Lake Keesus Aquatic Plant Survey

Lake and Pond Solutions Co.

Lake Keesus Aquatic Plant Survey Results July 17, 2012

Goal Statement

Development of the Lake Keesus aquatic plant management plan and revision intends to continue to balance the long-term recreational use and ecological diversity that Lake Keesus has maintained in its history. Consideration of various recreational users and the ability of the system to sustain a healthy biological community have been analyzed to accomplish conceivable goals.

The Lake Keesus Aquatic Plant Management Plan was a cumulative planning effort. Information and recommendations provided are based on public input from concerned adjacent lake residents, ecological data, and the guidelines provided by the Wisconsin Department of Natural Resources for aquatic plant management planning.

Three public meetings were held in 2008-2009 to provide information and education to adjacent lake residents regarding current ecological status of Lake Keesus, management options, and threats posed by aquatic invasive species. The objectives of the meetings were to gather local input on acceptable management techniques and to obtain overall goals for Lake Keesus future which are provided below.

Lake Keesus APM Goals

1. Maintain a variety of water-oriented recreational opportunities for lake users while promoting lake access in an environmentally sound way. Recreational opportunities are of the utmost importance to the residents of Lake Keesus.
2. Protect and restore valuable and sensitive fish and wildlife habitats.
3. Minimize impacts of existing aquatic invasive species to the lake ecosystem and prevent the addition of new aquatic invasive species.
4. Educate district landowners and lake users about the benefits of aquatic vegetation and the threats posed of aquatic invasive species to the lake ecosystem.

Introduction

Lake Keesus is located within the town of Merton Waukesha county WI. The lake is drained by an unnamed tributary of the Oconomowoc River with a shoreline length of approximately 5.3 miles and a maximum depth of 42 feet. The substrate is consisted of approximately 30% sand, 20% gravel and 50% muck. Due to the steep shoreline in the main portion of the lake, most of the plant growth was found within the three bays to the South.

The Lake Keesus Management Plan was originally developed by Hey and Associates, Inc. in 2009 and distributed to the Lake Keesus Management District and the Wisconsin Department of Natural Resources. The following, updated aquatic plant survey will assist the District and state aquatic plant managers when implementing further management programs.

Comprehensive Point Intercept Survey Methods

As completed previously in 2007, a 2012 aquatic plant point-intercept survey was conducted using 471 predetermined sample locations. Sample locations were provided by the WDNR (Figure 8) and are systematically organized to produce homogenous sampling analysis from previous data. Each sample site was downloaded onto a Delorme Earthmate GPS PN-20 for ease of navigation from site to site.

A MarCum LX-5 was used to determine depth at every sample location. Five designations were used, based on depth and site characteristics. Each rake-full and underwater camera visual were assigned density ratings increasing from 1-3, 3 being the most-dense.

1) **Non-navigable Sites** were designated to indicate sample locations with shallow water and dense vegetation. Visual identification was recorded in these sites.

2) **Land Sites** indicate sample sites located on terrestrial habitat.

3) **Rake Sites** include points that were in less than 12 feet of water. A long-handled, double-headed sampling rake was dragged along the sediment to accurately represent the aquatic vegetation found at rake sites.

4) **Camera Sites** designate locations with depths ranging from 12-34 feet that were sampled visually with an Aqua-Vu underwater camera.

5) **Deep Sites:** Aquatic plant growth was consistently found no deeper than 29 feet. Sample points beyond 29 feet were designated as "deep sites" and did not merit sampling.

The ***Density*** of a particular species is indicated using a scale of 1-3 to describe rake fullness, 3 being the most-dense.

Frequency describes the number of times a species was found, divided by the total number of vegetated sites. The ***Relative Frequency*** of a plant species collected describes each species contributing a certain percentage of the whole plant community (totaling 100%).

Floristic Quality Index *(Swink and Wilhelm, 1994)*
Due to the fact that each lake possess unique ecological characteristics, comparing lake biological health can be difficult. The Floristic Quality Index (FQI) attempts to identify natural conditions within the system, monitor long-term floristic trends, and to monitor restoration efforts.
The FQI for any area (lake in this case): the floristic quality (I) equals the average coefficient of conservatism (C-value) times the square root of the number of native species ($\sqrt{N}$).

Results

Of the 471 sites 416 were visited due to navigational limitation (non-navigable sites and land sites). 167 sites were sampled with the long pole rake, 141 sites were sampled with the underwater camera, 32 sites were non-navigable, 23 sites were on land and 109 sites were deeper than the 29 feet (the maximum depth at which growth was sampled). 69.62% of sites shallower than 29 feet contained growth.

There were 17 total species identified, which includes the two exotic, invasive species, Eurasian water-milfoil (EWM) and curly-leaf pondweed (CLP). These species were also discovered in the 2007 point-intercept survey; however the concentration of these species has changed considerably as shown below and in the corresponding Lake Keesus Statistics graph.

In 2007, EWM was found at 53.4% of vegetated sample sites while CLP was found at 31.6%. The 2012 survey EWM was found at 61.3% of the vegetated sites while CLP was discovered in just 0.5% vegetated sites.

Some of the most dominant aquatic plants identified other than EWM in the 2012 survey were coontail (*Ceratophyllum demersum*), muskgrass (*chara sp.*), Illinois pondweed (*Potamogeton illinoensis*), stoneworts (*nitella sp*.), and wild celery (*Vallisneria Americana*). All of which are comparable to the 2007 survey. Each surveyed aquatic plant species of Lake Keesus can be seen with a short description in the following pages. Plant presses of each species are also provided. Note: Two plants (*Bladderwort* and *Narrow leaf cattail*) were not provided due to poor representative species. Density ratings maps for more prevalent species of Lake Keesus can be found in figures 2-7.

Floristic Quality Index

According to the survey completed in 2012, the Lake Keesus FQI is 20.2, slightly below the Swink and Wilhelm, 1994 Wisconsin average of 20.9 for the area. In 2007 the FQI was 24.6. The components of the Lake Keesus FQI calculation are consistently average. EWM infestation throughout the majority of the vegetative areas could be affecting the FQI. With careful management techniques, Lake Keesus has the potential to gradually shift floristic qualities to its natural state, preventing further decline.

Discussion

Relative to other lakes in southeast Wisconsin, the Lake Keesus aquatic plant diversity is average. Threatening species do exist within Lake Keesus and with persistent management; the invasive species can be kept in check. Without proper management, it is possible for species like EWM and CLP to create a mono-culture due to their advantageous growth habits and characteristics.

CLP was only found at one of the 416 sample sites a frequency of only 0.2%. In contrast, the 2007 sample recorded a frequency of 31.6% of sample locations. It is likely this species had senesced for the season by the time our July 17th survey was performed and may account for the

dramatic difference. CLP is a cold-water species and has the ability to germinate before the ice-out. Early growth is advantageous, creating a canopy that prevents sunlight penetration to native plants. Ultimately, navigation and recreation suffer due to the high biomass and an early senescence period.

EWM showed a 7.9% increase within vegetated sites from the 2007 survey. The increased growth is somewhat alarming. Like CLP, EWM can threaten navigational/recreational use, water quality, and biodiversity within Lake Keesus. EWM is likely responsible for the decreased FQI calculated for 2012. Although the FQI is still "average" and it is difficult to analyze a trend from two surveys, it is important to continue monitoring the aquatic plant community to determine the effectiveness of future management.

EWM has gained recognition through its unique ability to invade a body of water. The germination period is much earlier than our native plants, creating a sunlight barrier to bottom sediments and potential native growth. EWM also persists throughout the entire growing season and has the ability to spread through fragmentation.

Coontail is a native plant that was surveyed abundantly in both surveys. Although it has the ability to grow in high densities, it should be managed to reduce populations, not to eradicate. Coontail is an effective nutritional buffer, storing nutrients like phosphorus and nitrogen. Nitrogen and phosphorus are an important consideration as these nutrients will fuel nuisance blooms.

Wild celery is an important macrophyte for wildlife and was surveyed frequently during the 2012 sampling. It serves as a valuable food for waterfowl, other marsh birds, and muskrats. Wild celery is typically protected and seldom creates navigational or recreational issues.

An important abundant species surveyed in Lake Keesus is *chara sp*. Although an alga, it is often mistakenly identified as an aquatic plant. *Chara* is valued for its ability to absorb nutrients and clarify the water. *Chara* can grow in thick mats and occasionally becomes an issue for navigation and recreation. It seldom requires control and should never be completely eradicated. *Chara* is an important food source for waterfowl and also serves as habitat for fish, especially bass and pan fish.

Nitella sp., another alga often mistaken as a macrophyte and similar to *chara* in appearance, was also discovered. This species was not found during the 2007 survey, but was found in deeper waters (up to 26 feet) during the 2012 survey. Nitella would not be a significant food source for waterfowl due to the fact that the majority of surveyed locations were deep, but like *chara*, this growth serves as a nutrient buffer to the system.

Recommendations

Eurasian Watermilfoil should be continuously monitored and action taken to prevent further infestation. It is recommended to compliment harvesting operations with timely herbicide applications. As this species is an early-grower, spring treatments should be considered to include the use of 2,4-D.

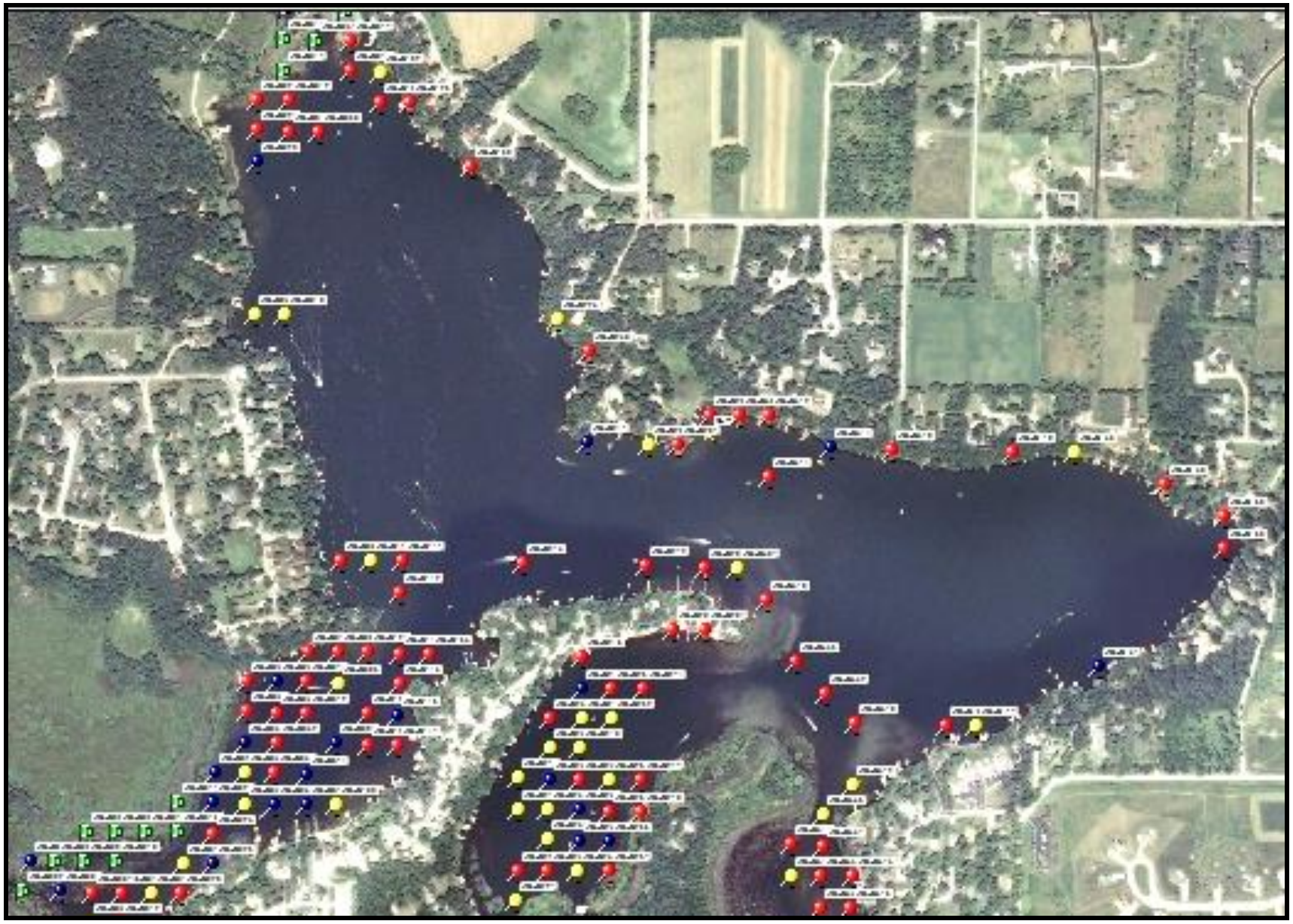
Prior to application, an informal survey of the plant community should be performed to identify, mark (using global positioning systems) and calculate proper treatment concentrations of the targeted stands. Applications should be performed at such a time to minimize damage to all non-target species.

Although Curly Leaf Pondweed was only discovered in one of the sample points, care should be taken during all future surveys to ensure any infestations are properly managed. The aquatic herbicide Aquathol K is commonly used to treat this species and all such applications should be performed early in the season, prior to turion production.

On-going harvesting should target areas of non-native growth with the intent to reduce surface growth and encourage native species. Based on our 2012 sample, there is no evidence to support a change or deviation from the 2009 aquatic plant management strategy listed below.

Shallow Bay Navigation Channels – top priority: continue cutting at 2-3 foot depth in areas greater than 3 feet deep; 15-20 feet wide adjacent to shorelines and ~100 feet wide at bay entrances. Follow guidelines for herbicide use.
Shallow Bay General Use Areas – 2nd priority: removed topped-out EWM, cutting at 2-3 foot depth in areas greater than 3 feet deep; harvesting in the shallow bay general use areas may only occur when EWM has >50% coverage or frequency of occurrence in the top 2 feet of the water column. The harvesting supervisor must verify that the topped out plants are EWM and not native vegetation. Follow guidelines for herbicide use.
Natural Shoreline Areas – No harvesting. Follow guidelines for herbicide use.
Developed Near Shore Areas – Manual removal is primarily recommended 30 feet from the shoreline for invasive species. No harvesting in areas less than 3 feet in depth. Herbicides: selective removal of aquatic invasive species using selective herbicides, follow AIS guidelines.
Fishing Area – Harvesting is **3rd priority** to cut 15-20 foot wide channels at 100-200 foot intervals, only harvesting if vegetation is dense. Herbicides – follow guidelines for lake-wide AIS control.

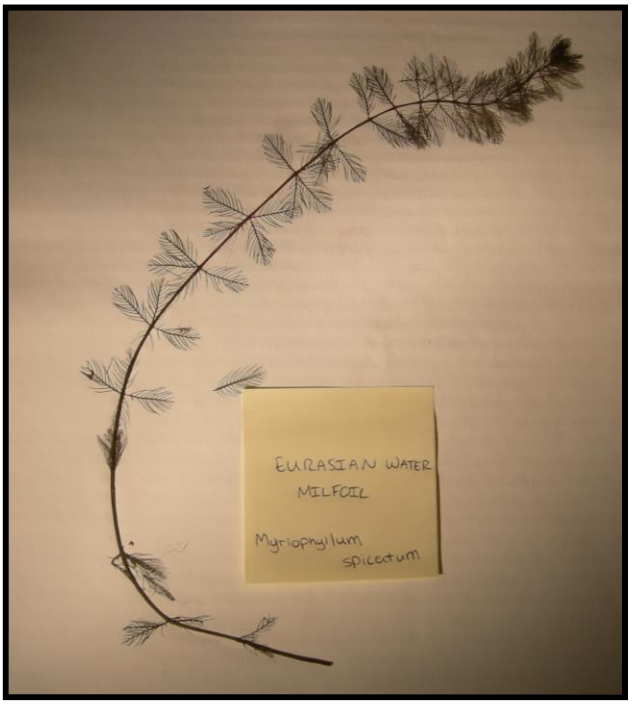
The following map illustrates EWM concentrations / density. Blue indicates the densest stands (3); yellow areas are moderate (2), while the red points are the least dense (1). An informal, spring survey should begin with these known points. Harvesting operations should also concentrate efforts in these areas while monitoring the north shoreline on a regular basis.



Plant Species

All plant descriptions were taken directly from "Through the Looking Glass…", by Susan Borman, Robert Korth, and Jo Temte, third printing 2001, copyright 1997 Wisconsin Lakes Partnership, UWEX-CNR, UWSP.

All photographs provided by Lake and Pond Solutions Co and represent actual plant samples taken during the 2012 point intercept survey.



Common Name: Eurasian water milfoil
Scientific Name: *Myriophyllum spicatum*
Classification: Submergent

Description:

Exotic. Eurasian water-milfoil has long, spaghetti-like stems, sometimes 2 or more meters in length, that emerge from roots and rhizomes. Stems often branch repeatedly at the water's surface, creating a canopy of floating stems and foliage. Leaves are divided like a feather, with a short stalk and about 14-20 pairs of thread like leaflets. The leaf divisions are all about the same length and closely spaced, resembling the bones of a fish spine. Leaves are in whorls of 4-5, and can be widely spaced (1-3 cm or more). The flower spike sticks out of the water with whorls of flowers in the axils of short bracts. The fruit (2-3 mm) has four parts with a smooth to slightly roughened surface.

Distribution:

Exotic, originated in Europe and Asia; distribution in Wisconsin is primarily in the south, but spreading north; range includes most of U.S.

Common Name: Wild Celery
Scientific Name: *Vallisneria americana*
Classification: Submergent

Description:

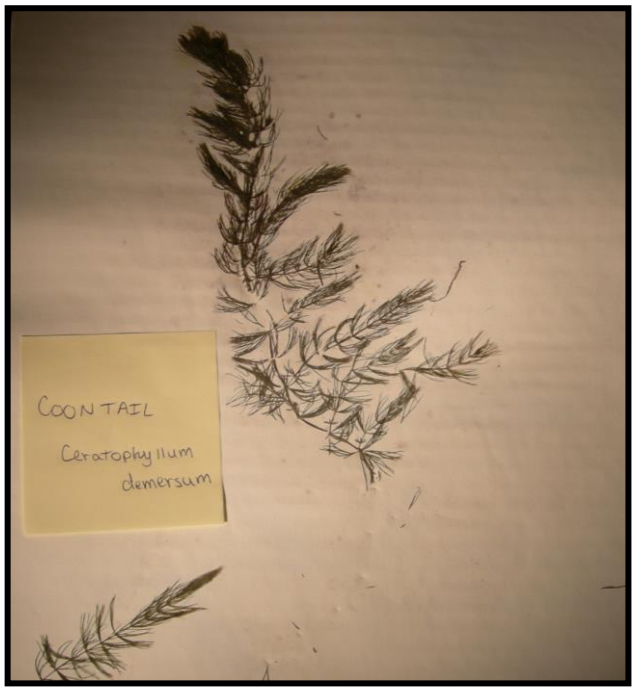
Wild Celery has ribbon-like leaves that emerge in clusters along a creeping rhizome. Leaves (up to 2 m long, 3-10 mm wide) have a prominent central stripe and a cellophane-like consistency. The leaves are mostly submersed, with just the tips trailing on the surface of the water.

Male and female flowers are produced on separate plants. The tiny male flowers (1 mm wide) are clustered in a case that develops underwater. As the flowers mature, they are released from the case. Each male flower is in a closed "floral envelope" that contains and air bubble. This helps lift it to the surface. When it reaches the surface, the floral envelope opens and creates a sail that allows it to skim along the surface.
The femal flowers (3.5-6.5 mm wide) also develop underwater, but then they are raised to the surface by a fast-growing, spiral-coiled stalk. These delicate, white flowers bob at the surface creating a dip in the surface tension. When one of the tiny male flowers sails by, it glides down to meet and pollinate the female flower. After fertilization, the female flower is retracted beneath the surface and a long, capsular fruit (5-12 cm) develops.

Distribution:

Native; found throughout Wisconsin; range includes most of U.S.

Common Name: Coontail
Scientific Name: *Ceratophyllum demersum*
Classification: Submergent



Description:

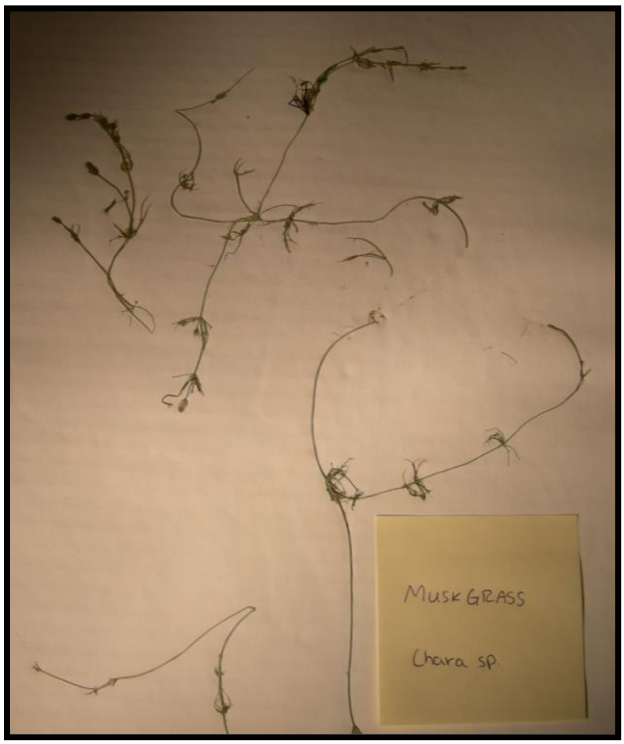
Coontail has long, trailing stems that lack true roots. However, the plant may be loosely anchored to the sediment by pale modified leaves. The leaves are stiff and arranged in whorls of 5-12 at a node. Each Leaf (1-3 cm) is forked once or twice. The leaf divisions have teeth along the margins that are tipped with a small spine. Whorls of leaves are usually more closely spaced near the ends of the branches, creating the raccoon tail appearance.

Flowers are tiny and hidden in the axils of the leaves. Male and femal flowers are on separate plants. The stamen of the male plants floats to the surface at maturity and discharges pollen. The pollen sinks down through the water and may or may not land on tiny female flowers, tucked in the leaf axils. Fruit is rarely produced, partly because of this unpredictable method of pollination. When fruit does develop, it is a nut-like achene with two spines at the base and one on top (the persistent style).

Distribution:

Native; common throughout Wisconsin; range includes most of U.S.

Common Name: Muskgrass
Scientific Name: *Chara sp*.
Classification: Submergent



Description:

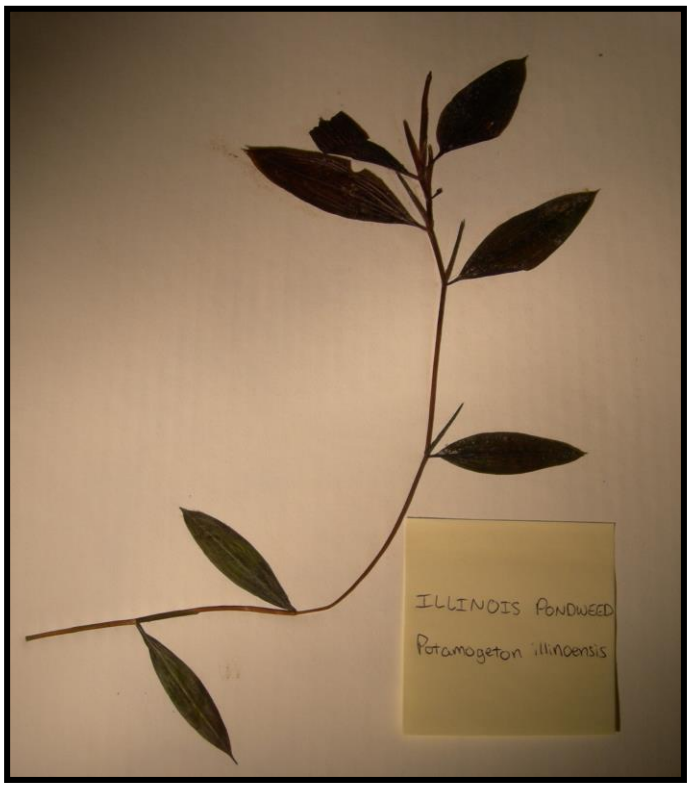
This unusual type of algae has a growth form that resembles a higher plant, but a closer look reveals each join of the stem is a single cell with no conductive tissue. Muskgrass is simple in structure and has rhizoids rather than true roots. These plants range in size from ankle-high to knee-high. The main branches of muskgrass have ridges. They are often encrusted with calcium carbonate, giving the plant a harsh, crusty feel. The side branches develop in whorls like spokes of a wheel.

Muskgrass can reproduce vegetatively by spreading rhizoids as well as sexually. The male reproductive structures, called antheridium, and the female reproductive structure, called oogonium, are located at the base of branches. Each pear-shaped oogonium is capped with five cells.

Distribution:

Native; common throughout Wisconsin; range includes most of U.S.

Common Name: Illinois Pondweed
Scientific Name: *Potamogeton illinoensis*
Classification: Submergent



Description:

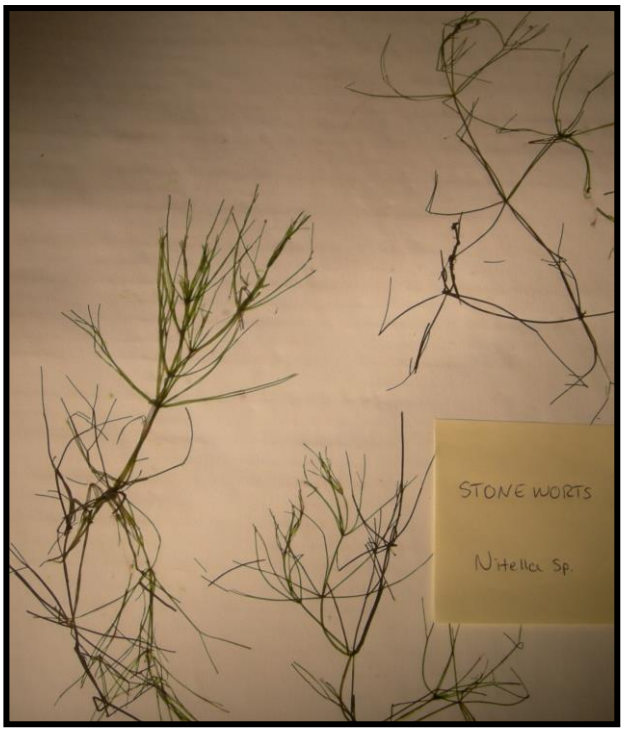
Illinois pondweed has stout stems (up to 2 m long, 1-5 mm wide) that emerge from thick rhizomes. Most submerged leaves (8-20 cm long, 2-5 cm wide) are lance-shaped to oval and either attach directly to the stem or have a short stalk (up to 4 cm). These leaves have 9-19 veins and often have a sharp, needle-like tip. The stipules (4-10 cm) are free in the axils of the leaves and have two prominent ridges called keels. Floating leaves which a have thick stalk and ellipse shaped-blade (7-13 cm long, 2-6 cm wide) are sometimes produced. The stalk is usually shorter than the blade.

Flowers and fruits are produced on a stalk (4-12 cm long) that is usually thicker than the stem. The fruit is arranged in a dense cylindrical spike (2.5-6 cm long). Each fruit (3-4 mm wide) has three low dorsal ridges and a short beak (0.5 mm).

Distribution:

Native; scattered locations in Wisconsin; range includes most of U.S.

Common Name: Stonewort
Scientific Name: *Nitella sp.*
Classification: Submergent



Description:

Nitella is a type of algae that looks like a higher plant. It has no conductive tissue and has simple anchoring structures called rhizoids rather than true roots. Branches are arranged in whorls around the stem. Stems and branches are smooth and translucent green. The overall plant ranges in size. *Nitella* can reproduce vegetatively by spreading rhizoids as well as sexually. The male reproductive structures, called the antheridium, and the female reproductive structure, called the oogonium, are located at the base of the branches. Each pear-shaped oogonium is capped with ten cells.

Distribution:

Native; common throughout Wisconsin; range includes most of U.S.

Common Name: Sago pondweed
Scientific Name: *Stuckenia pectinata*
Classification: Submergent

Description:

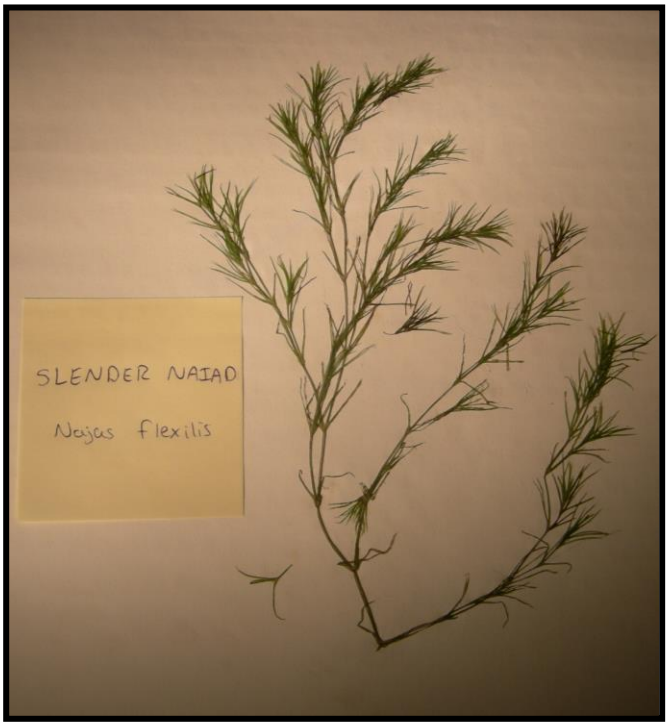
The stems of sago pondweed sprout from slender rhizomes that are peppered with starchy tubers. The leaves are very thin and resemble pine needles, ending in a sharp point. Each branch may be forked several times into a spreading, fan-like arrangement. Stipules are fused to leaves for most of their length, creating a stipular sheath.

Flowers and fruit are produced on a slender stalk that may be submersed or floating on the water surface. The flowers and fruit are arranged in small whorls that are slightly spaced apart on the stalk. This creates the appearance of beads on a string. Each fruit is oval to egg-shaped in outline. The fruit is rounded on the back with a short beak and sometime a low dorsal ridge, two lateral ridges or both.

Distribution:

Native; common in Wisconsin; range includes most of U.S.

Common Name: Slender Naiad
Scientific Name: *Najas flexilis*
Classification: Submergent



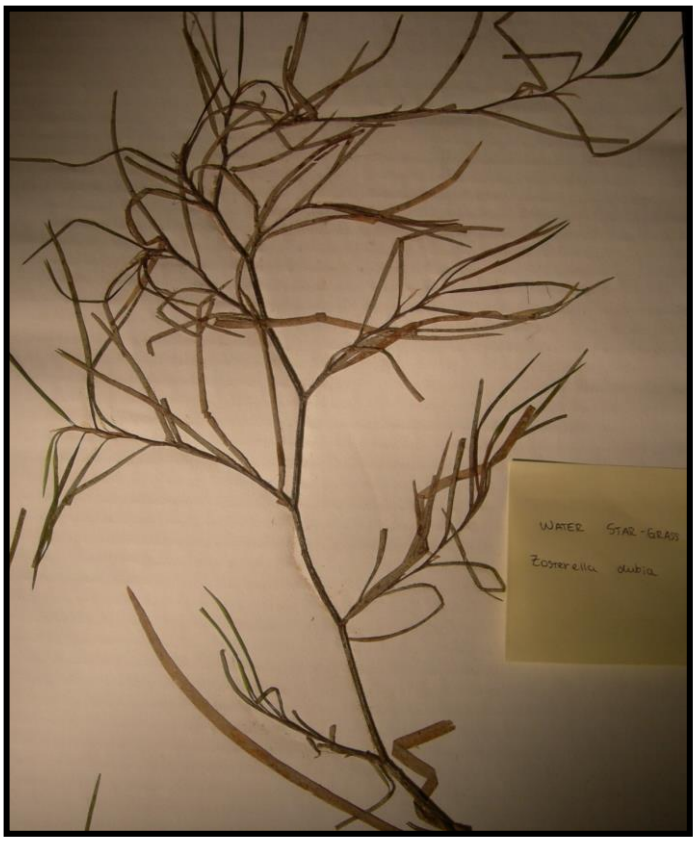
Description:

Slender naiad has fine, branched stems that emerge from a slight rootstalk. The leaves are paired, but there are sometimes there are bunches of smaller leaves crowded in the leaf axils. Size and spacing of the leaves is extremely variable, depending on growing conditions. Sometime, the plant is compact and bushy, and other times trailing and slender. Leaves are narrow with a broad base where they attach to the stem. This base is shaped like sloping shoulders. Each leaf tapers to a point tip. The leaf margin is finely serrated. Tiny flowers develop in the leaf axils and produce fruit with a paper-thin wall. The seed has a glossy surface with 30-50 rows of small, faint pits.

Distribution:

Native; common throughout Wisconsin; range includes northern and central U.S.

Common Name: Water star-grass
Scientific Name: *Zosterella dubia*
Classification: Submergent



Description:

Water stargrass has slender, freely branched stems that emerge from buried rhizome. The narrow, alternate leaves attach directly to the stem with no leaf stalk and lack a prominent mid vein. Yellow, star-shaped flowers are produced individually. The capsular fruit contains 7-30 seeds.

Distribution:

Native; common in Wisconsin; range includes most of the U.S.

Common Name: White water lily
Scientific Name: *Nymphaea odorata*
Classification: Floating-Leaf

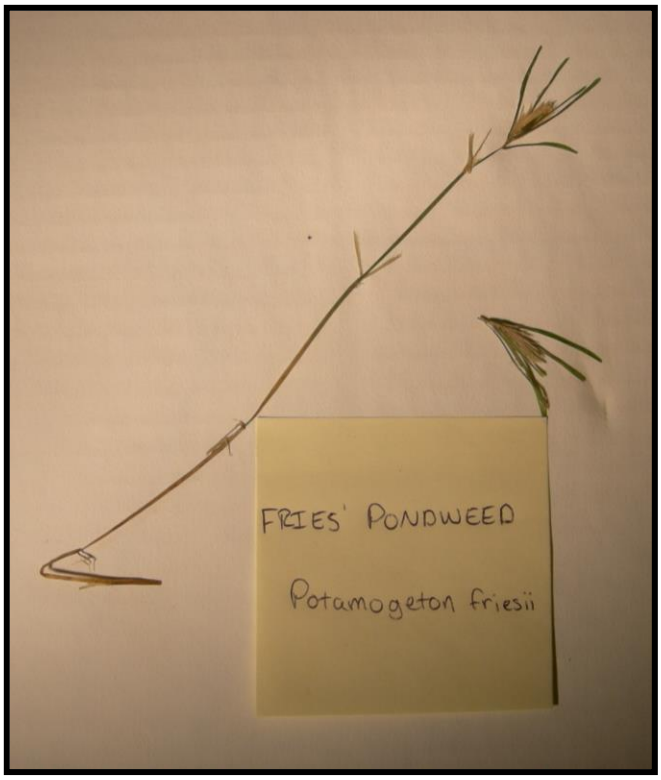
Description:

The cylindrical leaf stalks of white water lily emerge from a fleshy, buried rhizome. These flexible stalks are round in cross section with four large air passages. The leaves are round with a narrow sinus and a reddish-purple underside. Most of the leaves float on the water's surface. The flowers float on the water's surface and are borne on individual stalks that arise directly from the rhizome. They have four greenish sepals and numerous white petals in a circular arrangement around many yellow stamen attached to a central disc.

Distribution:

Native; widely distributed in Wisconsin; range include most of U.S.

Common Name: Fries' pondweed
Scientific Name: *Potamogeton friesii*
Classification: Submergent



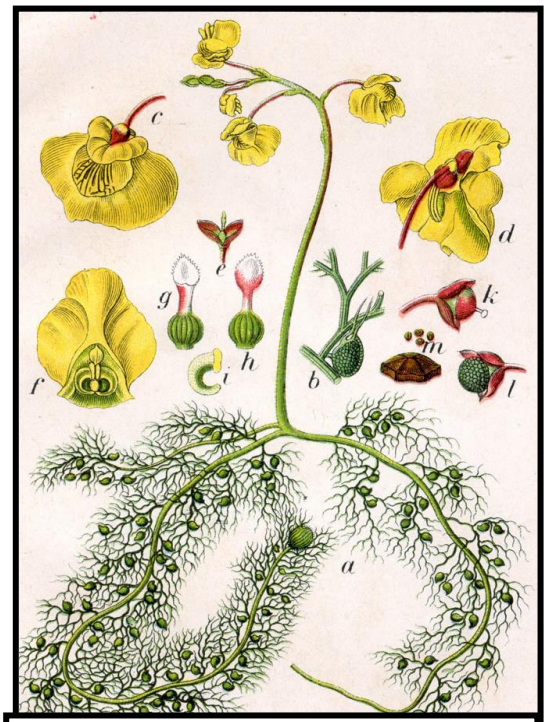
Description:

Fries' pondweed has narrow leaves, and each leaf has 5-7 veins and a rounded tip with a short beak. There is a pair of glands at the nodes and white, fibrous stipules. Flowers and fruits are borne on flattened stalk. The fruit is rounded with low ridges or no ridges. Winter buds are a strong characteristic. The inner leaves of each winter bud are compressed and arranged in a fan shape that is at a right angle to the outer leaves.

Distribution:

Native; common throughout Wisconsin; rand includes most of U.S.

Common Name: Common bladderwort
Scientific Name: *Utricularia vulgaris*
Classification: Submergent



Picture taken from Wikipedia.org

Description:

Common bladderwort has floating stem that can reach 2-3 meters in length. Along the stem are leaf-like branches that are finely divided. The divisions are filament-like, have no midrib, and fork 3-7 time. Scattered on these branches are bladders that trap prey. Young bladders are transparent and green tinted, but they become dark brown to black as they age. The branches also have fine spines scattered along their margins.

Yellow, two-lipped flowers are produced on stalks that protrude above the water surface. There may be 4-20 flowers per stalk. The upper lip of the flower creates an awning over the sac-like pouch and sickle-shaped spur of the lower lip. The plant is branched in several directions at the base of the flower stalk. This creates a stable base that keeps the top-heavy flower stalk from capsizing.

Distribution:

Native; common in Wisconsin; range includes most of U.S.

Common Name: Common waterweed
Scientific Name: *Elodea canadensis*
Classification: Submergent

Description:

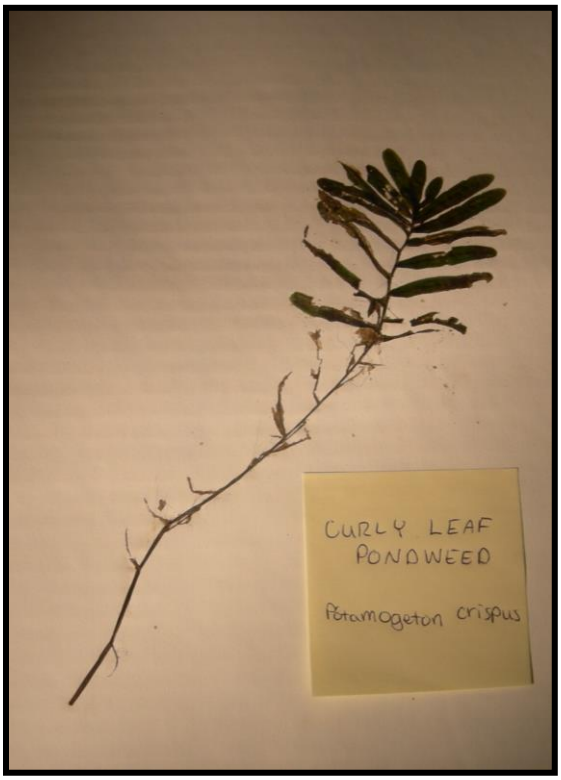
Common waterweed has slender stems that emerge from a shallow rootstalk. The small, lance- shaped leaves attach directly to the stem. Leaves are in whorls of three, or occasionally only two and tend to be more crowded toward stem tips. The branching stems often form a tangled mat that can become a nuisance.

Male and female flowers are on separate plants. Female flowers have three small white petals with a waxy surface that improves flotation. They are raised to the surface on a long, slender stalk. Male flowers develop in a vase-like structure called a spathe that is 7-10mm long. At maturity, the male flowers are also raised to the surface on thread-like stalks. There the anthers split open, releasing pollen to drift away and possibly fertilize female flowers. However, male plants are quite rare. So although you may see dozens of tiny white flowers floating above a bed of common waterweed, they are usually all femal flowers that will not produce seed.

Distribution:

Native; Common in Wisconsin; range includes most of U.S.

Common Name: Curly-leaf pondweed
Scientific Name: *Potamogeton crispus*
Classification: Submergent



Description:

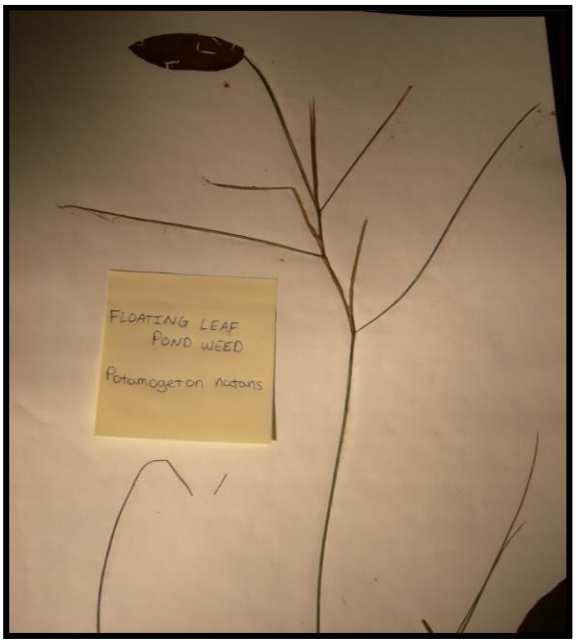
The slightly flattened stems of curly-leaf pondweed grow out of a slender rhizome. Although it is a submersed aquatic plant, the spaghetti-like stems often reach the surface by mid-June. Submersed leaves are oblong and attach directly to the stem in an alternate pattern. Margins of the leaves are wavy and finely serrated, creating an overall leaf texture that is "crispy." The stipules are fused to the base of the leaf and disintegrate as the growing season progresses. No floating leaves are produced.

In the spring, curly-leaf produces flower spikes that stick up above the water surface. The small flowers are arranged in a terminal spike on a curved stalk. Fruits develop that each have three edges and a conical beak. Curly-leaf also produces vegetative buds called turions that look like small, brown pine cones on shortened branches along the stem.

Distribution:

Exotic. The first confirmed specimen of this European exotic in the U.S. was collected in Delaware in the mid-1800s. The first record of curly-leaf in Wisconsin was 1905, and it is now common throughout the state. Range includes most of U.S.

Common Name: Floating-leaf pondweed
Scientific Name: *Potamogeton natans*
Classification: Submergent



Description:

Floating-leaf pondweed has stems that emerge from red-spotted rhizomes. Submersed leaved are stalk-like, with no obvious leaf blade. Floating leaves are heart-shaped at their base. The point where the floating leaf attaches to the stalk is distinctive. It looks like someone pinched the stalk and bent it, so the leaf blade is at a right angle to the stalk and lays flat on the water. This "pinched" portion is usually a lighter color than the rest of the stalk. The fibrous stipules of both the submersed and floating leaves are free in the leaf axils.
Flowers and fruit are produced in a dense cylindrical spike that pokes up above the water surface. Fruit is oval to egg-shaped in outline and rather plump. The surface of the fruit has a wrinkled appearance on the sides, a very low dorsal ridge and a short beak.

Distribution:

Native; common in Wisconsin; range includes northern and western portions of U.S.

Common Name: Spatterdock
Scientific Name: *Nuphar Variegata*
Classification: Floating-leaf

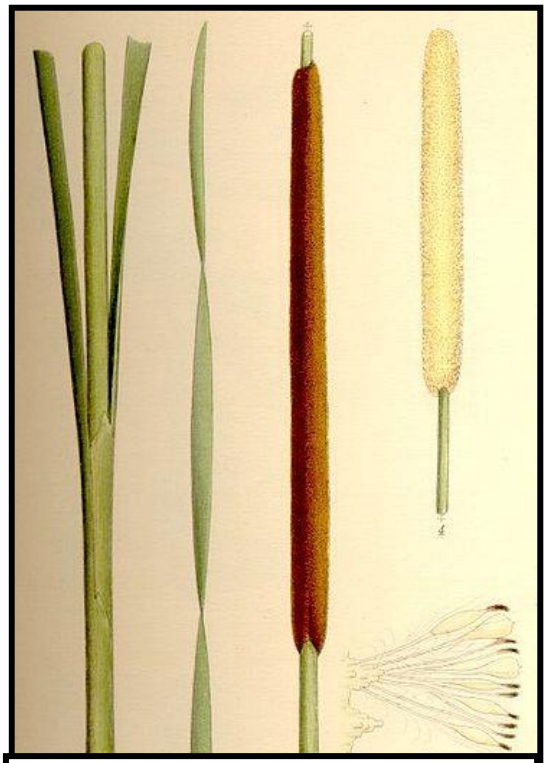
Description:

The leaf and flower stalks of spatterdock emerge directly from a robust, spongy rhizome that is marked with a spiral of scars where old leaf and flower stalks were attached. The sturdy leaf stalks have flattened upper surface with a narrow wing running down each side. Leaves of spatterdock are heart-shaped with rounded lobes that are parallel or overlapping. The leaf notch is usually less than half the length of the midrib. Most of the leaves float on the water's surface. Flowers are globular to saucer-shaped with five to six yellow petals that often have a deep red patch at the base. The sepals curve around numerous small, strap-like petals, stamen and yellowish-green disc with the stigmas. This central disc eventually develops into a seed pod.

Distribution:

Native; widely distributed in Wisconsin; range includes eastern and central U.S.

Common Name: Narrow-leaved cattail
Scientific Name: *Typha angustifolia*
Classification: Emergent



Picture taken from Wikipedia.org

Description:

Narrow-leaved cattail has dark green, sword-like leaves that emerge from a robust, spreading rhizome. The leaves are sheathed around one another at the base. At the junction of the leaf sheath and blade, the sheath has membranous ear-shaped lobes called auricles.

The flower looks like a hotdog on a stick. The lower portion is a cylindrical spike of thousands of tightly-packed female flowers. Each flower has a slender stigma, a fine bract with a spatula –like tip and hairs that are dark on the tips. Some of these female flowers will produce a nutlet and others are sterile. The top of the female spike is separated from the male spike, often by 2 cm or more of bare stem. The male spike has hundreds of anthers that spread pollen to the wind. After the pollen has been released, the male flowers drop off the flower stalk. If you look at the pollen with strong magnification, you can see the pollen grains are individual.

Distribution:

Native; common, particularly in southern Wisconsin but the range is increasing with more disturbances; range includes most of U.S.

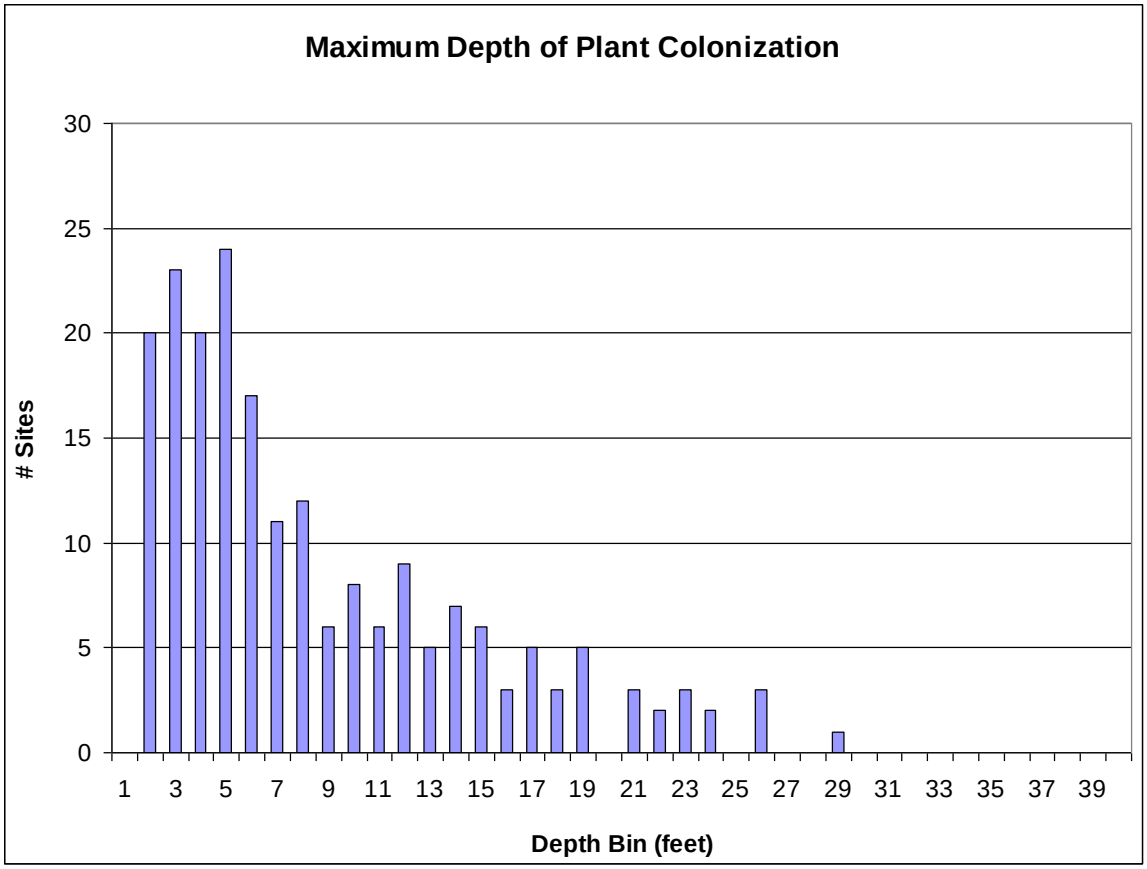


Figure 1 Maximum depth of plant colonization within Lake Keesus found during comprehensive point intercept survey.

Figure 2. **Eurasian water milfoil** density ratings of Lake Keesus 2012 comprehensive point intercept survey.

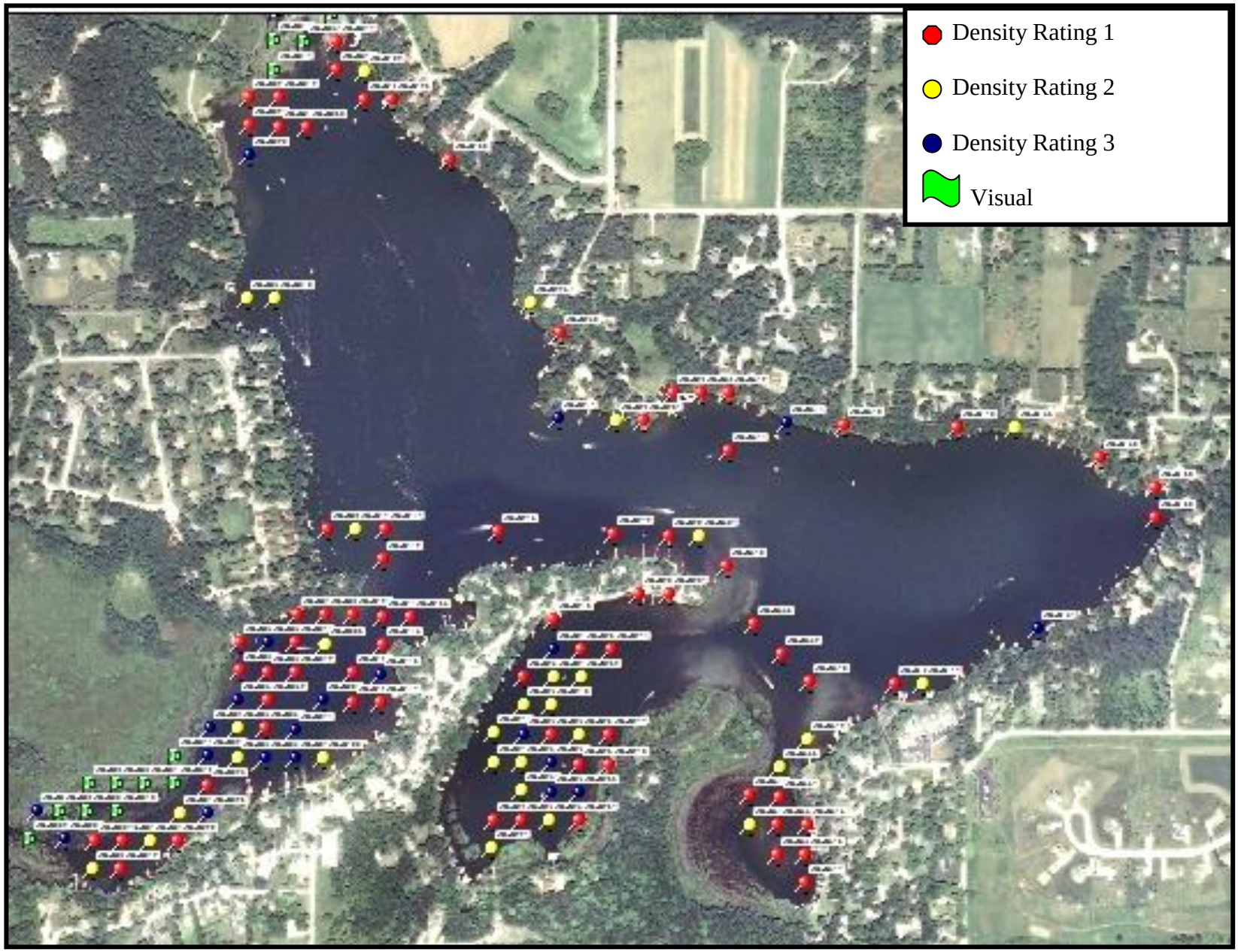


Figure 3. **Wild celery** density ratings of Lake Keesus 2012 comprehensive point intercept survey.

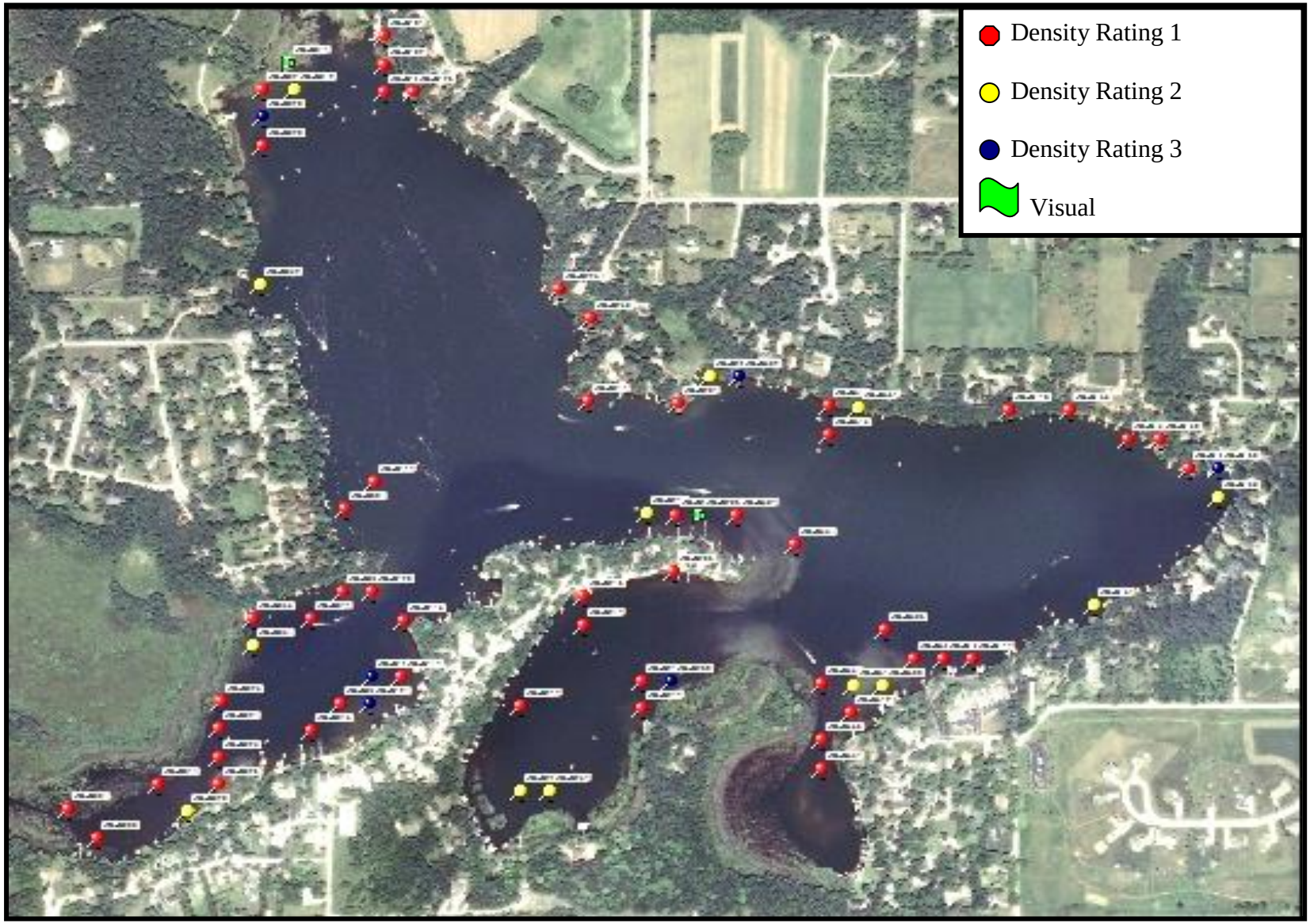


Figure 4. **Coontail density** ratings of Lake Keesus 2012 comprehensive point intercept survey.

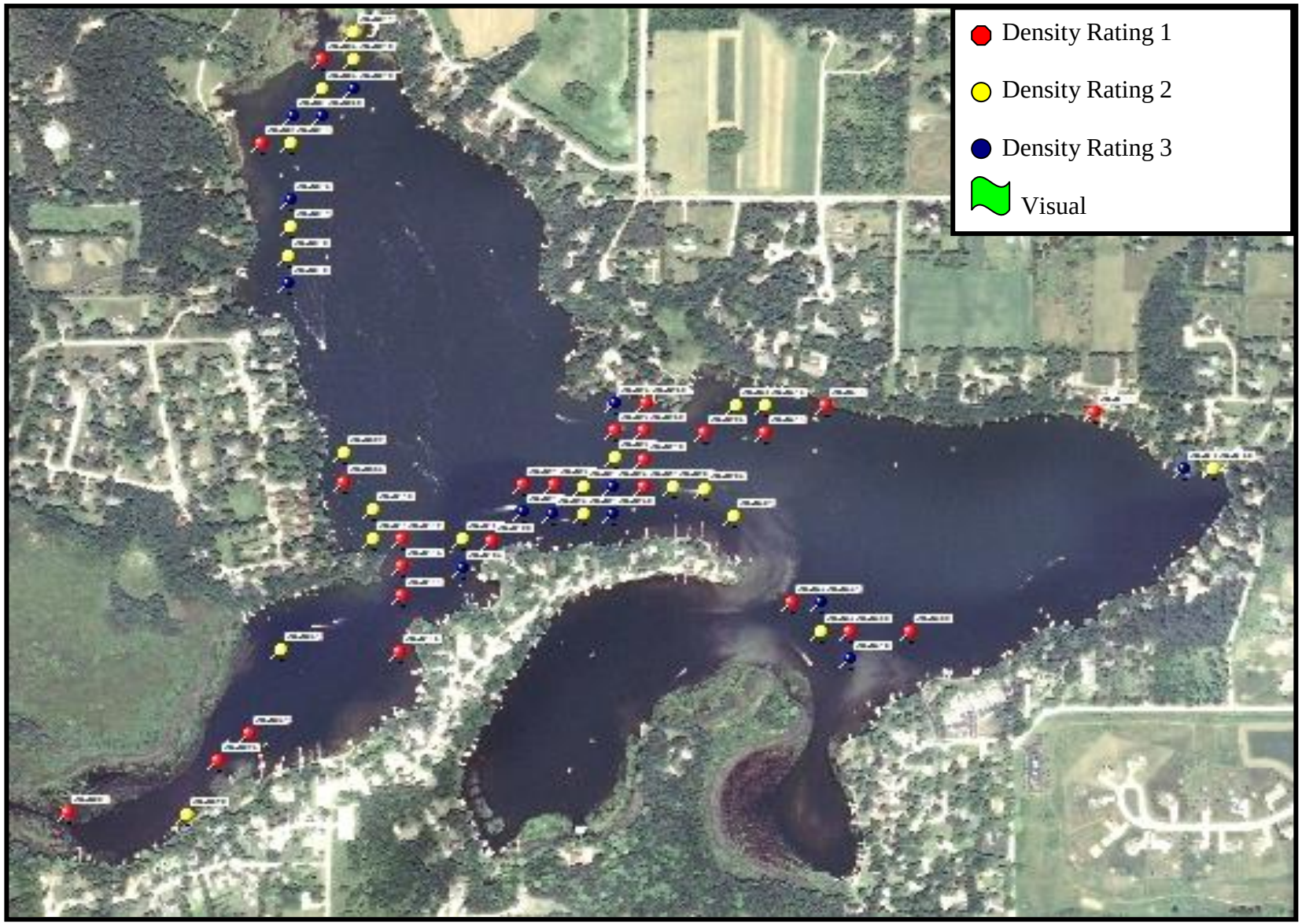


Figure 5. **Chara** density ratings of Lake Keesus 2012 comprehensive point intercept survey.

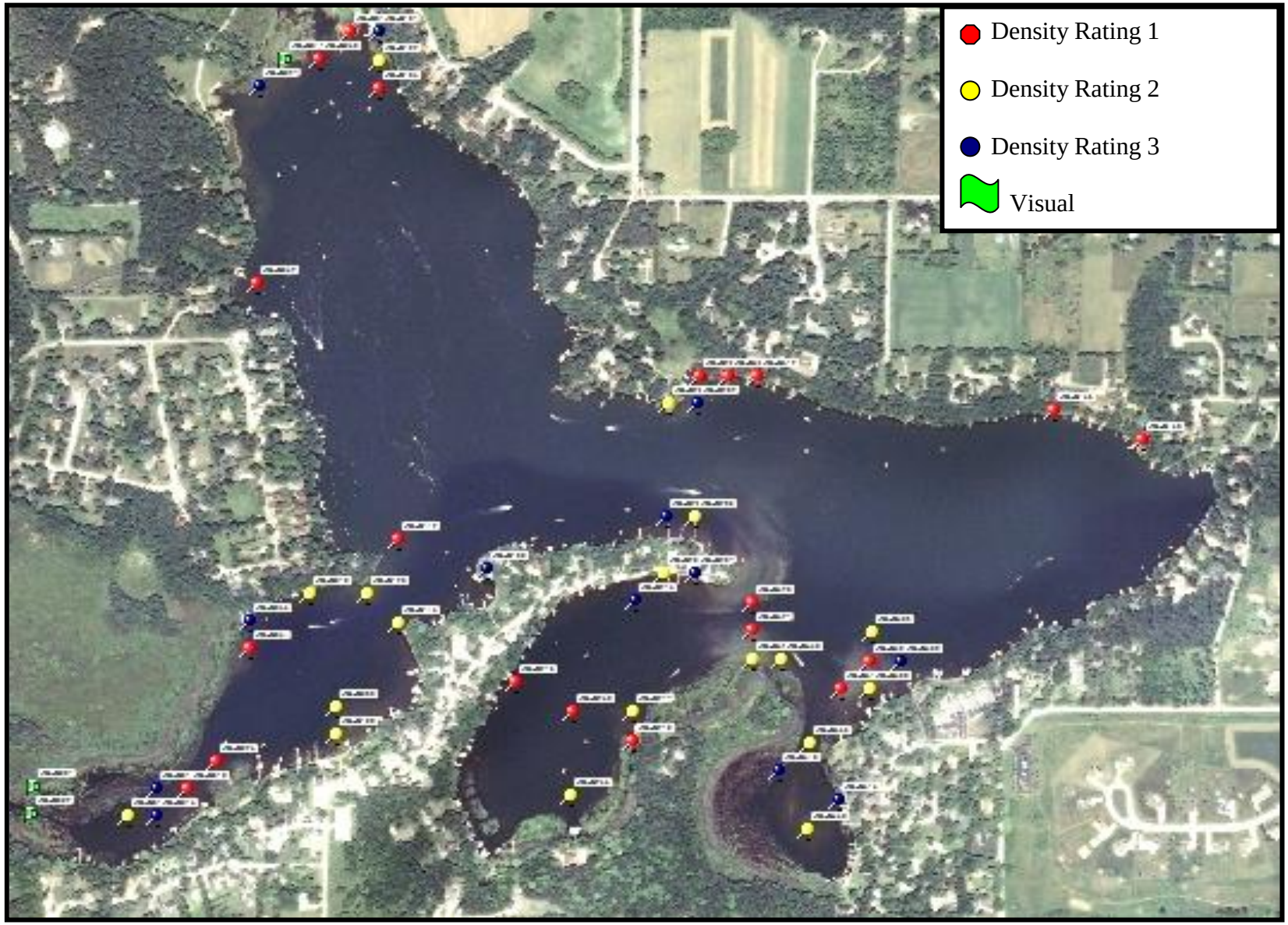


Figure 6. **Illinois pondweed** density ratings of Lake Keesus 2012 comprehensive point intercept survey.

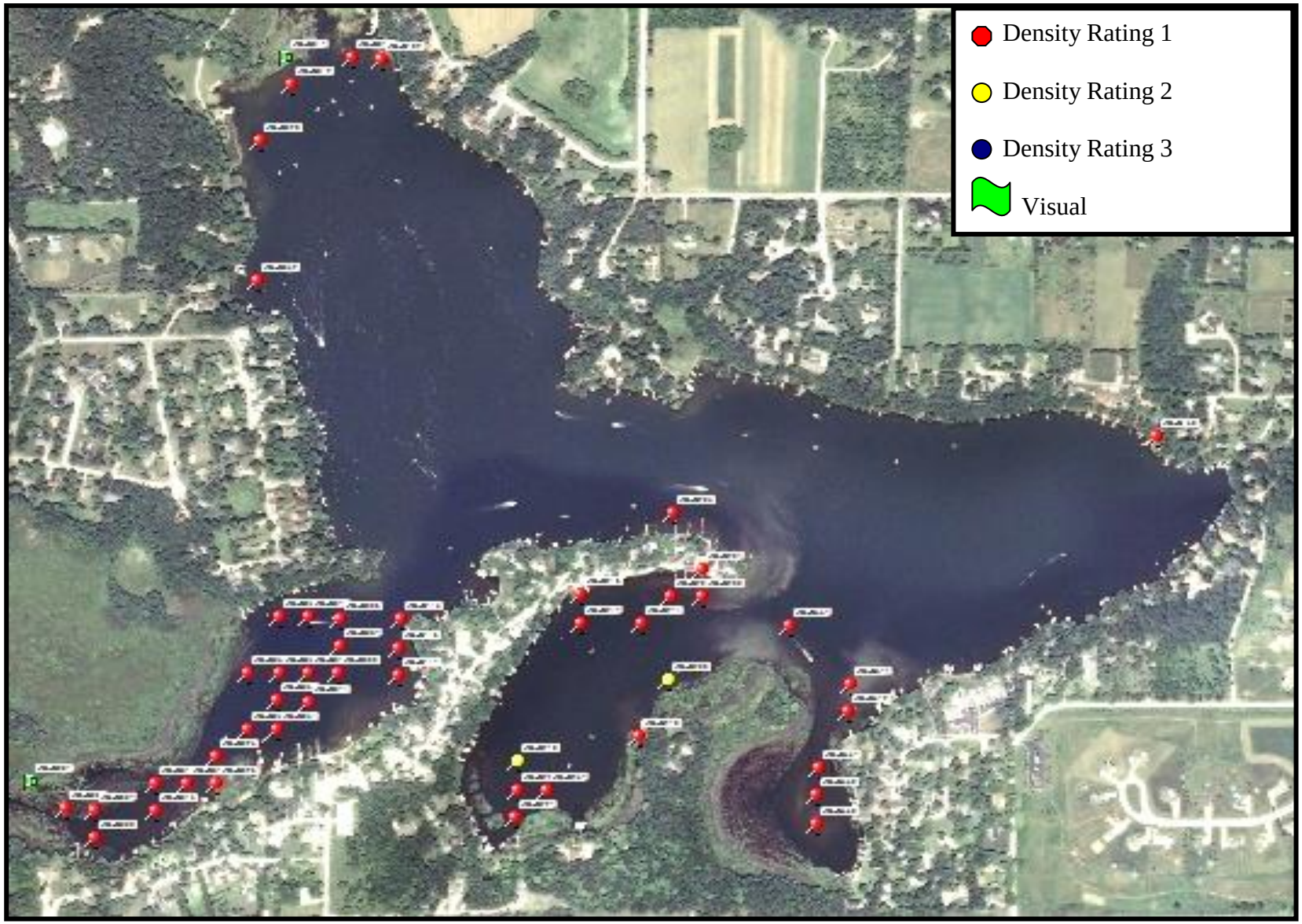


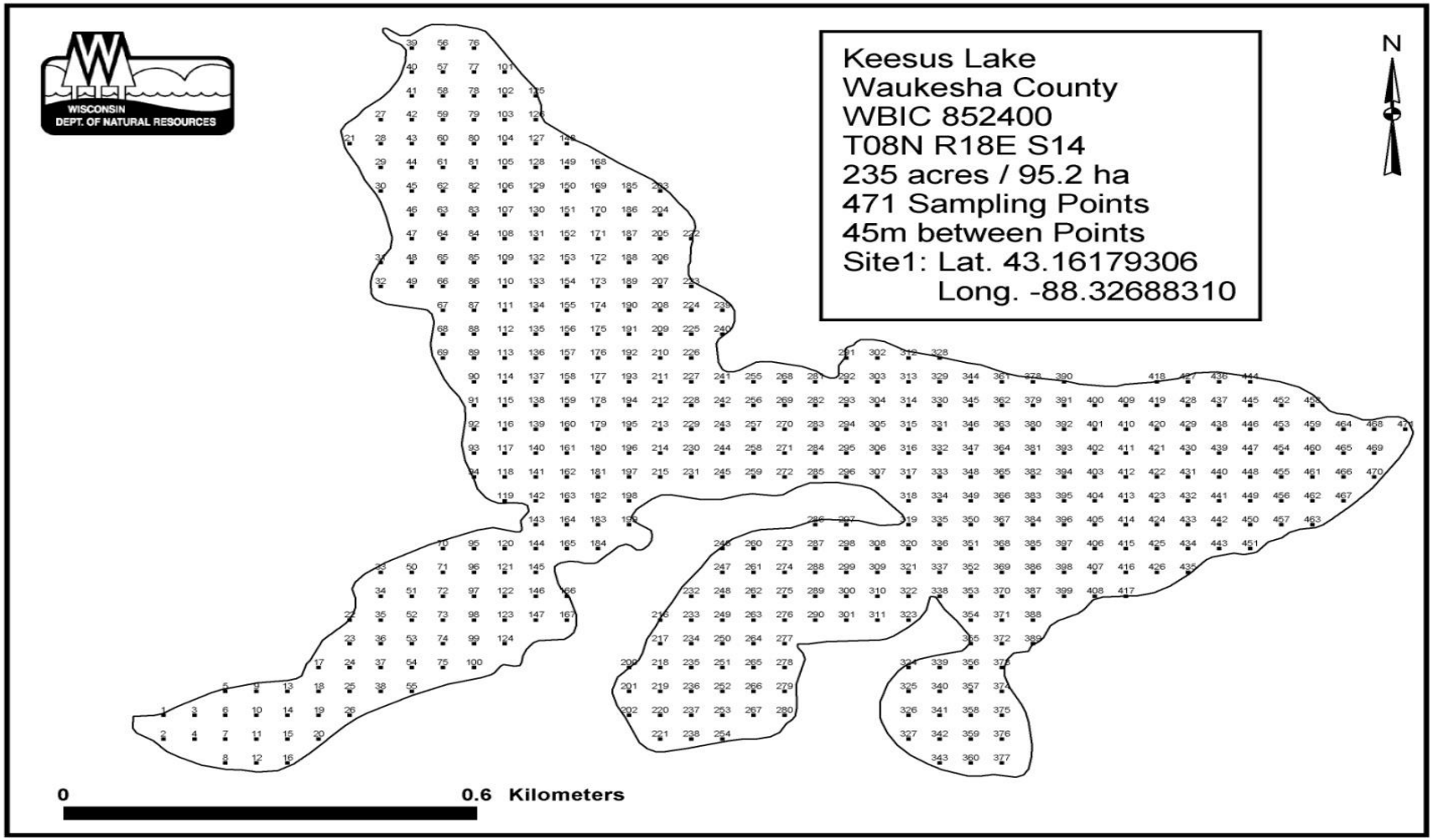
Figure 7. **Nitella** density ratings for Lake Keesus 2012 comprehensive point intercept survey.

Lake Keesus Statistics: Survey Date: 7-17/19 2012	**INDIVIDUAL SPECIES STATS:**	Frequency of occurrence within vegetated areas (%)	Frequency of occurrence at sites shallower than maximum depth of plants	Relative Frequency (%) 2012 / 2007 - Prior Survey Date 6-25-2007 and 6-27-2007, Hey and Associates, Inc.	Relative Frequency (squared)	Number of sites where species found	Average Rake Fullness	# Visual Sightings	present (visual or collected)	Present During 2007 Hey and Assoc. Sampling
Myriophyllum spicatum ,Eurasian water milfoil		61.3	42.7	**28.7 / 53.4**	0.1	125.0	1.6	15.0	present	X
Potamogeton crispus ,Curly-leaf pondweed		0.5	0.3	**0.2 / 31.6**	0.0	1.0	1.0		present	X
Ceratophyllum demersum, Coontail		29.9	20.8	14.0	0.0	61.0	1.8		present	X
Chara sp., Muskgrasses		24.5	17.1	11.5	0.0	50.0	1.9	3.0	present	X
Elodea canadensis, Common waterweed		1.0	0.7	0.5	0.0	2.0	1.0		present	X
Heteranthera dubia, Water star-grass		3.9	2.7	1.8	0.0	8.0	1.1	1.0	present	
Najas flexilis, Slender naiad		7.4	5.1	3.4	0.0	15.0	1.3		present	X
Nitella sp., Nitella		9.3	6.5	4.4	0.0	19.0	1.7		present	
Nuphar variegata, Spatterdock								4.0	present	X
Nymphaea odorata, White water lily		2.9	2.0	1.4	0.0	6.0	1.5	46.0	present	X
Potamogeton friesii, Fries' pondweed		2.9	2.0	1.4	0.0	6.0	1.0		present	
Potamogeton illinoensis, Illinois pondweed		24.5	17.1	11.5	0.0	50.0	1.0	2.0	present	X
Potamogeton natans, Floating-leaf pondweed		0.5	0.3	0.2	0.0	1.0	1.0	1.0	present	X
Stuckenia pectinata, Sago pondweed		9.3	6.5	4.4	0.0	19.0	1.3		present	X
Typha angustifolia, Narrow-leaved cattail								23.0	present	X
Utricularia vulgaris, Common bladderwort		2.0	1.4	0.9	0.0	4.0	1.0		present	X
Vallisneria americana, Wild celery		33.8	23.5	15.8	0.0	69.0	1.4	2.0	present	X
Filamentous algae		2.9	2.0			6.0	1.0	4.0	present	X

Additional Species Found during 2007, Hey and Associates, Inc. sampling									
Lemna minor, Minor Duckweed									
Lemna trisulca, Star Duckweed									
Potamogeton amplifolius, Large-leaf pondweed									
Potamogeton obtusifolius, Blunt-leaf pondweed									
Potamogeton praelongis, White-stem pondweed									
Potamogeton zosteriformis, Flat-stem pondweed									
Wolffia columbiana, Common watermeal									

SUMMARY STATS:	Sample Year 2012 / 2007
Total number of sites visited	416 / 208
Total number of sites with vegetation	204 / 206
Total number of sites shallower than maximum depth of plants	293.0
Frequency of occurrence at sites shallower than maximum depth of plants	69.6
Simpson Diversity Index	0.84 / 0.9
Maximum depth of plants (ft)**	29 / 15
Number of sites sampled using rake on Rope (R)	0.0
Number of sites sampled using rake on Pole (P)	166.0
Average number of all species per site (shallower than max depth)	1.5
Average number of all species per site (veg. sites only)	2.1
Average number of native species per site (shallower than max depth)	1.1
Average number of native species per site (veg. sites only)	1.7
Species Richness	15.0

Figure 8, Lake Keesus Point Intercept Map



Lake Keesus Harvesting / Proposed Treatment Maps

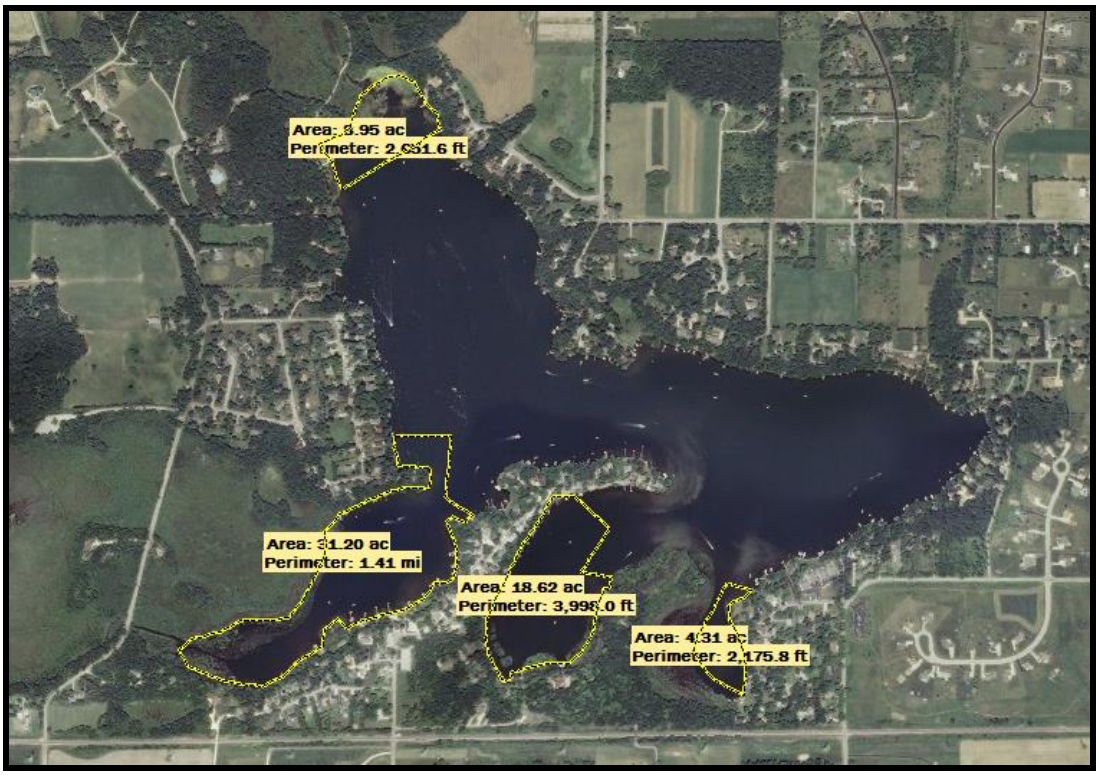
Area #1 North, Northwest end of lake: 8.95 acres, 2,651.6’ perimeter
Area encompasses large, surveyed EWM stand.

Area #2 Southwest Bay: 31.20 acres, 7,444.8’ perimeter
Area encompasses large, surveyed EWM stand.

Area #3 South Bay: 18.62 acres, 3,998.0’ perimeter
Area encompasses large, surveyed EWM stand.

Area #4 Southeast Bay: 4.31 acres, 2,175.8’ perimeter

Area encompasses large, surveyed EWM stand.



The four, main treatment / harvesting areas of concern

All mechanical harvesting should be limited to areas less than 3’ in depth to prevent disturbance of bottom sediment.

*All aerial photos used for area calculations, density maps and treatment / harvesting maps were taken from DeLorme Earthmate software©.