Lake Windermere
Aquatic Invasive Plant Inventory
2024

Prepared for the Lake Windermere Ambassadors
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ECOLOGICAL SERVICES

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1. Introduction

1.1. Invasive aquatic plants

Invasive aquatic plants are non-native species that disrupt the ecological balance of freshwater lake ecosystem and can create several negative consequences for water quality, freshwater biodiversity, and ecosystem functions. These plants often grow rapidly and can dominate a lake's ecosystem by outcompeting native plant species for space, light, and nutrients, leading to a reduction in biodiversity. This can have cascading effects on other organisms, including fish and invertebrates that rely on native plants for habitat or food. For example, Eurasian watermilfoil (*Myriophyllum spicatum*) form dense mats that shade out aquatic submersed plants and reduce overall plant diversity (Barko et al., 1991).

Invasive aquatic plants can also affect water quality in several ways including exacerbation of nutrient imbalances in the lake (which can lead to eutrophication) and oxygen depletion which can be harmful to fish and other aquatic organisms (Madsen et al., 2001). Additionally, invasive plants can disrupt water flow, impact native species, have high economic costs associated with their management, lead to changes in nutrient cycling, and can foster conditions conducive to harmful algal blooms. In 2007, the Canadian Wildlife Service determined that there were three possible ecosystem level threats to the Columbia Wetlands; invasive species, pollution events, and severe erosion (Hammond, 2007). Invasive plant and animal species were determined to be the most likely to occur in the Columbia Wetlands and if introduced, would pose the "greatest potential consequence" (Hammond, 2007).

1.2. Benefits of native aquatic plants

Invasive aquatic plants can be extremely harmful to a freshwater lake system in a myriad of ways (some described above), conversely native aquatic submersed plants also known as submerged macrophytes, play a crucial role in the health and functioning of lake ecosystems. These plants, which grow entirely underwater, provide a variety of ecological services that benefit both the environment and human activities. For instance, *s*ubmersed native plants contribute significantly to water quality by absorbing excess nutrients, particularly nitrogen and phosphorus, from the water. This process helps to mitigate eutrophication, a condition often caused by nutrient overloading, which leads to harmful algal blooms. Studies have shown that submerged plants can reduce nutrient concentrations, thus improving water clarity and overall ecosystem health (James et al., 2014; Smith et al., 2016). Plants do this by absorbing nutrients directly through their roots and leaves, limiting the availability of nutrients for harmful algae.

Submerged plants also provide critical habitat for a wide range of aquatic organisms, including fish, invertebrates, and macroinvertebrates. Aquatic plants offer shelter, food sources, and breeding sites. For example, submersed plants serve as refuges for juvenile fish, protecting them from predators and offering them foraging grounds (Heck & Wetstone, 1977). The roots of submerged plants help stabilize the sediment in lake beds, reducing the risk of resuspension of sediments into the water column. This stabilization enhances water clarity and prevents the turbidity often caused by disturbances such as strong currents or human activities like boating.

Submerged plants also release oxygen into the water as a by-product of photosynthesis. This oxygen is vital for maintaining healthy aquatic ecosystems and aquatic animals, particularly for fish and other aerobic organisms. Aquatic submersed plants play a role in carbon sequestration by capturing and storing carbon in their tissues. This process contributes to mitigating the impacts of climate change by removing carbon dioxide from the atmosphere and storing it in the sediments. Research suggests that submerged macrophytes in lake ecosystems can act as significant carbon sinks (Brix & Schierup, 1990). This carbon storage is particularly important in shallow water lakes where plant growth is robust. Submerged plants can also help mitigate the effects of floods and prevent shoreline erosion. By absorbing wave energy, they reduce the impact of water movement on the shore, preventing the erosion of lake banks and coastal habitats (Kusler, 1991).

1.3. Aquatic invasive plant sampling on Lake Windermere

Given the myriad of negative effects associated with invasive aquatic plants, in 2008 the author developed the Columbia Headwaters Invasive Plant Species Project (CHIPSP) (administered by Wildsight) to collect baseline data on invasive plants in the Columbia Wetlands, Lake Windermere, Columbia Lake and some higher elevation lakes in the Columbia Valley. The CHIPSP operated as an effective baseline inventory and management project for the Columbia Wetlands and surrounding region from 2008-2012. As a contractor to the Lake Windermere Ambassadors, R. Darvill (Goldeneye Ecological Services), has been continued annual aquatic invasive plant species inventories on Lake Windermere since 2014.

The major goal of annual aquatic invasive plant sampling in Lake Windermere is early detection of any aquatic invasive plant species, which if detected would lead to a rapid response. To-date, no aquatic invasive plants have been detected at the long-term sampling sites. The increasing popularity of recreating on Lake Windermere poses a high risk to the introduction and spread of aquatic invasive plant species in the lake and to further spread into the Columbia Wetlands ecosystem thereafter. Motor and non-motorized watercrafts are common vectors for transmitting aquatic invasive species. This project remains diligent in its annual efforts of early detection so that a rapid management response can be implemented if an aquatic invasive plant is detected.

2. Study Area

Lake Windermere (UTM: 571182; 5590080) is located in southeastern BC, near the headwaters of the Columbia River within the Regional District of East Kootenay (RDEK). The largest community adjacent to Lake Windermere is Invermere with a population of nearly 4,000 people (Wikipedia, 2024). Other communities surrounding the lake include Windermere and Fairmont with additional communities (Radium, Canal Flats) close by. The first 180 kilometers of the Columbia River are known as the Columbia Wetlands, a Ramsar site recognized for its international significance. Lake Windermere is within the continuous Columbia Wetlands ecosystem, the Ramsar and Wildlife Management Area designations in the wetlands excludes most of Lake Windermere except for the south end (Figure 1).

Lake Windermere extends for approximately 18 kilometers and is 0.7 to 2 kilometers wide depending on latitude. Much of Lake Windermere is classified as a shallow open water wetland, a transition zone between lakes and marshes where the depth of water is often less than 2 meters (Alberta Wetland Policy, 2017). The deepest area of the lake it located near the northwest end and measures approximately 5.5 meters deep. Lake Windermere is important to humans for a variety of purposes and ecosystem services including cultural services such as aesthetic views, fishing, birding, recreational boating, and cross-country skiing. It is also important for providing a water source to surrounding communities, flood and drought mitigation, wildlife habitat, nutrient cycling, and primary production.

Twenty-nine Bank Swallow colonies have been identified along the foreshore of Lake Windermere (Darvill, 2022a). The 'Key Biodiversity Area' KBA designation is bring pursued by Goldeneye Ecological Services due to the demonstrated importance of the area as breeding habitat to at-risk Bank Swallow (Darvill, 2022a; Ian Adams, personal communication, May 2022). An abundance of migratory waterbirds use Lake Windermere as stopover grounds during both the spring and fall migration; several at-risk bird species use this lake as migration staging area for resting and for feeding (Darvill, 2020). Some of the at-risk birds observed on Lake Windermere include: Western Grebe (*Aechmophorus occidentalis*), Eared Grebe (*Podiceps nigricollis*), Horned Grebe (*Podiceps auritus*), Double-crested Cormorant (*Phalacrocorax auritus*), American White Pelican (*Pelecanus erythrorhynchos*) (Darvill, 2019; Darvill, 2020). One hundred and sixty-five bird species have been recorded at Lake Windermere. The lake also provides habitat for many other species including at least nine different species of fish, of which seven are native (Hildebrand, 2022). Freshwater aquatic invertebrates, mussels and sponges are frequently observed in the benthic zone, but there is no data about their occurrences in Lake Windermere. Provincially blue-listed (at-risk) hard-stemmed bullrush Deep Marsh ecological communities are found in scattered locations along the foreshore.

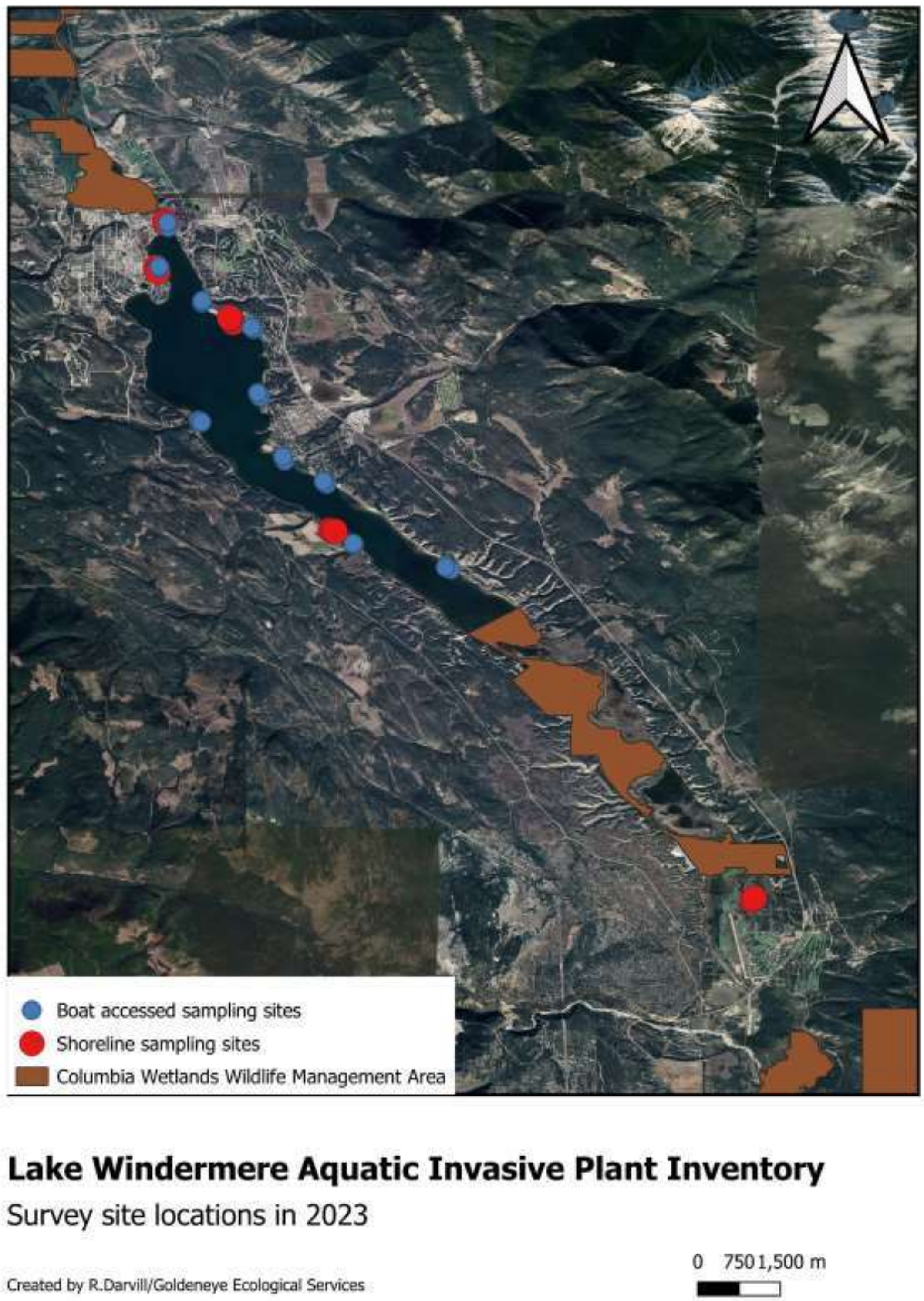

Figure 1. Map showing Lake Windermere's aquatic invasive plant survey station locations in 2024.

3. Methods

3.1. Shoreline surveys

Survey methodology adhered to the protocol outlined in the 'Canadian Columbia Basin Regional Framework for an Aquatic Invasive Species Program: 2015 to 2020 [Inter-Ministry Invasive Species Working Group (IMISWG), 2015]. Shoreline surveys for aquatic invasive plant species were conducted over a seven-hour period on September 10, 2024. Shoreline sampling occurred at five pre-established survey stations that were selected in 2015. Those sites were selected because they were determined to pose a higher risk of invasion compared to other shoreline locations due to higher amounts of trailered boat traffic coming from other areas that could be affected by aquatic invasive species, or they are public boat launches, or boat marinas with multiple boat docking slips. The same stations had been surveyed in all previous years of survey effort, with the exception of one station (Rushmere) was had not been visited since 2022 due to private property concerns.

A field crew of two people (R. Darvill, volunteer) conducted the aquatic invasive plant sampling at each station. A thatched rake with a 9.7-meter-long rope was use for sampling aquatic plants in the water. The rake was tossed into the water as far as possible and pulled back to the shoreline. This enabled the rake to collect freshwater plants below the surface of the water at the specific location where it was thrown. Specific locations were recorded. All aquatic plants collected on the rake were recorded to the family level; where possible the species level was identified and recorded. Rake pulls occurred at the initial feature (e.g., public boat launch) as well as at three sites (when possible) located 25, 50 and 75 meters both upstream and downstream of the initial feature. Two rake throws were conducted at each of the seven sites at each station. At two survey stations (i.e., Fairmont Side Channel, End of Ruault Road), it was not possible to sample at seven sites per survey station due to obstructions such as private property (i.e., Fairmont Side Channel, extensive vegetation, bushy riparian vegetation). The five shoreline survey stations were as follows: Baltac Beach, Fairmont Side Channel, end of Ruault Road, Unofficial boat launch near Bayshore Condos and Althalmer/Pete's Marina.

3.2. Offshore surveys using a boat

Offshore sampling for aquatic invasive plants used an aluminum boat and outboard motor that was provided by the District of Invermere and a crew of two people (R. Darvill, Pam Saunders). All offshore sampling occurred on September 18, 2024 at 11 locations/stations considered to be at high-risk for introduction of aquatic invasive plant species. High-risk locations were those areas with an increased incidence of trailered boat traffic (boats coming from other waterbodies that could be infected with aquatic invasive species), public boat launches, and boat marinas. The locations sampled were: Rushmere, Lakeshore Resort, Ruault Road, Indigenous Beach, Tretheway Docks, Akiskinook Resort, end of Coy Road, Baltac Beach, Lakeview Meadows, Althalmer/Pete's Marina, and the 'unofficial boat launch near the Bayshore Condos'.

The 2024 offshore surveys utilized the IMISWG (2015) methods for AIS sampling on a lake with a boat. This ensures surveys can be repeatable over time to maintain consistency with previous years of survey effort. However, given the relatively large spatial scale of Lake Windermere and given limited resources, as in previous years of survey effort, a modification was made to the IMISWG protocol. The IMISWG protocol recommends that continuous surveys be conducted every 100 meters. However, this project's scaled-down survey effort focused on 11 high-risk locations. The scaled-down effort was also done during all years of and between 2015 and 2024.

At each survey location, two rake pulls were conducted (one off the right side and one off of the left side of boat). The rake was tossed into the water as far as possible and pulled back to the boat, enabling the rake to collect plants present on the lake bottom. All aquatic plants collected on the rake were recorded to the family level; where possible the species level was identified and recorded. If the water was calm and shallow enough to see the benthic surface, a single observer would observe all of the additional plant species seen on the lake bottom within this 100 meter transect, with the naked eye from the boat. This transect was done between the two rake toss sites at each station. For all transects, the boat travelled 100 meters northward of the initial site, parallel to the shoreline. An additional two rake toss/pulls were conducted at the end of a 100 meter transect, one off the right and one off the left-hand side of boat. All observations were recorded in the field and later transcribed into an excel file.

4. Results

4.1. Shoreline surveys

No aquatic invasive plant species were detected during shoreline surveys in 2024. A list of native aquatic plant species that were observed at each station are listed in Appendix 1. Chara, a genus of freshwater macroalgae (not plant), was commonly found in Lake Windermere. All watermilfoil species (*Myriophyllum sp.)* detected during surveys had ten (or less) leaflet pairs per leaf. Native watermilfoil species have 5-10 leaflet pairs, whereas invasive Eurasian Watermilfoil (*Myriophyllum spicatum*) has leaves with 12-21 leaflet pairs (Minnesota Sea Grant, 2016).

The Potamogeton species identified in the excel table (Appendix 1 and 2) with parenthesis stating 'short/narrow leaves', could be either *P. gramineus* or *P. obtusifolious*, or possibly another related to Potamogeton species. Potamogeton species can be hard to identify, depending on condition/stage of the plant and they hybridize fairly frequently to produce plants with hybrid characteristics (Thomas Wolf, personal communication, 2017; Washington State Department of Ecology, 2001). Since the purpose of these surveys is to detect invasive plants, species level determination for native aquatic submersed plants is not required.

4.2. Offshore surveys using a boat

No aquatic invasive plant species were detected during offshore (boat) surveys. A list of native aquatic plant species that were observed at each station are listed in Appendix 2. Chara, a genus of freshwater macroalgae (not plant), was commonly found in Lake Windermere. The most abundant beds of diverse native aquatic submersed plants were observed at the Ruault Road sampling site. Consistent with past years of survey effort, some survey stations had a lack of abundant and/or diverse aquatic plant communities, such as Lakeshore Resort, Baltac Beach, the 'unofficial boat launch near Bayshore Condos' and Tretheway Docks. As noted in previous year of sampling effort and as discussed in the invasive plant species report from 2023 sampling (Darvill, 2024), there was a thick coating of sediment on aquatic plants at the Tretheway sites. This sediment was greyish in colour and a strong odour released from the sediment when pulling up the sampling rake and boat anchor was observed.

5. Discussion

Invasive aquatic plants pose a major threat to freshwater lake ecosystems. They can reduce biodiversity, degrade water quality, disrupt food webs, alter habitats, and impose economic burdens. These plants can also affect hydrological processes, further exacerbating the environmental damage. Conversely, native aquatic submersed plants are vital to the ecological health of freshwater lakes. They support biodiversity, improve water quality, produce oxygen, sequester carbon, control erosion, and help prevent the spread of invasive species. Their presence enhances the overall resilience and functionality of freshwater ecosystems, making them integral to the balance and sustainability of these environments.

Due to the ongoing diligence of annual aquatic plant sampling at Lake Windermere, we know that aquatic invasive plants are not present in the at the 5 shoreline sampling stations or at the 22 sites at 11 boat-accessed sampling stations. Those sampling sites represent areas with the highest potential for introducing invaders. While not the intention of this project, observations of the lake's ecology are made annually with recommendations provided in all Final Reports (e.g., Darvill 2021; Darvill 2022b, Darvill, 2024). During 2023 and 2024 sampling efforts a noticeable lack of native aquatic submersed plants was observed at some sampling locations (e.g., Lakeshore Resort, Baltac Beach), as well as a decrease in the abundance and diversity of plants at some locations (e.g., Pete's Marina/Athalmer, Tretheway Docks). During 2023 and 2024 sampling, two of the survey stations (i.e., Tretheway Docks, Baltac Beach) had a thick and crusty coating of sediment on aquatic plants present at those sites (see photo on cover page). Tretheway Docks has a private marina and has one of the highest numbers of boat slips on Lake Windermere.

Motorboats are prolific on Lake Windermere during summer months, and they can contribute to the sediment coating of aquatic plants primarily through their propeller action and the wake they generate. The movement of a boat through the water causes sediment from the lakebed or riverbed to be stirred up and resuspended into the water column. Once the boat has passed, these suspended particles often settle on submerged aquatic plants. This can lead to various ecological problems, many of which are well-documented in scientific literature. For instance, sediment coating on aquatic plants can block sunlight critical for photosynthesis; shading reduces plant growth and photosynthetic efficiency (Stevenson et al., 2011) which is essential for maintaining the oxygen levels in aquatic systems (Collins, Naden & Sear, 2012). McDowell et al. (2012) note that when aquatic plants lose their ability to photosynthesize effectively, it can result in plant mortality, altering the overall structure of the aquatic community. As plants die or become stressed from sediment buildup, the habitat they provide for fish, invertebrates, and other organisms is lost. This can lead to a decline in freshwater biodiversity (Wood & Armitage, 1997). Aquatic plants also serve as important filters for water quality, trapping excess nutrients and preventing eutrophication. When plants are smothered by sediment, their ability to filter water is reduced, which can lead to nutrient build-up, promoting harmful algal blooms (Hartig et al., 2012).

6. Conclusion and Recommendations

No invasive aquatic plants have been detected in Lake Windermere. This is important since they can have a determinantal impacts on the abundance and diversity of native aquatic plants, which are critical to maintain in a healthy freshwater lakes ecosystem. However, there are other threats to aquatic plants to consider and manage in order to maintain a healthy freshwater ecosystem. For instance, motorboats contribute to sedimentation on aquatic plants through propeller action and the wake they generate, which resuspends and redeposits sediment on aquatic plants. This sedimentation blocks light, harms plant growth, reduces biodiversity, and leads to water quality degradation through eutrophication and hypoxia. The ecological impacts are significant, as they affect not only the aquatic plants but also the larger ecosystem functions they support, including habitat provision, water filtration, and sediment stabilization. Without a healthy community of native aquatic plants, you cannot have a healthy lake ecosystem (Thomaz, 2023).

In order to maintain the ecological critical freshwater plants in Lake Windermere, a number of recommendations have been made in previous years (e.g., Darvill, 2024). These recommendations are still upheld and include:

- Identify all environmental factors that influence submerged macrophyte communities in Lake Windermere.
- Evaluate the diversity, abundance and distribution of native aquatic plant species in Lake Windermere.
- Designate special management zones in Lake Windermere that show high risk and are ecological significant. This should include areas of abundant and diverse aquatic native plants (e.g., at Ruault Rd where there is currently a public boat launch not highly used), emergent (blue-listed) hard-stemmed bullrush Deep Marsh ecological communities, and important habitats for at-risk species (e.g., Bank Swallow colonies).
- Given the ecological significance of native aquatic submersed plants to a freshwater lake ecosystem and the well-documented negative impacts of boats on aquatic plants, create

"no motorized boating zones" in the 'special management zones'. Where there are competing interests between nature conservation and recreation, work towards a compromise by assigning certain areas of a lake to recreation and other parts (special management zones) should be left for nature conservation and to maintain the ecological health of Lake Windermere.

- Submerged aquatic plants can be a measurable indicator of the ecological health of Lake Windermere. Annual sampling could be conducted that uses a method focusing on lake littoral margins where there is the greatest public interaction and interest.
- Aquatic habitat restoration could be considered by planting macrophytes in areas where they are lacking.
- Increase educational education efforts about the vital ecological health benefits provided by aquatic submersed plants (e.g., create a brochure for local events, social media, local newspapers).

Aquatic submersed plants are vital components of lake ecosystems, providing a range of ecological and environmental benefits. They improve water quality, support biodiversity, stabilize sediments, and contribute to carbon sequestration, among other functions. Their role in maintaining ecosystem health makes them an essential focus of conservation and management efforts in freshwater ecosystems. Effective management and prevention strategies are critical to protecting freshwater ecosystems like Lake Windermere.

7. Acknowledgements

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Prepared by: This document is intended to provide adequate information to describe the aquatic invasive plant inventory that was completed on Lake Windermere in 2024. Please do not hesitate to contact the consulting biologist with any inquiries about this inventory and document.

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9. Appendices

Appendix 1. Results from the Lake Windermere shoreline surveys for aquatic invasive plants on September 10, 2024.

Site	AIS sampling location at site	Aquatic Plants Identified (ranked in order of abundance in the pull)	Observations/Notes
Baltac Beach	Launch (Public Boat Launch) UTM: 0570747; 5593610	**Pull 1:** No plants **Pull 2**: No plants	Rocky substrate, little aquatic vegetation. Several mooring buoys present (7 in front of sampling sites). New sign present stating "No new buoys at Baltac.
	South 1 (25m) UTM: 0570749; 5593585	**Pull 1:** No plants **Pull 2**: No plants	
	South 2 (50m) UTM: 0570757; 5593564	**Pull 1:** No plants **Pull 2**: No plants	
	South 3 (75m) UTM: 0570774; 5593545	**Pull 1:** No plants **Pull 2**: No plants	
	North 1 (25m) UTM: 0570738; 5593634	**Pull 1:** *Chara sp. (1 fragment)* **Pull 2:** *Chara sp.*	
	North 2 (50m) UTM: 0570724; 5593661	**Pull 1:** *Chara sp.* **Pull 2**: *Najas sp., Chara sp.*	All plants in low abundance.
	North 3 (75m) UTM: 0570711; 5593678	**Pull 1:** *Chara sp., Myriophyllum sp., Potamogeton pectinatus.* **Pull 2:** *Chara sp., Potamogeton pectinatus, Potamogeton sp. (*short/narrow leaves*).*	All plants in low abundance.
Fairmont Side Channel	Boat launch UTM: 0580438; 5577293	**Pull 1:** *Potamogeton sp.*(likely *P. vaginatus), Chara sp.* **Pull 2:** *Potamogeton sp.*(likely *P. vaginatus), Chara sp.*	Outhouse, picnic tables, garbage cans. Plant diversity and abundance looks the same as previous years, but there is more garbage at site (e.g., degraded sand bags, plastic bottles).
	South 1 (25m) UTM: 0580421; 5577270	**Pull 1:** *Chara sp., Potamogeton sp. (likely P. vaginatus), Potamogeton richardsonii.* **Pull 2:** *Chara sp., Potamogeton sp. (likely P. vaginatus), Potamogeton richardsonii.*	Plant diversity and abundance looks the same as previous years. Could not go further south to sample; private property. Did not sample here 2015-2024.

	North 1 (25m) UTM: 0580451; 5577311	**Pull 1:** *Potamogeton sp. (likely P. vaginatus), Chara sp., Potamogeton richardsonii.* **Pull 2:** *Potamogeton sp. (likely P. vaginatus), Chara sp., Potamogeton richardsonii.*	Plant diversity and abundance looks the same as previous years.
	North 2 (50m) UTM: 0580451; 5577335	**Pull 1:** *Potamogeton sp. (likely P. vaginatus), Chara sp., Potamogeton richardsonii.* **Pull 2:** *Potamogeton sp. (likely P. vaginatus), Chara sp., Potamogeton richardsonii.*	Additional garbage at this site: beer cans, empty plastic bags.
End of Ruault Road	UTM: 0572647; 5587663	**Pull 1:** *Chara sp., Ranunculus aquatilis (1 fragment), Potamogeton richardsonii* **Pull 2:** *Chara sp (few small fragments)*	Extensive amount of milfoil washed up on shoreline at the Ruault sites.
	North 1 (25m) UTM: 0572625; 5587674	**Pull 1:** Elodea canadensis, *Chara sp., Potamogeton robbinsiii.* **Pull 2:** *Chara sp., Najas sp.*	Freshwater sponge. Bed of bullrush does not allow for rake toss at 50m or 75m N.
	South 1 (25m) UTM: 0572673; 5587654	**Pull 1**: *Chara sp.* **Pull 2:** *Chara sp.*	Few small fragments on each rake pull.
	South 2 (50m) UTM: 0572696; 5587643	**Pull 1**: *Chara sp.* **Pull 2:** *Chara sp.*	Few small fragments on each rake pull.
	South 3 (75m) UTM: 0572717; 5587634	**Pull 1**: No plants. **Pull 2:** No plants.	
Unofficial boat launch near Bayshore Condos	Boat Launch UTM: 0569395; 5595026	**Pull 1:** No plants. **Pull 2:** No plants.	Gravel/rocky substrate. Several boats moored in area with many buoys.
	North 1 (25m) UTM: 0569388; 5595050	**Pull 1**: No plants. **Pull 2:** No plants.	Gravel/rocky substrate. Several boats moored in area with many buoys.
	North 2 (50m) UTM: 0569372; 5595074	**Pull 1:** No plants. **Pull 2:** *Myriophyllum sp.* (1 fragment)	
	North 3 (75m) UTM: 0569359; 5595089	**Pull 1:** *Najas sp., Myriophyllum sp. (1 fragment).* **Pull 2:** *Myriophyllum sp. (2 fragments).*	
	South 1 (25m) UTM: 0569391; 5595004	**Pull 1:** No plants. **Pull 2:** No plants.	

	South 2 (50m) UTM: 0569392; 5594980	**Pull 1:** No plants. **Pull 2:** *Chara sp.* (small fragment)	
	South 3 (75m) UTM: 0569396; 5594957	**Pull 1:** *Chara sp.* **Pull 2:** *Chara sp., Myriophyllum sp.*	Low abundance of all plants pulled up on rake tosses.
Athalmer/ Pete's Marina	Boat launch UTM: 0569526; 5596333	Pill 1: *Chara sp., Elodea canadensis, Najas sp., Myriophyllum sp., Ranunculus Aquatilis* Pull 2: *Elodea canadensis, najas sp., Chara sp., Myriophyllum sp.*	Freshwater sponge pulled up on both rake tosses. Some garbage (metal wire) pulled up on first toss.
	North 1 (25m) UTM: 0569527; 5596358	**Pull 1:** *Najas sp., Chara sp., Elodea canadensis, Myriophyllum sp., Potamogeton pectinatus.* **Pull 2:** *Najas sp., Chara sp., Potamogeton pectinatus, Elodea canadensis.*	
	North 2 (50m) UTM: 0569517; 5596384	**Pull 1:** *Elodea canadensis, Najas sp., Potamogeton pectinatus*, *Chara sp., Myriophyllum sp., P. richardsonii, Ranunculus aquatilis.* **Pull 2:** *Elodea canadensis, Potamogeton pectinatus, Najas sp., P. richardsonii.*	
	North 3 (75m) UTM: 0569512; 5596405	**Pull 1**: *Chara sp., Najas sp., Elodea canadensis, Myriophyllum sp.* **Pull 2:** *Chara sp., Potamogeton pectinatus, Najas sp., Potamogeton pectinatus, P. richardsonii, Myriophyllum sp.*	Similarly, to previous year (2023 survey), the submergent beds of aquatic plants at the docks of Pete's Marina are noticeably smaller then previous years of aquatic plant sampling.
	South 1 (25m) UTM: 0569540; 5596308	**Pull 1:** *Myriophyllum sp. (1 fragment).* **Pull 2**: *Chara sp., Elodea canadensis, Myriophyllum sp., Najas sp., Potamogeton richardsonii, Potamogeton sp. (likely P. vaginatus), Najas sp., Potamogeton sp.* (short/narrow leaves).	Freshwater moss on rake pulled in from water.
	South 2 (50m) UTM: 059541; 5596284	**Pull 1:** *Najas sp., Myriophyllum sp., Elodea canadensis, Potamogeton richardsonii, Chara sp. Pull 2: Chara sp., Najas sp., Myriophyllum sp., Potamogeton sp.* (short/narrow leaves), *Elodea candensis, Potamogeton pectinatus.*	Empty freshwater mussel shell pulled up from rake toss. Freshwater sponge on one pull.

Appendix 2. Results from the rake pulls conducted during offshore aquatic invasive plant inventories at 11 survey stations on Lake Windermere on September 18, 2024**.**

Site Name	GPS coordinates (UTM Easting; Northing)	Rake Pull # or transect survey	Aquatic Plant Species	Notes/Observations/Additional species
Lakeshore Resort	574822; 5586574	1	*Chara sp.*	Low plant abundance, primarily bare sand.
	574822; 5586574	2	*Chara sp.*	Low plant abundance, primarily bare sand.
		100m transect	No additional plant species seen.	
	574752; 5586629	1	*Chara sp., Elodea canadensis* (2 fragments)*, Potamogeton sp.* (short/narrow leaved species).	
	574752; 5586629	2	*Chara sp.*	2 empty mussel shells.
Ruault Road	573127; 5587241	1	*Potamogeton praelongus, Myriophyllum sp., Potamogeton natans, Potamogeton robbinsii, Potamogeton richardsonii.*	Abundant bed of native aquatic plants at this site.
	573127; 5587241	2	*Myriophyllum sp., Megalodonta beckii.*	Freshwater sponge.
		100m transect	No additional plant species seen.	
	573036; 5587301	1	*Myriophyllum sp., Potamogeton natans, Utricularia sp., Potamogeton praelongus, Potamogeton robbinsii, Potamogeton pectinatus, Potamogeton richardsonii.*	
	573036; 5587301	2	*Myriophyllum sp., Potamogeton natans, Potamogeton richardsonii, Potamogeton robbinsii, Potamogeton praelongus.*	
Indigenous Beach	572547; 5589004	1	No plants.	Sandy substrate.
	572547; 5589004	2	No plants.	Sandy substrate.
		100m transect	No plants, bare ground.	Sparse accounts on *Chara* at this site during 2022 surveys. No plants in 2023.
	572467; 5589069	1	*Chara sp., Potamogeton sp. (*short/narrow leaved species*).*	
	572467; 5589069	2	*Chara sp.* (few fragments).	
Trethewey Docks	571754; 5589708	1	*Chara sp., Elodea canadensis* (1 fragment)*, Myriophyllum sp.* (1 fragment).	Leaves on aquatic plants coated in thick sediment layer. Boat marina adjacent to site.
	571754; 5589708	2	*Chara sp., Myriophyllum sp.* (1 fragment).	Thick sediment on plants.
		100m transect	No additional plant species seen.	
	571694; 5589762	1	*Chara sp*. (3 fragments)	
	571694; 5589762	2	*No plants.*	
Akisknook Docks	571297; 5591430	1	*Myriophyllum sp. (3 fragments)*	
	571297; 5591430	2	*Myriophyllum sp., Chara sp.*	
		100m transect	Deep water, could not see lake bottom during transect.	
	571258; 5591545	1	*Potamogeton praelongus, Potamogeton richardsonii, Elodea canadensis, Myriophyllum sp., Potamogeton robbinsii.*	High abundance of plants.
	571258; 5591545	2	*Elodea canadensis, Myriophyllum sp., Potamogeton praelongus, Potamogeton pectinatus.*	Abundant bed of native milfoil and elodea at this site.

End of Coy Road	570216; 5590729	1	*Chara sp., Myriophyllum sp., Potamogeton natans.*	Freshwater sponge, empty freshwater shell.
	570216; 5590729	2	*Chara sp., Najas sp.*	Freshwater sponge, empty freshwater shell.
		100m transect	*Potamogeton natans, Potamogeton richardsonii.*	
	570145; 5590832	1	*Chara sp., Potamogeton natans, Potamogeton pectinatus, Potamogeton sp.* (short/narrow leaved species).	
	570145; 5590832	2	*Chara sp., Potamogeton sp.* (short/narrow leaved species), *Potamogeton natans.*	
Baltac Beach	571148; 5593361	1	*Chara sp.*	Some crusty sediment on plants. Medium-high abundance of *Chara* pulled up.
	571148; 5593361	2	*Chara sp.*	High abundance of *Chara sp.*
		100m transect	No additional plant species seen. Too deep to see lake bottom.	
	571057; 5593425	1	*Chara sp.*	Medium-high abundance of *Chara* pulled up.
	571057; 5593425	2	*Chara sp.*	One fragment of *Chara sp.* Mainly bare ground.
Lakeview Meadows/Timber Ridge	570181; 5594078	1	*Chara sp., Potamogeton natans, Elodea canadensis, Potamogeton robbinsii, Myriophyllum sp.*	Abundant bed of native milfoil at this site.
	570181; 5594078	2	*Myriophyllum sp., Potamogeton robbinsii.*	
		100m transect		Dense beds of *Myriophyllum* interspersed with patches of bare ground.
	570188; 5594183	1	*Chara sp*. (high abundance), *Myriophyllum sp.* (1 fragment).	
	570188; 5594183	2	*Chara sp.* (medium abundance), *Myriophyllum sp.* (1 fragment).	
Unofficial boat launch near Bayshore Condos	569435; 5594998	1	*Potamogeton pectinatus, Elodea canadensis, Myriophyllum sp., Potamogeton praelongus.*	
	569435; 5594998	2	*Myriophyllum sp., Elodea candensis, Chara sp.*	
		100m transect	No new plants, but abundant bed of milfoil along transect.	
	569410; 5595099	1	*Chara sp., Myriophyllum sp.*	High abundance of *Chara.*
	569410; 5595099	2	*Chara sp., Myriophyllum sp.*	
Althalmer/Pete's Marina	569563; 5596249	1	*Chara sp., Potamogeton natans, Myriophyllum sp., Najas sp., Potamogeton sp (short/narrow leaves).*	Freshwater sponge, aquatic moss.
	569563; 5596249	2	*Myriophyllum sp., Hippuris vulgaris, Chara sp., Potamogeton sp* (short/narrow leaves), *Najas sp.*	Freshwater sponge, aquatic moss.
		100m transect	*Potamogeton sp. (long/narrow leaves), Potamogeton pectinatus.*	*Potamogeton sp*. (long/narrow leaves) seen is probably *P. vaginatus*.
	569554; 5596368	1	*Najas sp., Chara sp., Potamogeton sp. (long/narrow leaves), Myriophyllum sp., Potamogeton richardsonii, Potamogeton sp (short/narrow leaves),*	Freshwater sponge, aquatic moss.
	569554; 5596368	2	*Chara sp., Najas sp.*	Freshwater sponge, aquatic moss.
Rushmere	574770; 5585484	1	*P.natans, Chara sp.*	Freshwater sponge

	574770; 5585484	2	*P.natans, Myriophyllum sp., Potamogeton praelongus, Chara sp., Potamogeton richardsonii, Potamogeton robbinsii.*	
		100m transect	*Utricularia sp., Megalodonta beckii.*	
	574679; 5585535	1	*Chara sp., Potamogeton natans*	Freshwater sponge.
	574679; 5585535	2	*Utricularia sp., Chara sp., Potamogeton natans.*	Freshwater sponge.