.1K	$9.9K
Invasive Shoreline Plants[2]	Workshops & outreach on plant ID and control methods	Prevention of new areas; reduce existing areas	$15K	$15K	-	-	-	$30K
Slender Arrowhead[3]	Incremental removal by DASH	20% removal per year[4]	$22K	$22K	$22K	$22K	$22K	$110K
Invasive Species Prevention	Outreach to lake users & residents	Lower risk of spread & intro of new invasive species	$3.5K	$3.5K	-	-	-	$7K
		Total	$99.8K	$99.8K	$79.1K	$62.1K	$62.1K	$402.9K
		Cost Per Parcel	$216	$216	$171	$134	$134	$870
		Cost per Parcel with Grant	$135	$135	$171	$134	$134	$708

[1]Costs do not include supplemental efforts by landowner for control in private dock and swimming areas through pulling, repeated hand cutting and/or bottom barriers.

[2]Costs are for education and outreach only; control work and associated costs will be the responsibility of individual landowners.

[3] Slender arrowhead efforts could be scaled up or down based on available funding

9.4.1 Timing, Intensity and Area of Control

Table 9-7 lays out the recommended timing & intensity of control for each action for the first five years of implementation. As discussed previously, the management of invasive species is a long-term effort that will require adaptive management based on the resources available and the efficacy of the actions. It is recommended that for implementation an advisory committee be formed. This committee would review the previous year's results and adjust the next year's actions to best meet the plan goals.

Table 9-6: Target Areas, Timing and Intensity of Control for Years 1-5

Target Plant	Action	Target Area	Timing & Intensity of Control Years 1-5
1. Eurasian watermilfoil	Diver surveys & hand-pulling1	All Basins	• Annual Surveys recommended until there has been 3 years of no EWM found then reduce frequency to every other year.
	Chemical control	All Basins	• None unless EWW spreads rapidly and hand-pulling is no longer effective
2. Fragrant waterlily	Chemical control	North and South Basin	• Year 1 & 2 – treat all areas of infestation • Years 3-5 monitor and treat if necessary • For very small patches repeated landowners cutting is preferable

		Middle Basin	• Target reduction is 12-15 acres of reduction over 5 years
			• Annually 3-5 acres dependent upon permitting restrictions to prevent harmful drops in dissolved oxygen from decaying plant matter)
			• Treatment locations will be determined each year by advisory committee based on the following prioritization:
			  • Main navigation channel between basins
			  • Navigation paths to lake residences
			  • All other areas

	Mechanical harvesting	Middle Basin	• Ongoing - as desired by individual landowners • Continue exploration of lower cost contractors that would make harvesting more viable and closer to cost of chemical control; implement at larger scale if costs become comparable in areas where feasible (no physical obstructions and deeper water)
	Hand-cutting (4-6	Residential swimming and boating areas	• Ongoing as desired by individual landowners • Strongly encouraged to immediately cut whenever lilies spread to new areas or as follow-up to herbicide treatments
	Bottom barriers	Residential swimming and boating areas	• As desired by individual landowners or community club per their HPA or individual permit • Existing barriers would remain

Target Plant	Action	Target Area	Timing & Intensity of Control Years 1-5
3. New invasive prevention	Outreach campaign to lake residents	All Basins	• Year 1 & 2 – initial material development and distribution (assuming grant) • Ongoing materials can be distributed as desired by community
	Volunteer outreach at boat launch	Boat Launch	• Year 1 & 2 – program development and outreach material creation • Ongoing as desired by community and volunteers
4. Shoreline invasive plants	Landowner workshops	All Basins	• Year 1 & 2 – one workshop per year • Ongoing as desired by community
	Outreach campaign	All Basins	• Year 1 & 2 – initial material development and distribution (assuming grant) • Ongoing as desired by community
	Control by individual landowners	All Basins	• Ongoing as desired by individual landowner – training on appropriate techniques through workshops and outreach materials • Assistance and/or equipment may be available for invasive knotweed control from Snohomish County Noxious Weed control board
5. Slender-leaf arrowhead	Diver-Assisted Suction harvesting	All Basins	• Target of 20% per year – may revise based on effort achievable in first year since no comparable previous efforts for this plant. May also be scaled up or down based on available funding. • Initial priority would be plants near boat launch to prevent spread to other lakes; next priorities will be determined by lake advisory committee
	Seek emerging research on control options	All basins	• Review ongoing research into alternative control options for slender leaf arrowhead and adapt approach as needed.

9.4.2 Permits, Licenses and Permissions

Working on vegetation control in and near water and wet areas requires several permits and licenses to ensure that control work is done with minimal to no impact on the environment.

The Aquatic Plants and Fish Booklet (Permit)

- Issued by the Washington Department of Fish and Wildlife
- The Pamphlet permit can be acquired and printed from this web site: https://wdfw.wa.gov/licenses/environmental/hpa/types/aquatic-plants
- This permit covers activities that occur in "Waters of the State" including areas of standing water on the lake shore.
- Plant control activities vary depending if the plant is an "aquatic noxious weed" (on the state noxious weed list) or an "aquatic beneficial plant" (all native and nonnative aquatic plants except those on the state noxious weed list). Read and follow the permit carefully.
- All work outside allowable work windows listed in the permit time period table requires an individual HPA permit.
- The permit is specific about what weed control situations it allows, what situations required an HPA permit (see below) and what activities do not pertain
- The permit does not regulate the use of grass carp or herbicide, which are regulated by other WDFW rules and the WA State Dept. of Ecology respectively

Formal Hydraulic Project Approval Permit (HPA)

- This permit covers all other activities, including weed control work, that happen in "Waters of the State" and are not allowed under the Aquatic Plants and Fish Pamphlet permit.
- Details of when a formal HPA is needed are in the Aquatic Plants and Fish Pamphlet permit.
- An HPA permit can be applied for online at: http://wdfw.wa.gov/licensing/hpa/
- Permit costs $150 and takes 45 days to process

Pesticide Applicators License with an Aquatic Endorsement

- Issued by the Washington State Department of Agriculture
- Requires testing, testing and annual license fees are required
- Without re-certification credits, the license is good for five years.
- WSDA pesticide licensing web site: https://agr.wa.gov/services/licenses-permits-and-certificates
- A license is not necessary for a private landowner using the injection method to control knotweed on their own property.

Aquatic Noxious Weed Control Permit

- Issued by the Washington State Department of Ecology and managed by the Washington State Department of Agriculture
- For emergent plants (state listed noxious weeds only)
- Free permit, takes approximately one month to receive
- Apply online: https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Aquatic-pesticide-permits/Aquatic-noxious-weed-control
- Public notification (letters and/or signs) are needed and the permit involves record keeping of herbicide use and reporting back to WSDA
- Each permit has its own list of Ecology permitted herbicides and surfactants

Aquatic Plant and Algae Management General Permit

- Issued by the Washington State Department of Ecology

- Required for herbicide use on submerged and floating leaf aquatic plants (and for native plants/non noxious weeds in any aquatic situation)
- Permit costs about $700/year and takes approximately 2-6 months to receive
- Apply online: https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Aquatic-pesticide-permits/Aquatic-plant-algae-management
- Public notification is required (newspapers, signs, letters)
- Record keeping and water quality testing (chemical dependent) are required
- Each permit has its own list of Ecology permitted herbicides and surfactants.

9.5 EVALUATION OF MANAGEMENT APPROACHES FOR LAKE ROESIGER

A summary of the chosen management approaches are summarized in section 9.4.1 – 9.4.3.

9.5.1 Potential Health and Environmental Risks

The potential health and environmental risks and the options that were selected to minimize these risks are fully addressed in section 8.0 Aquatic Plant Control Alternatives.

9.5.2 Balance of Proposed Approach Between Waterbody Enhancement and Environmental Protection

The proposed plan will have significant long-term positive impacts for both waterbody enhancement and environmental protection. The aquatic vegetation management plan exclusively addresses the control and prevention of invasive species in areas where beneficial uses are currently impeded by excessive plant growth (see section 5.0). The removal of these plants will provide significant benefits for lake recreation including boating, swimming and fishing. In addition, removal of invasive species will lead to improvements in aquatic habitat. Invasive removal will increase the abundance and diversity of native aquatic plants which provide the native aquatic life that depends upon them for food, shelter and other benefits.

There could be some short-term impacts to the water quality and ecological health of the lake from the plan including:

- DASH and diver hand-pulling may have a short increase in turbidity
- Chemical control of lilies will lead to a die-off of plants that can deplete dissolved oxygen and release nutrients that can stimulate algal growth. The plan and associated herbicide permitting mitigates for these impacts by limiting the area of treatment at any one time.
- Bottom barriers exclude all plant growth and may harm the benthic organisms under the barrier. The size and coverage of barriers is limited by permits to prevent significant harm in any one area.
- All control methods will lead to temporary decreases in any aquatic vegetation. However, native plants have been shown to quickly re-colonize suitable growing areas when invasive competitors are removed.

When these short-term considerations were evaluated in the plan development, it was determined that the long-term health and environmental improvements outweighed these concerns. Furthermore, the alternative of taking no action will lead to future impacts to both the recreational and ecological beneficial uses of the lake.

9.5.3 Compatibility with Fisheries, Waterfowl, Wildlife, Wetlands, Rare Plants, Endangered Species, Water Rights, and Ecology of Water Body

No endangered species or rare plants have been identified in Lake Roesiger (see Section 4 and Appendix B). The final management approach will have no adverse impact on wildlife, waterfowl, or fish

known to use Lake Roesiger. This approach will reduce aquatic invasive plant coverage within the littoral zone. As a result, these areas will reduce the coverage of invasive species and allow for the re-establishment of native species, improving the ecology of the water body and the quality of aquatic habitat in the lake.

10.0 MONITORING, RESPONSE, AND PREVENTION

The Roesiger IAVMP is designed to be adaptive. Monitoring the conditions that result from its implementation will be necessary to decide each year's implementation actions. Each year following implementation, visual surveys of the target aquatic plants, at minimum, should be conducted to assess efficacy. Survey plots in treatment areas and non-treatment areas (to serve as a control) are also recommended to assess the recovery of native plants following invasive control. A complete re-survey of the lake's vegetation is recommended every 2-4 years depending on treatment progress. These periodic surveys will provide a means to monitor existing infestations of aquatic plants, detect new infestations should they occur and measure the effectiveness of implemented control methods.

Given the high degree of concern regarding aquatic herbicide usage in the lake among a segment of lake residents, monitoring for the selected herbicide before and after the fragrant water lily treatment is also recommended. These data could be used to address concerns regarding the environmental persistence of the chemicals to inform the management actions.

The Roesiger IAVMP already includes preventative actions as part of the final management approach. In addition to the actions already specified in the plan, any equipment used during aquatic plant surveys, control efforts or monitoring efforts will be decontaminated and cleaned following Ecology standard operating procedures for minimizing the spread of invasive species (Ecology, 2018).

Finally, the Lake Roesiger community and Snohomish County should continue to explore and research emerging technologies that could improve treatment efficacy and reduce implementation costs.

11.0 FUNDING OPTIONS

Should the community decide to move forward and implement this plan, it will require a long-term financial investment by the Lake Roesiger community. There are a variety of mechanisms by which residents can raise funds for local lake management. In addition, there may be state or local grants that could reduce the financial burden.

11.1 LOCAL PROPERTY OWNER FUNDING

Three options that the Lake Roesiger community could use to collect funds from local residents are presented below. Each of these options has been successfully implemented by lake groups in Snohomish County.

11.1.1 Local Funding – Lake Association Collection

Collecting funds via a lake association is a common method for funding lake-related activities. Fund collection can take many forms and may be a combination of efforts such as annual dues, one-time collection, or even fundraisers. The manner and timing in which lake communities collect lake funds varies widely and is at the discretion of the membership.

Lake associations typically incorporate as a non-profit organization when they decide to take on financial responsibilities or commit to long-term lake management activities. There are already two non-profit organizations at Sunday Lake, one for the community club and one for lily control efforts. Formalizing a lake association provides several benefits including the ability to open a bank account, ability to apply for some grants, and a structure in which to better advocate for the lake. While non-profits are the most common structure, other structures might work for a lake group depending on the goals and structure of the organization.

The Washington Secretary of State's office has a full list of considerations and steps when deciding to incorporate as a non-profit or other organization (see resources below). Some considerations include filing for tax exempt status with the IRS or registering as a charitable organization. Additional helpful resources may be found in an internet search about starting a non-profit in WA State.

- Starting a nonprofit
- WA state non-profit handbook
- Non-profit online registation

11.1.2 Local Funding – Lake Management District

Another option for local funding is the formation of a Lake Management District (LMD), as laid out in Washington State administrative code - RCW 36.61. An LMD could be formed for the specific purpose of funding Lake Roesiger invasive aquatic plant control. It could potentially include properties around the lakeshore and within the larger watershed. An LMD is established to collect fees annually for a specific length of time.

LMD's must be formed through the county legislative authority. It is initiated through "either the adoption of a resolution of intention by a county legislative authority or the filing of a petition signed by ten landowners or the owners of at least twenty percent of the acreage contained within the proposed lake or beach management district, whichever is greater" (RCW 36.61.030). The County may require a bond of $5,000 by landowners to pay for some of the administrative costs with establishing the LMD.

There are numerous procedural steps in forming a LMD including at least two public hearings. The owners of every property included within a proposed LMD will then have the opportunity to vote to

approve or not approve the LMD. A majority vote is required to establish the LMD. If passed, there are additional steps regarding the assessment role for taxing or for bonding if desired. There are several benefits of a LMD. It ensures everyone has a clear vote in the process. It also allows bonding of large upfront costs that could be paid back over several years by annual assessments. However, there are drawbacks to a LMD. The LMD creation takes about12 to 18 months to set up.

11.1.3 Local Funding – Surface Water Management (SWM) Fee Surcharge

Another potential option for local funding is for Snohomish County to establish a surcharge on top of the current SWM fees to be paid by all developed shoreline properties. The surcharge would be for a specific length of time and would be collected with the property taxes. Similar SWM fee surcharges have been established for lake-related projects at Lake Ketchum, Lake Serene, Lake Goodwin and Lake Shoecraft.

To implement a surcharge, the community should first work with SWM to determine if they can assist in the setup and administration of the surcharge. Should these steps occur, a County Council person would then introduce an ordinance that would be voted on by the broader Council. While this option would not require a vote of affected property owners, it would require strong support from property owners for the County Council to approve such a surcharge.

11.2 GRANT OPPORTUNITIES

Grants can help stretch local dollars and provide funding for larger cost items such as herbicide treatments or diver hand pulling. They are not a reliable source of funding for long-term or ongoing lake management activities. There are limited grant opportunities for funding the recommended actions with the most promising being the Department of Ecology's Invasive Aquatic Plants Management Grants Program.

At this time, grants of up to $75,000 are available for invasive aquatic plant control projects. A 25% ($25,000) local match for any grant funds awarded is required. Grant match may include some in-kind labor efforts. The grants are funded by a portion of boater registration fees. Grants are typically offered every year or every other year pending funding availability. According to current guidelines, an approved Integrated Aquatic Vegetation Management Plan are required to be eligible for funding. Eligible public bodies that may apply include state agencies, counties, special purpose districts (including LMD's) and Tribes.

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13.0 APPENDICES

APPENDIX A. WATER RIGHTS

Active certificates of water rights issued for Lake Roesiger. *Source:* Ecology, 2021b.

Record Document Number	WR Doc ID	Certificate Number	Person or Organization	Priority Date Claim First Use	Purpose of Use	Instantaneous Quantity (CFS)	Annual Quantity (Acre-ft)
S1-20218CWRIS	2274165	S1-20218 C	SCHNEIDER ALBERT A	07/17/1972	Domestic Single	0.01	1.0
S1-20396CWRIS	2273945	S1-20396 C	RILEY CLAUDE E	01/04/1973	Domestic Single	0.01	1.0
S1-20478CWRIS	2273980	S1-20478 C	BRABANO FRANK	03/09/1973	Irrigation	0.01	1.0
S1-20541CWRIS	2274010	S1-20541 C	BARBANO VITO	04/02/1973	Irrigation	0.01	1.0
S1-20547CWRIS	2274014	S1-20547 C	CALL A F & M L	04/11/1973	Domestic Single	0.01	1.0
S1-20600CWRIS	2273727	S1-20600 C	YOST BERNARD L	05/01/1973	Domestic Single	0.01	1.0
S1-20748CWRIS	2273795	S1-20748 C	FOGG OLIVER A	07/10/1973	Domestic Single	0.01	1.0
S1-20810CWRIS	2273828	S1-20810 C	FRANKLIN MARY F	08/08/1973	Domestic Single	0.01	1.0
S1-20811CWRIS	2273829	S1-20811 C	FRANKLIN MARY F	08/08/1973	Domestic Single	0.01	1.0
S1-20895CWRIS	2273565	S1-20895 C	DOHERTY ELSE E	09/11/1973	Domestic Single	0.01	1.0
S1-20903CWRIS	2273570	S1-20903 C	DENHOLM W D SR & E J	09/14/1973	Domestic Single	0.01	1.0
S1-20906CWRIS	2273572	S1-20906 C	ANDERSON D J & L M	09/14/1973	Domestic Single	0.01	1.0
S1-20907CWRIS	2273573	S1-20907 C	ANDERSON E I & E M	09/14/1973	Domestic Single	0.01	1.0
S1-20927CWRIS	2273583	S1-20927 C	BAIRD WILLIAM R	09/20/1973	Domestic Single	0.01	1.0
S1-20931CWRIS	2273585	S1-20931 C	LAIRD WM J & LOIS M	09/24/1973	Domestic Single	0.01	1.0
S1-20933CWRIS	2273586	S1-20933 C	LINDSEY FRED B	09/24/1973	Domestic Single	0.01	1.0
S1-20942CWRIS	2273592	S1-20942 C	PAY HUBERT W	09/26/1973	Domestic Single	0.01	1.0
S1-20961CWRIS	2273603	S1-20961 C	NELSON M E & A B	10/10/1973	Domestic Single	0.01	1.0
S1-21035CWRIS	2273647	S1-21035 C	GOODSPEED CHARLES A	11/13/1973	Domestic Single	0.01	1.0
S1-21049CWRIS	2273656	S1-21049 C	BOHLANDER CARL G	11/15/1973	Domestic Single	0.01	1.0
S1-21081CWRIS	2273677	S1-21081 C	HENRY CHARLES J JR	11/30/1973	Domestic Single	0.01	1.0
S1-21129CWRIS	2273696	S1-21129 C	BARKULOO HERBERT W	01/03/1974	Domestic Single	0.01	1.0
S1-21164CWRIS	2273714	S1-21164 C	WESTLING VIRGIL L	01/09/1974	Domestic Single	0.01	1.0
S1-21195CWRIS	2273421	S1-21195 C	BRUMBAUGH M H	01/23/1974	Domestic Single	0.01	1.0
S1-21234CWRIS	2273444	S1-21234 C	SAFFLE LUCILLE M	02/06/1974	Domestic Single	0.01	1.0
S1-21291CWRIS	2273473	S1-21291 C	WILSON VIVIAN G	02/27/1974	Domestic Single	0.01	1.0
S1-21347CWRIS	2273504	S1-21347 C	BERGMAN KATHERINE	02/19/1974	Domestic Single	0.01	1.0
S1-21431CWRIS	2273547	S1-21431 C	BUTCHER FRED G & M C	04/05/1974	Domestic Single	0.02	1.0
S1-21435CWRIS	2273550	S1-21435 C	TVEIT TERRY O	04/08/1974	Domestic Single	0.02	1.0
S1-21436CWRIS	2273551	S1-21436 C	TON CORNELIUS	04/08/1974	Domestic Single	0.02	1.0
S1-21439CWRIS	2273553	S1-21439 C	HOVANDER CHARLES R	04/08/1974	Domestic Single	0.01	1.0
S1-21579CWRIS	2273305	S1-21579 C	OLSBY ROBERT G	05/03/1974	Domestic Single	0.01	1.0
S1-21641CWRIS	2273348	S1-21641 C	CALKINS RANSOM B	05/16/1974	Domestic Single	0.01	1.0
S1-21653CWRIS	2273354	S1-21653 C	TAYLOR JACK R	05/17/1974	Domestic Single	0.02	1.0
S1-21668CWRIS	2273362	S1-21668 C	OCHSNER M W	05/20/1974	Domestic Multiple	0.02	1.0

Record Document Number	WR Doc ID	Certificate Number	Person or Organization	Priority Date Claim First Use	Purpose of Use	Instantaneous Quantity (CFS)	Annual Quantity (Acre-ft)
S1-21863CWRIS	2273165	S1-21863 C	OLSON LLOYD R	06/24/1974	Domestic Single	0.02	1.0
S1-21864CWRIS	2273166	S1-21864 C	CAMERON DONALD R	06/24/1975	Domestic Single	0.02	1.0
S1-21939CWRIS	2273192	S1-21939 C	CAMERON DONALD M	06/28/1974	Domestic Single	0.02	1.0
S1-21984CWRIS	2273212	S1-21984 C	ROACHE THOMAS J	07/01/1974	Domestic Multiple	0.02	1.0
S1-22007CWRIS	2273217	S1-22007 C	HAIGHT EARL E	07/09/1974	Domestic Single	0.02	1.0
S1-22017CWRIS	2273222	S1-22017 C	SORGENFREI HENRY	07/23/1974	Irrigation	0.02	0.5
S1-22087CWRIS	2273250	S1-22087 C	WOODS DONALD W	09/09/1974	Domestic Single	0.02	1.0
S1-22172CWRIS	2272981	S1-22172 C	LUNDSTAM JACK O	10/29/1974	Domestic Single	0.02	1.0
S1-22215CWRIS	2272995	S1-22215 C	GAY GLORIA C	06/30/1974	Domestic Single	0.01	1.0
S1-22375CWRIS	2273069	S1-22375 C	BURR DOLORES JUNE	01/02/1975	Domestic Single	0.02	1.0
S1-22547CWRIS	2272842	S1-22547 C	MILLER SEBA	07/10/1975	Domestic Single	0.02	1.0
S1-22707CWRIS	2272895	S1-22707 C	THOMASON LAWRENCE C	07/01/1976	Domestic Single	0.02	1.0
S1-23058CWRIS	2272707	S1-23058 C	ERGA JOE	02/17/1978	Domestic Single	0.01	1.0
S1-24118CWRIS	2272596	S1-24118 C	THOMASON EDGAR C	07/15/1982	Domestic Single	0.02	1.0
S1-24868CWRIS	2272427	S1-24868 C	REICHENBERGER ETAL	07/11/1986	Domestic Single	0.02	0.5
					TOTAL	0.68	49.0

APPENDIX B. RARE PLANT SPECIES OCCURANCE

From: Fertig, Walter (DNR) <Walter.Fertig@dnr.wa.gov>
Sent: Friday, July 16, 2021 5:12 PM
To: Burghdoff, Marisa <Marisa.Burghdoff@co.snohomish.wa.us>
Cc: Seebacher, Lizbeth (ECY) <lsee461@ecy.wa.gov>; Oden, Jennifer <Jennifer.Oden@co.snohomish.wa.us>
Subject: RE: Lake Roesiger plant survey

CAUTION : This email originated from outside of this organization. Please exercise caution with links and attachments.

Hello Marisa

Thanks for reaching out about any rare plant species at Lake Roesiger. I just ran a check of our Biotics database (where we keep records for rare plant and animal species we track as state endangered, threatened, and sensitive). There are no records for any listed species from the lake or the vicinity, and I can't think of any that could potentially occur there. I appreciate you taking the time to check on this.

Walter Fertig
State botanist, WA Natural Heritage Program
WA Department of Natural Resources, Olympia, WA

APPENDIX C. PUBLIC SURVEY RESULTS AND COMMENTS

C.1 PUBLIC SURVEY SUMMARY AND RESULT

LAKE ROESIGER DRAFT INTEGRATED AQUATIC VEGETATION MANAGEMENT PLAN COMMUNITY SURVEY RESULTS 10/26/2021

SNOHOMISH COUNTY
Conservation & Natural Resources

Surface Water Management

Questions – Email lakes@snoco.org or call 425-388-3204

Survey Outreach Efforts

Snohomish County Efforts:

- Mailers – sent to all residents on the lake shoreline and surrounding streets
- 10/1 - First postcard mailed
- 10/15 - Second postcard mailed (in response to reports of post office delays)
- Email – multiple announcements sent to 133 subscribers Roesiger updates by Snohomish County
- Next Door – 2 posts announcing plan and meeting to Roesiger area neighborhoods

Lake Roesiger Community and Boat Club Efforts:

- Multiple email announcements to membership (forward of County email)
- Facebook post
- Website updated with link to survey

1. How did you hear about the Lake Roesiger Plan? (Check all that apply)

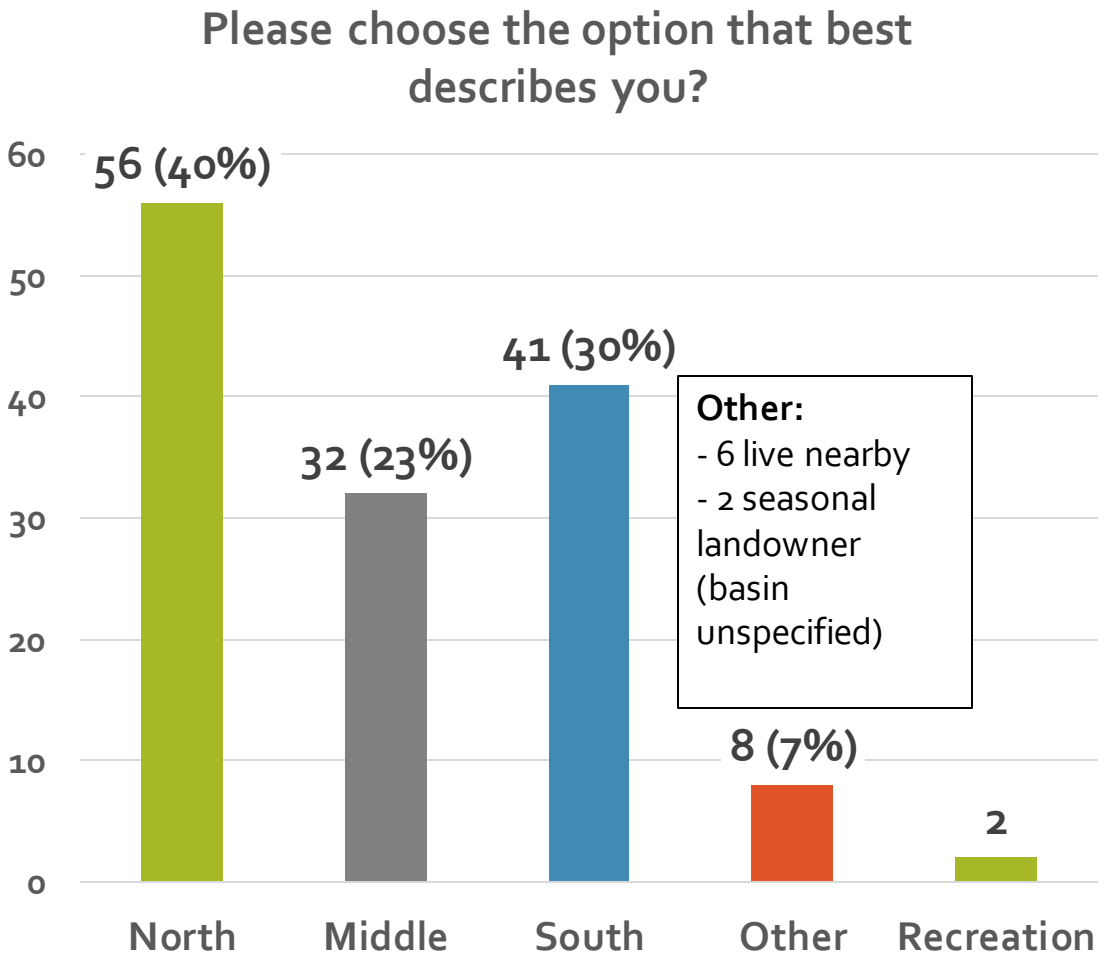
More Details

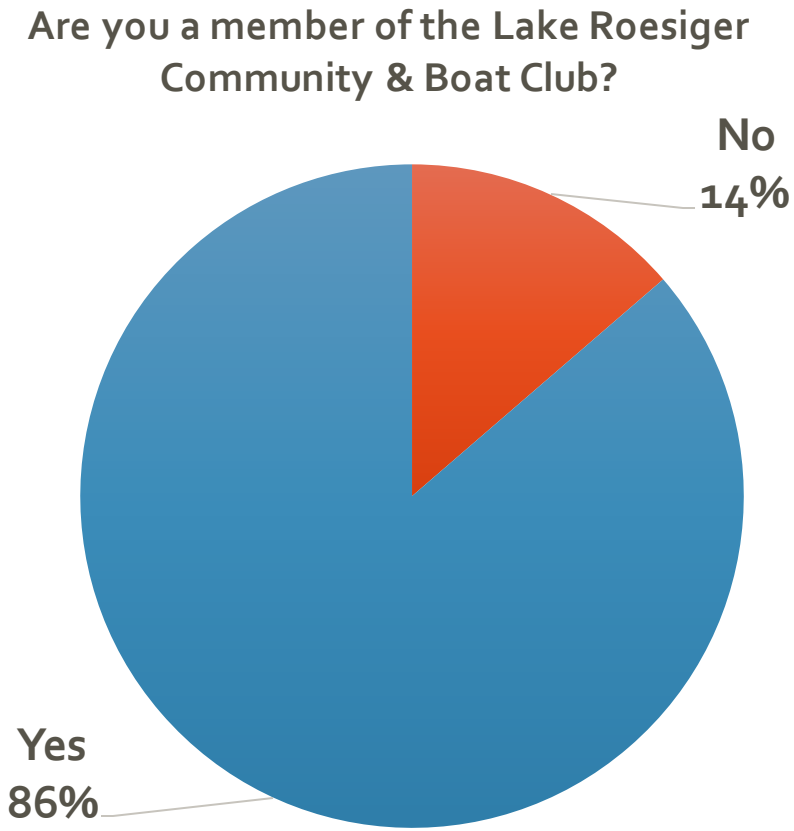
Postcard	55
NextDoor	24
Neighbor/Friend	37
Email	74
Other	36

RESPONSE RATE

- There were 142 respondents
- There was around a 30% response rate for Roesiger shoreline landowners – this is a high survey response rate.
- Numbers based on approximately 463 shoreline parcels of which there are about 425 unique landowners

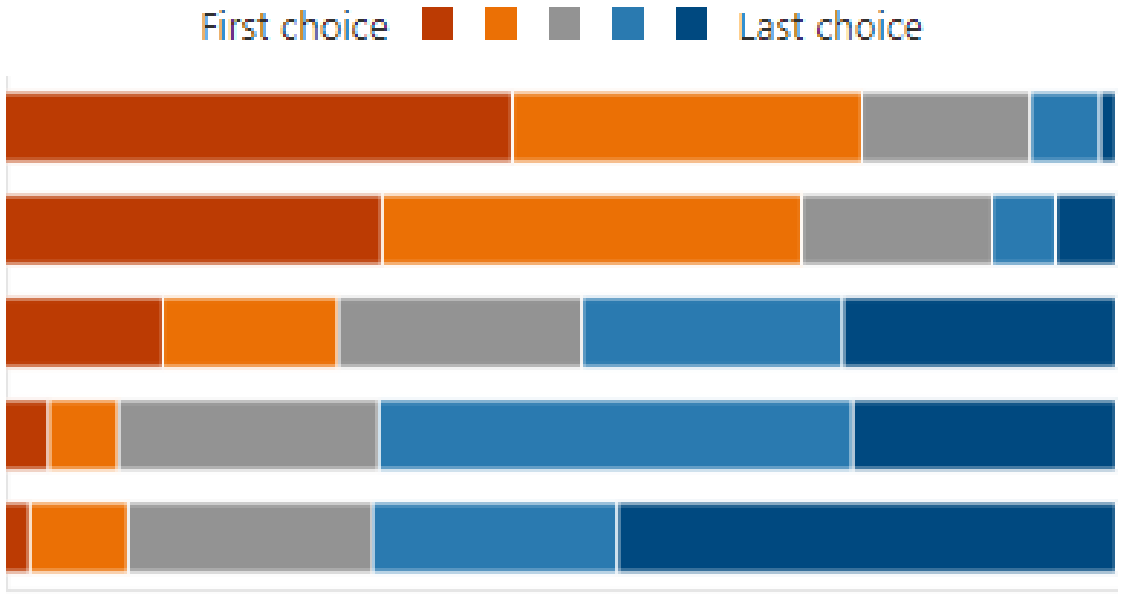
Local Demographics



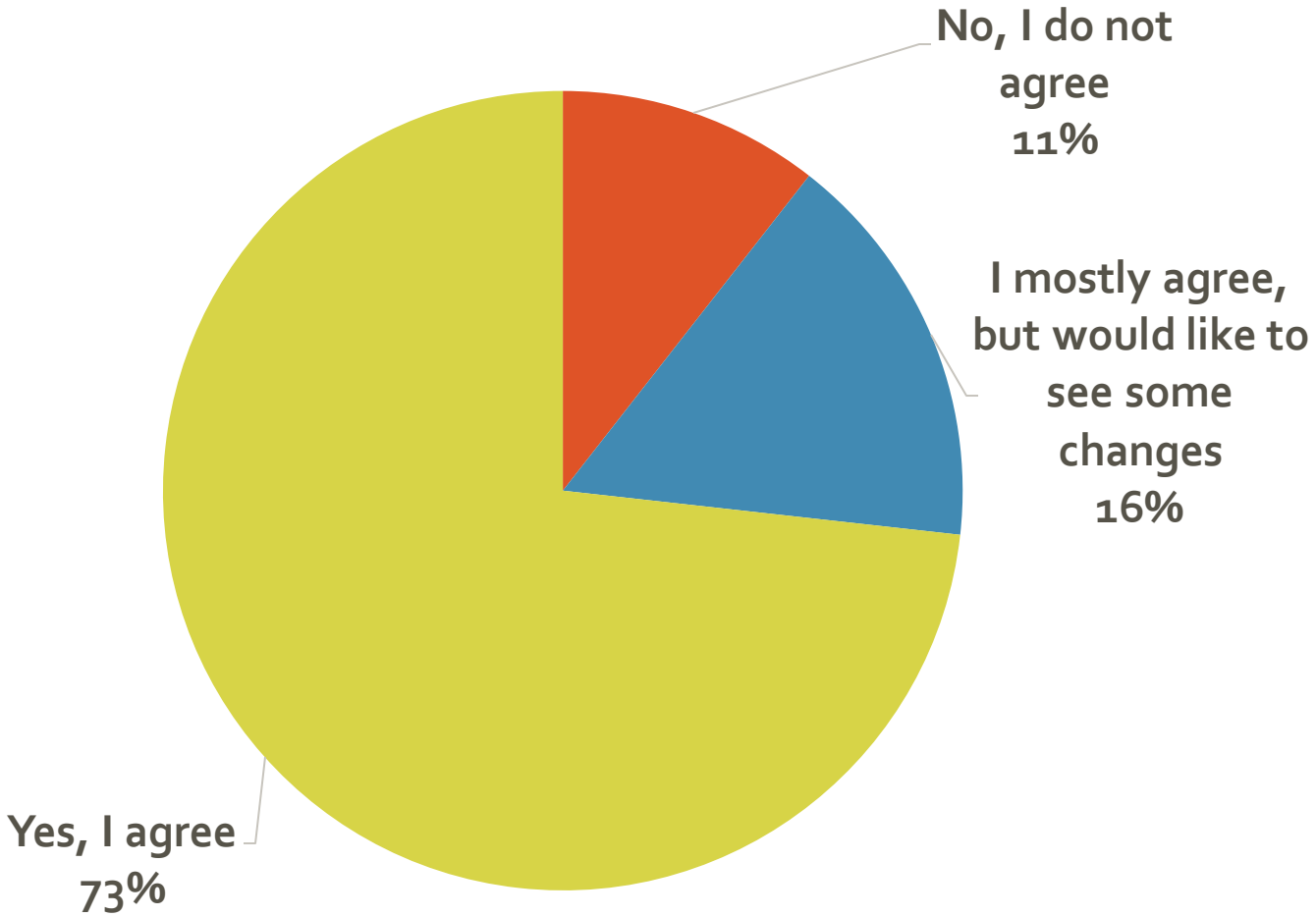


Several invasive plants are found at Lake Roesiger. While the committee has ranked control of these plants in order of priority, we'd like to confirm this with the community. Please rank the following in order of importance to you with the top being the highest priority and the bottom the lowest.

Rank	Options
1	Eurasian watermilfoil
2	Fragrant waterlily
3	Prevention of new invasive pla...
4	Shoreline invasive plants (inva...
5	Slender arrowhead



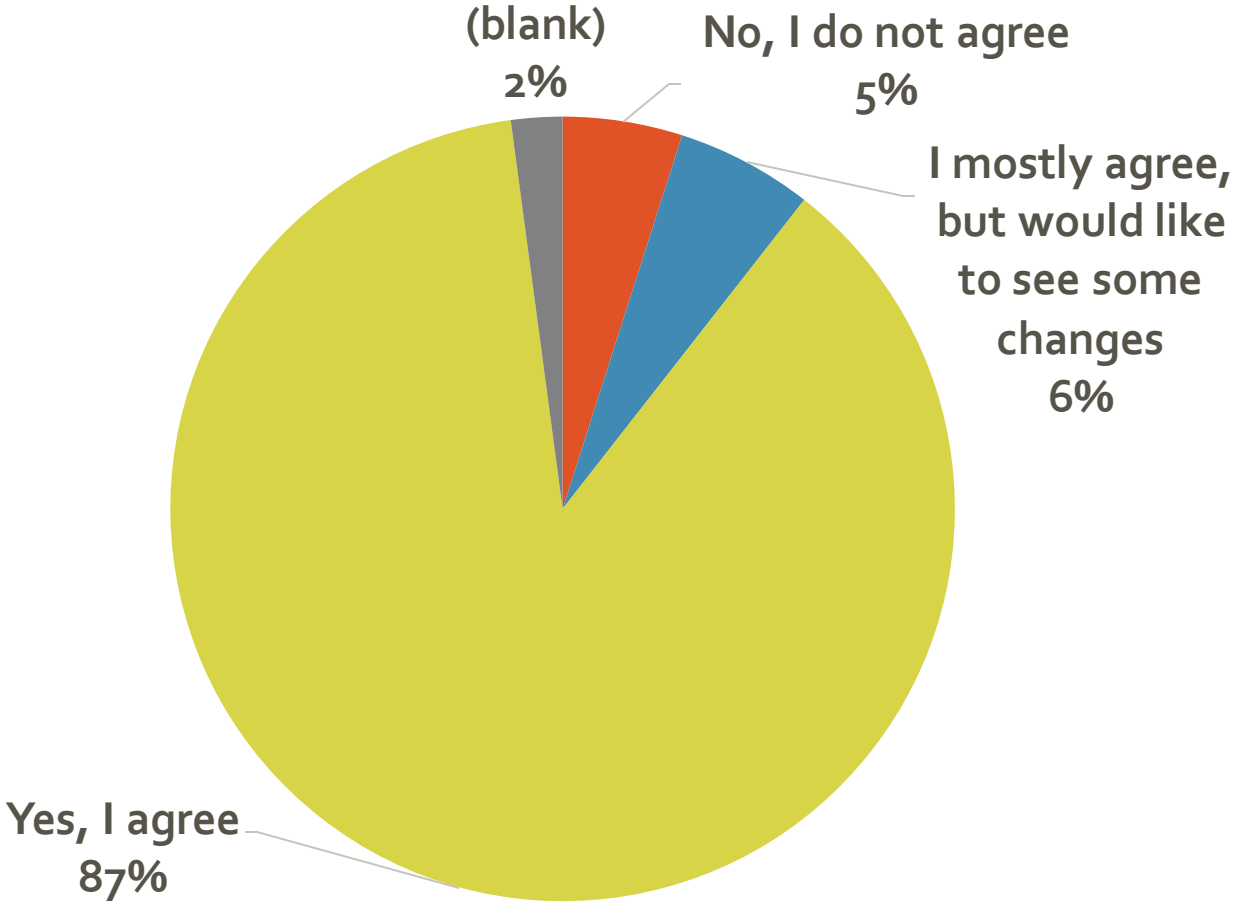
Eurasian watermilfoil: To achieve the proposed goal of eradication, the recommended control method is to continue diver hand-pulling but increase the frequency to a whole-lake annual survey until plants are not detected followed by monitoring. If the milfoil infestation dramatically increased, the chemical option ProcellaCOR is an additional recommended tool.
Do you agree with this recommendation?



Reasons for not supporting:

- Do not agree with use of any chemicals (14)
- Too costly (2)
- Prefer use chemicals as first approach (2)

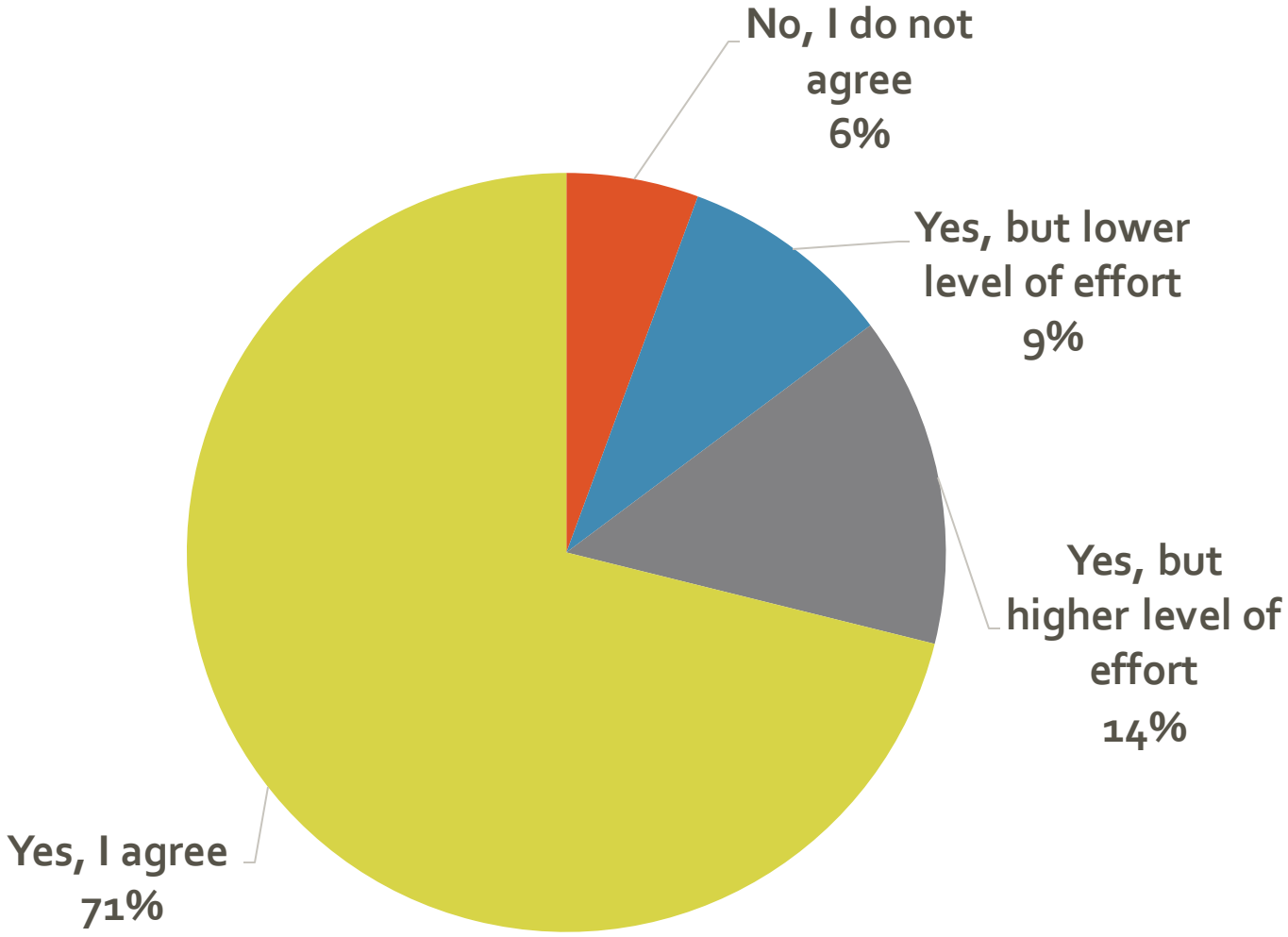
Shoreline Invasives (invasive knotweed, purple loosestrife, yellow flag iris): To achieve the goal of preventing further spread and reducing coverage, the recommended approach is to have individual landowners control plants on their properties which would be supported by education on plant identification and control methods. Education would include landowner workshops and outreach materials distributed via mailers, email and social media. Do you agree with this recommendation?



Reasons for not supporting:

- Should be professional approach not landowner (4)
- Too costly (2 respondents)
- Would like chemical option (1) respondents)

Slender arrowhead: To achieve the goal of preventing spread to other waterbodies and reducing current coverage, the recommended approach is to use Diver Assisted Suction Harvesting (DASH). An initial target of 20% per year was put forward. The committee has identified this as a lower priority plant, so this effort could be scaled up or down based on available funding.
Do you agree with this recommendation?



Higher Level of Effort (16):

- Creates problem - muck building up, swimming fish, other plants (6)
- Property owners can help (2)

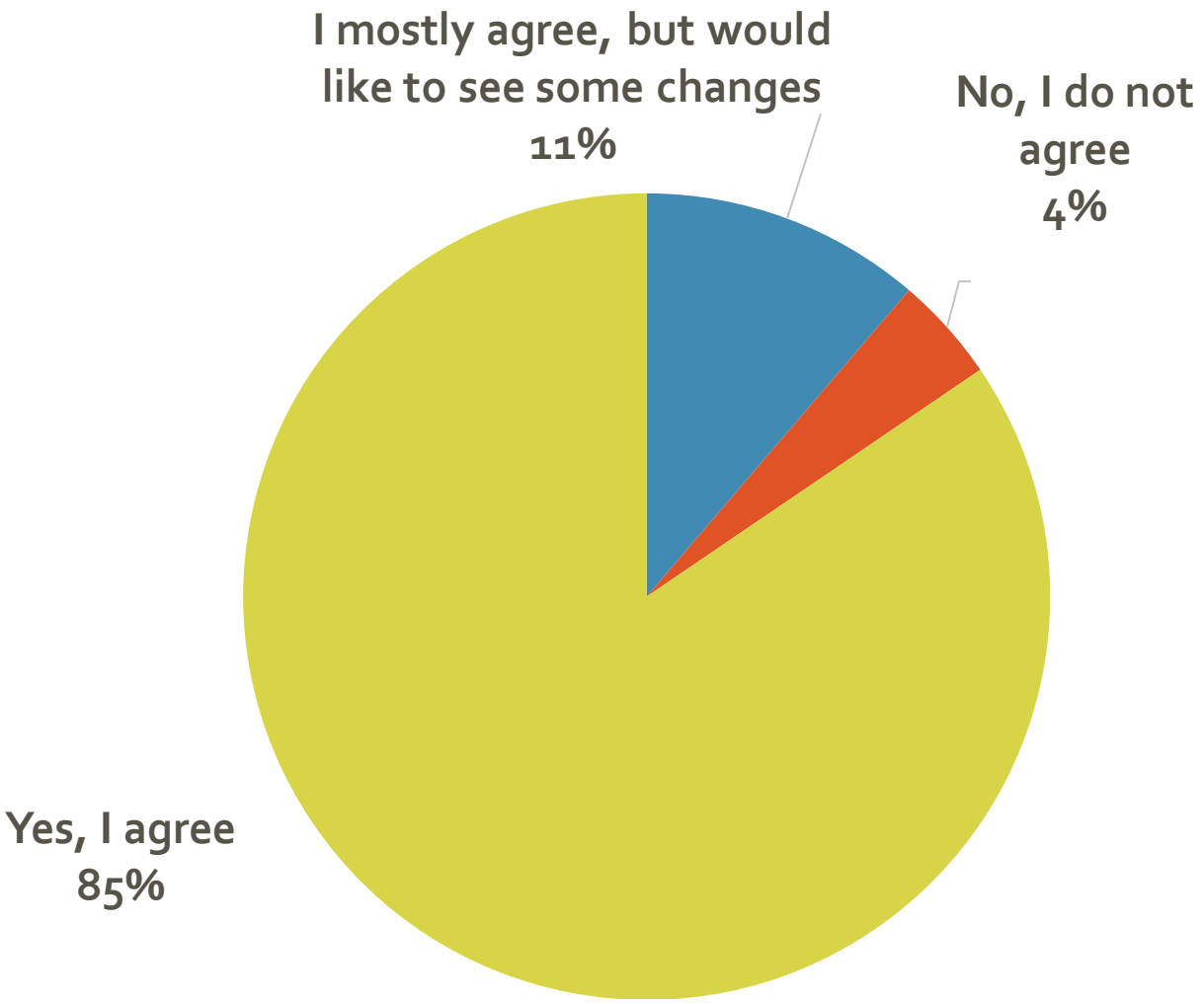
Lower Level of Effort (6):

- Focus on higher priorities (2)
- Not a problem (4)

Do not agree (6):

- Prefer chemical approach (2)
- Cost (3)

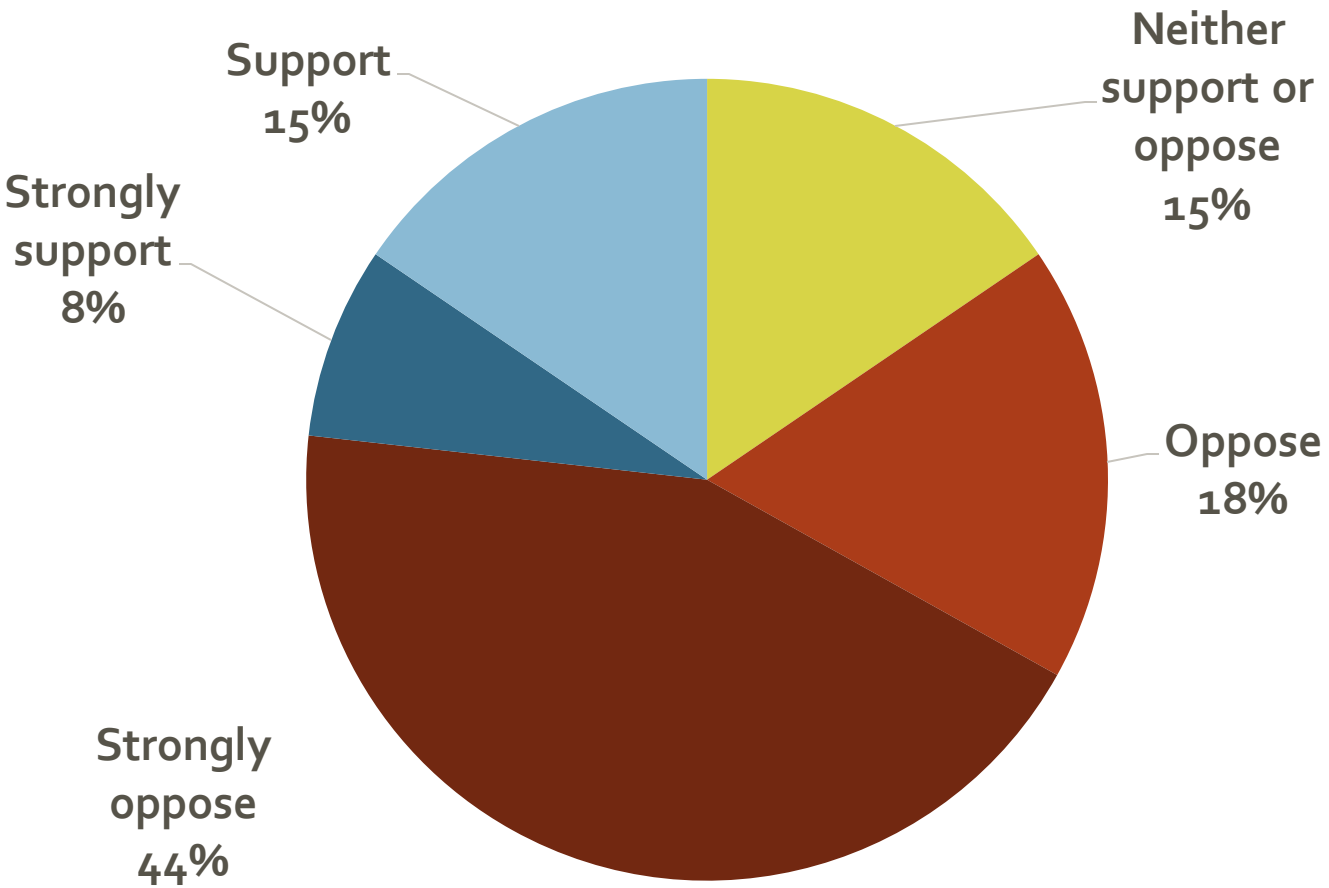
Invasive species prevention – The recommended approach to prevent new invasive species is outreach and education to lake users. Efforts would include volunteer outreach at the boat launch and outreach materials distributed to lake residents by mailers, emails and social media. Do you agree with this recommendation?



Reasons for not supporting:

- Concerns that ineffective (7)
- Prefer boat inspections(2 respondents)
- Include fee for boat launch users (2)
- Club should be used for outreach (2)
- Other (1 each)
  - Cost
  - Low priority
  - WDFW responsibility

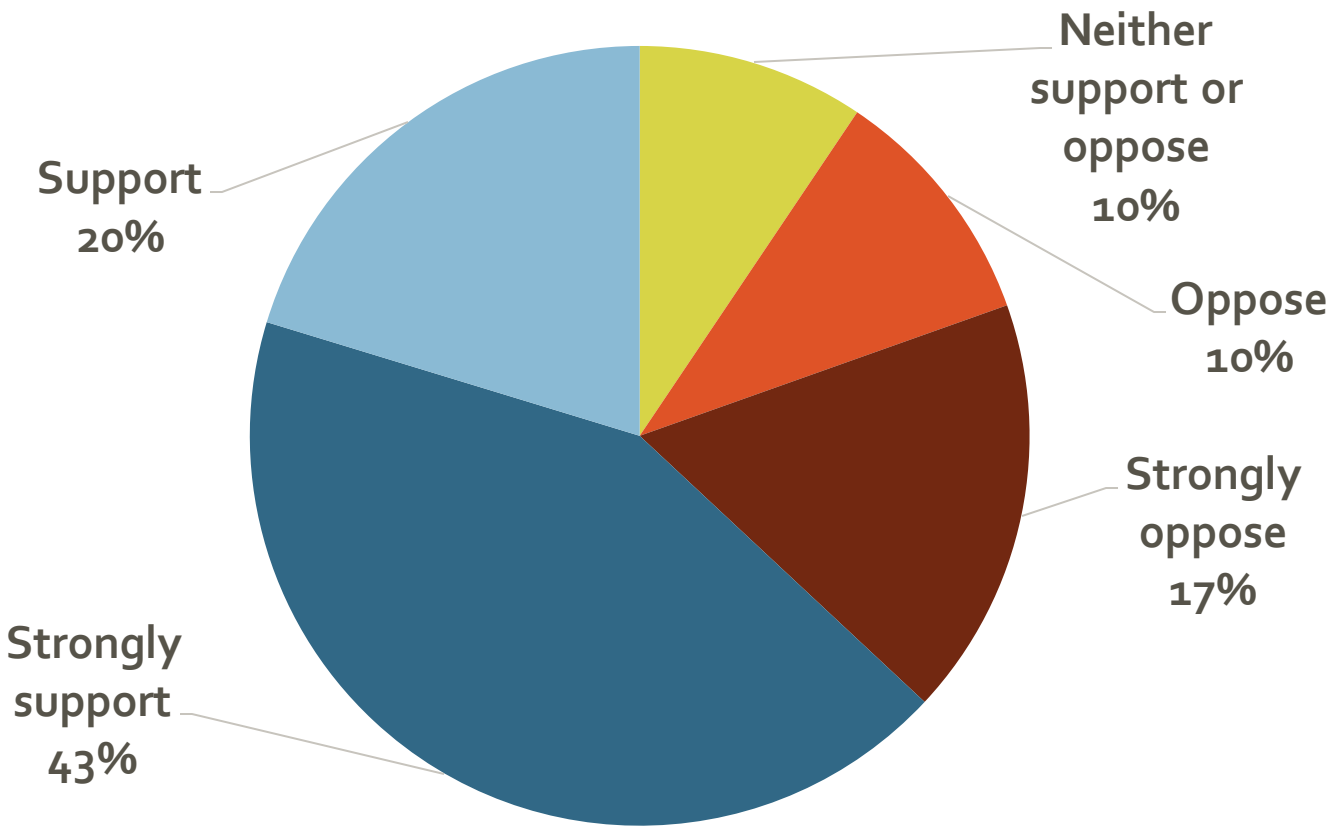
Scenario 1: This scenario includes **Hydraulic Dredging** for fragrant water lily for an estimated 80 - 90% reduction in lilies, a 3 feet reduction of muck AND the recommended prevention and control for all other plants. The estimated annual cost per parcel is $47,700 for the first year with grants. How likely are you to support this scenario?



Comments for those who chose dredging:

- Muck removal is important (4)
- Other (2)
  - Chemical best option if not dredging
  - Need to act now

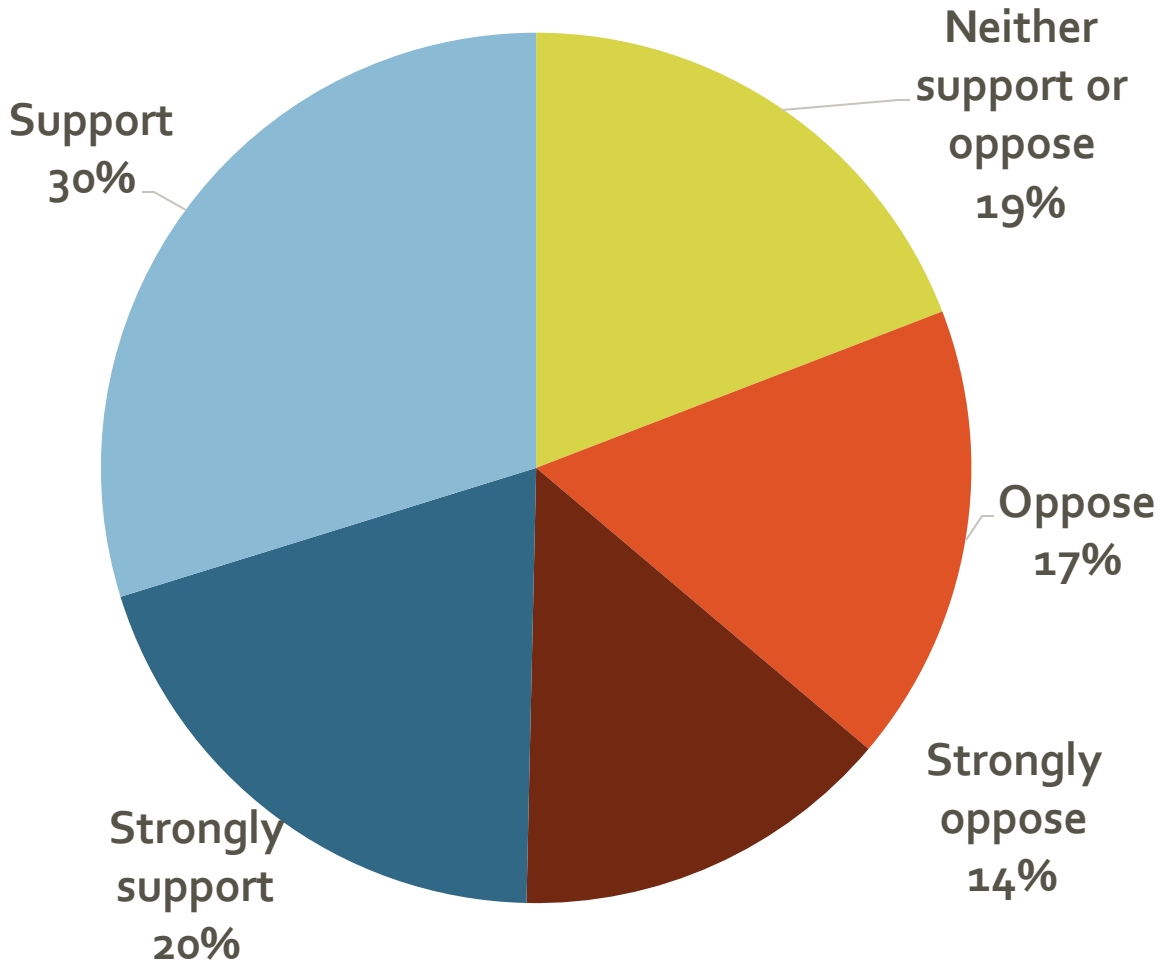
Scenario 2: This scenario includes **Chemical Control** for fragrant water lily using imazapyr and/or imazamox for an estimated 40-50% lily reduction in the middle basin, lily eradication in north and south basins AND the recommended prevention and control for all other plants. The estimated annual cost per parcel is $135-$171 with grants. How likely are you to support this scenario?



Comments for those who chose chemical treatment:

- Prefer dredging, but cost makes chemical best option (10)
- Chemical is most cost effective/efficient option (4)
- Combine chemical & harvest (2)
- Other (1 each)
  - Higher level of lily removal
  - Individuals should be able to treat in front of their properties

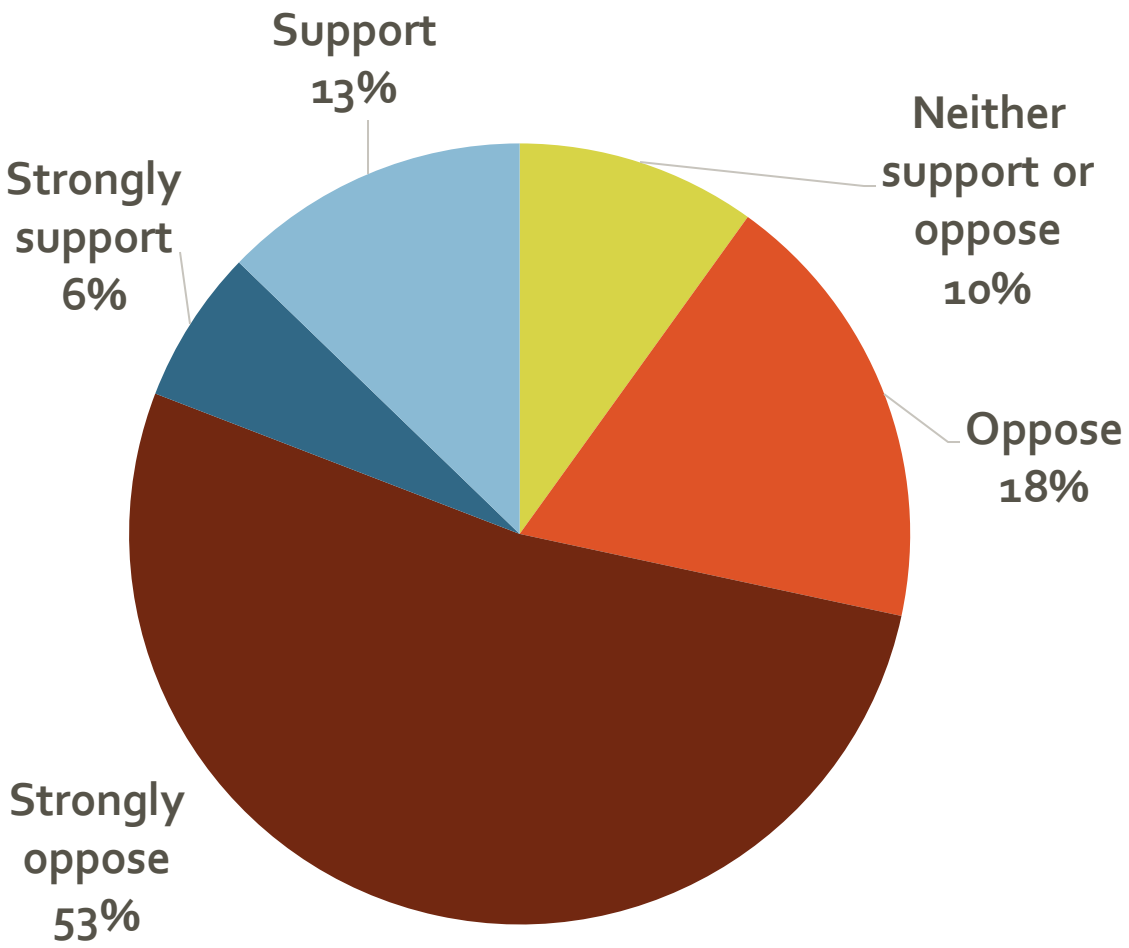
Scenario 3: This scenario includes **Mechanical Harvesting** for fragrant water lily for an estimated 15-20% lily reduction in the middle basin only AND the recommended prevention and control for all other plants. The estimated annual cost per parcel is $136-177 with grants. How likely are you to support this scenario?



Comments for those who chose Mechanical Harvesting:

- Prefer because no chemicals (3)
- Combine chemical & harvest (2)
- Other (1 each)
  - Harvest more
  - Purchase a harvester
  - Lilies provide benefits

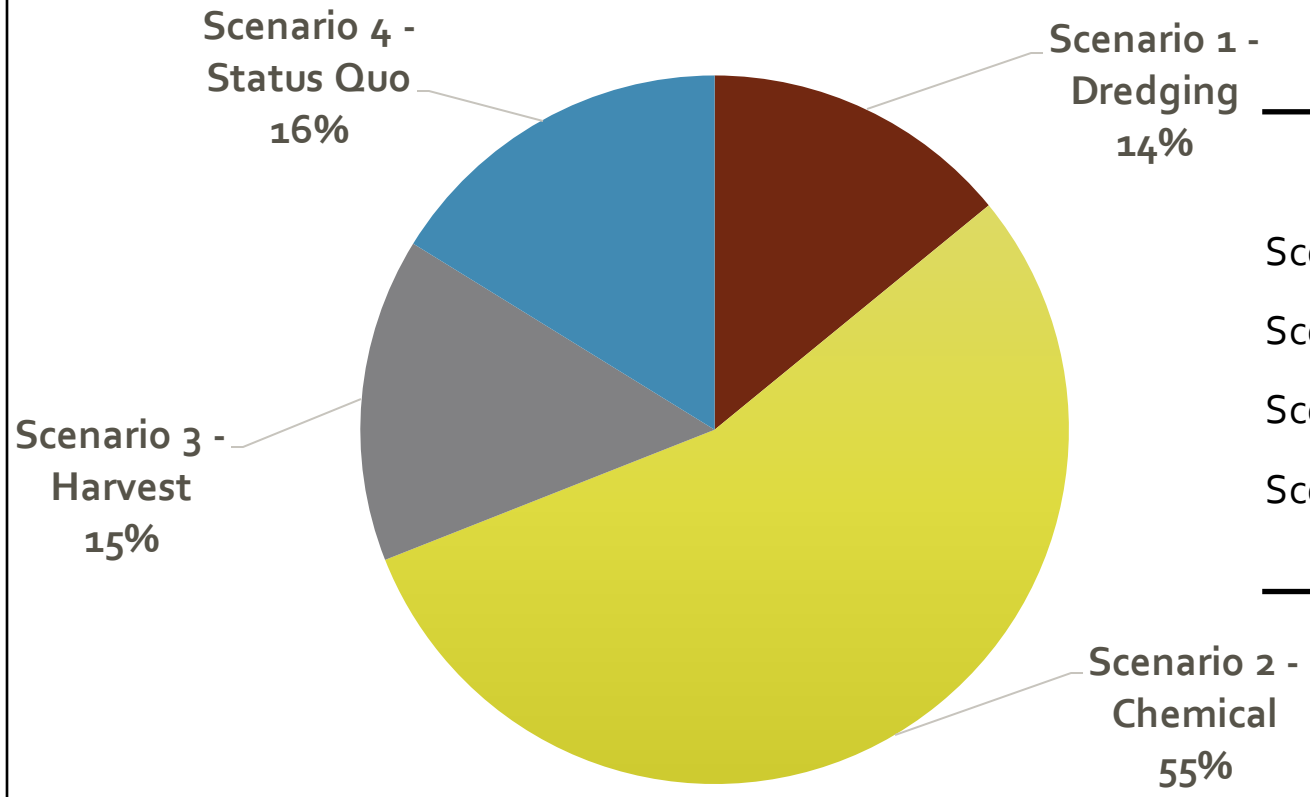
Scenario 4: This scenario would be **Status Quo** or to take no further action on invasive plant control as a community. Efforts to continue some diver surveys and hand-pulling of Eurasian watermilfoil could continue dependent upon voluntary donations to the Lake Roesiger Community and Boat Club.



Comments for those who chose status quo:

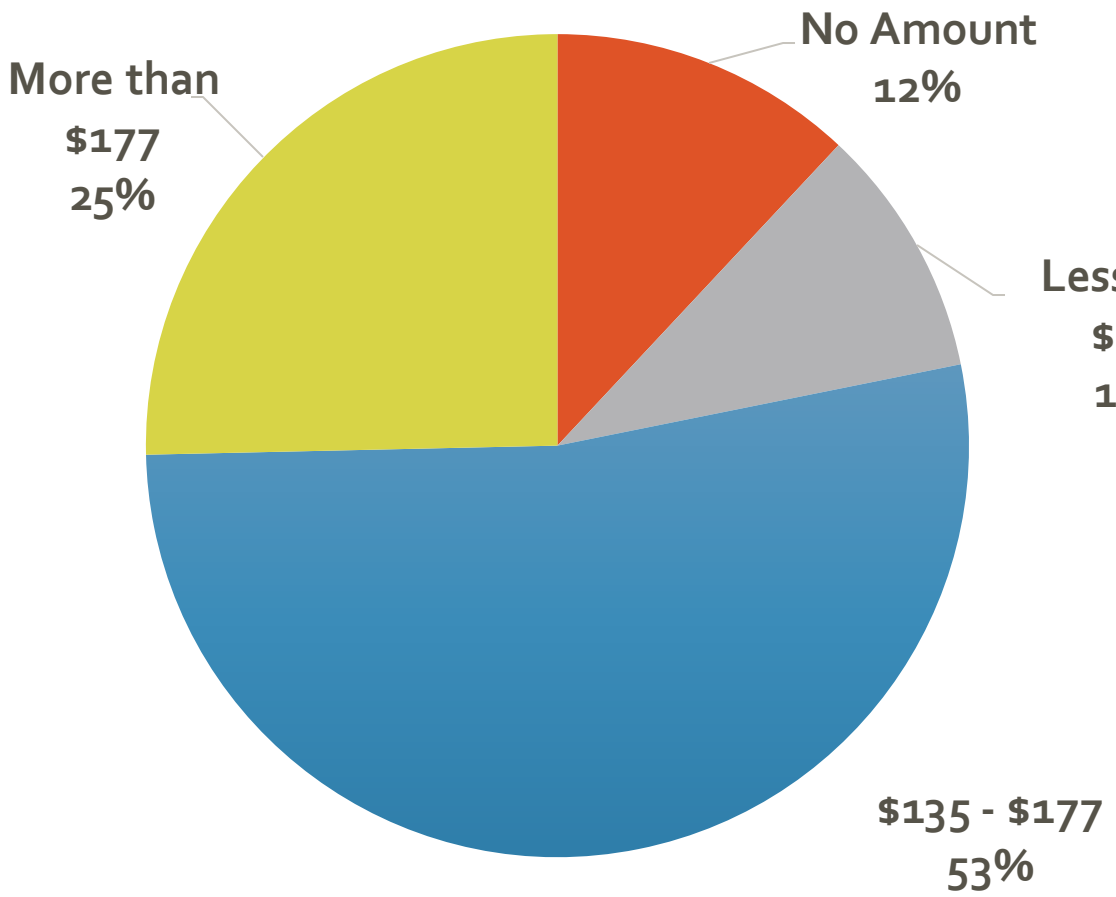
- Middle basin issue/middle basin should pay (10)
- Do not want chemicals (4)
- Cost (2)

Which do you feel is the best scenario for invasive fragrant water lily control at Lake Roesiger?



	Middle	North	Other	South	Rec.	Total
Scenario 1 - Dredging	6	9	2	3		20
Scenario 2 - Chemical	24	28	4	18	2	78
Scenario 3 - Harvest	2	9	1	8		21
Scenario 4 - Status Quo		10	1	12		23
Total	**32**	**57**	**8**	**43**	**2**	142

One option is for residents to pay an annual fee to pay for aquatic plant control. The mid-range draft scenarios are estimated to cost between $134 to $177 per year. How likely are you to support paying such a fee for aquatic plant control?



	North	South	Middle	Other	Rec.	Total
No Amount	9	8				**17**
Less than $135	4	8		2		**14**
$135 - $177	32	17	17	6	2	**75**
More than $177	11	8	15			**36**
Total	**57**	**43**	**32**	**8**	**2**	

General Comments

Need to act now (6)

Payment/Funding

Middle basin landowners should pay more (6)

County/State should pay more (4)

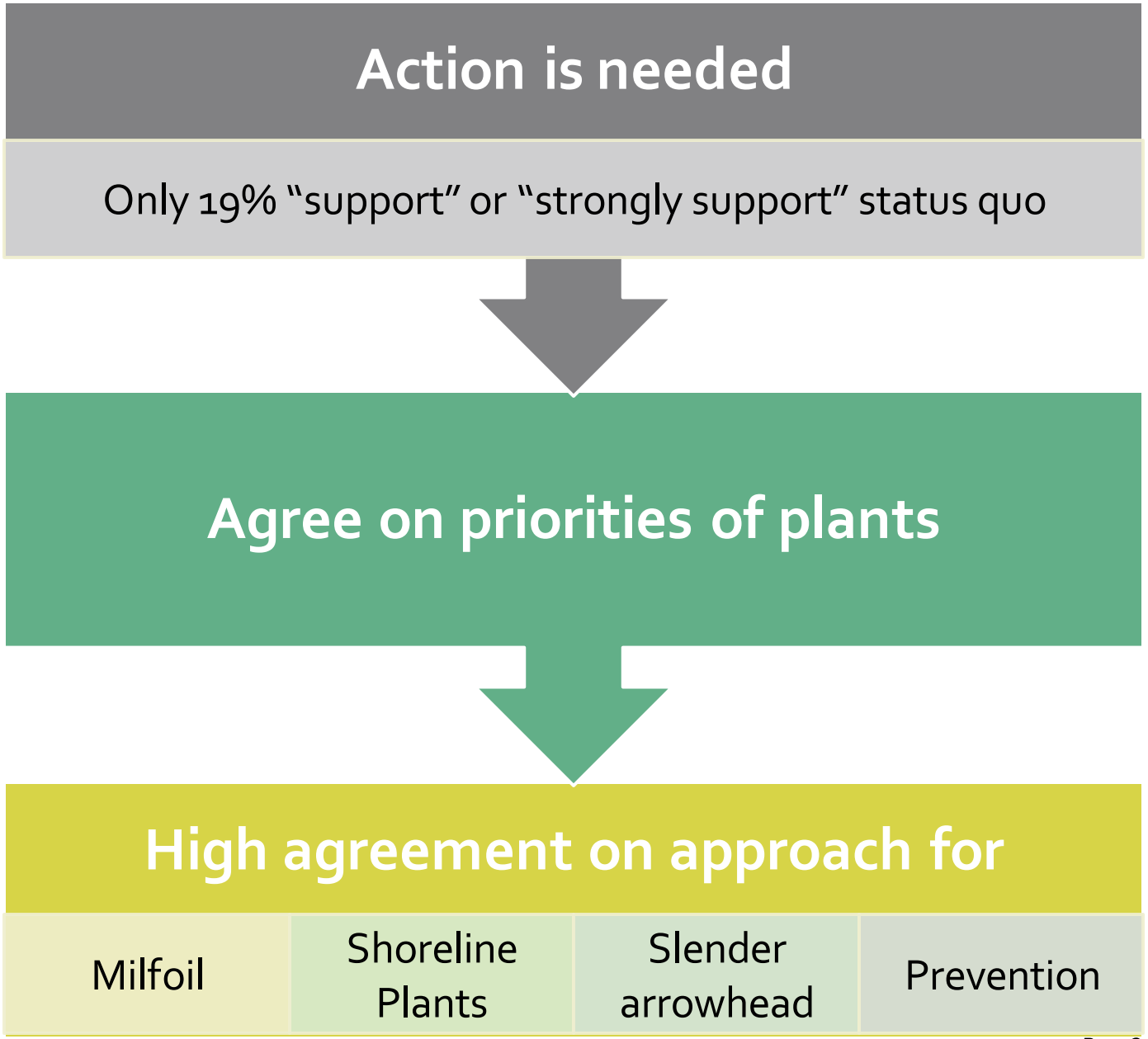
Everyone should contribute (4)

No mandatory fees (3)

Parcels near lake should pay (2)

Expressed Thanks(11)

Survey Takeaways



Survey Takeaways - Lily Control

No Dredging

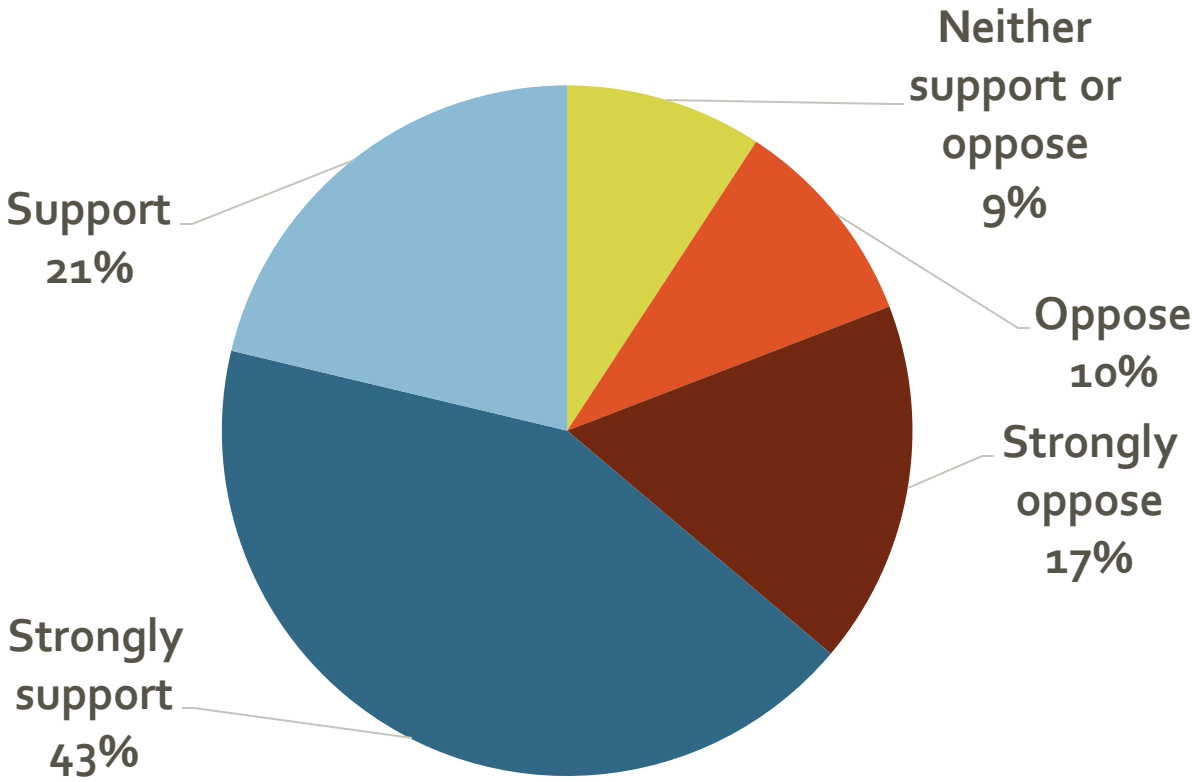
60% oppose or strongly oppose

No Status Quo

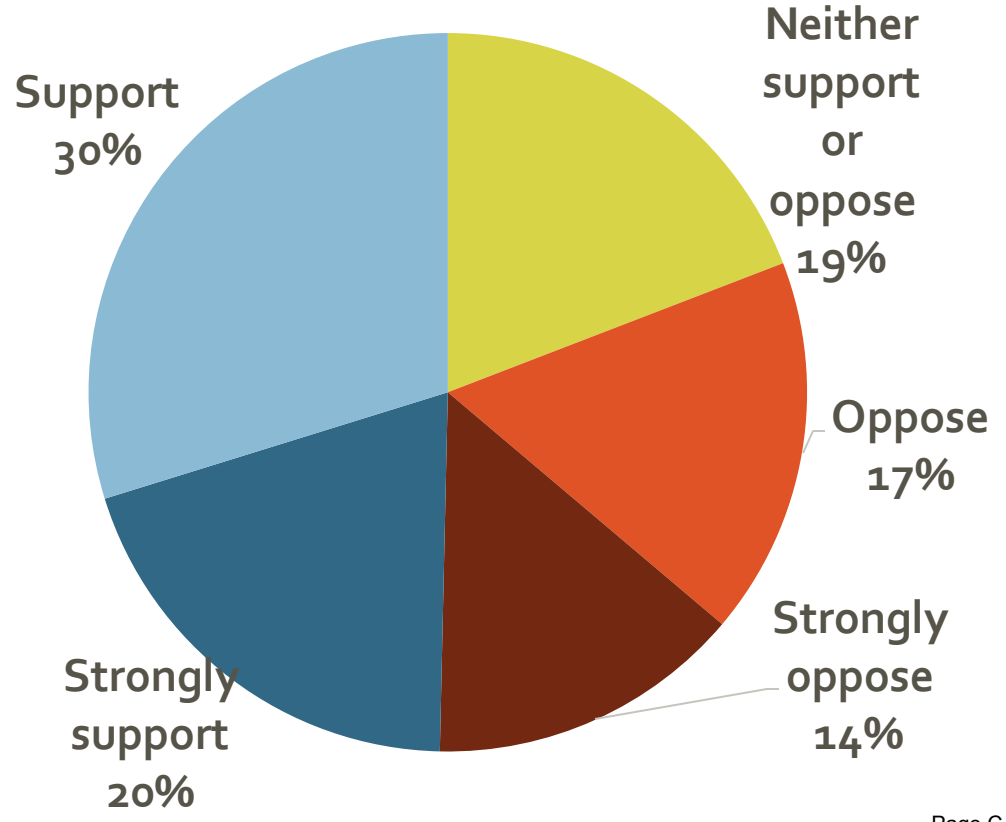
70% oppose or strongly oppose

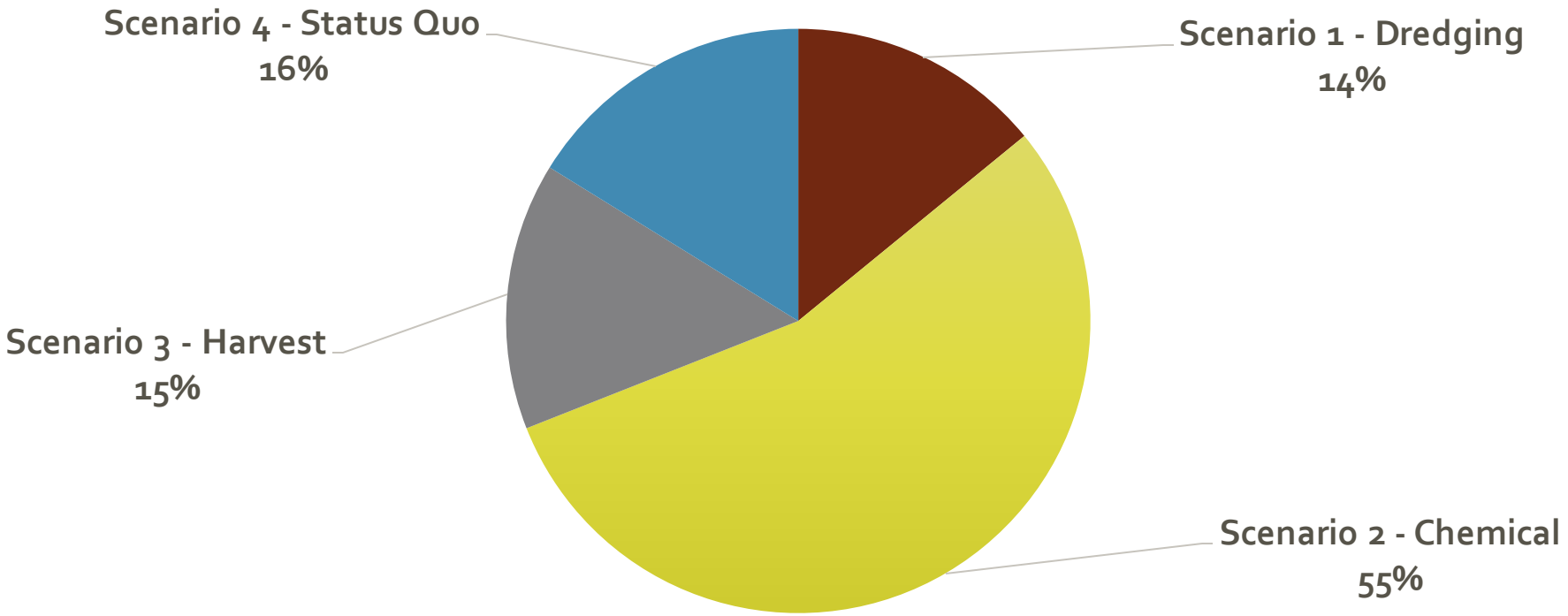
Chemical and Mechanical Harvesting Both Supported

Chemical

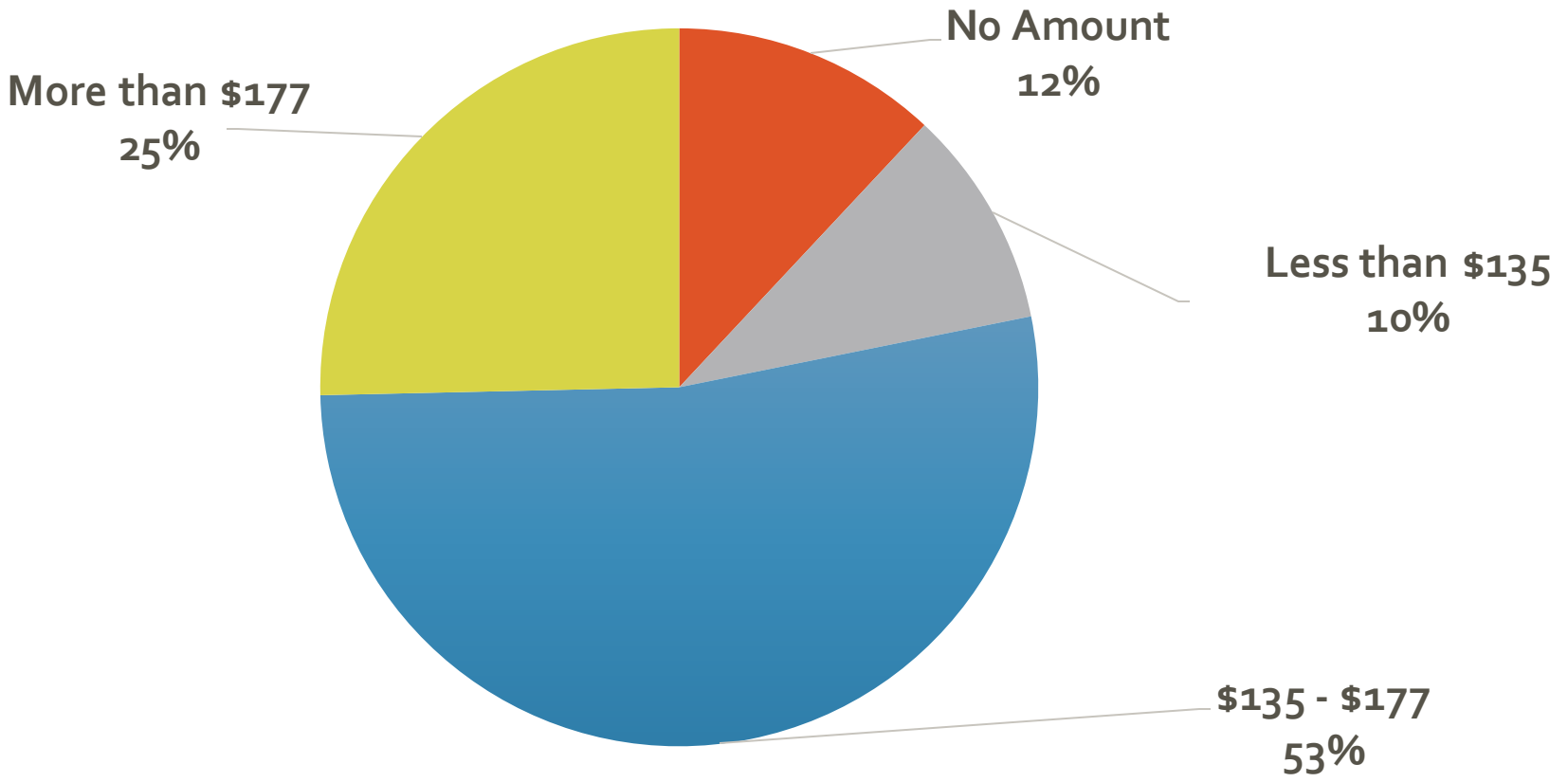


Mechanical Harvesting





CHEMICAL CONTROL IS PREFERRED OPTION



SURVEY TAKEAWAYS – THERE IS A HIGH WILLINGNESS TO PAY

C.2 PUBLIC SURVEY COMMENTS RECEIVED ON PLAN APPROVAL

Question: Why do you not agree with the recommended control option for Eurasian watermilfoil or what changes would you like to see?

Note – Question was only posed to those who did not select that they agreed with the recommended Eurasian watermilfoil control option in the previous question. Responses only shown for those who provided a comment

Response	Comment
I mostly agree, but would like to see some changes	I do not agree with the chemical option. Many residents still use lake water in their homes and to water outside.
I mostly agree, but would like to see some changes	I am in favor of hand pulling but really need to study the effects of chemical use.
I mostly agree, but would like to see some changes	Chemical control
I mostly agree, but would like to see some changes	No use of chemicals as an additional tool.
I mostly agree, but would like to see some changes	NO CHEMICALS IN THE LAKE.
I mostly agree, but would like to see some changes	opposed to chemicals in the lake.
I mostly agree, but would like to see some changes	Due to the low amount of milfoil in the lake, I do not see any need for a chemical alternative
I mostly agree, but would like to see some changes	No use of chemicals.
I mostly agree, but would like to see some changes	I used to pull weeds for a contract company as a kid on Lake Washington. It is NOT economical in the long run. Divers simply charge too much, and are not able to frequent the lake enough. The only plausible solution is to follow Lake Stevens lead as they did with milfoil treatment and use ProcellaCOR in large quantities, 3 or 4 times a year
I mostly agree, but would like to see some changes	Do not want chemical option, instead increase dash which has worked well.
I mostly agree, but would like to see some changes	no herbicide ,rather property owner notification and education.
I mostly agree, but would like to see some changes	I question the chemical option. Increase diver hand pulling first.

Response	Comment
I mostly agree, but would like to see some changes	I don't agree chemicals are completely safe
No, I do not agree	No chemical control
No, I do not agree	I believe the milfoil can be contained with diving. Recomend recruiting and training more volunteers
No, I do not agree	i only agree with eradication through mechanical means, not chemical means
No, I do not agree	I don't want chemicals
No, I do not agree	Too expensive
No, I do not agree	Too costly
No, I do not agree	Chemical TX is much more cost effective
No, I do not agree	none

Question: Why do you not agree with the recommended approach for shoreline invasives or what changes would you like to see to this recommendation?

Note – Question was only posed to those who did not select that they agreed with the recommended shoreline invasives control option in the previous question. Responses only shown for those who provided a comment

Response	Comment
I mostly agree, but would like to see some changes	Knotweed needs professional intervention
I mostly agree, but would like to see some changes	We would like to see the county send out materials to those who have big infestations of Japanese knotweed to let them know how damaging it can be, and strongly advocating for elimination
I mostly agree, but would like to see some changes	I agree with all those ways to handle that specific invasive species of plant but would like to add chemical means to control this
I mostly agree, but would like to see some changes	We would like to see more landowner commitment to properly remove the invasive plants.
I mostly agree, but would like to see some changes	People need to take action or the open water will disappear.
I mostly agree, but would like to see some changes	Offer recommendations of landscapers who can design and install native plant friendly shorelines.
I mostly agree, but would like to see some changes	Plant identification on each parcel if landowner requested

Response	Comment
No, I do not agree	can not depend on individual homeowners to do this -- most do not even live here year round.
No, I do not agree	Too expensive
No, I do not agree	reliance on individual land owners will not ensure eradication of invasive shoreline species.
No, I do not agree	homeowners are not experts in weed control and may not take the most care of the lake ecosystem
No, I do not agree	Too costly
No, I do not agree	none

Question: Please provide more details about your selection for slender arrowhead [following question regarding if they agreed with recommendation]

Note – Question was only posed to those who did not select that they agreed with the recommended slender arrowhead control option in the previous question. Responses only shown for those who provided a comment.

Response	Comment
No, I do not agree	Don't mess with divers. I can speak from experience. Chemicals, unfortunately, is the only way to achieve any results. ts.
No, I do not agree	Near-shore coverage should also be addressed thru landowner education about hand-pulling, allowing greater flexibility for chemical (middle) or DASH (all basins) control methods.
No, I do not agree	none
No, I do not agree	Too costly
No, I do not agree	Too expensive
No, I do not agree	Too expensive
Yes, I agree but I would like to see a higher level of effort	Because they're submerged, I don't think most residents realize the severety of the slender arrowhead problem. Most of the middle basin, and ALL of the channel between middle basin and south basin, is covered with slender arrowhead. We live in the channel between the middle and south basins, and the slender arrowhead also creates muck that is increasing every year. When we purchased our home in 2012, we could float or swim in the channel without a problem. Now if we want to float or swim, the muck has raised the lake floor so much that the slender arrowhead is starting to stick out of the water. You can't float or swim without the slender arrowhead constantly brushing against your body. Not to mention, the muck has raised the channel floor so much that our boat's prop drags through the slender arrowhead going to and from our dock. The slender arrowhead is filling the lake in just as much as the water lily, and it needs to be made a higher priority. If nothing is done, the channel will continue to fill in to the point that boats won't be able to travel between the middle and south basins.

Response	Comment
Yes, I agree but I would like to see a higher level of effort	Could property owners be taught good ways to help remove this one?
Yes, I agree but I would like to see a higher level of effort	I would pull weeds on my shoreline but would like to have formal permission to do so
Yes, I agree but I would like to see a higher level of effort	I'd like to see a more aggressive action
Yes, I agree but I would like to see a higher level of effort	I'd personally pay to have this removed in front of our property.
Yes, I agree but I would like to see a higher level of effort	If funding was available, I would like to see a higher level of effort because slender arrowhead fills in to the areas when fragrant water lilies are removed.
Yes, I agree but I would like to see a higher level of effort	increase initial target to be greater than 20%
Yes, I agree but I would like to see a higher level of effort	Its impact is not as visually obvious as other species but this plant is smothering the lakebed in many areas of the lake and grows in levels so what is seen is sometimes only the top layer of what could be up to 3ft of plant material from what I have removed around my dock. Where I have manually removed, fish populations and fishing quality has skyrocketed.
Yes, I agree but I would like to see a higher level of effort	More dash and chemical options
Yes, I agree but I would like to see a higher level of effort	more priority
Yes, I agree but I would like to see a higher level of effort	My area of the lake has a high level of slender arrowhead and it is very difficult to try and control
Yes, I agree but I would like to see a higher level of effort	The bureaucracy associated with this plan is cumbersome and costly - a most aggressive plan should be enacted at the earliest opportunity.
Yes, I agree but I would like to see a higher level of effort	This is what I see in the north lake. Often floating.
Yes, I agree but I would like to see a higher level of effort	Worried this plant will spread without more attention
Yes, I agree but I would like to see a higher level of effort	years ago the south basin was pristine with sunlight bouncing off the river like bedrock and now is filled with years of muddy decayed arrowhead and active plants spreading out in the deeper water which makes it almost impossible to harvest.
Yes, I agree but I would like to see a lower level of effort	90% of this effort should be for control and removal of Lilly pads

Response	Comment
Yes, I agree but I would like to see a lower level of effort	I do not believe this plant is a huge issue.
Yes, I agree but I would like to see a lower level of effort	I do not see this as a urgent concern on the North Lake .
Yes, I agree but I would like to see a lower level of effort	I'm not sure how big the impact on the lake it is.
Yes, I agree but I would like to see a lower level of effort	its a lower priority. would like to see funds for higher priority projects
Yes, I agree but I would like to see a lower level of effort	property owners and volunteer efforts to pull the arrowhead on a volunteer basis
Yes, I agree but I would like to see a lower level of effort	There is a lot of this plant already in the lake basins. It has not had very much discussion. More education needed.

Question: Why do you not agree with the recommended approach for invasive species prevention or what changes would you like to see?

Note – Question was only posed to those who did not select that they agreed with the recommended invasive species control option in the previous question. Responses only shown for those who provided a comment

Response	Comment
I mostly agree, but would like to see some changes	You are wasting your time and money trying to educate the average boat entering the lake at the boat launch, they don't care.
I mostly agree, but would like to see some changes	The WDFW Boat Launch is viewed by many as a magic contact point to reach lots of people. Nearly everyone who comes there is not interested in discussion but getting their boat into or out of the water. The existing "signs" are still too many and thus the messaging is confused.
I mostly agree, but would like to see some changes	Also emphasize at EVERY communitee club meeting what these invasives are. Show videos (captive audience), and have materials - also ask for residents to pass on to their neighbors
I mostly agree, but would like to see some changes	and community club presentations, talks
I mostly agree, but would like to see some changes	The new signs are nice but I really doubt a boat owner takes the time to read the sign while in the process of launching their boat.
I mostly agree, but would like to see some changes	I am not sure outreach will have the desired effect

Response	Comment
I mostly agree, but would like to see some changes	I would like to see a more concerted effort in boat inspections at boat launches for invasive species.
I mostly agree, but would like to see some changes	I have concerns regarding potential confrontations at the boat launch, and how volunteers would be trained.
I mostly agree, but would like to see some changes	Require a fee to lunch boats or increase existing fee to off set cost with efforts to reduce introduction of new migrating plants from boats.
I mostly agree, but would like to see some changes	Add daily boat launch use fees along with targeted education for users.
I mostly agree, but would like to see some changes	I don't see where volunteers would be feasible to pass out the information at the boat launch.
I mostly agree, but would like to see some changes	Mandatory boat/ trailer checks
I mostly agree, but would like to see some changes	There's already signs at the boat launch and don't feel it's safe for people to confront boaters at the boat launch.
No, I do not agree	Too expensive
No, I do not agree	prioritize existing problems
No, I do not agree	I agree but feel this need to be done by WDFW. Its their boat launch and their responsibility
No, I do not agree	none

Q18/19: Which do you feel is the best scenario for invasive aquatic plant control at Lake Roesiger? If desired, please provide any additional comments with regards to the provided scenarios.

Note – responses only shown for those respondents who provided and additional comment on their selected Scenario

Response	Comment
Scenario 1 - Dredging	The real challenge is the "muck" that is collecting on the bottom. This promotes the growth of the lily pads and arrowleaf and extends their coverage. We need to figure out a way to remove the muck especially from the middle lake.
Scenario 1 - Dredging	I would like to see the 3 feet of muck reduction in areas that have muck at the surface as a priority, as this would give a fighting chance to those like myself that want to use the lake but aren't able to even enter the lake from their dock. I am very interested in making the middle section completely accessible and see fish start to live in this area.
Scenario 1 - Dredging	Scenario 1 is my preferred method as I feel removing muck is important. I feel also using chemical as in Scenario 2 for the north and south lakes is also very important.

Response	Comment
Scenario 1 - Dredging	I think scenario 1 would be the best possible plan, but I recognize it's challenges with funding and permitting. If scenario 1 could not be funded or permitted, scenario 2 would be the second best option.
Scenario 1 - Dredging	We need to take action soon. This delay just makes the problem worse. Get in your boat and travel the lake and you'll see the aggressive growth.
Scenario 1 - Dredging	It is not enough to tell us what to remove. Please tell us what to plant. What should we be lining our shores with?
Scenario 2 - Chemical	I'd like to ensure that the middle basin residents are granted permission and permits to continue the application of the selected non-toxic herbicide (on their own dime) for their own personal areas.
Scenario 2 - Chemical	we can no longer ignore the vast growth of the Lillies that have spread from the middle basin to the North and South basins. We have researched and read that the only effective way to get these eradicated/controlled is by using chemicals.
Scenario 2 - Chemical	I chose scenario #2 as I believe that the Lily infestation has gotten so out of the control that chemical spraying is the only cost effective way to reduce it. I'm not a great fan of hazardous chemicals but it appears that the 3 types mentioned have a significantly smaller impact to the environment. I would love to choose Scenario #1, as I believe that the muck is the larger problem. However the costs associated with it are most likely out of reach for many lake residents. $47.7K per parcel? Does that include all lake parcels or just a tally of those in the middle lake that are impacted? I can't imagine that those that don't live in the muck impacted areas would be willing to fork over the $$$ it would take to dredge. And honestly, I wouldn't blame them at all. It also appears that cost doesn't cover dredging along property owners docks and shorelines which is, in my opinion, more of a priority.
Scenario 2 - Chemical	Chemical option seems the only cost-effective option to Make a significant impact on the quality of the lake
Scenario 2 - Chemical	Don't bother with SCUBA divers.....
Scenario 2 - Chemical	Can't we combine Scenario 2 and 3 to get a better solution?
Scenario 2 - Chemical	Water lily control will require multiple methods (2+3), not just one. Since lily pads die off at the end of the season anyway, the concern for oxygen depletion seems unnecessary. I would recommend maximum possible coverage in any chemical application.
Scenario 2 - Chemical	Support options 2 and 3
Scenario 2 - Chemical	My only concern that was not addressed in the reading portion is the clean up of the die off. It may have been discussed in the video I did not watch.
Scenario 2 - Chemical	What's the plan to collect money from all the parcels ? And if most parcels don't contribute to any plan are the costs then reallocated to those who are participating?
Scenario 2 - Chemical	Would like to see a higher % reduction with the water lily
Scenario 2 - Chemical	The identified 463 number of denominator parcels for this program is just plain wrong. "Lake Roesiger" includes the people who have parcels on "both sides" of the roads surrounding the lake, as well as parcels above the lake with shared waterfront easements. A better number is 698 parcels.

Response	Comment
Scenario 2 - Chemical	Find way to reduce the cost to lake front properties. Parcels could be more broadly defined than lake front properties since surrounding areas use the lake frequently and real estate values reflect close location to the lake.
Scenario 2 - Chemical	I would love to have the first scenario, but after being part of the group that worked to have the lily pads sprayed, getting people to pay out of pocket was an issue. Scenario two, provides the most reduction for the price point.
Scenario 2 - Chemical	I would prefer scenario #1 but that would cost considerable money for those on a limited budget. It would be nice if some payment plans were available for review.
Scenario 2 - Chemical	Prefer Scenario #1, but the cost is the issue!
Scenario 2 - Chemical	I believe scenario 1 would be best, though I don't think it will be supported due to cost.
Scenario 2 - Chemical	We think the first scenario is obviously the most effective solution but think the cost to individuals is more than most could manage.
Scenario 2 - Chemical	Scenario 1 would be the most optimal, but the cost is unfortunatley too high to be acceptable, I believe.
Scenario 2 - Chemical	While I would strongly prefer an 80-90% reduction in lilies in Scenario 1, I think it is probably cost prohibitive and unlikely to be approved.
Scenario 2 - Chemical	I would love Scenario 1, but obviously it doesn't work monetarily. I feel we need dredging as there is such a pile up of muck.
Scenario 2 - Chemical	Scenario 1 is just too costly.
Scenario 2 - Chemical	Scenario 1 is ideal, but it's way too cost prohibitive. Of the remaining scenarios, Scenario 2 is the logical choice. It accomplishes the most eradication at a reasonable price.
Scenario 2 - Chemical	Expecting property owners to fund this assumes that this is a private lake with no public access to the waterway. In this case, this is not the case and expecting private homeowners to fund this is unreasonable since they are not the majority of lake users.
Scenario 2 - Chemical	thanks for all the information!!
Scenario 3 - Harvest	The Dredging would be my preferred scenario with the very large exception of the cost. Is there a way to get these results but with a reduced cost? Using volunteer labor or other measures?
Scenario 3 - Harvest	More education needs to take place for other means - i.e. bottom barriers, use the JARPA for permitting for those who want to use it; Top of water barriers (floating large billboards); teach residents to pull rhizomes particularly for small patches (north and south lakes), keep watching for more alternatives.
Scenario 3 - Harvest	Continue using bottom barriers, hand pulling (on Lily pads), and continue to look for other methods
Scenario 3 - Harvest	I prefer Scenario 1 but costs are a major factor. I suggest going with #3 but increasing the investment to include up to 50% of lily reduction or something in the $2500 range for per parcel cost.
Scenario 3 - Harvest	I am very concerned about using chemicals in the lake.

Response	Comment
Scenario 3 - Harvest	I really like the effectiveness and proposed results of the dredging option, but the cost is super prohibitive. Is there an option where we can lease or buy (with grant assistance) the equipment needed and then train volunteers (I would volunteer) to operate it? I have operated heavy equipment and marine equipment previously and would volunteer my time to drive the costs down for all participants.
Scenario 3 - Harvest	Although water lilies are invasivr, they currently provide habitat for many aquatic bird, anohibian and fish species present un the lake. This should be weighted as well.
Scenario 3 - Harvest	I am not interested in application of any poison to the Lake.
Scenario 4 - Status Quo	I don't feel its my responsibility to pay for middle lake issues. Milfoil I am all for a minimal cost but water lilies are not my problem
Scenario 4 - Status Quo	Can't afford any provision that comes at a cost to me as a resident on the lake
Scenario 4 - Status Quo	These solutions are mostly to satisfy owners on middle lake. This lake had always been the Lilly pad lake and those that bought there knew it and had discount prices. Why should we all have to subsidize their problem. Middle lake owners should pay this cost if they want irradication.
Scenario 4 - Status Quo	My opposition to Scenarios 1,2,3 lies with splitting costs among all 463 parcels . The lily problem is and has all along been a mid lake concern ,largely sustained by the historic slow eutrafication of the shallow water body . Costs to control the mid lake lilly concerns should be by the midlake parcel owners as it essentially a midlake concern . The northlake doesnt have ,nor never will have this lilly concern as lake levels are too deep for the plant to take hold . Its a midlake problem and hence the costs of midlake owners. wyye landowners hallow
Scenario 4 - Status Quo	I have been coming to Lake Roesiger for over 40 years. I built a cabin on the middle Lake for a widow who swam out into the lake and hand harvested the water lilies from in front of her cabin. Over the years of repeated occasional pad harvesting she was able to get ahead of the lilies and have a clean swim area. This lady by herself was over 65 and by herself. For me personally I see the middle lake to be the only deterrent to the Wake Boat problem in the North Lake in front of our Cabin on Tulloch.
Scenario 4 - Status Quo	Elderly on fixed incomes cannot support another bill.
Scenario 4 - Status Quo	I think the middle lake property owners should pay for removals
Scenario 4 - Status Quo	The condition of the lake and shore is one of the criteria to consider when purchase of said property was made. Secondly, as the state has determined they have more control over the critical wetland then those who pay the taxes on the property, perhaps they should pay the the annual $47K!
Scenario 4 - Status Quo	We do not support using chemical control of any kind.
Scenario 4 - Status Quo	No chemical control
Scenario 4 - Status Quo	Its obvious that the water lilys are by far the most expensive component in any scenario. However thay are primarily a middle basin issue. It seems like the lilys and most other invasive plants listed can be mitigated easily by property owners in

Response	Comment
	the north and south basins, and you are trying to make this more of a wholistic issue than it really is.
Scenario 4 - Status Quo	We have owned property on the lake since 1972, there have always been invasive lily pads - I think the home owners on the middle lake should pull them mechanically. I support community support for mechanical removal only - NO CHEMICALS AT ALL. We are extremely against using chemicals in or around the lake. We feel the home owners on the middle lake should shoulder the cost of the mechanical removal of lily pads with moderate support from the home owners on the other lakes. I believe that park visitors and boat launch users should also support this financially.
Scenario 4 - Status Quo	Responsibility for each parcel should depend on how that parcel is affected. There are many areas not impacted as greatly and the burden should not be the same. Most homeowners we know make an effort to control the problems in their areas and it continues to increase their property values. Those homes located in the worst of the lily pads were purchased quite low in comparison and should have a higher responsibility.
Scenario 4 - Status Quo	The owners that surround Waterloo us should pay yo have them removed
Scenario 4 - Status Quo	Scenario 4 is best

Q21: Are there any additional comments you would like to share about the draft Lake Roesiger Integrated Aquatic Vegetation Management Plan?

Comment
Having lived in the lake for 30+ years and fighting lily pads the entire time, removal efforts must start ASAP. We our losing our middle lake and its effects our so extensive we have to act.
The visible spread of the Lilly pads to the North and South basins, shows that the solution has to be run by the county because individual property owners are unable/unwilling to stop it at the pace it continues to grow.
Go for it. The lilies keep to many owners from using their docks or swimming. The invasive plants will eventually cost significantly more in the future.
Let’s get it done and home the state allocates some of our tax dollars to help in a significant way
Scenario 4 shouldn't even be considered. If we don't do something about the water lily and slender arrowhead, our lake will fill in and become unusable. We've already let these problems go on far too long. We need to take action NOW.
I would like for homeowners to be able to use approved chemicals in their own swimming/dock areas to control the lilies and weeds. We have spent many years trying to control through pulling and it is hard work and must be done every year.
Elderly and non-boat owners, especially in north lake should not have to support others
Property values have sky rocketed on the lake but that only raises property taxes for those of us that live here. There should be county support from increased property taxes to help fund lake health for public lakes. This is not a private lake so the burden should not fall solely on lake front owners.
Put political pressure on county council, to pass budgetary funds for preserving our county lakes (they say they want to preserve quality of life in the county...this is a big reason why we have great quality of life) Reach out to DNR and save the XXX groups to help, to reach out for grants, etc.

This is a state lake why should we have to do it all
This is a public lake. The funds for the lake's care should be provided by public funds.
It would be most helpful if ALL lake residents were required to pay their fair share. Not enough people are paying the community dues, but still reap the benefits of the lake use.
I would like to see a higher per year investment by parcel as well as higher Community Club dues. We all stand to benefit, not just the middle lake property owners and I am happy to invest with my north and south basin neighbors for everyone's benefit.
Noticed the use of mechanical harvester in north basin in the spring/summer of 2021. Concurrent with this observation, for the first time (we have had property on the north basin of the lake for over 4 decades, we noticed significant floating aquatic plant debris in the north basin. We have been concerned that the mechanical harvesting of the lily in middle lake may contribute it’s spread in the north basin.
I'd like to see processes put in place to make it easier for residents to do some of their own plant removal without restrictions or permits.
More education is needed for what individual property owners can do to help the health of the lake. Teach lakeside owners to pull out weeds at their shorelines
Boat Launch Fee for Non-Residents to help pay for the health of lake usage. Middle Lake paid less for their property in knowing what they were buying in to. It seems that a percentage rating would be fairer when it comes to responsibility of property owners according to which basin they live on.
I would be willing to pay for invasive plant control for the Lake ,just not the Lilly control of the middle lake as I believe its a losing battle and a ongoing costly one that is primarily of concern to the parcel owners on the midlake .Not a problem on the north or even south lakes over the 25 years I,ve resided on the lake and long before that . Clearing out the lillys will cause more ecological damages to the overall lake than letting nature run its course . f
I don’t want to be a poop about this, I propose that the property owners on the middle lake be required to pay a higher fee for whatever plan gets passed. And even if the Lilly pads are removed we still have a lot of muck by the shoreline to try getting through to get to a swimming depth. I think this whole thing is a bad idea.
We understand that managing invasive plants is important to the overall health of the lake. We feel that there should be some community support for removal but the majority of cost should rest on the landowners who are in the area where the plants are. We support community work parties & individual landowner maintenance of invasive plants. In no way do we support adding any chemicals to or around the lake ever.
There needs to be a variety of people on the lake committee, not just those with the biggest problems off their dock. Seems they're avoiding their own hard work and expense by working hard to pass it on to everyone.
The draft plans mainly benefit middle lake property owners at the expense of the majority of the lake. The middle lake owners should share the expense of efforts to increase their property values. Lilies and muck have been in the middle lake for well over sixty years that I have observed. People that bought property on the middle lake were should have been aware of the issues and should be ashamed of wanting the rest of the lake property owners to pay to make changes which benefit them . the middle lake owners who want the non-native lilies removed should get on a county supervised volunteer weed pulling program.
leave it alone, it will correct itself
I would prefer to keep the county/government out of the funding aspects to allow the LRCC maximum flexibility address these issues, and to eliminate the "overhead" costs of external management.
I would be willing to contribute towards funding, but I do not support any kind of mandatory fees.

I'm not happy about this and cannot afford these prices for irradication. I would have to sell.
Don't want more property taxes
Did I mention not messing with SCUBA divers?.....
I would pay 50 a year for milfoil and middle lake 40 foot wide navigation channel nothing more
I'm confused on the cost of 47 thou. per parcel.
We appreciate the state working on this significant issue for the beautiful place. The presentation materials where very well done and extremely informative for people to understand
Appreciate the extensive amount of work to create these reports and recommendations. Also the education of all the plants and options using various communication methods and reports was very helpful.
This is a very proper undertaking that will engage needed action, involve the community to achieve that action, and precipitate what may become energetic discussion about leadership and financial roles for State of Washington and Snohomish County. However, the "community" must be properly defined and involved, and that definition includes parcels on both sides of the roads surrounding Lake Roesiger.
A very large thank you to all involved in putting this together
Thank you for conscientiously working with us!
Thank you for your hard work putting this together.
Thank you
Thank you to the steering committee for all your hard work and thank you for opening this up to the community for discussion.
I think that you guys have done a wonderful job researching the problem and presenting the best options available. Keep up the good work!
Thank you for all of your efforts putting this proposal together for the community.
Thanks a lot for putting this all together!
Give control of management of my shoreline back to the home owner.
If there are any opportunities to volunteer or in any way support this effort, please let me know.
i would be willing to pay more than $177, but would need to know the upper limit before agreeing to that choice.
Would be willing to pay more per year to help offset costs for those who are not able to pay.
No
no
Please review #15 above
No

APPENDIX D. FINAL VOTE RESULTS & COMMENTS

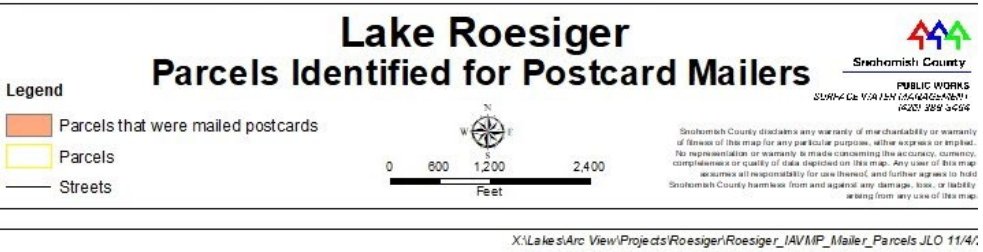
D.1 FINAL VOTE DESCRIPTION & RESULTS

Lake Roesiger Integrated Aquatic Vegetation Management Plan Final Vote Results 11/12/2021

SNOHOMISH COUNTY
Conservation & Natural Resources

Surface Water Management

Questions – Email lakes@snoco.org or call 425-388-3204



X:\Lakes\Arc View\Projects\Roesiger\Roesiger_IAVMP_Mailer_Parcels JLO 11/4/

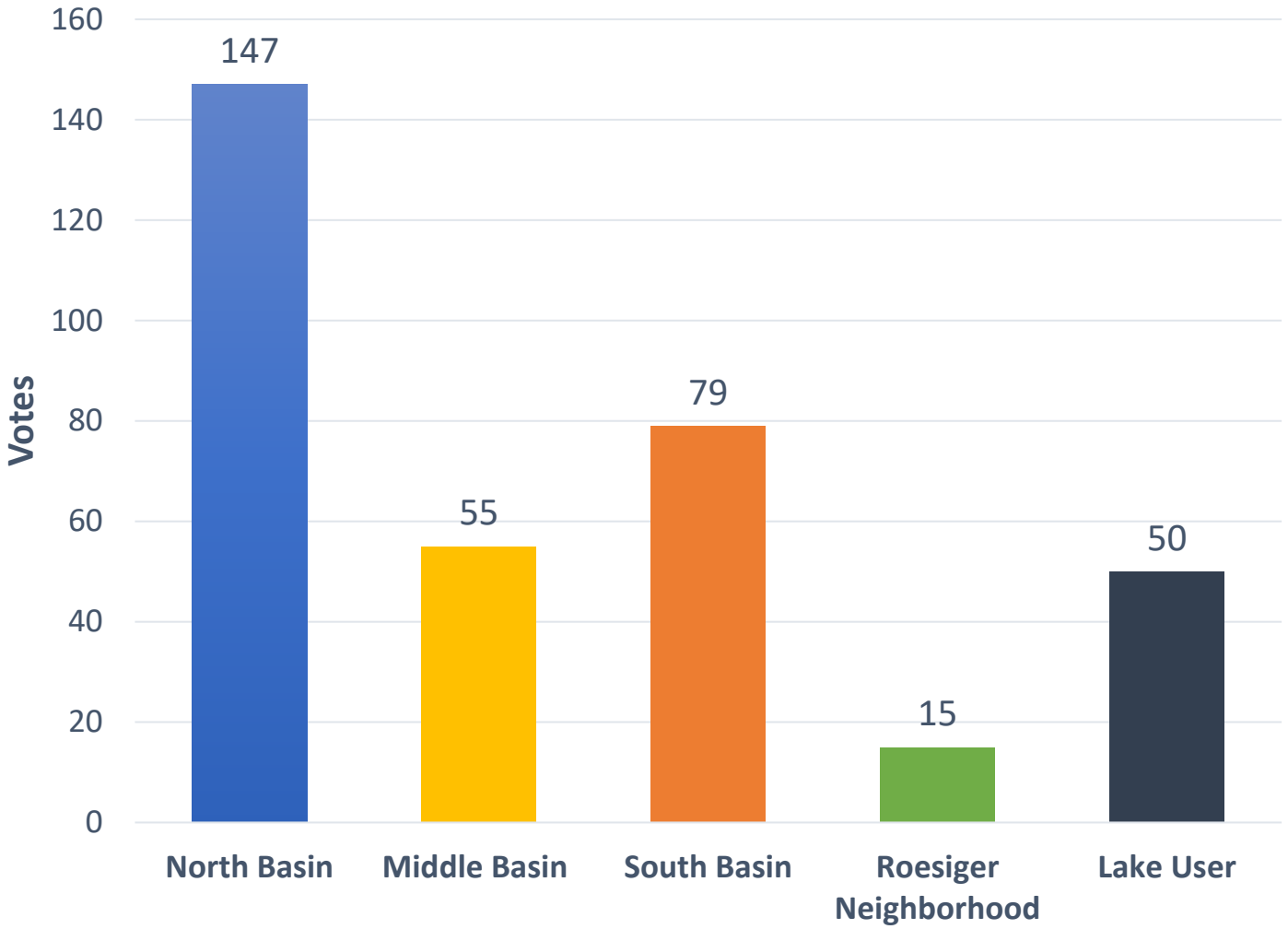
Survey Outreach Efforts

Snohomish County Efforts:

- Vote posted on website
- Mailers – sent 11/1 to all residents on the lake shoreline and surrounding streets (see map)
- Email – multiple announcements sent to 140 subscribers to Roesiger updates by Snohomish County
- Next Door – 3 posts about vote
- Created and posted FAQ based on questions

Lake Roesiger Community and Boat Club Efforts:

- Email announcements to membership
- Facebook post
- Website updated with link to vote



Response rates and locations

- There were 346 total valid votes
- There were 274 Roesiger shoreline votes (middle, north and south)
- Shoreline vote represents approximately 59% of the estimated 464 shoreline parcels

Roesiger Neighborhood = respondents that don't live on the lake shoreline but live near the lake (see previous map)[2]
Lake User = respondents who don't live near Lake Roesiger, but use the lake for recreation

Quality assurance review of survey

354 households responded

36 respondents indicated ownership of more than one parcel (31 with 2; 4 with 3; 1 with 8)

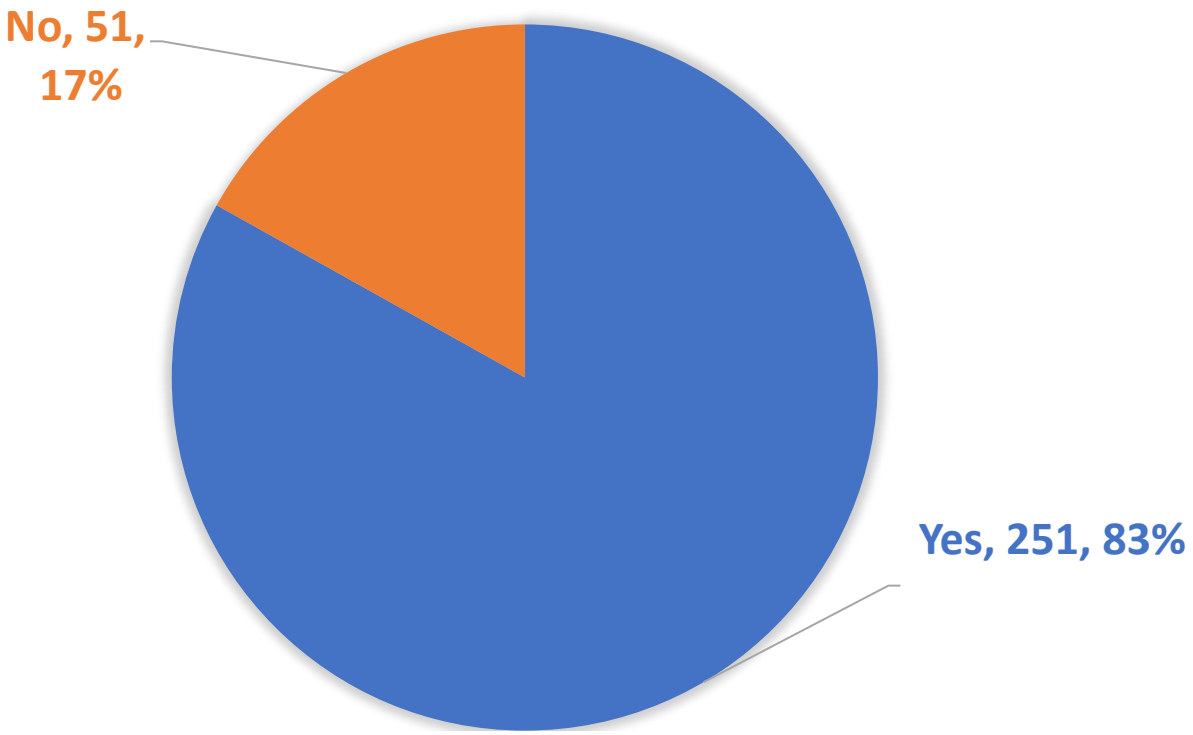
22 responses were identified as duplicate votes (households accidentally cast more than one ballot)

- Only one vote was counted per household
- All households with duplicate votes were notified by email. If votes were different, they were asked which they would like to submit – if no response, the first vote was preserved.

25 respondents that identified as “lake users” did not provide a name and/or address when asked “To ensure there is only one vote cast per household, please enter your name and address.”

- Three who provided email addresses were asked for clarifying information and no responses were received
- Remaining 22 had no contact information to confirm name and/or address
- Any vote without name and/or address were not counted as it could not be confirmed if these were duplicate entries

Lake Roesiger Community and Boat Club Membership



*Does not include those identifying as “Lake User” as they are not eligible to be members

Vote results for each question are presented showing three different groups

1. All respondents

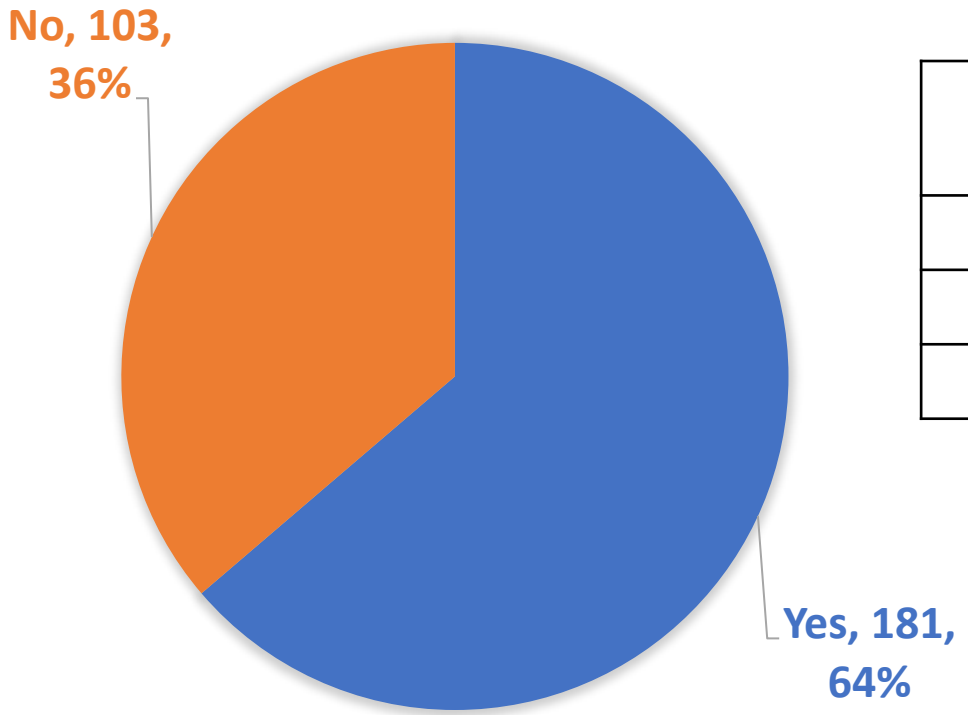
(all valid voters)

2. Lake Roesiger shoreline & neighborhood residents only (no lake users)

3. Lake Roesiger Community and Boat Club Members

Question 1 Results - Do you approve the proposed Lake Roesiger Integrated Aquatic Vegetation Management Plan as described in the revised Lake Roesiger IAVMP Executive Summary?

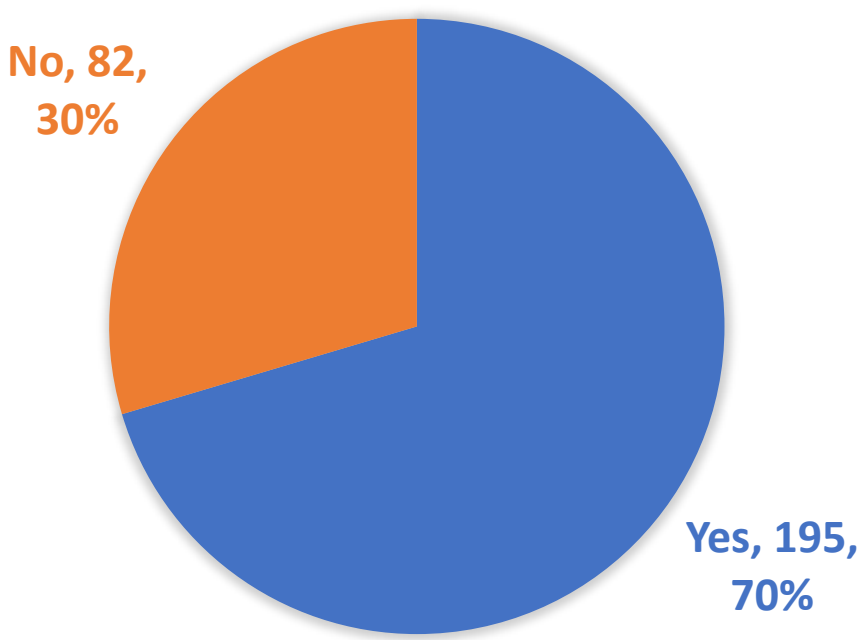
1. All Respondents



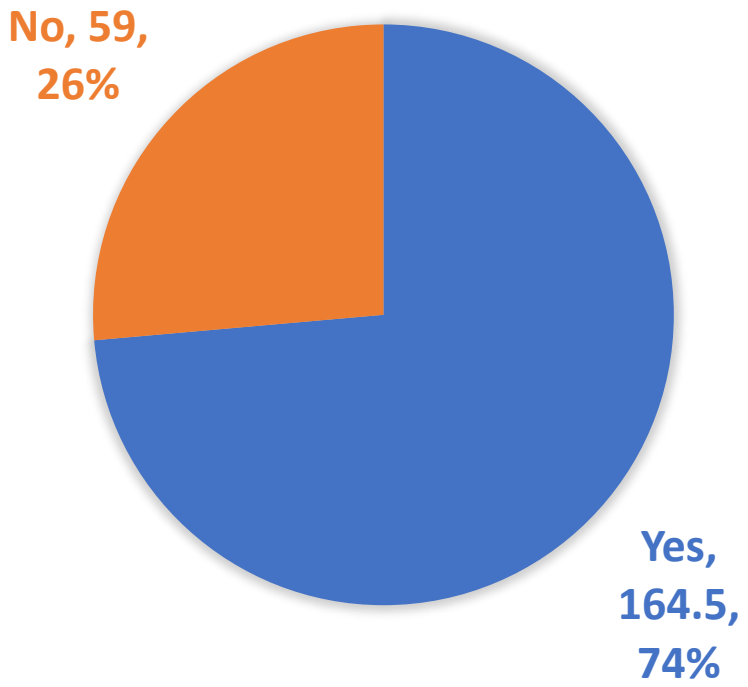
	North Basin	Middle Basin	South Basin	Roesiger Neighborhood	Lake User	Total
Yes	107	51	49	11	18	236
No	40	4	30	4	32	110
Total	**147**	**55**	**79**	**15**	**50**	**346**

Question 1 Results Continued: Do you approve the proposed Lake Roesiger Integrated Aquatic Vegetation Management Plan as described in the revised Lake Roesiger IAVMP Executive Summary?

2. Lake Roesiger shoreline & neighborhood residents



3. Lake Roesiger Community and Boat Club Members

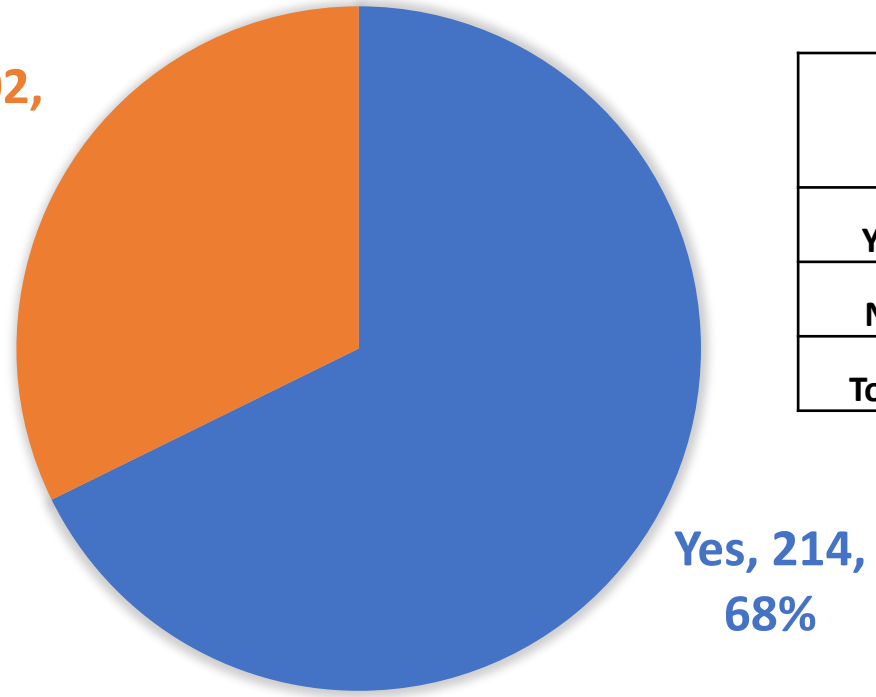


Please provide any additional comments regarding your decision to approve the plan or not approve the plan.

Comment Theme	Total
Opposed to chemicals	44
General support for plan	23
Middle basin should pay all or higher percentage of cost	9
Positive feedback on process	8
Concern with voting process	6
County, state, and/or lake users should pay for plan	5
Prefers dredging	4
Support plan, but prefer no chemicals	3
Aquatic vegetation beneficial	2
Other	12

Question 2 Results - Would you support the Lake Roesiger community working with Snohomish County to apply for a grant from the state for the initial plan implementation ($75,000 over two years and requires a $25,000 match)

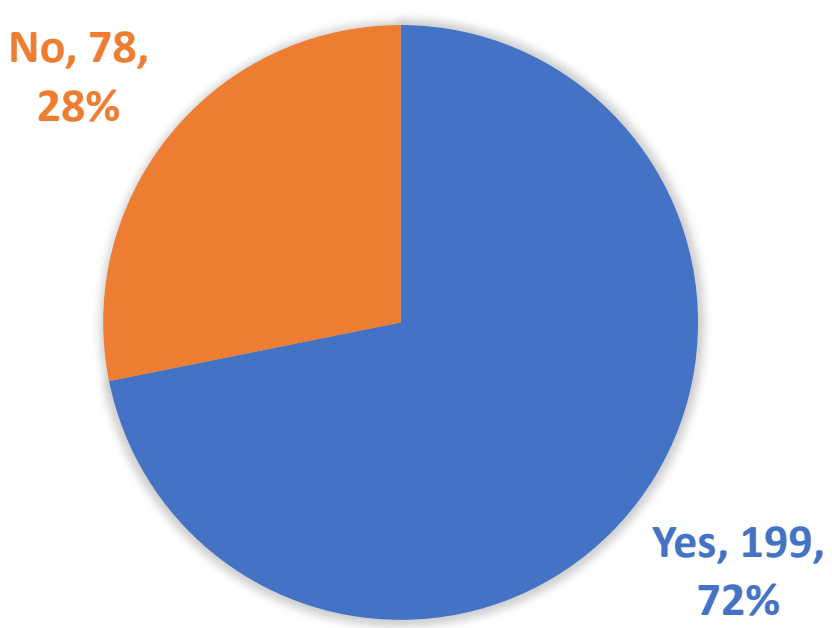
1. All Respondents



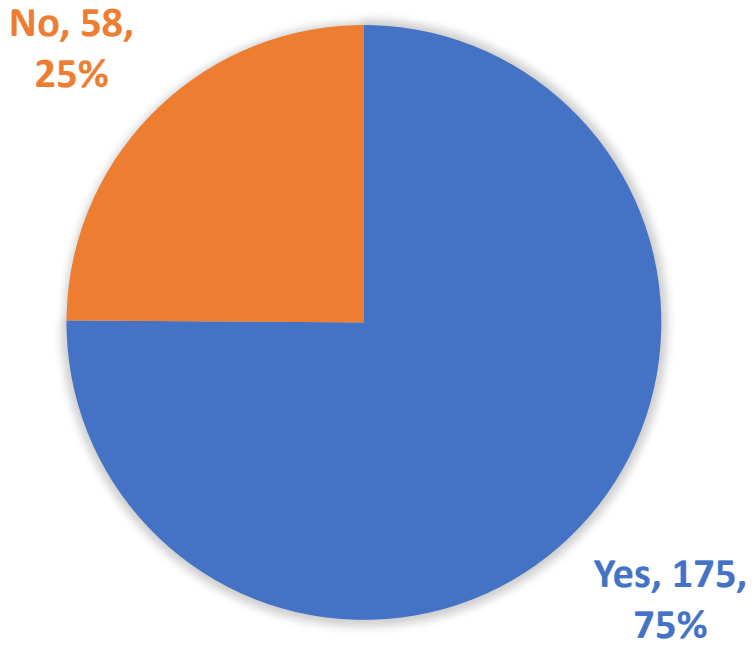
	North Basin	Middle Basin	South Basin	Roesiger Neighborhood	Lake User	Total
Yes	107	51	49	11	18	236
No	40	4	30	4	32	110
Total	**147**	**55**	**79**	**15**	**50**	**346**

Question 2 Results Continued - Would you support the Lake Roesiger community working with Snohomish County to apply for a grant from the state for the initial plan implementation ($75,000 over two years and requires a $25,000 match)

2. Lake Roesiger Shoreline & Neighborhood Residents

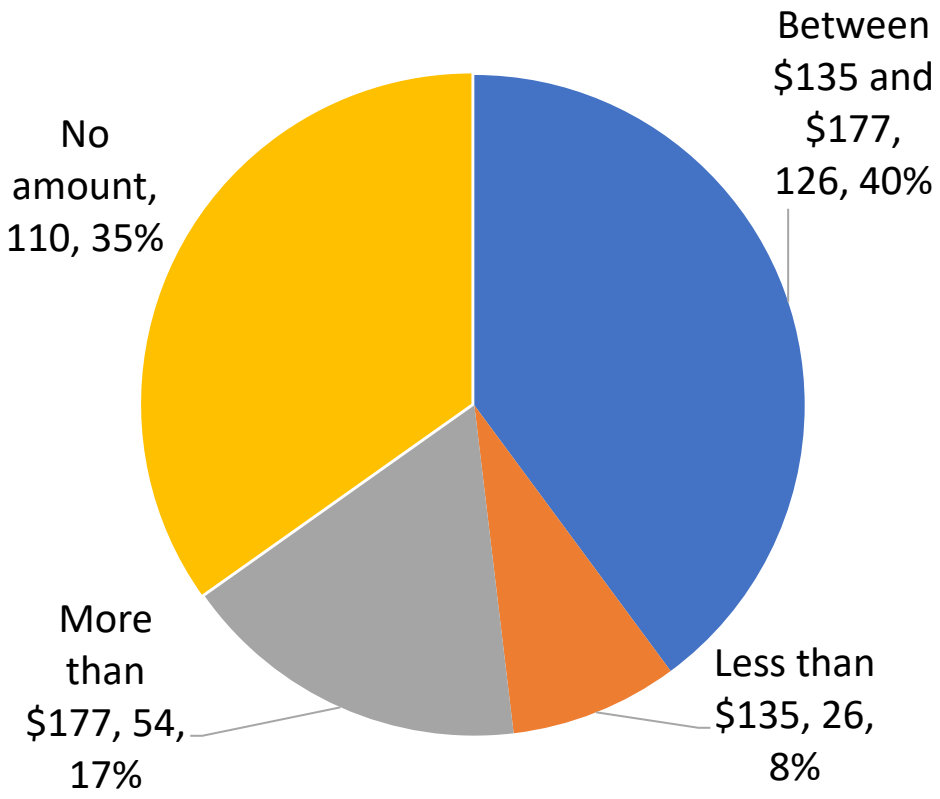


3. Lake Roesiger Community and Boat Club Members



Question 3 Results - If the plan is approved, would you support the Lake Roesiger area community paying an annual fee charged on a per parcel basis to implement the final plan?*

1. All Respondents

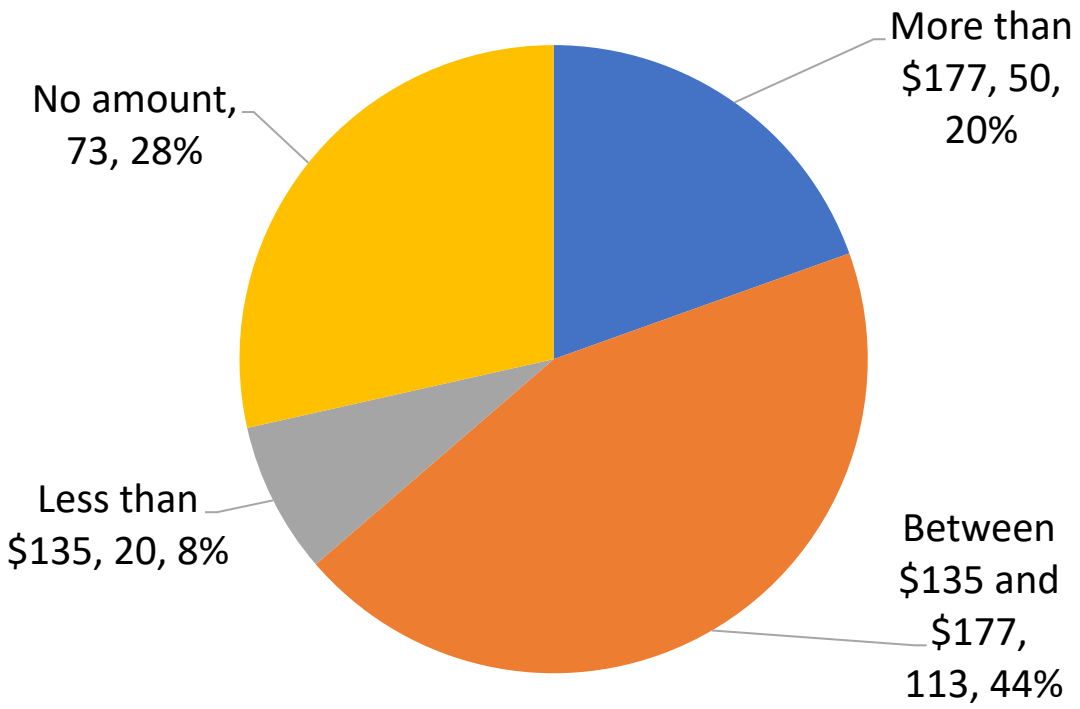


	North Basin	Middle Basin	South Basin	Roesiger Neighborhood	Lake User	Grand Total
More than $177	22	18	10	1	3	54
Between $135 and $177	65	28	31	5	8	137
Less than $135	14	5	7	3	3	32
No amount	46	4	31	6	36	123
Grand Total	**147**	**55**	**79**	**15**	**50**	**346**

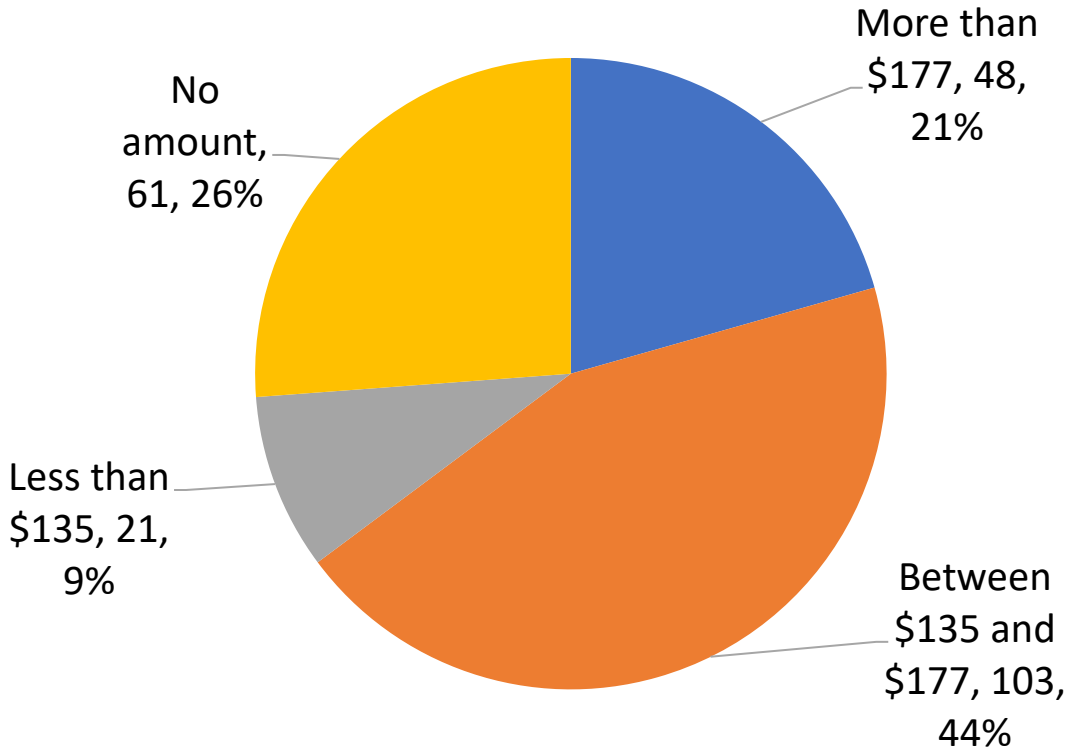
*This is NOT a vote to raise taxes on parcels, but is to provide guidance to the community to pursue this option or not

Question 3 Results Continued – If the plan is approved, would you support the Lake Roesiger area community paying an annual fee charged on a per parcel basis to implement the final plan?*

2. Lake Roesiger Shoreline & Neighborhood Residents



3. Lake Roesiger Community and Boat Club Members



Please provide any additional comments regarding funding for plan implementation

Comment Theme	Total
County and/or state should pay	13
Middle basin should pay all or higher percentage of cost	6
General support for fee and/or grants	6
Opposed to chemical use	5
Concern about duration of fee	5
I am not a lake owner - do not count my vote on fees	5
Lake users should pay	5
Opposed to fee	3
Would pay more than $177, but need to know amount	3
Concern with voting process	2
Need additional information	2
Fee would be hardship	2
Would support if no chemicals	2
Look for more grant opportunities	2
Other	18

Outcomes & Next Steps

Outcomes:

The Lake Roesiger Integrated Aquatic Vegetation Management plan has been approved by the community as a majority approves the plan.

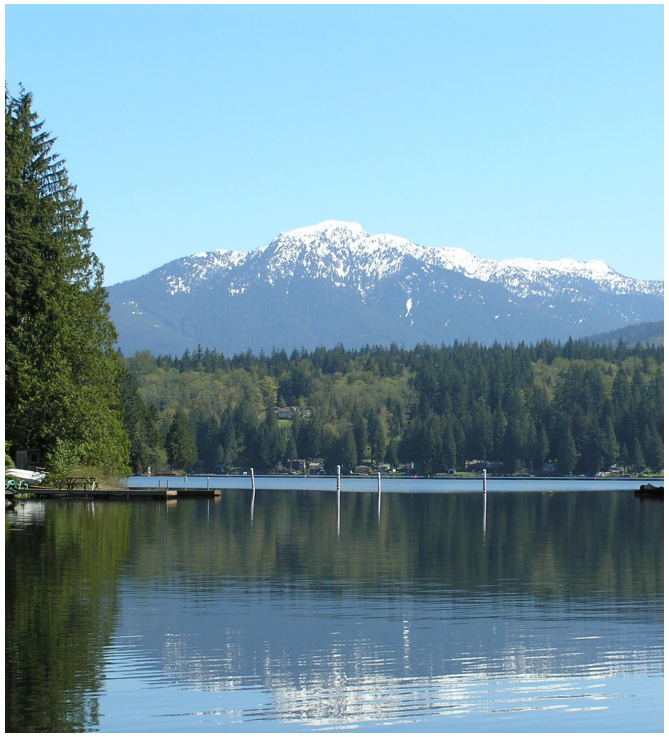
Next Steps:

The Community will need to identify funding if they wish to begin implementation and can use survey results to help decide. Potential decision points:

- If County should apply for an implementation grant (Due Dec 15, 2021)
- Identify best method and funding structure to raise community funds to supplement grant and fund beyond grant (commitment from community to pursue funding would be needed for County to apply for grant)

The County will

- Finalize the full plan and submit to the Washington State Department of Ecology completing this grant project
- Coordinate with Roesiger and Community Boat Club on next steps including potentially applying for an implementation grant.



D.2 FINAL VOTE COMMENTS REGARDING PLAN APPROVAL

#	Please provide any additional comments regarding your decision to approve the plan or not approve the plan.
1	A plan with safe chemical treatment is the most effective towards eradication, is less labor intensive, and is cost sensible. We believe any attempt by the LRCC Steering Committee member to vilify on a public forum the use of these safe chemicals is highly inappropriate.
2	all the information and survey information with FAQ is very helpful.
3	Although I normally do not approve of chemical means to irradicate plants, in this case, I believe it is the only way to keep the middle channel open.
4	Although we approve the plan, I feel we are being held hostage to pay for the irresponsibility of other property owners not willing to take care of the blooms in front of their homes.
5	An element missing from the analysis, especially for middle basin, is the impact on carbon. Eutrophication of lakes can be both a sink and a source for carbon. They are dynamic relative to uplands. Water lilies store CO2 and oxygen in their stems and leaves (partially used to float their surface leaf and flower), because CO2 is not readily available for uptake within the water column. Will use of herbicide on fragrant water lily cause release of carbon? Will it cause a net gain of carbon to the atmosphere? Will the loss of vegetation in middle basin reduce overall carbon sequestration? One alternative that was briefly mentioned, but never made it too far, is strategic removal of fragrant water lily in Middle basin. For example, just to keep navigation viable between north and south basin and for access to private docks. This option would be my preferred choice. Given the climate crisis that requires our collective heave-ho to resolve I feel it would be best if a carbon impact assessment be performed prior to commencing with the plan.
6	Any plan where chemical spraying is an option is not a plan I can support. Roesiger isn't a very weedy lake as is
7	Anything involving spraying pesticides is unacceptable. We need to address the cause of the problem which is access nutrients.
8	Approved, but I also want to make sure that it addresses the water levels in the middle portion of the lake and the root system that is throughout the specific section of the lake.
9	Aquatic vegetation is food for ducks. It is also habitat for fish and other aquatic life that both fish and birds feed on. Recreation in the North and South lakes is not impacted by aquatic vegetation. The vegetation in the middle lake is a key part of the lake as a whole. The lakes ecosystem will not be improved by killing aquatic vegetation.
10	bought & developed our place sixty yrs. ago now its time for up keep on the lLake !!!! RON
11	Charge fee to public boat launch users
12	chemicals

#	Please provide any additional comments regarding your decision to approve the plan or not approve the plan.
13	Clarification on cost of setting up payment process verses landowners paying fees on their own. Would this be offset by percentage of participants?
14	Completely opposed to using any chemicals in the lake.
15	Desire to keep the lake healthy for generations to come
16	Disagree with use of chemicals in lake
17	Don't agree with each parcel having to pay the same amount. The majority of the spend is for the middle lake. We didn't buy on the middle lake for a reason, those parcels should have to pay more. Our taxes are already so expensive here. The methods sound ok but we would like to see a breakdown of the fees that is more fair. We are ok in paying something to help the health of the lake but the way it's broken down now is not fair to those who didn't buy in the middle lake.
18	Don't like the use of chemicals in the lake.
19	Don't poison the lake.
20	Dredge middle lake
21	Everyone will benefit by controlling/reducing the problems with noxious weeds; but prefer no chemical treatments
22	Excellent lake analysis, presentation of options, and plan. Thank you to all who were part of this process.
23	Good vetting of the options by the committes made this an easy choice.
24	Have you checked out what fish and wildlife dept can do for us
25	I agree we need to remove the invasive species as noted in the plan
26	I agree with the plan.only because something needs done. I do not want chemicals dumped in our lake. we may think they're fine now. but what about years from now? It's a concern for me.
27	I am against the use of chemicals in our waterways.
28	I am all for it and willing to help pay for it
29	I am completely against putting poison chemicals of any kind in the lake
30	I AM IN FAVOR OF THE DREDGING OPTION
31	I am in support of measures taken to deal with noxious weeds in the North lake and to a lesser degree in the middle and south lakes. I acknowledge that measures taken in the middle lake likely will be positive for all lake residents, but I do have some concerns related to the cost of measures that will provide significant future financial gain for middle lake residents who purchased properties at a lower

#	Please provide any additional comments regarding your decision to approve the plan or not approve the plan.
	costs due to the presence of these 'weeds'. It is too simple to provide a blanket per parcel fee to cover costs. A pro-rated fee structure needs to be developed that provides a fair outcome for all residents.
32	I am not interested in putting carcinogens into the lake my family swims in. I find this "solution" to be ridiculous.
33	I am not involved with middle lakes problems
34	I am willing to pay additional fees for the removal of lily pads in front of our home. If there is a way to accomplish this please contact me at christnernw@gmail.com
35	I approve the plan.
36	I believe that the homeowners on the middle lake must bare the major portion of the cost.
37	I do not want our lake poisoned and I do not think it is fair for the entire lake to pay for the middle lake Lilly issues. Those residents that live on the middle lake should be the ones paying for the removal of all the Lilly pads the have let go to hell taking over that entire area.
38	I don"t like their is no end date in the fee"s charged yearly 5--10--20--50 years?
39	I don’t approve of chemicals going into the lake.
40	I don’t think we should be allowing only 30% of community making the decision between the 4 scenarios offered. Do we even know if only parcel owners participated in the vote and was the survey audited to make sure only one parcel one vote? I think we should have had a lrbc community meeting in person to go over all the options prior to the county instituting a final vote on this matter.
41	I dont believe all property owners are aware of this action. I have never recieved notice of this vote until a member sent it to me. I was told it was mailed twice. I dont believe iam the only one and that this is being pushed by property owners of special interest. I have been part of the this lake for 61 years and believe that introducing chemicals or other item will harm the lake and only serve those who live in the middle lake who, by the way, bought their property knowing the condition of the middle lake. I adamantly oppose this project and request all decisions be made by a majority of property owner's, not just what is represented here as this way is not accurate I reccomend that this survey gets sent out in the tax statements so all will have knowledge.
42	I found out about this by accident and asked my neighbor about it and they had no idea what I was talking about. This program was quietly and secretly ushered thru. I don't feel the property owners were adequately informed about this project. I feel it was a few pushing this thru for all.
43	I have been enjoying this lake for my entire life (38 years). I have helped maintain and try to mitigate lily pads and weeds. Every year they get worse and worse. It becomes harder and harder to swim and enjoy the lake with these menacing plants encroaching on my space.
44	I lived here 39 years, these plants have always been in the lake. We need to protect the water quality by starting with our own practices. Less paving , less fertilizer, better land management. People that bought homes on the middle lake for considerable less money and now want everyone to pay for a

#	Please provide any additional comments regarding your decision to approve the plan or not approve the plan.
	clean up that can be done in a safer yet longer way ,don't want to wait for the out come. The county needs to stay out of the communities rights to maintain and establish better water practices and weed control. Also there should be a majority vote of all residents according to how many property owners there are not how many people respond many have been left out of the loop.
45	I REALLY do not want to put chemicals in the water. So frustrated that landowners have not taken care of their property when this was a small problem creating a larger problem. I am a big swimmer and hope these chemicals do not make me sick. I do believe we need to do something so am voting to go ahead with this plan with hopes of stopping the chemicals ASAP and moving to manual removal.
46	I support the plan, but removing the "muck" from especially the middle lake is the challenge. Chemical use on the lily pads will create more "muck".
47	I think that we should combine some of the chemical treatment with the manual removal methods.
48	I thought we were voting on one of the four scenarios IN the plan. The plan looks good and I appreciate the detail research that went into it. Thank you.
49	I understand that this represents a huge amount of background work, and want the Club to know that their time and efforts are appreciated
50	I voted no because the entire County was allowed to vote for what will surely a permanent tax on our lakefront property. If the County would allow any boat launching at Lake Roesiger to be required to buy an annual Launching sticker they would be able to help cover the weed removal they might be bringing to a lake Roesiger.
51	I was under the impression we would have at least two options (one being non-chimcal) to chose from. I do not want a new chemical to be tested on our lake.
52	I wish there was a non herbecide option.
53	I'm not convinced that herbicides/chemicals are completely safe and I'm concerned there was a low amount of people who took the survey.
54	I'm OK with the general framework and relative priorities, but the control method for lily pads is one-dimenisonal where a multi-pronged approach will more likely be required.
55	Letting people vote to raise others tax Bill's is great
56	Lillys make dock use impossible.
57	Move ahead
58	My Wife and I have in excess of 100 years on the lake, before purching we made a conscious effort to avoid the middle lake and other areas that were lilly pad infested. I don't want to be financially impacted by people that were too short sighted or STUPID not to perform their due diligence.
59	Need to do something or our lake will soon be a swamp

#	Please provide any additional comments regarding your decision to approve the plan or not approve the plan.
60	Need to get rid of the Lily Pads
61	Needs to be supported by the whole county not just <475 parcels. It is a public lake not private.
62	No
63	No chemicals in the lake
64	No chemicals in the lake
65	No chemicals in the lake!! Allergic to people, pets and wildlife.
66	No chemicals in the lake, it poisons wildlife!
67	no chemicals please
68	No chemicals please
69	no Comment
70	No comment
71	No poison of any kind in the water!!
72	No poison of any kind in the water!!
73	No poison!!!!!!!
74	No rodeo
75	NOT AGREED on PRIORITY 2 - FRAGRANT WATER LILY -Do not agree with the use of chemical treatment and believe focus should be on manual or mechanical removal only. Agreed on PRIORITY 1 - EURASIAN WATERMILFOIL Agreed on PRIORITY 3 – PREVENT NEW AQUATIC INVASIVE SPECIES Agreed on PRIORITY 4 – INVASIVE SHORELINE PLANTS Agreed on PRIORITY 5 – SLENDER ARROWHEAD
76	On social security and fixed income. Unfair to senior citizens (+75)
77	Our beach property has been invaded more and more every year by the fragrant water lillies.
78	Our parcel is currently taxed over $1000/month . This high taxation is a reflection of the fact that all the Lakes' parcel owners are paying significantly higher tax burden share than the average County taxpayer . Taxes have increase > 500% since we first bought in 1997 and reflects the level of increase on Lake property owners overall. .We have seen ,nor received very little local benefits on this high taxation thats supporting the whole County budget . The Lake is open for year round use by all County and other non parcel owners year round . Hence I strongly believe that the estimated $173/yr /parcel

#	Please provide any additional comments regarding your decision to approve the plan or not approve the plan.
	should be paid by the county and spread out among all County tax payers and not just us Lake property owners . We pay enough taxes already . I would vote no for any added fee or tax aimed at just the Lake property owners .
79	People living on the middle lake need to take care of their lilly pad problem. Don't want muck to travel from the middle lake area to the north lake area.
80	Please do not consider putting carp in to eat the weeds. I have seen in the midwest a couple of lakes be ruined by them.
81	Please mail me the Aquatic Plant Pamphlet.
82	Please no chemicals in the lake. We have other options.
83	Poison kills the natural balance.
84	Shame on those that would poison our waters.
85	So you want everyone to pay for removing the Lilly pads on the middle lake that have been there for as long as I can remember 40 to 50 years. It is bad enough what the county extracts from property taxes and you want to willingly give them more to mishandle? I hope everyone knows once you agree to this plan you own it forever.
86	Status quo is not ok, we need an equitable plan
87	Still seems like it would be safer to use divers instead of chemicals to tackle this problem both to protect the safety of our lake and its residents.
88	Terrible idea will potentially harm fish and wildlife and make me very uncertain about the safety of using the lake in future for my family
89	Thank you for all the work on this. Greatly appreciated!
90	Thank you to all - county and volunteers - that have worked tirelessly on this effort. We fully support your efforts and the cost per parcel seems fair and reasonable. We love our piece of heaven. We need to be proactive. It is not just for our enjoyment but also for the generations to come. With gratitude, Karen and Shawn Firminger
91	ThankYou for your extensive work on this plan. We appreciate your information and efforts. Just a note: we don’t like toxic chemicals or expensive divers.
92	The choices were split on non herbicide between the expensive option and the DASH/non poison option. Together, those would have totaled very close to the 50% option and in truth - the 3 options aside from poison should have been totalled as non herbicide. This assessment does not take that into account and 2 options should have been provided - the non herbicide and the one we are left with

#	Please provide any additional comments regarding your decision to approve the plan or not approve the plan.
93	The County/ State owns the water and decides what we are allowed to do with it / charges us extremely high property taxes and demands that we get permits for docks and boating licenses so it should be their responsibility to provide us with a well maintained Shoreline and lake at their expense
94	the lake will take care of it self
95	The land owners in the middle lake should bear a larger portion of the cost to clear the lily pads. We have lived on the lake for 50 years and the lily pads and sediment in the middle lake have always been there. When the people on the middle lake purchased their properties they did so knowing the existence of the lily pads and sediment. We believe that it is the responsibility of the individual owners to maintain their land areas with some potential support from the community.
96	The lily pads can be dealt with without chemicals and it concerns me that nobody can swim in the lake a week following the chemicals going into the lake.
97	The middle lake is due to be cleaned up in addition to the other plants etc; I think some dredging of the channel would be good as well so boat navigation easier thru the middle lake.
98	The numbers speak for themselves — very few oppose and their reasons are silly
99	The only area that needs work is the middle lake , and they are the only ones that will benefit from a large expensive management plan, let the property owners on the middle lake pay for it.
100	The plan accomplishes the most plant control and eradication at an affordable cost. The other three options were either cost-prohibitive or not nearly as effective at controlling and eradicating invasive plants.
101	The plans seems reasonable to me and appears cost effective for most people.
102	The poison will not solve your problem and will create other problems on top of that killing other wildlife around the area damaging the ecosystem.
103	this is a middle lake problem and why i did not buy there
104	This proposal seems to focus on fixing the lake for people's continued use. How about a heavier push to reduce harmful human behaviors? Hire someone to man the boat launch and park for checking boats, mandatory classes for lake owners so we put boats in the water safely?
105	This step engages the next phase, where our community will work with County and State staff, County Council member(s), and each other, to develop participation and the needed funding plan. Limiting this Vote to lakefront parcel owners only is both incorrect identity of participants and unfair to all of us who live at Lake Roesiger.
106	Use of chemicals is destructive to both human and wildlife health! It should NEVER Be considered!!
107	We 100% support chemical elimination of the lilies.

#	Please provide any additional comments regarding your decision to approve the plan or not approve the plan.
108	We approve all of the plan without using chemicals/herbicide/poison, UNLESS it is a last resort. There was ample evidence from the prior surveys that this option should have also been put on this survey.
109	We do not want chemicals in the water
110	We don't want chemicals in the lake. My daughter, nieces, nephews and other family and friends use the lake regularly
111	We have to do something.
112	We look forward to maintaining Lk Roesiger as one of the premier Snohomish Lakes
113	We only approve the plan if there is NO chemical control used.
114	We refrain from using any chemicals in our yard to protect the lake, and prefere to begin with manual removal as first step.
115	Weeds are better than chems
116	Well thought out and presended by committed people.
117	Why wouldn't dredging the middle lake and removing the old earthen dam between upper and middle lake work? Removing aquatic plants won't increase the lake depth.
118	Will not be as clean of water to swim in
119	Yes I approve the plan.
120	You are using chemicals in the lake which is not healthy for fish, wild life or for those of us that swim in the lake

D.3 FINAL VOTE COMMENTS REGARDING PLAN FUNDING

#	Please provide any additional comments regarding funding for plan implementation.
1	Charge everyone not just land owners but all users of lake
2	community volunteering and education would be great
3	County or state should pay.
4	Don't support use of chemicals in the plan.
5	Find a better solution
6	Full information on what the SWM entails should be put in with the executive summary.
7	future investment beyond 5 year plan needs to be reassessed and agreed upon before proceeding
8	Grants and through fees/taxes is the best way for everyone to contribute to the betterment of our lake.

9	I do not support chemicals in the lake
11	I don't feel it's my position to Vote on a fee as I do not live in the lake. I would support a donation box and donate to help the fee
12	I don't own a parcel, but am willing to donate at least $200 toward funding
13	I don't like the idea of being taxed more in order to collect the payment
14	I don't live on the lake so I'm not going to vote for fees
15	I don't sign blank checks. However I would be open to discussion if cost rise above $177
16	I feel that these fees are very minimal for what we will gain.
17	I personally would support addition funds within reason.
18	I want more detail on the plan.
19	I was excited that there was some type of help/grant for the lake and donated money, unfortunately when the choice came down to use chemicals or not I didn't feel good about that so I voted no. It's unfortunate that only one vote is required per property because there could be other opinions on this plan.
20	I would be greatly opposed to private property owners being forced to fund such a venture
21	I would contribute if I could....but am on a fixed income and have no extra
22	I would only support the $25,000 match if all lake homeowners contribute to the plan
23	I would support a fee of more than $177, but not when there is no upper limit set in the question.
24	I would support a few for a non chemical plan.
25	I would support more than $177 but can't go to thousands
26	If this multi-year program is not properly engaged "as a community", it will fail to gather the needed support. We have always included voting members on both sides of the "roads surrounding Lake Roesiger." We have some people with a residence on an upland parcel who own lakefront parcels, people with the residence or house on the lakefront who own parcels upland of the roads, people with parcels not seemingly connected (directly) to the lake that have shared waterfront, and some being excluded who are very clearly Lake Roesiger property owners and deeply-involved citizens. So our community history, previous major community projects like PUD Water and continuing PUD Septic Pumping, as well as the practical Council District voter rolls (Sam Low and Nate Nehring), define how this Vote should be conducted. The approach used for this November 2021 survey/Vote is a mistake,… because everyone's "support" will be needed to make it happen.
27	If you want to get rid of the Lilly pads pull them like weeds but they are good for the lake and the wild life
28	It doesn't say if the extra surface water tax had any expiration. Also why do just property owners have to pay the bill when it's a public lake.
29	It is a public county lake and the county needs to fund it.
30	Leave the lake as is, any of these programs will cause other problems
31	Let biden pay
32	LRCC Oversite Committee to monitor effectiveness
33	Major funds must come from the middle lake homeowners

34	Maybc a fee for non residents for boating and park use
35	no chemicals
36	No lakefront property no vote .community only
37	none
38	Now, don't imply the lilly pad issue will catch up with us because after all these years it hasn't
39	Our water front is clear of any of the noxious plants listed, so again I have a problem for paying for other property owners irresponsibility.
40	Please consider alternative solutions that do not involve health hazards.
41	Please look for more grant money
42	removing lily pads will not improve anyone else's property values
43	Scenario 2 seems a good one and fine to pay it; would even do more if needed; would consider Scenario 1 as well but doubt people want to pay that much.
44	See my comment on Item 6 . If the County will provide a grant of $100,000 /yr thats good as it gives us Lake property owners something back for the high taxes levied already . Parcel owners should not have to pitch in anything out of pocket beyond what we already pay in assessed taxes .n levied taxes . .
45	Send the survey out in the tax statements do all owners are aware of this.
46	Should the plan fail to pass, we would still be willing to pay into alternative funds to match and or fund.
47	Since the County/State owns and regulates, and tells us what we can and cannot due with or on the lake then they (County/State) should pay for it totally.
48	Since this is mainly a problem in the middle lake basin have the people in that area pay for the removal themselves.
49	Thank you
50	Thanks for the work. We need to preserve and improve the health of the lake. The chemical and mechanical methods make the most sense to us
51	That’s why we pay taxes
52	That’s why we pay taxes
53	That's what property taxes should pay for
54	That's what property taxes should pay for
55	The county and state should be responsible for the funding, that is why we pay taxes.
56	The fee should account for the projected increase in cost over time so it may be reasonably adjusted if necessary.
57	The property fee is something that I shouldn't vote on, because it doesn't affect my property. It is up to those who will be directly impacted to weigh in on it. So, please ignore my no vote.
58	This is a county lake enjoyed by everyone in the state! It’s the counties responsibility
59	This is a per-year fee. How long and what happens at the end of that time period.

60	This is a PUBLIC lake and should gather funds as such. Public should also be charged to maintain lake quality
61	This is something that should be funded by the county
62	This process has created more divide then previously. I hate seeing all this fighting with in our small community. This is more toxic then the lily's in my opinion.
63	This was not presented as something we would pay for. We were told this was grant based.
64	We are all part of the community and all enjoy using all 3 areas of the lake. As such we should all rightly share the burden of looking after the health of the lake. $177 annual fee seems ridiculously low when only $50 or $100 more per resident could add up so quickly and help magnify the weed eradication goals and results.
65	We are willing to pay. I do think the owners in the middle lake with all the lilies pay a small % more as this effort will increase their property value and enjoyment of lake. Also, there needs to motivation for them to be diligent in removing new growth once the efforts have started.
66	We do not want the county to make decisions for our community
67	We don't support the plan, therefore we cannot support potential funding.
68	We need a clean, safe lake
69	We need to fix our behavior, not just fix the lake so we can continue our behavior
70	We would be willing to pay an annual fee for 5 years ONLY if NO chemical control is used.
71	We would possibly support a higher amount than $177 but would need to know the upper limit to commit..
72	With Snohomish County assessing and collecting higher taxes for owners if property on Lake Roesiger, the higher taxes should include any maintenance to control the weeds/Lilly pads on the lake. Why are owners paying higher taxes? What do they get for it?? Nothing!! Fix the lake with what is already being collected!! NO NEW TAXES!!
73	With the current economic situation unfolding in America, I find it unreasonable to add additional financial burden to citizens.
74	Without knowing what area(s) of lily pads the plan is to address, I'm not ready to commit to paying for it.
75	Would it be worth exploring other ways to get additional funds? County? Fundraisers? How have the other lake who done this funded their efforts?

APPENDIX E. SPRAY ADJUVANTS REGISTERED FOR USE ON AQUATIC SITES IN WASHINGTON

Washington State Department of Agriculture

Washington State Department of Agriculture
Pesticide Management Division
Registration and Licensing Services Program
PO Box 42560 • Olympia WA 98504-2560
Telephone (360) 902-2030 • FAX (360) 902-2093

Spray Adjuvants Registered for Use on Aquatic Sites in Washington
(Revised May 15, 2017)

These spray adjuvants are registered for use on aquatic sites in Washington, as of May 15, 2017. Before distributing or using an adjuvant, please verify that it is currently registered in Washington.

Spray adjuvants are listed in alphabetical order. No discrimination or endorsement is intended. The aquatic acute toxicity data are from studies that were submitted by the registrants.

Product Name / State Registration Number	Registrant	Principal Functioning Agents	Acute Toxicity - Rainbow Trout	Acute Toxicity - Daphnids
Agri-Dex / 5905-50094	Helena Chemical Company	Petroleum oil, polyoxyethylene sorbitan fatty acid ester, sorbitan fatty acid ester	LC50 (96 hour) >1000 mg/l, Practically non-toxic	LC50 (48 hour) >1000 mg/l, Practically non-toxic
AgriSolutions Inergy / 1381-13001	Winfield Solutions	Modified vegetable (seed) oil, polysiloxane polyether copolymer, alkyl phenol ethoxylate	LC50 (96 hour) 37.5 mg/l, Slightly toxic	EC50 (48 hour) 127.27 mg/l, Practically non-toxic
Atmos / 1381-13006	Winfield Solutions	Modified vegetable (seed) oil, saccharides, sorbitan fatty acid ester	LC50 (96 hour) 21.71 mg/L, Slightly toxic	EC50 (48 hour) 28.63 mg/L, Slightly toxic
Avor / 9349-16011	Precision Laboratories Inc	Polyoxyethylene sorbitan fatty acid ester, mono- and diglycerides of C8-C18 fatty acids	LC50 (96 hour) >100 mg/l, Practically non-toxic	EC50 (48 hour) 121 mg/l, Practically non-toxic
Bond / 34704-04003	Loveland Products	Synthetic latex, alcohol ethoxylate	LC50 (96 hour) 190 mg/l, Practically non-toxic	LC50 (48 hour) 614 mg/l, Practically non-toxic
Break-Thru SP 133 / 56630-15001	Evonik Corporation	Polyglycerol oleate, polyoxyethylene, sorbitan fatty acid ester	LC50 (96 hour) >1000 mg/l, Practically non-toxic	LC50 (48 hour) >100 mg/l, Practically non-toxic
Brandt Magnify / 48813-15003	Brandt Consolidated	Alkyl polyglycoside, ammonium sulfate, ammonium nitrate	LC50 (96 hour) >100 mg/L, Practically non-toxic	EC50 (48 hour) 7.70 mg/L, Moderately toxic
Breeze / 1381-13007	Winfield Solutions	Saccharides, alkyl polyglycoside, ammonium sulfate	LC50 (96 hour) >100 mg/l, Practically non-toxic	EC50 (48 hour) >100 mg/l, Practically non-toxic

Bronc Max / 2935-03005	Wilbur-Ellis Company	Ammonium sulfate, dodecylbenzenesulfonic acid sodium salt, citric acid, dimethylpolysiloxane	LC50 (96 hour) ≥100 mg/l, Slightly toxic to Practically non-toxic	EC50 (48 hour) >100 mg/l, Practically non-toxic
Bronc Plus Dry / 2935-12005	Wilbur-Ellis Company	Ammonium sulfate, urea, polyoxyethylene-polyoxypropylene copolymer, citric acid, dimethylpolysiloxane	LC50 (96 hour) 382.9 mg/l, Practically non-toxic	EC50 (48 hour) 223.6 mg/l, Practically non-toxic
Bronc Plus Dry-EDT / 2935-03002	Wilbur-Ellis Company	Ammonium sulfate, urea, polyoxyethylene-polyoxypropylene copolymer, citric acid, polyacrylamide, dimethylpolysiloxane	LC50 (96 hour) 382.9 mg/l, Practically non-toxic	EC50 (48 hour) 223.6 mg/l, Practically non-toxic
Chempro A-10 / 46059-16001	Chemorse Ltd	Dimethylpolysiloxane, methylated silicon	LC50 (96 hour) >1000 mg/l, Practically non-toxic	EC50 (48 hour) >100 mg/l, Practically non-toxic
Cide-Kick II M / 999400-12001	Brewer International	Limonene, modified vegetable (seed) oil, alcohol ethoxylate	LC50 (96 hour) 45 mg/l, Slightly toxic	EC50 (48 hour) 6.6 mg/l, Moderately toxic
Class Act NG/ 1381-01004	Winfield Solutions	Ammonium sulfate, saccharides, alkyl polyglycoside	LC50 (96 hour) 447 mg/l, Practically non-toxic	EC50 (48 hour) 377 mg/l, Practically non-toxic
Competitor / 2935-04001	Wilbur-Ellis Company	Modified vegetable (seed) oil, polyethylene glycol fatty acid ester, polyoxyethylene sorbitan fatty acid ester	LC50 (96 hour) 95 mg/l, Slightly toxic	LC50 (48 hour) >100 mg/l, Practically non-toxic
Cut-Rate / 2935-06001	Wilbur-Ellis Company	Ammonium sulfate, citric acid	LC50 (96 hour) 782.2 mg/l, Practically non-toxic	EC50 (48 hour) 223.6 mg/l, Practically non-toxic
Cygnet Plus / 105114-50001	Brewer International	Limonene, modified vegetable (seed) oil, alcohol ethoxylate	LC50 (96 hour) 45 mg/l, Slightly toxic	EC50 (48 hour) 6.6 mg/l, Moderately toxic
Destiny HC / 1381-09002	Winfield Solutions	Modified vegetable (seed) oil, saccharides, sorbitan fatty acid ester	LC50 (96 hour) 21.71 mg/L, Slightly toxic	EC50 (48 hour) 28.63 mg/L, Slightly toxic
Denali-EA / 2935-15006	Wilbur-Ellis Company	Polyoxyalkylene Polyol Fatty Acid Ester, Alcohol Ethoxylate, Citric acid	LC50 (96 hour) 11.25 mg/L, Slightly toxic	EC50 (48 hour) 9.746 mg/L, Moderately toxic

Droplex / 1381-12001	Winfield Solutions	Modified vegetable (seed) oil, polyoxyethylene sorbitan fatty acid ester, vegetable (seed) oil	LC50 (96 hour) >100 mg/l, Practically non-toxic	EC50 (48 hour) >100 mg/l, Practically non-toxic
Dyne-Amic / 5905-50071	Helena Chemical Company	Modified vegetable (seed) oil, polysiloxane polyether copolymer, alkyl phenol ethoxylate	LC50 (96 hour) 23.2 mg/l, Slightly toxic	LC50 (48 hour) 60 mg/l, Slightly toxic
Fast Break / 1381-50006	Winfield Solutions	Dimethylpolysiloxane, methylated silicon	LC50 (96 hour) >1000 mg/l, Practically non-toxic	EC50 (48 hour) >100 mg/l, Practically non-toxic
Forge / 46661-15002	West Central	Propanoic (propionic) acid, alcohol ethoxylate, lecithin	LC50 (96 hour) 34.38 mg/l, Slightly toxic	EC50 (48 hour) 14.68 mg/l, Slightly toxic
Fraction / 45989-06001	Kalo	Ammonium sulfate, citric acid	LC50 (96 hour) 782.2 mg/l, Practically non-toxic	EC50 (48 hour) 223.6 mg/l, Practically non-toxic
Glacier-EA /2935-16001	Wilbur-Ellis Company	Methylated seed oil, polyoxyethylene polyol fatty acid ester, butyl lactate	LC50 (96 hour) 180.56 mg/l, Practically non-toxic	EC50 (48 hour) 659.09 mg/l, Practically non-toxic
Hasten-EA / 2935-15003	Wilbur-Ellis Company	Modified vegetable (seed) oil, polyethylene glycol fatty acid ester	LC50 (96 hour) 375 mg/l, Practically non-toxic	EC50 (48 hour) 84.615 mg/l, Slightly toxic
InterLock / 1381-05004	Winfield Solutions	Modified vegetable (seed) oil, polyoxyethylene sorbitan fatty acid ester, vegetable (seed) oil	LC50 (96 hour) >100 mg/l, Practically non-toxic	EC50 (48 hour) >100 mg/l, Practically non-toxic
Kinetic / 5905-11004	Helena Chemical Company	Polysiloxane polyether copolymer, polyoxypropylene-polyoxyethylene copolymer	LC50 (96 hour) 13.9 mg/l, Slightly toxic	LC50 (48 hour) 60.7 mg/l, Slightly toxic
Level 7 / 1381-05002	Winfield Solutions	Saccharides, alkyl polyglycoside, ammonium sulfate	LC50 (96 hour) >100 mg/l, Practically non-toxic	EC50 (48 hour) >100 mg/l, Practically non-toxic
LI 700 / 34704-04007	Loveland Products	Lecithin, propanoic (propionic) acid, alkyl phenol ethoxylate	LC50 (96 hour) 130 mg/l, Practically non-toxic	LC50 (48 hour) 190 mg/l, Practically non-toxic

Liberate / 34704-04008	Loveland Products	Lecithin, alcohol ethoxylate, modified vegetable (seed) oil	LC50 (96 hour) 17.6 mg/l, Slightly toxic	EC50 (48 hour) 9.3 mg/l, Moderately toxic
MSO Concentrate / 34704-04009	Loveland Products	Alcohol ethoxylate, tall oil fatty acids, modified vegetable (seed) oil	LC50 (96 hour) 35 mg/L, Slightly toxic	EC50 (48 hour) 18 mg/l, Slightly toxic
MSO Concentrate with Leci-Tech / 34704-07001	Loveland Products	Alcohol ethoxylate, lecithin, modified vegetable (seed) oil	LC50 (96 hour) 35 mg/L, Slightly toxic	EC50 (48 hour) 17 mg/l, Slightly toxic
NIS-EA / 2935-14001	Wilbur-Ellis Company	Polyoxyethylene sorbitan fatty acid ester, butyl lactate, alcohol ethoxylate phosphate ester	LC50 (96 hour) 82.609 mg/L, Slightly toxic	EC50 (48 hour) 218.75 mg/l, Practically non-toxic
One-AP XL / 45989-02001	Kalo	Ammonium sulfate, urea, polyoxyethylene-polyoxypropylene copolymer, citric acid, polyvinyl polymer (polyacrylamide), dimethylpolysiloxane	LC50 (96 hour) 382.9 mg/l, Practically non-toxic	EC50 (48 hour) 223.6 mg/l, Practically non-toxic
Pro AMS Plus / 71058-50001	Independent Agribusiness Professionals	Ammonium sulfate, ammonium nitrate, alkyl polyglycoside	LC50 (96 hour) >100 mg/l, Practically non-toxic	EC50 (48 hour) 7.7 mg/l, Moderately toxic
Rainier-EA / 2935-15001	Wilbur-Ellis Company	Polyoxyethylene sorbitan fatty acid ester, butyl lactate, alcohol ethoxylate phosphate ester	LC50 (96 hour) 82.609 mg/L, Slightly toxic	EC50 (48 hour) 218.75 mg/l, Practically non-toxic
Renegade-EA/ 2935-15002	Wilbur-Ellis Company	Modified vegetable (seed) oil, ammonium nitrate, urea	LC50 (96 hour) 42.045 mg/l, Slightly toxic	EC50 (48 hour) 25 mg/l, Slightly toxic
Sinker / 5905-05001	Helena Chemical Company	Polyvinyl polymer (Polyacrylamide), alkyl phenol ethoxylate, sorbitan fatty acid ester	LC50 (96 hour) 750 mg/l, Practically non-toxic	LC50 (48 hour) >1000 mg/l, Practically non-toxic
Sphere 7 / 73127-10008	D & M Chem	Propanoic (propionic) acid, alcohol ethoxylate, lecithin	LC50 (96 hour) 34.38 mg/l, Slightly toxic	EC50 (48 hour) 14.68 mg/l, Slightly toxic
Spray-Rite / 7001-09003	J R Simplot	Ammonium sulfate, citric acid	LC50 (96 hour) 782.2 mg/l, Practically non-toxic	EC50 (48 hour) 223.6 mg/l, Practically non-toxic

Spreader 90 / 34704-05002	Loveland Products	Alcohol ethoxylate, dimethylpolysiloxane (including related compounds), glycerol, propylene glycol	LC50 (96 hour) 18 mg/l, Slightly toxic	EC50 (48 hour) 9.4 mg/l, Moderately toxic
Superb HC / 1381-06003	Winfield Solutions	Petroleum oil, saccharides, polyoxyethylene sorbitan fatty acid ester	LC50 (96 hour) 45 mg/L, Slightly toxic	EC50 (48 hour) >100 mg/L, Practically non-toxic
Syl-Tac-EA / 2935-15004	Wilbur-Ellis Company	Modified vegetable (seed) oil, polysiloxane polyether copolymer, polyethylene glycol fatty acid ester	LC50 (96 hour) 45 mg/L, Slightly toxic	EC50 (48 hour) 137.5 mg/L, Practically non-toxic
Tactic / 34704-05008	Loveland Products	Synthetic latex, propylene glycol, alcohol ethoxylate, polysiloxane polyether copolymer	LC50 (96 hour) >100 mg/l, Practically non-toxic	EC50 (48 hour) 310 mg/l, Practically non-toxic
Trail Blazer / 91327-15009	Aspect Ag LLC	Vegetable (seed) oil ethoxylate, tall oil fatty acids	LC50 (96 hour) >200 mg/l, Practically non-toxic	EC50 (48 hour) 28.9 mg/l, Slightly toxic
Trapline Pro /86806-16003	CHS Inc	Soybean oil, ethoxylated; polyethylene glycol undecyl ether; citric acid	LC50 (96 hour) 18.75 mg/l, Slightly toxic	EC50 (48 hour) 7.12 mg/l, Moderately toxic
Tronic / 45989-06003	Kalo	Vegetable (seed) oil ethoxylate, tall oil fatty acids	LC50 (96 hour) >200 mg/l, Practically non-toxic	EC50 (48 hour) 28.9 mg/l, Slightly toxic
Turbulence / 1381-13008	Winfield Solutions	Modified vegetable (seed) oil, polysiloxane polyether copolymer, alkyl phenol ethoxylate	LC50 (96 hour) 37.5 mg/l, Slightly toxic	EC50 (48 hour) 127.27 mg/l, Practically non-toxic
Winfield Solutions Inergy / 1381-13002	Winfield Solutions	Modified vegetable (seed) oil, polysiloxane polyether copolymer, alkyl phenol ethoxylate	LC50 (96 hour) 37.5 mg/l, Slightly toxic	EC50 (48 hour) 127.27 mg/l, Practically non-toxic
Yardage / 52467-13001	Exacto	Propanoic (propionic) acid, alcohol ethoxylate, lecithin	LC50 (96 hour) 34.38 mg/l, Slightly toxic	EC50 (48 hour) 14.68 mg/l, Slightly toxic

To verify that a spray adjuvant is currently registered for distribution in Washington, refer to the Washington State University Pesticide Information Center Online (PICOL) database (cru66.cahe.wsu.edu/LabelTolerance.html).

To verify that a spray adjuvant is allowed for use by an aquatic pesticide permit, refer to the Department of Ecology (www.ecy.wa.gov/programs/wq/pesticides/index.html).

Contact Information:

For information regarding the registration of spray adjuvants in Washington, contact Kelle Davis (Registration Services Supervisor) at 360-902-1851 or email kmdavis@agr.wa.gov.