

LAKE ROESIGER INTEGRATED AQUATIC VEGETATION MANAGEMENT PLAN

DRAFT EXECUTIVE SUMMARY

SEPTEMBER 2021

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 algae 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 threatening navigation in the already shallow middle basin of the lake. Collectively, these factors also 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 purpose of the plan is to provide a roadmap for the community to reduce the impact of invasive aquatic plants. The plan will include multiple control options for each target invasive plant and is intended to be adaptable over time.

The project was initiated by and is 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.

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.

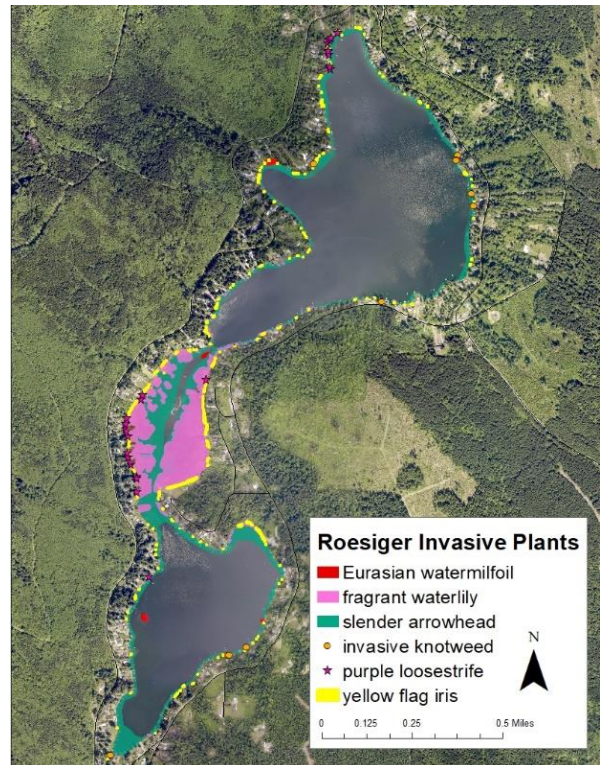


TABLE -1 NOXIOUS WEED DESIGNATIONS

In-Lake Plants	Class	Distribution	Shoreline Plants	Class	Distribution
Eurasian	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

¹The 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 & RECOMMENDED 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 (Table 8-2). As a result, four chemical options have been identified as acceptable for consideration to be used at Lake Roesiger (Table 8-3).

- 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 for which options should be further considered for each plant species as appropriate to Lake Roesiger and the management goals for each invasive weed. The committee then provided feedback to further refine the recommended control methods for each plan as described in the following sections.

PRIORITY 1 - EURASIAN WATERMILFOIL (CLASS B NOXIOUS WEED)

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.



MILFOIL FORMS DENSE MATS THAT LIMITS SWIMMING, BOATING AND FISHING

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

Recommended Control Method: To achieve the desired goal of eradication, the recommended 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, the chemical option ProcettaCOR is an additional recommendation. ProcettaCOR 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)

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.



FRAGRANT WATERLILY DECAY IS CAUSING THE LAKE TO FILL-IN MORE QUICKLY

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

Recommended 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. Three primary control options were identified as potentially effective for large-scale lily control: hydraulic dredging, chemical control, and mechanical harvesting. Because there is a wide range in the level of control that can be achieved and associated costs, the options are presented as different treatment scenarios in the Control Scenarios and Costs section.

PRIORITY 3 – 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



INVASIVE KNOTWEED



PURPLE LOOSTRIFE



YELLOW FLAG IRIS

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.

Recommended Control Method: The recommended 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 4 – 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.



SLENDER ARROWHEAD CROWDS OUT BENEFICIAL NATIVE PLANTS

Recommended Control Options: 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.

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.

CONTROL SCENARIOS AND COSTS

Four potential scenarios were developed to show the range of options for fragrant waterlily controls. The scenarios are described below and are followed by tables with detailed preliminary cost estimates. The recommended actions, expected outcomes, and associated cost estimates for Eurasian watermilfoil, invasive shoreline plants, slender arrowhead, and invasive species are identical in proposed scenarios 1 -3.

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.
- 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).

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. It would also be used in areas that hydraulic dredging is not appropriate due to submersed obstacles or is not feasible in year one. While highly effective, this scenario is extremely costly.

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 (20-22 acres); 3 feet muck reduction	\$22M	\$88K	\$88K	\$88K	\$88K	\$22.4M
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 ³	\$22K	\$22K	\$22K	\$22K	\$22K	\$110K
Invasive Species Prevention	Outreach to lake users & residents	Lower risk of spread & intro of new invasive	\$3.5K	\$3.5K	-	-	-	\$7K
Total			\$22.1M	\$206.5K	\$149K	\$149K	\$149K	\$22.8M
Cost Per Parcel			\$47,772	\$446	\$322	\$322	\$322	\$49,184
Cost Per Parcel with Grant			\$47,691	\$365	\$322	\$322	\$322	\$49,022

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

²Costs 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

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 ensure navigation between the basins is maintained, the rate of sediment accumulation would be slowed 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.

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 (134)	\$216	\$171	\$134	\$134	\$870 (707)
Cost per Parcel with Grant			\$135	\$135	\$171	\$134	\$134	\$708

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

²Costs 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

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. 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.

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 ^{1,2}	Workshops and outreach on control methods	Potential continued spread in basin	-	-	-	-	-	-
Invasive Shoreline Plants ³	Workshops & outreach on plant ID and control methods	Prevention of new areas; reduce existing areas	\$15K	\$15K	-	-	-	\$30K
Slender Arrowhead	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			\$100.5K	\$100.5K	\$82K	\$82K	\$82K	\$447K
Cost Per Parcel			\$217	\$217	\$177	\$177	\$177	\$965
Cost per parcel with grant			\$136	\$136	\$177	\$177	\$177	\$803

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

²Workshops would be the same as those held for shoreline invasive plants.

³Costs are for education and outreach only; control work and associated costs will be the responsibility of individual landowners.

⁴ Slender arrowhead efforts could be scaled up or down based on available funding

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.

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

¹Currently paid for by volunteer lake association dues and donations.

NEXT STEPS

The next step is to review the draft plan and obtain the community’s input as follows:

- **Online Survey (Oct 4 – Oct 17):** The County will provide the entire lake community this draft summary, the full draft plan and an online presentation to explain the plan and the potential management options. The community can provide feedback via an online survey
- **Community Meeting (Oct 26th from 6:30 – 8:30 PM):** There will be a lake-wide community meeting to review the plan feedback and discuss the proposed options and next steps.
- **Community Vote:** The Community will have an opportunity to vote on the final options following the meeting via an online survey. The results will be used to finalize the plan which will be submitted to the Department of Ecology for approval.

FUNDING OPTIONS

If the community agrees upon a path forward, implementing 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. The earliest grant funding could be obtained would be starting in July 2022. For longer term funding, the community can choose to continue voluntary local fund collection through the Lake Roesiger Community Club. Establishing a more formal funding structure is another option where all lake residents can contribute through the 1) Formation of a Lake Management District (RCW 36.61) or 2) Authorization of a lake property assessment through an extra Surface Water Management Service Charge. Both funding mechanisms require a process through the Snohomish County Council and would require broad community support. View the online presentation for more information regarding funding options.