PINE RIVER POND

Aquatic Plant Management Report

October 2025

PREPARED FOR:

Pine River Pond Association

PREPARED BY:

SŌLitude Lake Management

Table of Contents

Attachments:

- Figure 1. 2025 Vegetation Survey Map
- Figure 2. 2025 Milfoil Species Density and Distribution
- Plant Species Index

1.0 INTRODUCTION

In 2025, SŌLitude Lake Management was contracted by the Pine River Pond Association to conduct a comprehensive macrophyte survey of Pine River Pond in East Wakefield, New Hampshire. The primary objective was to evaluate the current status and potential expansion of native whorled watermilfoil (*Myriophyllum verticillatum*), originally documented in the pond in 2014. The survey also aimed to assess the overall species composition and abundance of aquatic vegetation within the littoral zone.

All macrophyte species encountered during the survey were identified and georeferenced, with focused attention on areas exhibiting whorled watermilfoil growth. Spatial data were compiled to produce detailed distribution maps illustrating species presence and density across the pond's littoral habitat.

This report presents a technical summary of the 2025 survey findings, including species-level data, spatial distribution patterns, and comparative analysis with prior years to identify trends and inform future management strategies.

Key Survey Findings

- No whorled watermilfoil (*Myriophyllum verticillatum*) documented in 2025.
- Another native milfoil - Northern Watermilfoil *(Myriophyllum sibiricum*) documented for the first time at sparse to moderate density in three localized areas.
- No invasive species found.
- 23 native species, including filamentous algae and macro-algae, were observed.
- Two macrophytes - pondweed (*Potamogeton spp.*) and bladderwort (*Utricularia spp.*) could not be identified to species based on morphology.
- Three new species observed.
- Three historical species absent in the past year(s) returned.

1.1 Lake Description

Pine River Pond is a 570-acre waterbody located in East Wakefield, New Hampshire, with a mean depth of 15 feet and a maximum depth of 55 feet, as reported by the New Hampshire Fish and Game Department. The shoreline is moderately developed, comprising a mix of seasonal and permanent residences. This development contributes to nutrient loading through surface runoff, septic leachate, and other anthropogenic inputs, potentially influencing aquatic plant proliferation and overall trophic dynamics.

Hydrologically, the lake receives input from multiple sources, including tributary streams, direct surface runoff, and groundwater discharge. Its primary outflow is via the Pine River, which ultimately drains into Ossipee Lake. Water level regulation is managed by the Arthur H. Fox Memorial Dam, constructed in 1977, which plays a critical role in maintaining hydrologic stability and supporting the ecological integrity of the lake system.

The lake lies within an 8,200-acre watershed, characterized predominantly by undeveloped, forested uplands. This limited land-use intensity contributes to the lake's mesotrophic condition by minimizing external nutrient loading. The relatively low nutrient influx helps suppress the frequency and severity of algal blooms and constrains excessive macrophyte growth—both key considerations in aquatic ecosystem management.

Ecologically, Pine River Pond supports a diverse array of aquatic habitats, particularly in the vicinity of its 15 islands and in shallow littoral zones where macrophyte beds are established. These vegetated areas provide essential habitat for fish, macroinvertebrates, and other aquatic organisms. Substrate composition across the lake is primarily sand and rock, with localized deposits of organic matter and fine sediments (muck), which influence macrophyte colonization and spatial distribution. Macrophyte growth is most prevalent in shallow zones with stable substrates, where light penetration and anchorage conditions are favorable.

A comprehensive understanding of the lake's physical, chemical, and biological characteristics—including nutrient dynamics, substrate heterogeneity, and bathymetric variation—is fundamental to informed aquatic plant management and long-term ecological stewardship.

2.0 AQUATIC VEGETATION SURVEY

2.1 Methods

The macrophyte survey of Pine River Pond was conducted on July 17, 2025, spanning the morning and afternoon. Survey efforts focused on the littoral zone, defined on-site using a Lowrance depth and biovolume unit, which allowed for precise determination of the vegetated areas within the pond. A 14-foot boat was used for navigation throughout the survey.

Vegetation growth in terms of plant density was assessed visually where possible, with areas of submersed macrophyte growth further evaluated using a throw-rake to sample species not visible from the surface (Image 1). All macrophytes observed were identified to the most specific taxon possible, typically at the species level, using morphological characteristics and field guides. Each species was recorded along with its relative location, which was documented using a hand-held GPS unit to ensure accurate spatial representation in the final report.

2.2 Survey Results

The aquatic macrophyte survey conducted on July 17, 2025, at Pine River Pond revealed notable shifts in species composition, density, and distribution compared to previous years (Table 1). The primary target of the survey, whorled watermilfoil, was not observed in 2025, marking a significant departure from its consistent presence in prior surveys (Table 2). This absence may reflect changing environmental conditions, competitive displacement, or natural population fluctuations. In its place, northern watermilfoil was documented for the first time in the pond, occurring at sparse to moderate densities across three coves on both the northern and southern shores. This species, while native, shares morphological and ecological traits with whorled watermilfoil and may occupy similar niches within the littoral zone.

Three new species were recorded in 2025: creeping bladderwort (*Utricularia gibba*), northern watermilfoil, and cattail (*Typha spp*.). Their emergence suggests subtle shifts in habitat suitability, possibly driven by changes in water chemistry, sediment composition, or competitive dynamics. The presence of creeping bladderwort at sparse density may indicate colonization of nutrient-enriched microhabitats, while the appearance of cattail along the shoreline reflects potential expansion of emergent vegetation in shallow zones.

Several historically documented species were absent in 2025, including aquatic moss, floating pondweed, humped bladderwort, inflated bladderwort, pipewort, purple bladderwort, slender naiad, southern naiad, tapegrass, water-starwort, waterweed, and whorled watermilfoil. Additionally, long-leaf pondweed and snail-seed pondweed—species previously observed only once since 2021—were not found, though their absence was anticipated due to their rarity. The lack of inflated bladderwort, an invasive species recorded in both 2023 and 2024, is a positive development, suggesting that its population may be declining or failing to establish. Continued absence will need to be confirmed in future surveys to assess long-term trends.

Among returning species, several exhibited reduced densities compared to 2024. Bur-reed, previously trace to dense, was observed only at trace to sparse levels. Flat-leaved bladderwort, grassy pondweed, large-leaf pondweed, ribbon-leaf pondweed, northern naiad, robbin's pondweed, thin-leaf pondweed, and ludwigia all showed declines in density, potentially indicating competitive suppression, herbivory, or environmental stressors such as sediment disturbance or reduced light availability. Watershield and white waterlily maintained trace to sparse densities, consistent with previous years, while yellow waterlily declined slightly.

Spike-rush remained stable at sparse to dense densities, continuing to play a key role in shoreline stabilization and habitat structure. Common bladderwort persisted at trace to sparse levels, and macro-algae (specifically *Nitella*) was again present, contributing to benthic complexity and nutrient cycling. Filamentous algae was also observed, as in previous years, suggesting ongoing nutrient input sufficient to support algal growth.

New observations in 2025 included an unidentifiable bladderwort species at sparse density, an unknown pondweed species at trace to sparse density, and the reappearance of arrowhead (*Sagittaria spp*.) and horsetail (*Equisetum spp*.), both at sparse to moderate densities. These

findings underscore the dynamic nature of the pond's plant community and the importance of continued monitoring to detect subtle ecological shifts.

Ecological Implications

The absence of whorled watermilfoil and emergence of northern watermilfoil may reflect a competitive transition within the *Myriophyllum* genus, potentially driven by changes in substrate, nutrient availability, or hydrologic conditions. Northern watermilfoil's establishment in multiple coves suggests it may be well-adapted to current lake conditions and could become a dominant species in future years.

The decline in density of several native macrophytes may be indicative of broader ecological stressors, such as reduced light penetration from algal growth, sedimentation, or fluctuating water levels. Conversely, the absence of invasive inflated bladderwort is encouraging and may reflect successful containment or unfavorable conditions for its persistence.

The appearance of new species and reappearance of others suggests that Pine River Pond continues to support a diverse and resilient aquatic plant community. However, the reduction in overall species richness and density in 2025 warrants attention. These trends may signal early signs of ecological transition, possibly linked to climate variability, land use changes in the watershed, or internal nutrient cycling.

Table 1. 2025 Pine River Pond Aquatic Plant Composition and Density

Common Name	Scientific Name	Observed Plant Density
Arrowhead	*Sagittaria spp.*	Sparse
Bladderwort species	*Utricularia spp.*	Sparse
Bur-reed	*Sparganium spp.*	Trace to Sparse
Cattail	*Typha spp.*	Sparse
Common Bladderwort	*Utricularia vulgaris*	Trace to Sparse
Creeping Bladderwort	*Utricularia gibba*	Sparse
Evening Primrose	*Ludwigia spp.*	Sparse
Filamentous Algae	*Various species*	Not Quantified
Flat-leaved Bladderwort	*Utricularia intermedia*	Sparse
Grassy Pondweed	*Potamogeton gramineus*	Trace to Sparse
Horsetail	*Equisetum spp.*	Sparse to Moderate

Common Name	Scientific Name	Observed Plant Density
Large-leaf Pondweed	*Potamogeton amplifolius*	Trace to Sparse
Macro-Algae	*Nitella spp.*	Sparse
Northern Naiad	*Najas flexilis*	Trace to Sparse
Northern Watermilfoil	*Myriophyllum sibiricum*	Sparse to Moderate
Pondweed species	*Potamogeton spp.*	Trace to Sparse
Ribbon-leaf Pondweed	*Potamogeton epihydrus*	Trace to Sparse
Robbin's Pondweed	*Potamogeton robbinsii*	Trace
Spike-rush	*Eleocharis spp.*	Sparse to Dense
Small or Thin-leaf Pondweed	*Potamogeton pusillus*	Sparse
Watershield	*Brasenia schreberi*	Trace
White Waterlily	*Nymphaea odorata*	Trace to Sparse
Yellow Waterlily	*Nuphar variegata*	Trace to Sparse

Table 2. Five-Year Species Absence and Presence (2021-2025)
*Red indicates invasive species

Common Name	Year				
	2021	2022	2023	2024	2025
Aquatic Moss	x	x	x		
Arrowhead	x		x		x
Bur-reed	x	x	x	x	x
Cattail					x

Common Name	Year				
	2021	2022	2023	2024	2025
Common Bladderwort	x	x	x	x	x
Common Horsetail			x		x
Creeping Bladderwort					x
Filamentous Algae				x	x
Flat-leaved Bladderwort	x	x	x	x	x
Floating Bladderwort				x	
Floating Pondweed	x	x	x		
Grassy or Variable-leaf Pondweed	x	x	x	x	x
Horned Bladderwort	x				
Humped Bladderwort	x	x	x		
Inflated Bladderwort			x	x	
Large-leaf Pondweed or Big-leaf Pondweed	x	x	x	x	x
Ludwigia/Evening Primrose				x	x
Long-leaf Pondweed				x	

Common Name	Year				
	2021	2022	2023	2024	2025
Macro Algae	x	x	x		x
Mixed Bladderwort	x				x
Northern Watermilfoil					x
Northern Naiad				x	x
Pipewort	x	x	x	x	
Purple Bladderwort	x	x	x		
Ribbon-leaf Pondweed	x	x	x	x	x
Robbin's Pondweed		x	x	x	x
Slender Naiad	x	x	x	x	
Snail-seed Pondweed	x				
Southern Naiad	x	x	x		
Spike-rush	x	x	x	x	x
Tapegrass	x		x	x	
Thin-leaf or Small Pondweed	x	x	x	x	x

Common Name	Year				
	2021	2022	2023	2024	2025
Water-Starwort	x			x	
Watershield				x	x
Waterweed	x	x	x		
Whorled Watermilfoil	x	x	x	x	
White Waterlily				x	x
Yellow Waterlily	x	x	x	x	x

3.0 2026 RECOMMENDATIONS

To preserve the ecological integrity and long-term sustainability of Pine River Pond, SŌLitude Lake Management recommends a strategic, science-based approach to aquatic plant and nutrient management. The 2025 survey results indicate both positive developments—such as the absence of invasive inflated bladderwort—and emerging concerns, including reduced species richness and persistent filamentous algae. These trends underscore the need for enhanced monitoring, targeted interventions, and community engagement.

1. Implement Annual Point-Intercept Surveys

We strongly recommend transitioning to a comprehensive point-intercept survey methodology. This standardized approach involves sampling aquatic vegetation at georeferenced grid points across the lake, allowing for:

- Quantitative analysis of species abundance and distribution
- Year-over-year comparisons to detect ecological trends
- High-resolution mapping of plant communities and density zones
- Early detection of invasive species and nuisance growth

The resulting dataset supports robust statistical analysis and visual outputs (e.g., heat maps, trend graphs), providing a powerful tool for guiding management decisions and communicating findings to stakeholders. This method also enhances the scientific rigor of the lake's monitoring program and aligns with best practices in aquatic ecosystem assessment.

2. Expand the Weed Watcher Program

The continued success of the Weed Watcher program depends on sustained volunteer engagement and training. We recommend:

- Expanding volunteer recruitment to increase lake coverage
- Providing annual training workshops focused on species identification, GPS use, and data recording
- Integrating volunteer observations with professional survey data to improve spatial resolution and seasonal tracking

This citizen science initiative empowers the community, fosters stewardship, and enhances the lake's surveillance capacity—particularly valuable for spotting early signs of invasive species or unusual growth patterns.

3. Maintain Diver Hand-Pulling as a Primary Control Method if Invasive Species Arise

For localized infestations of nuisance or invasive plants, diver hand-pulling remains the preferred management technique. It offers:

- Precision removal with minimal disturbance to native vegetation
- Effectiveness in sensitive habitats, such as the quaking bog
- Avoidance of chemical inputs, preserving water quality and biodiversity

We advise continued coordination with the NH Wetlands Bureau to ensure regulatory compliance and recommend documenting all removal efforts to evaluate efficacy over time.

4. Address Nutrient Enrichment Through Watershed-Based Strategies

The recurring presence of filamentous algae and macro-algae (e.g., Nitella) indicates ongoing nutrient loading, particularly phosphorus. To mitigate this, we recommend a suite of watershed management practices:

a. Nutrient Management

- Establish and maintain vegetative buffer zones along the shoreline
- Promote native, low-maintenance landscaping to reduce fertilizer use

- Educate residents on responsible lawn care and phosphorus-free products

b. Septic System Maintenance

- Encourage routine inspections and pump-outs
- Support upgrades to advanced treatment systems where feasible
- Provide educational materials on septic impacts to lake health

c. Stormwater Control

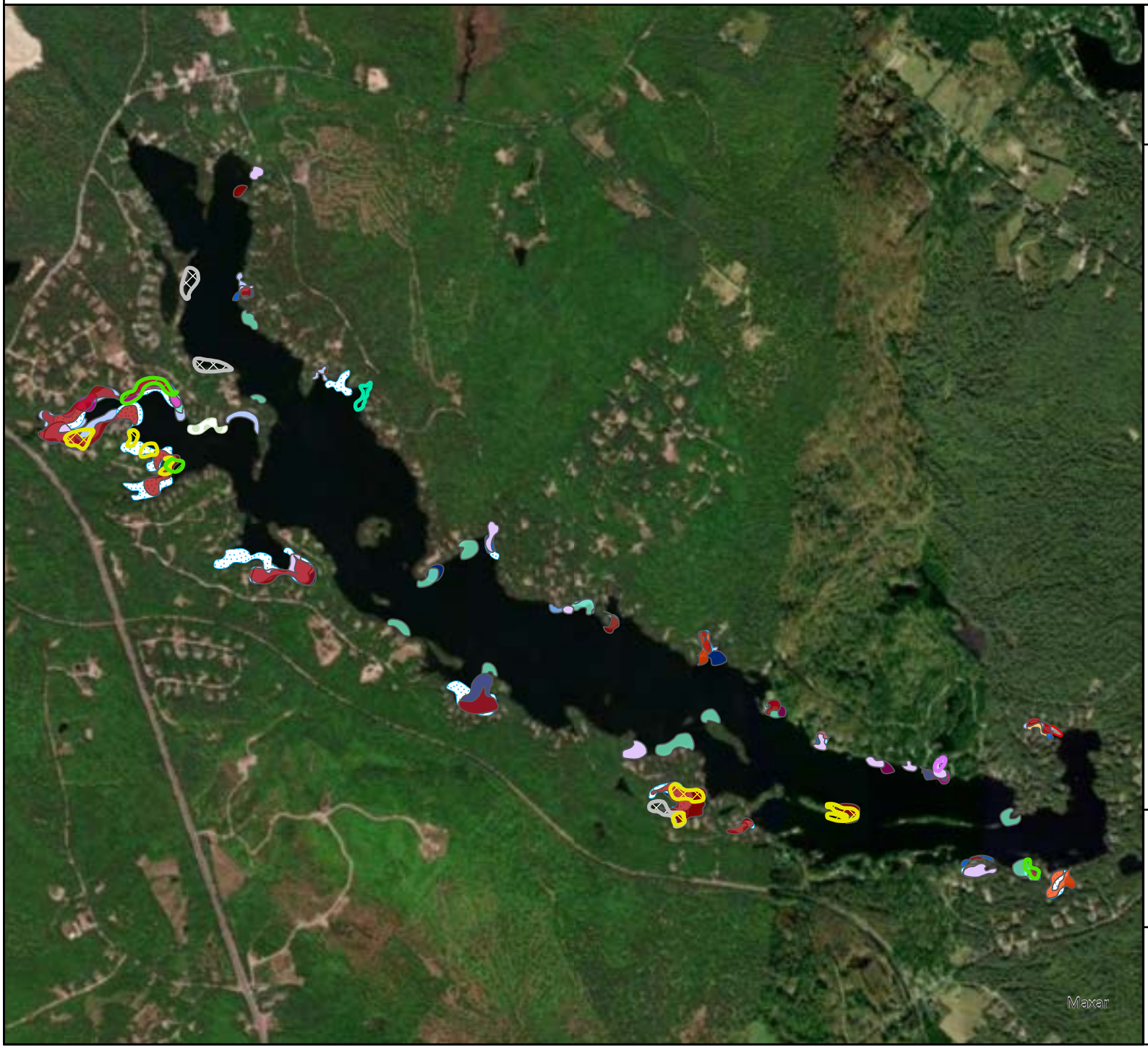
- Install rain gardens, infiltration trenches, and permeable surfaces
- Retrofit existing infrastructure to slow and filter runoff
- Prioritize stormwater planning in areas of new development

These interventions reduce external nutrient inputs, improve water clarity, and support the recovery of submerged vegetation, ultimately enhancing the lake's ecological resilience.

In summary, Pine River Pond remains a biologically rich and ecologically valuable system. However, the observed shifts in plant composition and persistent nutrient signals warrant proactive management. By adopting a comprehensive point-intercept survey, expanding community monitoring, and implementing watershed-based nutrient controls, the Association can safeguard the lake's health for future generations. SŌLitude Lake Management is committed to supporting these efforts and looks forward to continued collaboration in the 2026 season.

Figure 1. 2025 Vegetation Survey Map

Pine River Pond



Site Information

Pine River Pond
East Wakefield, New Hampshire

Center: 71°1'24"W 43°37'55"N
Scale: 1:31,484

0 500 1,000
US Feet

N

Key

Native Species and Density

- Trace to Sparse Bur-Reed
- Sparse Bladderwort Spp.
- Sparse Flat-leaved Bladderwort
- Sparse Creeping Bladderwort
- Trace to Sparse Common Bladderwort
- Sparse Small Pondweed
- Trace Robbin's Pondweed
- Trace to Sparse Grassy Pondweed
- Trace to Sparse Large-leaf Pondweed
- Trace to Sparse Pondweed Spp.
- Trace to Sparse Ribbon-leaf Pondweed
- Trace to Sparse Northern Naiad
- Sparse to Moderate Northern Watermilfoil
- Sparse Evening Primrose
- Sparse to Moderate Horsetail
- Sparse Cattail
- Sparse to Dense Spike-Rush
- Sparse Arrowhead
- Trace Watershield
- Trace to Sparse White Waterlily
- Trace to Sparse Yellow Waterlily
- Sparse Macro-Algae
- Filamentous Algae

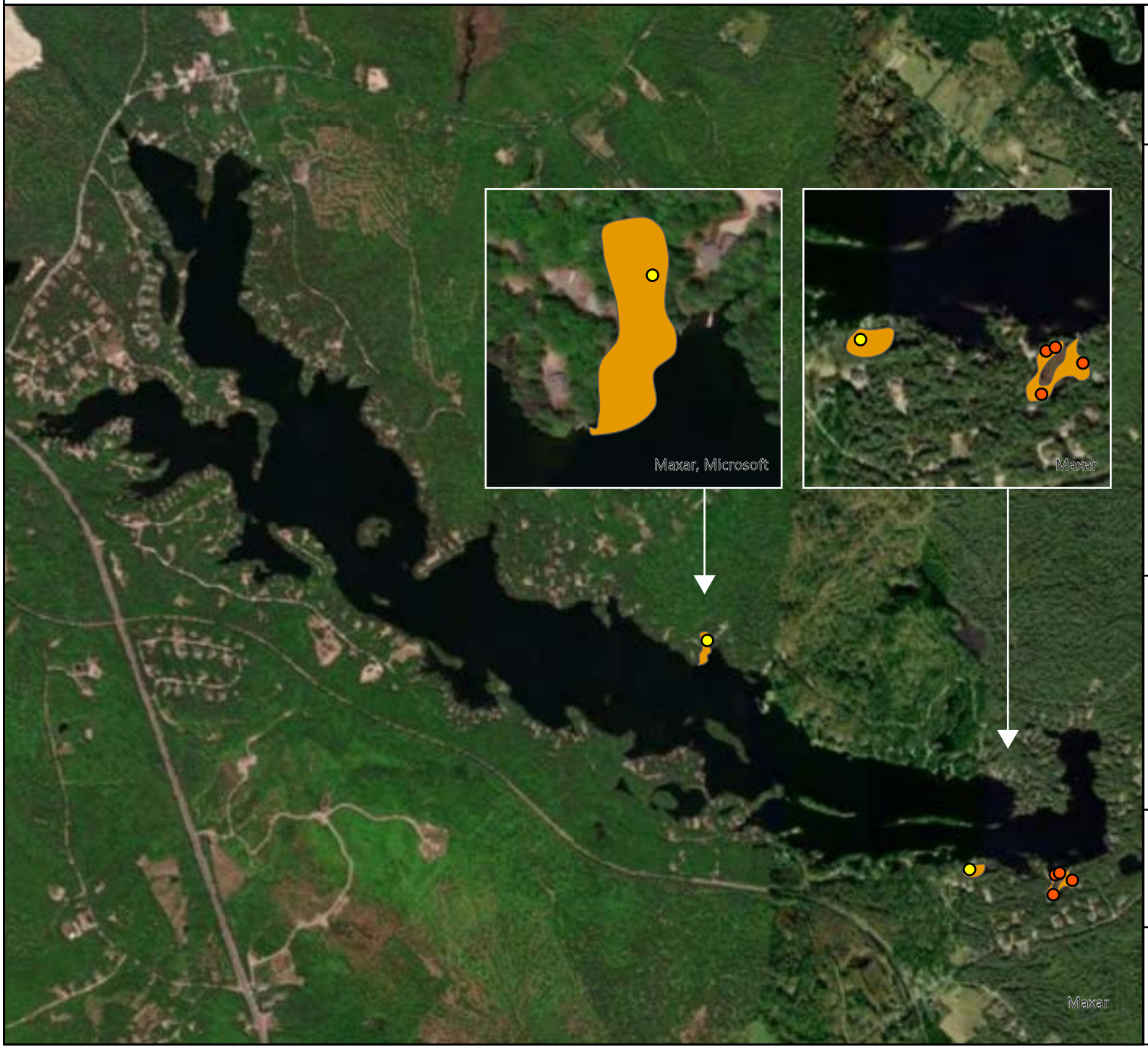
Map Details

Survey Date: July 17, 2025
Map Date: October 15, 2025
Prepared For: Pine River Pond Association
Map Author: E. Vulgamore
Office: Massachusetts

SOLITUDE
LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com

Figure 2. 2025 Milfoil Species Density and Distribution - Northern Watermilfoil

Pine River Pond



Site Information

Pine River Pond
East Wakefield, New Hampshire

Center: 71°1'24"W 43°37'55"N
Scale: 1:31,484

0 500 1,000
US Feet

N

Key

Northern Watermilfoil Density

- Sparse
- Moderate

General Plant Distribution

- Sparse to Moderate Northern Watermilfoil

Note: No Whorled Watermilfoil *(Myriophyllum verticillatum)* found in 2025.

Target Species

Northern Watermilfoil
(Myriophyllum sibiricum)

Map Details

Survey Date: July 17, 2025
Map Date: October 15, 2025
Prepared For: Pine River Pond Association
Map Author: E. Vulgamore
Office: Massachusetts

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com

PINE RIVER POND VEGETATION INDEX

NEW SPECIES

Arrowhead

Sagittaria spp.

Arrowhead is an emergent aquatic plant distinguished by its arrowhead-shaped leaves, which rise above the water surface on sturdy stalks. It typically inhabits shallow margins of lakes, ponds, wetlands, and slow-moving rivers, where it forms dense colonies that stabilize sediment and reduce shoreline erosion. Arrowhead provides essential habitat and foraging grounds for aquatic invertebrates, amphibians, and waterfowl, contributing to the ecological complexity of littoral zones. The plant reproduces both sexually through seed production and vegetatively via rhizomes, allowing it to spread efficiently in favorable conditions. Growth is influenced by water depth, light availability, and nutrient levels, with peak biomass occurring in mid to late summer. As a perennial, Arrowhead undergoes seasonal dieback in colder months, with regrowth initiated in spring. Its presence is often indicative of healthy, nutrient-rich wetland environments.

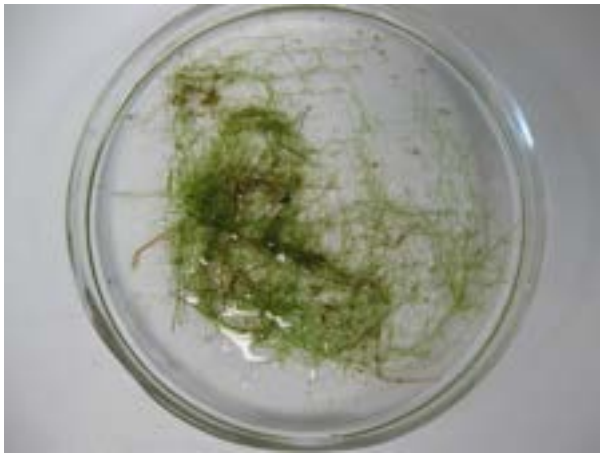
Cattail

Typha spp.

Cattail is a robust emergent aquatic plant commonly found along the shorelines of lakes, ponds, marshes, and slow-moving rivers. It is easily recognized by its tall, grass-like leaves and distinctive brown cylindrical flower spikes. Cattails thrive in shallow water and saturated soils, where they form dense stands that play a vital role in shoreline stabilization and sediment retention. Ecologically, cattails provide critical habitat and nesting sites for birds, amphibians, and aquatic invertebrates, while also contributing to nutrient uptake and water filtration. The species reproduces both by seed and extensive rhizome networks, allowing rapid colonization of suitable habitats. Growth peaks in late summer, and as a perennial, cattail undergoes seasonal dieback in fall and regrowth in spring. Its presence often indicates nutrient-rich conditions and can signal shifts in wetland dynamics.

Creeping Bladderwort

Utricularia gibba



Creeping bladderwort is a free-floating, rootless aquatic plant known for its delicate, thread-like stems and small, yellow flowers. Unlike most macrophytes, it does not anchor to the substrate and instead drifts near the water surface or entangles among other vegetation. This species is carnivorous, using tiny bladder-like traps to capture microscopic aquatic organisms, contributing to nutrient cycling in nutrient-poor environments. Creeping bladderwort typically inhabits shallow, still waters such as ponds, marshes, and quiet lake coves. Its growth is influenced by temperature, light availability, and water chemistry, with peak activity during warm summer months. As a native species, it plays a subtle but important ecological role, though its presence in dense mats may occasionally interfere with recreational use or signal elevated nutrient levels.

Horsetail

Equisetum spp.

Horsetail (Equisetum sp.) is a distinctive emergent plant characterized by its hollow, jointed stems and brush-like appearance, resembling miniature bamboo. It typically grows in moist soils along lake margins, wetlands, and streambanks, where it forms dense stands that help stabilize sediment and reduce erosion. Horsetail is a non-flowering vascular plant that reproduces via spores rather than seeds, making it unique among aquatic vegetation. Its high silica content contributes to its structural rigidity and resistance to herbivory. Ecologically, horsetail provides cover for small aquatic organisms and contributes to nutrient cycling in shoreline habitats. Growth peaks in late spring through summer, with perennial rhizomes supporting seasonal regrowth. Its presence often indicates stable, moist conditions and can signal the health of transitional wetland zones.

Macro-Algae

Nitella spp.

Nitella is a genus of submerged macro-algae belonging to the Characeae family, commonly referred to as stoneworts. Unlike true vascular plants, Nitella lacks roots and vascular tissue, but it closely resembles submerged aquatic vegetation in appearance and ecological function. It typically grows in clear, low-nutrient waters, forming bushy, branched structures anchored loosely to soft sediments. Nitella plays a vital role in aquatic ecosystems by stabilizing sediments, oxygenating the water column, and providing habitat for invertebrates and juvenile fish.

As a sensitive bioindicator, Nitella's presence often reflects good water quality and low nutrient loading. However, it can also persist in moderate nutrient conditions, especially in areas with minimal disturbance. Growth is seasonal, peaking in late spring through summer, and is influenced by light availability, temperature, and substrate composition. While not invasive, dense growth of Nitella may occasionally interfere with recreational activities, though it generally supports ecological balance and biodiversity in freshwater systems.

Northern Watermilfoil

Myriophyllum sibiricum

Northern watermilfoil is a native, submersed aquatic plant found in lakes, ponds, and slow-moving rivers across North America. It features finely divided, feather-like leaves arranged in whorls of 3–5 around slender stems that can reach up to 2 meters in length. Compared to its invasive relatives, such as Eurasian watermilfoil, M. sibiricum is less aggressive and typically forms loose, non-dominant beds.

This species thrives in clear, moderately nutrient-rich waters with sandy or silty substrates, at depths of 0.5–3 meters. Growth is seasonal, peaking in summer and regressing in fall, with overwintering via root crowns and turions. Light availability, temperature (15–25°C), and substrate type are key factors influencing its distribution.

Ecologically, northern watermilfoil provides habitat for fish and macroinvertebrates, stabilizes sediments, and contributes to nutrient cycling. It reproduces both sexually (via small emergent flowers) and vegetatively (through fragmentation and turions), enabling colonization and resilience.

While generally beneficial, accurate identification is essential to distinguish it from invasive or hybrid Myriophyllum species. Its presence often indicates a balanced aquatic plant community and good water quality. Monitoring its density and spread supports effective lake management and biodiversity conservation.

PINE RIVER POND VEGETATION INDEX

HISTORICAL SPECIES

American Tapegrass - NOT OBSERVED
Vallisneria americana

American Tapegrass is a submerged aquatic plant characterized by long, ribbon-like leaves that can grow up to 1 meter in length. It typically forms dense beds in shallow waters and is often found in lakes, ponds, and slow-moving streams. This species plays a vital role in lake dynamics by providing habitat and shelter for various aquatic organisms, including fish and invertebrates. American Tapegrass is a critical oxygen producer, contributing to water quality and clarity through photosynthesis. Its growth is primarily influenced by temperature and light availability, with peak growth occurring during the warm summer months. As a perennial species, it exhibits seasonal dieback in winter, with new growth emerging in the spring.

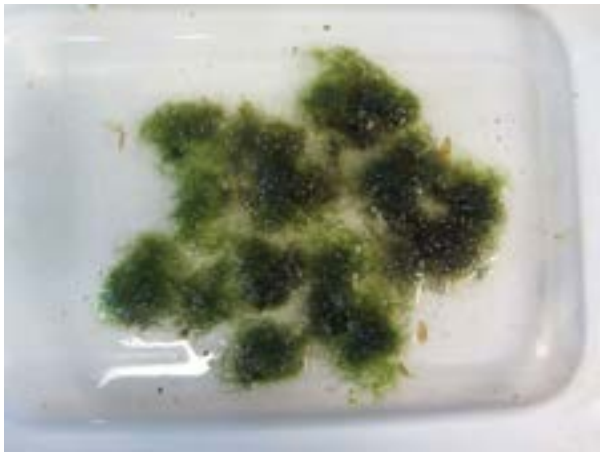
Bur-reed
Sparganium spp.

Bur-reed comprises several species of emergent plants that thrive in shallow water habitats. Characterized by their cylindrical flowering spikes and broad, flat leaves, Bur-reeds provide essential shoreline stabilization and habitat for aquatic wildlife. They are often found in wetlands and marshes and can tolerate a range of water levels. In terms of limnology, Bur-reed plays a crucial role in nutrient cycling, as its biomass contributes organic matter to the sediment upon decomposition. Growth patterns vary by species, but they generally establish in the spring and produce flowers in mid to late summer, contributing to the overall biodiversity of aquatic ecosystems.

Common Bladderwort
Utricularia vulgaris

Common Bladderwort is a unique, floating aquatic plant distinguished by its submerged, filamentous growth and small bladder-like structures that capture prey. These bladders are adaptations for nutrient acquisition, allowing the plant to thrive in nutrient-poor waters. Commonly found in ponds and lakes, it provides cover for fish and invertebrates. This annual species grows rapidly during the warm months, producing flowers that rise above the water's surface in mid-summer. As temperatures cool in the fall, the plant may die back, with seeds remaining viable in sediment for future growth.

Filamentous Algae
Various species



Filamentous algae encompass a diverse group of algae characterized by their thread-like structures, often forming green mats on the water's surface. These algae thrive in nutrient-rich environments and are common indicators of excess nutrient inputs, particularly phosphorus. While they play a role in primary production, excessive growth can lead to decreased water clarity and negatively impact submerged vegetation. Filamentous algae typically exhibit rapid growth during warm weather, flourishing in late spring and summer. Their presence can signal shifts in lake dynamics, requiring careful monitoring to manage nutrient loads effectively.

Flat-leaved Bladderwort
Utricularia intermedia

Flat-leaved Bladderwort is a floating aquatic plant with distinctive, flat, strap-like leaves and specialized bladders for capturing small organisms. Commonly found in nutrient-rich, shallow waters, it plays a vital role in controlling insect populations and provides habitat for various aquatic organisms. This species typically exhibits a robust growth pattern from late spring through early fall, producing flowers above the water surface during the summer. Its growth is closely linked to water quality, as it can thrive in conditions that support a rich diversity of life while indicating potential nutrient overloads.

Floating Bladderwort - NOT OBSERVED
Utricularia radiata

Floating Bladderwort is a unique aquatic plant that drifts on the water's surface, characterized by its small, floating leaves and specialized bladders that capture prey. It is commonly found in nutrient-rich environments, where it plays a significant role in regulating nutrient levels and supporting aquatic food webs. This annual species exhibits rapid growth during the warm months, with flowering typically occurring in mid-summer. While it contributes to primary production, its prevalence can indicate nutrient loading, making it an important species to monitor in lake management efforts.

Grassy Pondweed
Potamogeton gramineus

Grassy Pondweed is a submerged aquatic plant known for its grass-like leaves and ability to grow in a variety of water conditions, from shallow to moderately deep areas. It serves as an important habitat for fish and invertebrates, contributing to the overall biodiversity of the ecosystem. This perennial species typically grows vigorously in late spring, with peak biomass occurring in summer before senescing in the fall. Its presence enhances water clarity and quality, as it stabilizes sediments and provides oxygen through photosynthesis.

INVASIVE - NOT OBSERVED

Inflated Bladderwort
Utricularia inflata

Inflated Bladderwort is an invasive, floating aquatic plant distinguished by its large, inflated bladders and elongated leaves. This carnivorous plant captures small organisms, enabling it to thrive in nutrient-poor waters. Often found in lakes and slow-moving streams, it plays an important role in nutrient cycling and supports aquatic food webs. Inflated Bladderwort typically grows from late spring through early fall, with flowering occurring during the summer. Its growth is closely tied to water quality, making it an important species for assessing ecosystem health.

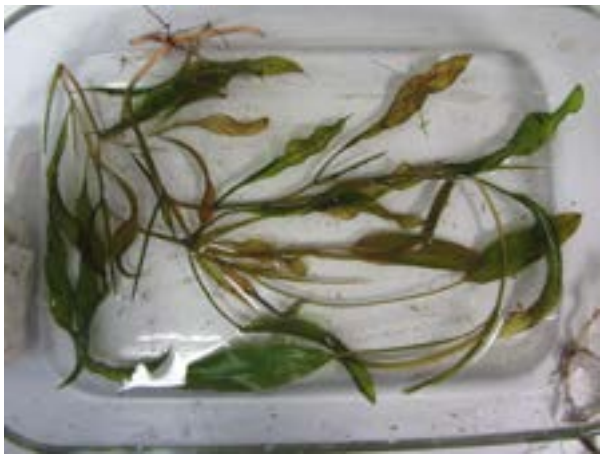
Large-leaf Pondweed
Potamogeton amplifolius

Large-leaf Pondweed is characterized by its broad, floating leaves that can reach substantial sizes, providing excellent habitat for aquatic organisms. Found in a variety of freshwater habitats, this perennial species supports biodiversity and improves water quality by stabilizing sediments and providing oxygen. Large-leaf Pondweed typically exhibits rapid growth from late spring through summer, with flowering occurring in mid-summer. Its seasonal growth patterns are influenced by light and nutrient availability, making it a key species for understanding lake dynamics.

Evening Primrose
Ludwigia spp.

Ludwigia consists of various species that can be found in both emergent and submerged forms. Characterized by their distinct, opposite leaves and yellow flowers, Ludwigia can thrive in a range of wetland habitats, including lakes and ponds. These plants play a role in stabilizing shorelines and providing habitat for aquatic fauna. Some species can become invasive under certain conditions, which may disrupt local ecosystems and alter nutrient dynamics. Growth typically begins in early spring, with flowering occurring in late summer. Monitoring Ludwigia is essential to manage its potential impacts on lake health.

Long-leaf Pondweed - NOT OBSERVED
Potamogeton nodosus



Long-leaf Pondweed is recognized for its elongated, narrow leaves that can float on the surface or grow submerged. This species thrives in a variety of aquatic environments and contributes to habitat diversity for fish and invertebrates. Long-leaf Pondweed generally exhibits vigorous growth during the warm months, with flowering occurring in mid-summer. As a perennial plant, it can influence sediment stability and nutrient cycling, playing a significant role in maintaining water clarity and quality in its habitats.

Northern Naiad
Najas flexilis

Northern Naiad is a submerged aquatic plant characterized by its slender, finely dissected leaves that can reach up to 1 meter in length. It is often found in clear, nutrient-poor waters, providing essential habitat for fish and invertebrates. This annual species typically exhibits rapid growth during the warm summer months, contributing to primary production and water quality enhancement. Its seasonal lifecycle includes dieback in fall, with viable seeds persisting in sediment for future germination. Northern Naiad's presence can indicate healthy, stable aquatic ecosystems.

Pipewort - NOT OBSERVED
Eriocaulon aquaticum

Pipewort is an emergent aquatic plant with a distinctive, tufted appearance characterized by narrow leaves and globe-like flower heads. It typically grows in shallow water and can be found in wetlands and lake margins. Pipewort plays a significant role in stabilizing sediments and providing habitat for various aquatic species. Its flowering occurs in mid to late summer, attracting pollinators and contributing to local biodiversity. As a perennial, Pipewort demonstrates resilience to seasonal fluctuations in water levels, enhancing the overall ecological health of its habitat.

Ribbon-leaf Pondweed
Potamogeton epihydrus

Ribbon-leaf Pondweed is recognized for its narrow, ribbon-like leaves that can grow submerged or floating. It thrives in a variety of aquatic environments, providing habitat for fish and invertebrates while stabilizing sediments. This perennial species typically exhibits robust growth during the summer months, with flowering occurring in late summer. Its presence can enhance water quality by providing oxygen and supporting nutrient cycling, making it an essential component of healthy aquatic ecosystems.

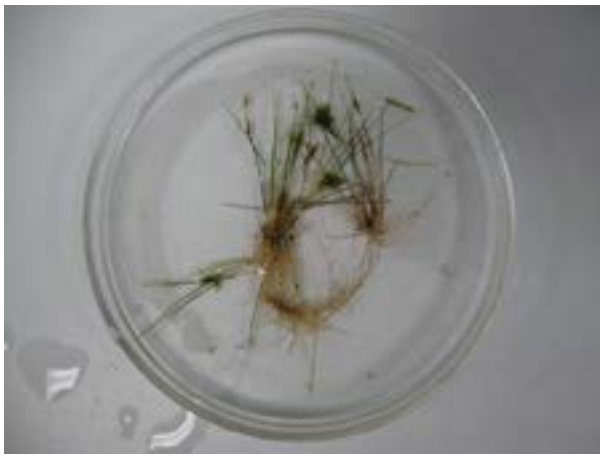
Robbin's Pondweed
Potamogeton robbinsii

Robbin's Pondweed is characterized by its slender stems and narrow, elongated leaves. This submerged aquatic plant thrives in various freshwater habitats, contributing to biodiversity and water quality. Typically found in moderately deep waters, it serves as important habitat for fish and invertebrates. Robbin's Pondweed experiences peak growth in late spring and summer, with flowering occurring in mid-summer. Its seasonal growth patterns and ability to adapt to varying conditions make it a valuable species in lake ecosystems.

Slender Naiad - NOT OBSERVED
Najas gracillima

Slender Naiad is a delicate, submerged aquatic plant characterized by its thin, finely dissected leaves. It often inhabits shallow, nutrient-rich waters, providing habitat for aquatic organisms while contributing to primary production. This annual species typically experiences rapid growth in summer, with flowering occurring in late summer. As temperatures cool in fall, it undergoes dieback, leaving viable seeds to persist in the sediment. Its presence can indicate shifts in water quality and ecosystem dynamics, making it an important species for monitoring.

Spike-rush
Eleocharis spp.



Spike-rush comprises several species of emergent plants characterized by their slender, grass-like stems and spike-like flower heads. These plants thrive in shallow waters and wetlands, providing critical habitat for a variety of aquatic organisms. Spike-rush plays a significant role in shoreline stabilization and nutrient cycling within lake ecosystems. Growth patterns vary by species, but they generally establish in early spring, with flowering occurring throughout the summer. Their resilience to fluctuating water levels makes them essential contributors to the overall ecological health of aquatic systems.

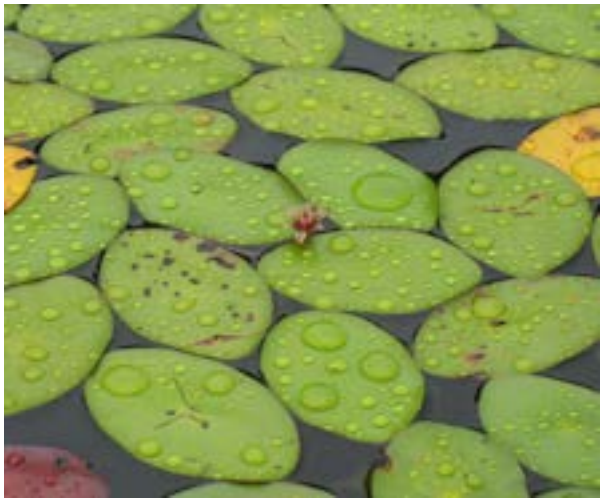
Small Pondweed
Potamogeton pusillus

Thin-leaf Pondweed is a submerged aquatic plant known for its narrow, elongated leaves. This species thrives in a range of water depths and is often found in nutrient-rich environments. It provides habitat for fish and invertebrates and plays a role in improving water quality by stabilizing sediments and producing oxygen. Thin-leaf Pondweed typically exhibits robust growth during the warm months, with flowering occurring in mid to late summer. Its adaptability to various conditions makes it a valuable component of aquatic ecosystems.

Water-Starwort - NOT OBSERVED
Callitriche spp.

Water-Starwort consists of various species characterized by their small, star-shaped leaves and ability to grow submerged or floating. These plants thrive in shallow waters and wetlands, providing important habitat for aquatic organisms while stabilizing sediments. Water-Starwort plays a role in enhancing water quality by contributing to nutrient cycling and oxygen production. Growth typically occurs from spring through fall, with flowering happening in mid-summer. Their adaptability to varying water levels and conditions makes them a critical part of healthy aquatic ecosystems.

Watershield
Brasenia schreberi



Watershield is an emergent aquatic plant characterized by its floating leaves and unique, jelly-like coating that protects it from herbivory. Commonly found in shallow, calm waters, Watershield provides habitat for fish and invertebrates and plays a role in nutrient cycling. This perennial species typically exhibits robust growth from late spring through summer, with flowering occurring in mid-summer. Its resilience to environmental changes makes it an important indicator of ecosystem health in freshwater systems.

Whorled Watermilfoil - NOT OBSERVED
Myriophyllum verticillatum

Whorled Watermilfoil is a submerged aquatic plant distinguished by its whorled leaf arrangement and feathery appearance. This perennial species thrives in a variety of freshwater habitats, providing essential habitat for fish and invertebrates while enhancing water quality through oxygen production. Whorled Watermilfoil typically exhibits rapid growth during the warm summer months, with flowering occurring in mid to late summer. Its adaptability to different water conditions makes it a valuable species for maintaining biodiversity and ecosystem stability.

White Waterlily
Nymphaea odorata

White Waterlily is a well-known aquatic plant characterized by its large, white, fragrant flowers and broad, floating leaves. It typically thrives in calm waters and is often found in lakes and ponds. White Waterlily plays an important role in providing habitat and shade for fish and invertebrates, while its leaves help to stabilize sediments. This perennial species typically begins growth in early spring, with peak flowering occurring in mid-summer. Its seasonal growth patterns and ability to adapt to various conditions make it a key component of healthy aquatic ecosystems.

Yellow Waterlily
Nuphar variegata

Yellow Waterlily, also known as spatterdock, is recognized for its large, round leaves and distinctive yellow flowers. This emergent plant thrives in shallow waters and contributes to shoreline stabilization and habitat diversity. Yellow Waterlily is particularly important for providing shelter and breeding grounds for aquatic fauna. Growth typically occurs from early spring, with flowering in mid to late summer. Its presence can indicate healthy, biodiverse ecosystems, and it plays a role in nutrient cycling within aquatic environments.