

A Point Intersect Aquatic Plant Survey on Geneva Lake, Walworth County, WI, July 2020

Conducted by Ontarra LLC.

For the Geneva Lake Environmental Agency



Photo Courtesy of Onterra

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BACKGROUND

Aquatic plants are a vital part of a healthy lake. They provide habitat (i.e. food, cover, substrate, etc.) for other forms of aquatic and semi-aquatic organisms such as fish, insects, wildlife and waterfowl. They dampen wave action and protect the shoreline from wave generated erosion. Aquatic plants also serve as a sink for nutrients. Aquatic plant management is important in assuring that a lake's aquatic plants do not interfere with recreation and the overall health of a lake. The first step in aquatic plant management is to know the composition and extent of the aquatic plant community

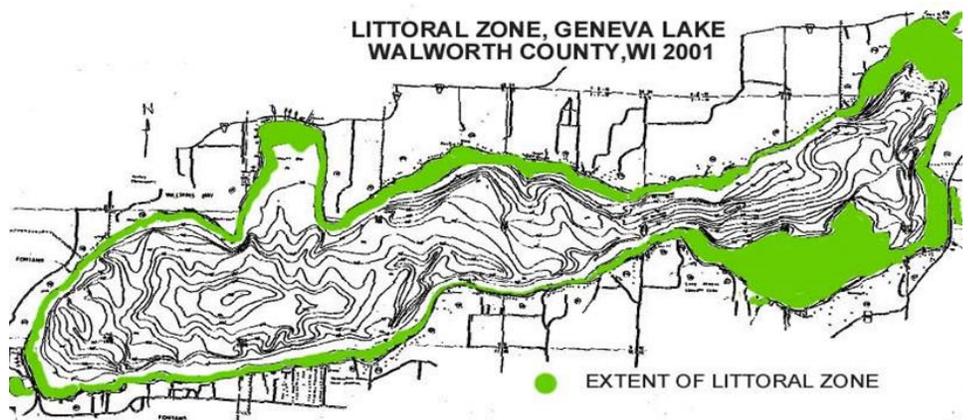
The Geneva Lake Environmental Agency hired Onterra LLC to conduct a lake-wide, point-intersect, aquatic plant survey on Geneva Lake during July 21, 22, 23, 2020. Although the survey focused on the vascular plant some macro algae were also identified. Onterra had conducted a similar survey during the summer of 2019. The 2020 intersect grid was the same as used in 2015 and 2019.

The 2018 discovery of the nonnative, invasive, starry stonewort (SSW) (*Nitelopsis obtuse*) in the Trinke Lagoon, drove the need to conduct back to back surveys in 2019 and 2020. A meander survey of the lake's access sites conducted during the fall of 2018 did not find any other SSW in the lake at that time. Of concern was if starry stonewort had spread into or within the lake.

The 2019 survey discovered a bed of SSW approximately 0.6 ac in size and in 14 ft. of water, located in the southeastern portion of the lake (N 42° 33' 35.80", W 88° 27' 22.72"). A simultaneous meander survey also found a small bed of SSW at the mouth of the lagoon where SSW was first found (N 42° 33' 31.52", W 88° 27' 47.54"). In 2020 a sub-PI survey was conducted in the Trinke Lagoon that included 28 sample points.

GENEVA LAKE INFO:

Geneva Lake is a deep lake with a mean depth of 61 ft. and a maximum depth of 140 ft. It has a surface area of 5,262 ac. with 20.2 miles of shoreline. It is 7.6 miles in length (east to west) and varies in width from a half mile to two miles. ⁽¹⁾



Source: GLEA

A lake's littoral zone is that part of a lake near the shore area where the light can penetrate to the bottom allowing for plant growth. Excluding the three bays, Geneva Bay on the northeast end of the lake, Williams Bay on the northwest end of the lake and the Trinke flats, on the southeast end of the lake, the littoral zone is relatively narrow. Maximum depth of vegetation found in the 2020 study was 37 ft., which indirectly defines the maximum depth of the littoral zone.

THE SURVEY

A total of 30 different aquatic plants were identified in Geneva Lake's 2020 aquatic plant survey, including a grouping of aquatic moss and filamentous algae (appendix A). The 2019 and the 2020 PI aquatic plant survey on Geneva Lake found conditions and plants to be similar. Although 28% more sites were visited in the 2020 survey (1,268 sample points), the number of sites with vegetation remained relatively the same with only a 3% increase (628 points with plants). The average number of all species per site with vegetation in 2019 was 2.6

Summary Statistics from 2019 and 2020 Aquatic Plant Point- Intersect Survey		
Geneva Lake WI, Source: GLEA and Onterra LLC.		
	2019	2020
Total number of sites visited	994	1268
Total number of sites with vegetation	607	628
Total number of sites shallower than maximum depth of plants	770	860
Frequency of occurrence at sites shallower than maximum depth of plants	78.83117	73.02326
Simpson Diversity Index	0.90315	0.900296
Maximum depth of plants (ft)**	32	37
Number of sites sampled using rake on Rope (R)	368	384
Number of sites sampled using rake on Pole (P)	446	495
Average number of all species per site (shallower than max depth)	2.019481	1.743023
Average number of all species per site (veg. sites only)	2.561779	2.384738
Average number of native species per site (shallower than max depth)	1.753247	1.548837
Average number of native species per site (veg. sites only)	2.257525	2.125997
Species Richness (Including algae and moss)	32	30
Species Richness (including visuals and algae and moss)	32	30

whereas in 2019 the average number of native species per site of vegetation was 2.1. In 2020 the average number of all species per site with vegetation was 2.3, while the average number of native species per site of vegetation in 2020 remained at 2.1.

Plant density was evaluated on the fullness of the rake used to retrieve plants from the lake bottom. After the rake was pulled along the bottom it was brought up to the surface. The plants on the rake were identified, recorded and quantified by the fullness of the rake. Rake fullness ranking ranged from 0 to 3 with zero representing no plants and 3 representing a full rake.

Geneva Lake’s Aquatic Plants: Two new species were identified in the 2020 survey that were not listed in the 2019 survey, forked duckweed (*Lemna triculca*) and small pondweed (*Potamogeton pusilius*). Forked duckweed has been observed on the lake for several years. It may have not been recorded or included in 2019 samples. Small pondweed may be a new species or just missed or missed ID in the past. Both species are not consider to be a problem.

Several plants found in 2019 were not identified in the 2020 survey. This may not be too significant as the likelihood of hitting the exact same spot and having the plant hook hit the same plant from year to year is low. Plant communities can change in a matter of a few years.

2020 Five Most Common Aquatic Plants Found in Geneva Lake WI. Source: Onterra LLC , GLEA						
Does not include filamentous algae and aquatic moss.						
Genus	species	common name	Occurance	Frequency of Occurance (%)	% of Population	
<i>Vallisneria</i>	<i>americana</i>	Water celery	272	43.3	18.1	
<i>Ceratophyllum</i>	<i>demersum</i>	Coontail	211	33.6	14.1	
<i>Ruppia</i>	<i>cirrrosa</i>	Ditch grass	185	29.5	12.3	
<i>Lemna</i>	<i>trisulca</i>	Forked duckweed	155	24.7	10.3	
<i>Myriophyllum</i>	<i>spicatum</i>	Eurasian watermilfoil	146	23.2	9.73	

The five most common plants found in the 2020 survey were, wild celery (*Vallisneria americana*), coontail (*Ceratophyllum demersum*), ditch grass (*Ruppia cirrhosa*), forked duckweed (*Lemna trisulca*) and the non-native Eurasian watermilfoil (*Myriophyllum spicatum*). See appendix____. The top three occurring aquatic plants found in the 2019 survey were the same as the top three for 2020, yet in a different order, 1) Coontail, 2) eel grass and 3) ditch grass.

Water Celery was found at 272 sites and represented 18.1% of the recorded aquatic plants, excluding filamentous algae and aquatic moss. It had a frequency of occurrence of 43.3% meaning at any given site there is a 43.3% chance of finding water celery. It is a very desirable aquatic plant with all parts of the plant being popular as food for waterfowl and fish. It is often called eel grass as it looks like large grass blades. It is generally a low growing plant and seldom reaches up to the surface of the water.

Coontail was found at 211 sites and represented 14.1% of the recorded aquatic plant community. There is a 33.6% chance of finding coontail at any given site. It can be a tall, much branching plant that grows to the surface. It is abundant in Wisconsin. Its fine, stiff leaves offer cover for a wide range of critters making it a good food source for fish and waterfowl. It has an exceptional ability to draw nutrients from the water and has been used in small ponds to reduce phosphorus levels.

Ditch grass was identified at 185 sites, represented 12.3% of the recorded aquatic plant community and a 29.5% chance of being located at any site. It is also a popular food source for waterfowl. It likes hard water lakes such as Geneva Lake. The state of Minnesota has classified it as one of the rarer aquatic plants in the state. *Ruppia cirrhosa* was listed as a special concern species in Minnesota in 1996. Earlier Geneva Lake plant surveys did not identify the presence of ditch grass. It may have been misidentified as a similar looking sago pondweed (*Stuckenia pectinate*).

Forked duckweed was found at 155 sites, represented 10.3% of the inventoried aquatic plant site and had a frequency of occurrence of 24.7%. It is a small, green, free-floating plant that is visible to the naked eye looking like tiny rowboats with small oars. As the name indicates, it also is a preferred waterfowl food.

Eurasian Watermilfoil. See discussion under invasives.

INVASIVES

Three aquatic invasive macrophytes have been confirmed as being present in Geneva Lake, Eurasian watermilfoil (*Myriophyllum spicatum*), curly leaf pondweed (*Potamogeton crispus*) and starry stonewort, (*Nitellopsis obtusa* Appendix (_____)). Eurasian watermilfoil and curly leaf pondweed are vascular plants. Starry stonewort is a macro algae.

Eurasian watermilfoil is an invasive that was identified in the Geneva Lake in a 1976 aquatic plant survey. The 2020 survey found it at 146 sites at an average rake density of 1.22 plants per rake pull. The 2020 survey it is listed as the fifth most abundant plant in Geneva Lake. It has been known to cross-breed with native species and as a result it can be challenging to tell the difference between the hybrid, the native and the invasive species.

Its much branching structure allows it to form thick beds that are impassable for fish. It can seriously interfere with recreation. It produces small flowers that rise above the water surface. Once seeds have been formed the stem can break apart and float to new rooting locations.

Curly leaf pondweed has also been identified in Geneva Lake in several past surveys. The 2020 survey found it at 21 sites with an average rake fullness of 1.0. Curly leaf is an early growing plant. It can complete its growing season as early as August and can start dying back at that time. Plant surveys done in late summer

may miss the full extent of curly leaf in a lake. It spreads primarily by turions or vegetative buds that sink to the bottom.

Starry stonewort (SSW) was initially found in the Trinke Lagoon in the fall of 2018. Consideration was given to dredging the lagoon with the hope of eradicating the plant. In the summer of 2019 it was found in two nearby locations in the lake. Historically SSW management has not been successful in eradicating established populations of SSW. Once found in the lake, SSW management strategy shifted to contain and control. It was found at only one site in the lake and at a rake fullness of 2. It was also observed at another site outside the lagoon but not sampled. It spreads vegetatively, primarily by starchy, star, shaped bulbils found on the plants rootlike structures buried in the lake bottom.

Trinke Lagoon Sub PI survey: The most recent aquatic invasive plant that has been documented in Geneva Lake is starry stonewort (SSW). By the summer of 2019 it had spread from its initial location in the lagoon to two locations in the lake, one location just outside the lagoon and the second about a quarter east of the lagoon in 14 ft. of water. During the 2020 lake-wide PI aquatic plant survey, a sub PI grid was laid out in first bay of the three-bay lagoon, specifically to ID the presence of SSW. Of the 28 points sampled, 24 had a positive identification of SSW (appendix _____).

PLANT COMMUNITY ASSESSMENT

Invasive Species: An important evaluation tool for a plant community is the amount of native species vs invasive species. Also important is the condition and size of the invasive communities. If the invasive species is one of many species in a heterogeneous community, their impact on the lake is less significant than if they are the only plant in a homogeneous community.

Of the three invasive species documented in Geneva Lake by the 2020 PI aquatic plant survey, Eurasian watermilfoil was the most abundant, found 272 times and representing 18% of the aquatic plant population. A study by a student at George Williams College found that areas of high human activity and plant community disturbance coincide with the presence of curly leaf pondweed and Eurasian milfoil ⁽²⁾.

The second most abundant invasive, Curley leaf pondweed, was found at 21 sites and represented only 1.4% of the plant community. Curly leaf pondweed is an early growing plant and may have started dying back at the time of this survey.

Starry stonewort (SSW) is a new invasive aquatic plant first discovered in the fall of 2018. To date it has only been identified at two locations in the Geneva Lake. Both locations are close to where it was first identified in the Trinke Lagoon. At one location it is part of a heterogeneous plant community and is in 6 ft. of water. The other location is in 14 ft. of water and is a homogeneous plant bed of starry stonewort, 0.6 ac. in size. The smaller heterogeneous bed that contains some SSWs was not discovered in the PI aquatic plant survey but in the 2019 meander aquatic plant survey. It was again documented in 2020.

Rake Fullness: The rake fullness for each plant was recorded for each time the rake was retrieved. Rake fullness was ranked 0 for the least full, to 3 for a full rake. The individual plant rake fullness for each species as recorded at each site was averaged to give an average lake-wide rake fullness for each species. All plants inventoried in 2020 averaged a rake fullness of between 1 and 2. Starry stonewort had the highest average rake fullness of 2.0. SSW was found at only one location which is believed to be a homogenous bed of SSW. The average rake fullness for all plants in the 2020 study was 1.2, indicating plant samples as collected from the bottom were not very dense with vegetation.

Diversity: There are several ways of evaluating a plant community's diversity. The Simpson Diversity Index evaluates the number of species relative to the total number of plants in the community. The closer to 1, the more diverse and subsequently the more likely the community is to adapt to changes in the environment without significant changes to the community. A value of 0 would indicate no diversity. Based upon the data collected in the 2020 aquatic plant survey, Geneva Lake's Simpson Diversity index value was 0.900296.

Richness: Species richness is another way of evaluating the diversity of a community by simply counting the number of species found in the community. The more bio-diverse the community is the more stable and resistant to change the community may be. Not including the filamentous algae and aquatic moss found in the 2020 survey, Geneva Lake has a species richness of 28. The Wisconsin statewide median species richness for lakes is 19⁽¹⁾

Coefficient of Conservatism: Biologists have used a "Coefficient of Conservatism" (C) value to represent the susceptibility of a species to disturbance. "C" values range from 0 to 10. The higher the "C" value assigned to a plant the more sensitive it is to changes in the environment.

Geneva Lake's aquatic plants have a range of "C" values from 0, for four non-native invasive species, to a high of 8 for five other species. The average coefficient for all aquatic plants identified in this survey was 6.3. The

median “C” value for lakes in Wisconsin is 6.3 ⁽¹⁾. Two plants found in Geneva Lake, Birds nest stonewort (*Tyolpella intricata*) and Nitella (*Nitella* spp.), did not have coefficient of conservatism assigned to them. Both species are macro-algae and consider desirable plants. It is proposed that their coefficient of conservatism would at least exceed the average value of 6.3 and may be higher.

Floristic Quality Index (FQI): Floristic quality index (FQI) combines a plant community’s coefficient of conservatism with the species richness. It evaluates not only how sensitive the community’s plants are to change, it also looks at the richness or diversity of the community. Floristic quality can be calculated for the community looking only at the native species and it can be calculated for the full community including the invasive species. The higher the floristic quality the more desirable the plant community. Generally 1-19 indicates low vegetative quality; 20-35 indicates high vegetative quality and above 35 indicates “Natural Area” quality.⁽³⁾

Geneva Lake’s native FQI was calculated to be 30.0. The Wisconsin state median FQI is 27.2⁽¹⁾. Geneva Lake’s full FQI was calculated to be 28.2. The further apart the native FQI and the full FQI values are the more influenced the plant community is by invasive species.

DISCUSSION: Geneva Lake has a diverse and healthy plant community. As with all inland lakes it is being threaten by changes in water quality and invasive species of all types. However, if given a chance it can do a lot to maintain that healthy plant community and good water quality. It does need help. Good water quality is directly related to a healthy aquatic plant community. A healthy aquatic plant community is the best ally in controlling aquatic invasive species. Chemical treatments, invasive species and human activities have caused and will continue to cause changes in the bottom community including the plant communities. A healthy littoral zone is vital to a healthy lake. The littoral zone is a lake’s lifeline. Wise shoreland land use that maintains the ecological integrity of the littoral zone is vital in keeping a healthy littoral zone.

Geneva Lake has five municipal launches and numerous private launches that offer lake access to thousands of boats each year. Those boat access sites can also be the access sites for aquatic invasive species. A strong boaters education effort to include an active Clean Boats and Clean Waters inspection and education program is a also a must.

Enforcement of aquatic invasive rules is also a must. Boats should not be launched or removed from Geneva Lake unless the boat and trailer is clean. Bulge water, bait water and bait should not be transferred from one

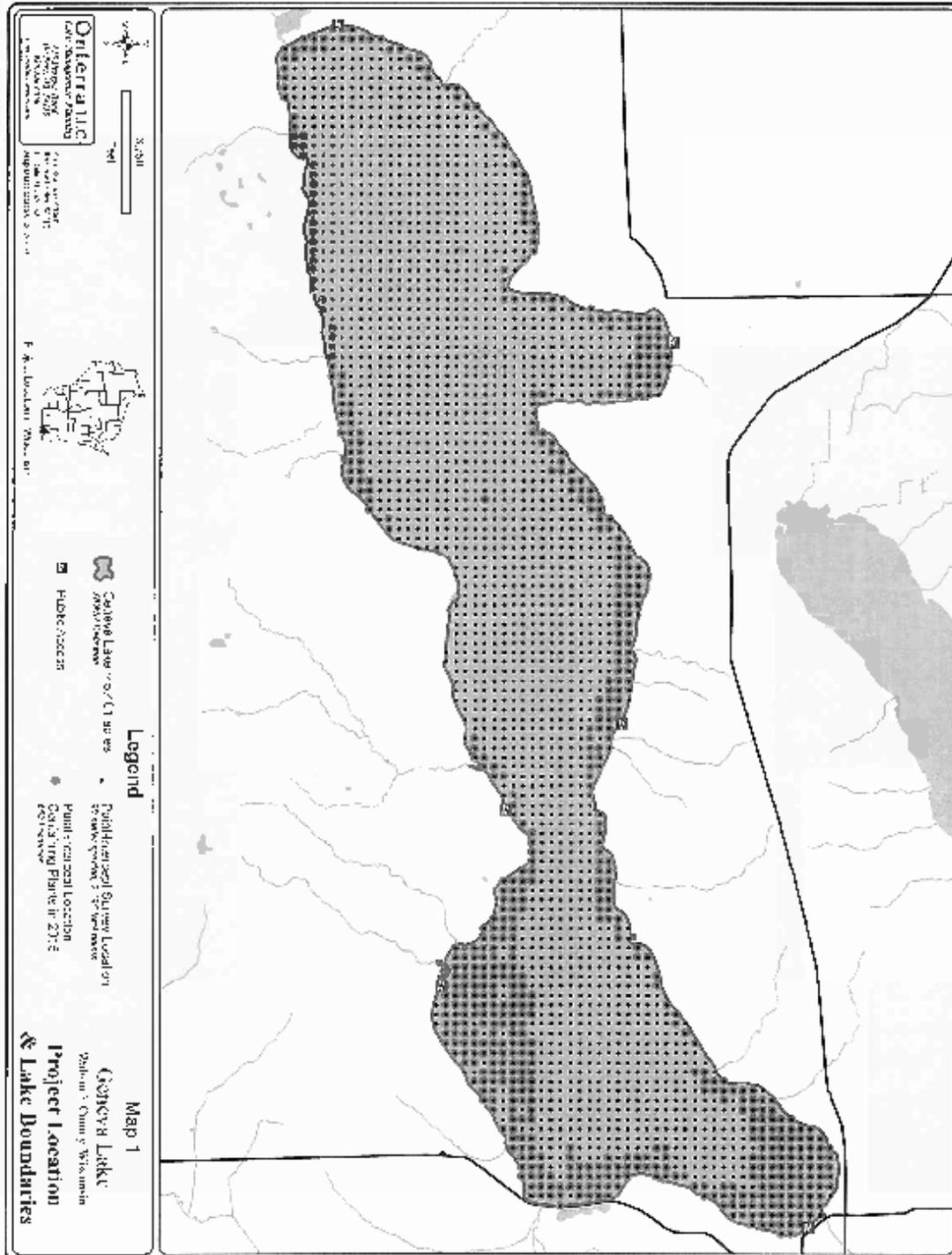
lake to another. Boat cleaning stations should be offered at each municipal launch site. If at minimum, a long handled broom and some designated cleaning and disposal area for bait and plants should be provided at each launch.

Aquatic plant management can offer science based strategies for the protection of the Geneva Lake's plant community. They may not all be agreeable, but to be successful there must be a lake-wide commitment by the whole Geneva Lake community to their implementation.

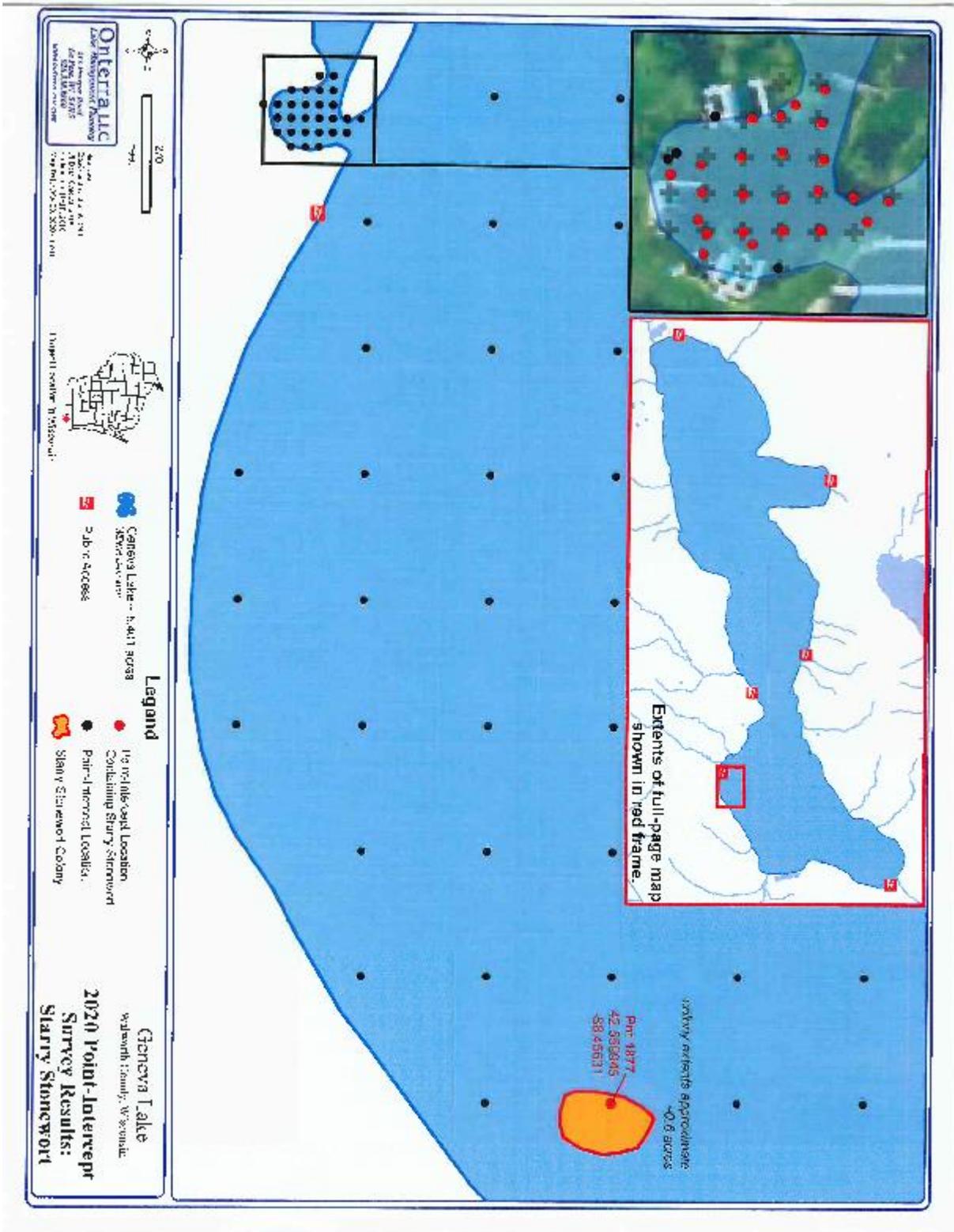
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1. *SEWRPC, Community Assistance Planning Report NO. 66, 2nd Edition, May 2008.*
2. *Tim Hoyman, B. Butterfield, E. Henrigillis, E. Heath, Onterra, LLC, Aquatic Plant Management Plan, Sturgeon Bay WI. Dec 2019, Unpublished.*
3. *Nicholas McCarney, **Ted Peters, *Richard Boniak, *George Williams College of Aurora University, ** Geneva Lake Environmental Agency, Geneva Lake Invasive Aquatic Macrophytes, * Presented as a Poster at the 2016 Wisconsin Lakes Conference.*
4. *U. S. Fish and Wildlife Service, Midwest Endangered Species Assessment, Floristic Quality Assessment. Viewed at <https://www.fws.gov/midwest/endangered/section7/s7process/plants/FQA.html>*

Appendix _____ Map of sample locations from the Geneva Lake PI aquatic Plant survey 2020. Source: Onterra LLC.



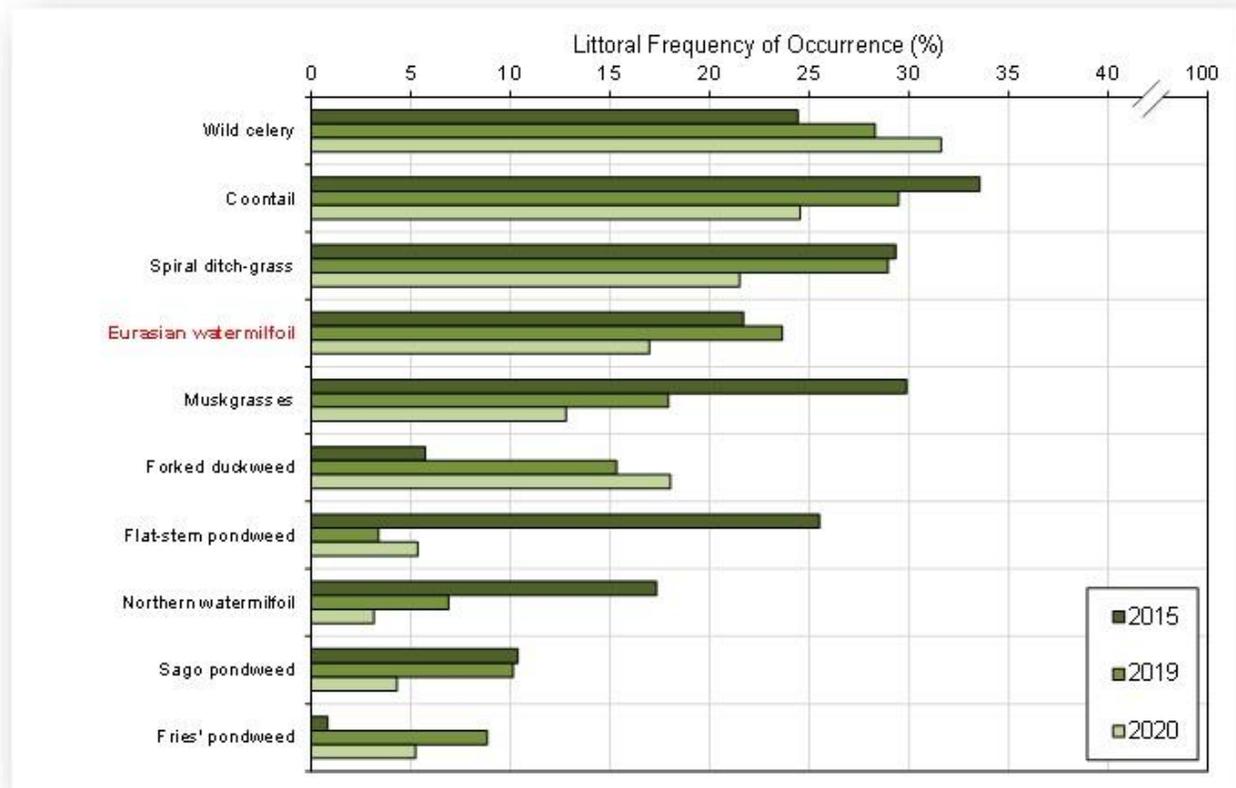
Appendix Map of Sub PI Survey done on Trinke Lagoon, Geneva Lake WI July 2020.



Appendix _____. Listing of aquatic plants found in the 2019 and 2020 Point Intersect aquatic plant survey on Geneva Lake, WI

Aquatic Plants Found in 2019 and 2020, Using the Point Intersect Surveys, Geneva Lake, Walworth County WI							
Plant Species	Common Name			Plant Species	Common Name		
		2019	2020			2019	2020
<i>Ceratophyllum demersum</i> (L.)	Coontail	x	x	<i>Potamogeton gramineus</i> (L.)	Variable pondweed	x	x
<i>Chara* spp.</i>	Muskgrass	x	x	<i>Potamogeton illinoensis</i> (Morong.)	Illinois pondweed	x	x
<i>Drepanocladus</i>	Aquatic moss		x	<i>Potamogeton nodosus</i> (Poret.)	River pondweed	x	x
<i>Eleocharis acicularis</i>	Needle spikerush	x		<i>Potamogeton natans</i> (L.)	Floating leaf pondweed	x	x
<i>Elodea canadensis</i> (Michx.)	Common waterweed	x	x	<i>Potamogeton praelongus</i> (Wulfen)	White stem pondweed	x	x
filamentous algae*	filamentous algae		x	<i>Potamogeton pusillus</i>	Small pondweed		x
<i>Lemna trisulca</i>	Forked duckweed		x	<i>Potamogeton richardsonii</i> (Ar. Bennett)	Richardson's pondweed	x	
<i>Heteranthera dubia</i>	Water stargrass	x	x	<i>Potamogeton robinsonii</i> (Dakes)	Fern pondweed	x	
<i>Lemna trisulca</i>	Forked duckweed	x	x	<i>Potamogeton strictifolius</i>	Stiff pondweed	x	x
<i>Myriophyllum heterophyllum</i> (Michx.)	Variable milfoil	x		<i>Potamogeton X undulatus**</i>	Curly -leaf X white-stem pondweed	x	
<i>Myriophyllum sibiricum</i>		x	x	<i>Potamogeton zosteriformis</i> (Fern.)	Narrow leaf pondweed	x	x
<i>Myriophyllum spicatum**</i> (L.)	Eurasian water milfoil	x	x	<i>Ranunculus aquatilis</i>	White water crowfoot	x	x
<i>Myriophyllum spicatum</i> (M. sibiricum x sibiricum)	Eurasian watermilfoil Hybrid	x		<i>Ruppia cirrhosa</i>	Wigeon grass	x	x
<i>Najas flexilis</i> (Willd.)	Naiad	x	x	<i>Stuckenia pectinata</i>	Sago pondweed, Sago	x	x
		x	x	<i>Tolypella intricata*</i>	BNS, Birds nest stonewort	x	x
<i>Najas guadalupensis</i>	Southern naiad			<i>Utricularia vulgaris</i> (L.)	Bladderwort	x	x
<i>Nitella flexilis*</i>	Nitella	x	x	<i>Vallisneria americana</i> (L.)	Water celery	x	x
<i>Nitelopsis obtusa***</i>	starry stonewort	x	x				
<i>Potamogeton amplifolius</i> (Tuckerman)	Large leaf pondweed	x		* an algae	** non native		
<i>Potamogeton crispus**</i> (L.)	Curly leaf pondweed	x	x	Source: Onterra LLC.			
<i>Potamogeton foliosus</i>	Leafy pondweed	x	x				
<i>Potamogeton fresii</i> (Rupr.)	Fries pondweed	x	x				

Appendix _____ Comparison of Littoral Frequency of Occurrence (%) for 2015, 2019 and 2020 PI Aquatic Plant Surveys. Source: Onterra LLC.



Appendix _____. Common plants found in the 2020 PI aquatic plant survey on Geneva Lake WI.



Wild celery (*Vallisneria americana*),



Coontail (*Ceratophyllum demersum*)

Appendix ____ . Common plants found in the 2020 PI aquatic plant survey on Geneva Lake WI. (cont.)



Ditch grass (*Ruppia cirrhosa*)



forked duckweed (*Lemna trisulca*)

Appendix _____ Common plants found in the 2020 PI aquatic plant survey on Geneva Lake WI. (cont.)



Eurasian Watermilfoil (*Myriophyllum spicatum*)

Appendix . Aquatic invasive plants known to exist in Geneva Lake. 2020



INVASIVE, NOT NATIVE, Eurasian Watermilfoil (*Myriophyllum spicatum*) RESTRICTED IN WISCONSIN



INVASIVE, NOT NATIVE, Curly Leaf Pondweed (*Potamogeton crispus*) RESTRICTED IN WISCONSIN



INVASIVE, NOT NATIVE, Starry stonewort (*Niteliopsis obtuse*) PROHIBITED IN WISCONSIN

