

# SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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## SEWRPC Staff Memorandum

### STARRY STONEWORT AND FORKED DUCKWEED SURVEY OF GENEVA LAKE, WALWORTH COUNTY, WISCONSIN

November 30, 2023

On November 30th 2022, Jacob Schmidt, the Director of the Geneva Lake Environmental Agency (“GLEA”) contacted Southeastern Wisconsin Regional Planning Commission (“Commission”) staff requesting that Commission staff develop a scope of work to examine the distribution of starry stonewort (“SSW”) (*Nitellopsis obtusa*) and forked duckweed (*Lemna trisulca*) within Geneva Lake (“Lake”) and document their abundance where observed. Commission staff consequently prepared a scope of work and letter agreement that were transmitted to the GLEA on February 8th, 2023. The Commission and the GLEA entered into an agreement to conduct the study on March 16th, 2023. This report summarizes the findings from this survey effort and provides management recommendations for these aquatic plant populations within the Lake.

#### BACKGROUND INFORMATION

Geneva Lake is a 5,262-acre headwater lake located within U.S. Public Land Survey Township 2 North, Range 17 East; Township 1 North, Range 17 East; and Township 1 North, Range 16 East, all in Walworth County. The municipalities with jurisdiction of the Lake and its shorelines are the City of Lake Geneva, the Villages of Fontana-on-Geneva Lake and Williams Bay, and Town of Walworth.

Starry stonewort is a relatively novel aquatic invasive species in Wisconsin. First observed within Wisconsin in Little Muskego Lake during September 2014, the invasive macroalga has since been found in several lakes throughout Southeastern Wisconsin. In invaded lakes, starry stonewort can form dense beds up to 6 feet in height, outcompeting both native and other invasive plant species as well as covering fish spawning areas.<sup>1,2</sup>

The first observation of starry stonewort in Geneva Lake was during August 2018 in Trinke Lagoon on the southern shoreline of the Lake.<sup>3</sup> The Wisconsin Department of Natural Resources (“WDNR”) and the GLEA performed a series of small, targeted point-intercept surveys (hereafter referred to as “sub-PI surveys”) at boat launches across the Lake to survey the distribution of starry stonewort. No starry stonewort was observed outside of Trinke Lagoon at that time. In 2019, Onterra LLC performed a full-lake aquatic plant point-intercept survey, which indicated that a population of starry stonewort was present northeast of Trinke Lagoon in the main body of the Lake. A WDNR meander survey in 2019 also identified starry stonewort at the Trinke Lagoon outlet. Onterra LLC conducted another point-intercept survey in July 2020 that indicated that starry stonewort was much more widespread within the first bay of Trinke Lagoon, with starry stonewort observed at 24 out of 27 points. This survey also observed a starry stonewort colony extending ~0.6 acres at

<sup>1</sup> For more information, see [dnr.wisconsin.gov/topic/Invasives/fact/StarryStonewort](http://dnr.wisconsin.gov/topic/Invasives/fact/StarryStonewort).

<sup>2</sup> G.D. Pullman and G. Crawford, “A Decade of Starry Stonewort in Michigan,” *Lakeline*, pg. 36-42, 2010.

<sup>3</sup> Ted Peters, “Keeping it Blue: A Healthy Lake the Best Safeguard Against Invasive Species,” *Lake Geneva Regional News*, May 2020.

point 1877, which is located nearly a half-mile northeast of the entrance to the Lagoon (hereafter referred to as the "colony area"). Hand pulling of starry stonewort was conducted in 2020 at the Trinke Lagoon outlet and at the colony area.

In collaboration with the GLEA, Commission staff conducted a series of sub-PI surveys in 2021 at launch sites around the Lake as well as in the colony area to examine the spread of SSW within the Lake. This survey was used in part to target diver-assisted removal of SSW from the Lake in 2021 during and immediately following the Commission's survey. The Commission prepared a 2021 staff memorandum report regarding the results of this survey.<sup>4</sup>

Wisconsin Lake and Pond Resource, LLC conducted a full point-intercept survey was conducted on the Lake in 2022.<sup>5</sup> During this survey, starry stonewort was observed at points outside of the sub-PI grid within the colony area established in 2021. Consequently, Commission staff expanded the sub-PI grid for the 2023 survey in the colony area by sixty points to the northeast to better encapsulate further spread in this direction while removing sixty number of points from the northwestern area of this grid to maintain an equivalent effort as in the 2021 survey.<sup>6</sup> These draft changes were presented to the GLEA on December 2nd, 2022 and were accepted on December 4th, 2022. Map 1 and Table 1 illustrate the sub-PI points utilized for the 2023 survey effort.

## **SURVEY EFFORT AND FINDINGS**

Commission staff conducted their aquatic plant survey from July 24th through July 28th, 2023 in collaboration with GLEA staff using the modified sub-PI survey grids. The water clarity in the Lake was excellent, allowing Commission staff to easily mark visual observations. Most of the open water areas were surveyed from a pier barge provided by Gage Marine while Abbey Lagoon, Trinke Lagoon, and the Lake Geneva launch were surveyed using the Commission's canoe. Some points in the Chapin Road survey area were not sampled after an agreement between Commission and GLEA staff that sampling these points was unnecessary due to their distance from the launch and the lack of SSW observations in the survey area.

### **Starry Stonewort Observations**

Commission staff observed SSW in Trinke Lagoon and the Trinke Lagoon Bay "colony area" where it has been observed during previous surveys (see Map 2). This subsection will describe the SSW populations within these areas and compare the current distribution to previous surveys.

#### ***Trinke Lagoon***

Commission staff observed SSW at 11 sub-PI points within Trinke Lagoon, which is a substantial decrease compared to the 18 points where it was observed in 2021. As in 2021, water clarity throughout the Lagoon was poor and the sediment was predominantly organic muck. The average SSW rake fullness was 1.5 and SSW was frequently observed growing with other native and invasive species, including invasive Eurasian watermilfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*) as well as native coontail (*Ceratophyllum demersum*), elodea (*Elodea canadensis*), water stargrass (*Heteranthera dubia*), muskgrass (*Chara* spp.), spatterdock (*Nuphar variegata*), and duckweeds (*Lemna* spp. and *Spirodela polyrhiza*).

#### ***Trinke Lagoon Bay***

Within the Trinke Lagoon Bay "colony area," Commission staff observed SSW at 51 points, which is a major increase over the 7 points with SSW in the 2021 survey. Compared to the previous survey, SSW was growing farther north, east, and at both shallower and deeper water depths. Despite expanding the survey grid to the north and east, Commission and GLEA staff surveyed a few additional areas north of the grid to account for further SSW expansion in this direction than had been anticipated. In 2021, Commission staff observed SSW between 12 and 14 feet while in 2023 SSW was observed between approximately 3.5 and 30 feet deep.

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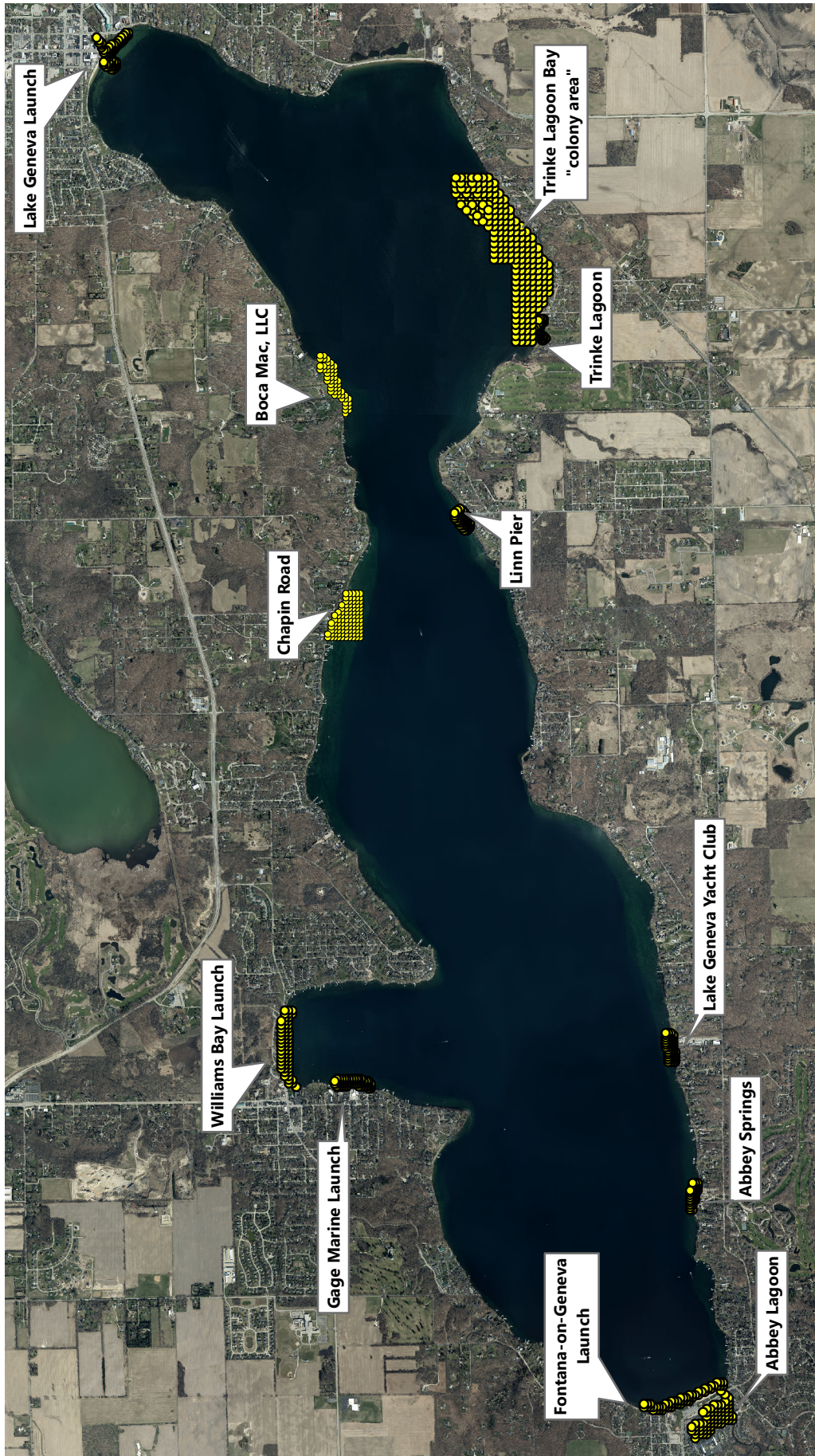
<sup>4</sup> SEWRPC Staff Memorandum, Survey of Starry Stonewort Population in Geneva Lake, Walworth County, Wisconsin, September 2021.

<sup>5</sup> Maps of starry stonewort produced by Wisconsin Lake & Pond Resource, LLC, following the 2022 point-intercept survey were provided to the Commission by the GLEA.

<sup>6</sup> SEWRPC, 2021, op. cit.



**Map 1**  
**Sub-Point-Intercept Points for Geneva Lake Starry Stonewort Survey: July 2023**



● SUB-POINT-INTERCEPT POINT

The average depth of SSW observations within the “colony area” was approximately 17 feet in 2023 compared to an average depth of 13 feet in 2021.

Starry stonewort abundance was generally low across the observed points in the “colony area,” with an average rake fullness of 1.3 and no rake fullness of 3 indicating a rake completely covered in SSW. Multiple native species were observed growing intermixed with SSW, with Eurasian watermilfoil, forked duckweed, widgeon grass (*Ruppia cirrhosa*), muskgrass, and coontail as the species most frequently observed with SSW.

Commission staff also observed SSW in the channel between Trinke Lagoon and the main Lake, where WDNR found SSW in 2019 and a hand-pulling crew observed it in 2021.

**Table 1**  
**2023 Geneva Lake Sub-Point-Intercept Survey for Starry Stonewort (*Nitellopsis obtusa*) and Forked Duckweed (*Lemna trisulca*)**

Survey Area Name	Number of Points	Point Spacing (meters)
Abbey Lagoon	66	30
Abbey Springs	32	20
Boca Mac, LLC	51	30
Chapin Road	97	30
Gage Marine Launch	55	20
Fontana-on-Geneva Launch	53	30
Lake Geneva Launch	61	20
Lake Geneva Yacht Club	50	20
Linn Pier	42	20
Trinke Lagoon	33	15
Trinke Lagoon Bay (“colony area”)	216	45
Williams Bay Launch	59	30

Source: SEWRPC

### Forked Duckweed Observations

Commission and GLEA staff recorded observations of forked duckweed at each sub-PI area throughout the survey. Staff observed forked duckweed at 251 out of 586 surveyed sub-PI points (42.8 percent) and found forked duckweed in each of the survey areas (see Map 3). Forked duckweed rake fullness averaged 1.2 across all observations. As a percentage of survey points per area, forked duckweed occurrence was highest in Trinke Lagoon Bay (57.4 percent), Boca Mac (51.0 percent), and Lake Geneva Launch (36.1 percent). The rapid increase in forked duckweed within the Lake observed during full point-intercept surveys, from 5.8 percent of the littoral points in 2015 to 28.8 percent in 2022, may indicate increasing nutrient availability in the Lake as this species readily uptakes bioavailable phosphorus and nitrogen in the water column. While this response does benefit the lake’s water quality, this increased growth does present a concern about the increasing trophic status of Geneva Lake.

### Other Species Observed

As in the 2021 survey, Commission staff recorded lists of other species observed at each of the survey areas with a total of 35 species across all areas surveyed (see Table 2).<sup>7</sup> The other species observed in the Lake were similar to those observed during the 2021 survey, although some species found in 2021 were not observed in 2023.<sup>8</sup> An addition is an observation of horned pondweed (*Zannichellia palustris*) in Abbey Lagoon that was not observed in 2021.

At the request of WDNR staff, Commission staff also recorded observations of whorled watermilfoil (*Myriophyllum verticillatum*) within Abbey Lagoon as chemical treatment has been applied to manage this population.<sup>9</sup> Commission staff observed whorled watermilfoil at 18 of 65 points (27.7 percent) spread throughout Abbey Lagoon. Four of these observations had a rake fullness of 2 while the remainder had a rake fullness of 1 or were visual observations.

Commission and GLEA staff also recorded observations of filamentous algae at 221 out of the 586 surveyed points (37.7 percent) in the Lake. Although observed in each survey area, filamentous algae were most frequently observed in Trinke Lagoon Bay, Linn Pier, Fontana-on-Geneva Launch, and Abbey Lagoon (see Map 4). Like forked duckweed, filamentous algae can readily uptake available nutrients from the water column and any increases in its occurrence or abundance may reflect increasing nutrient availability within the Lake.

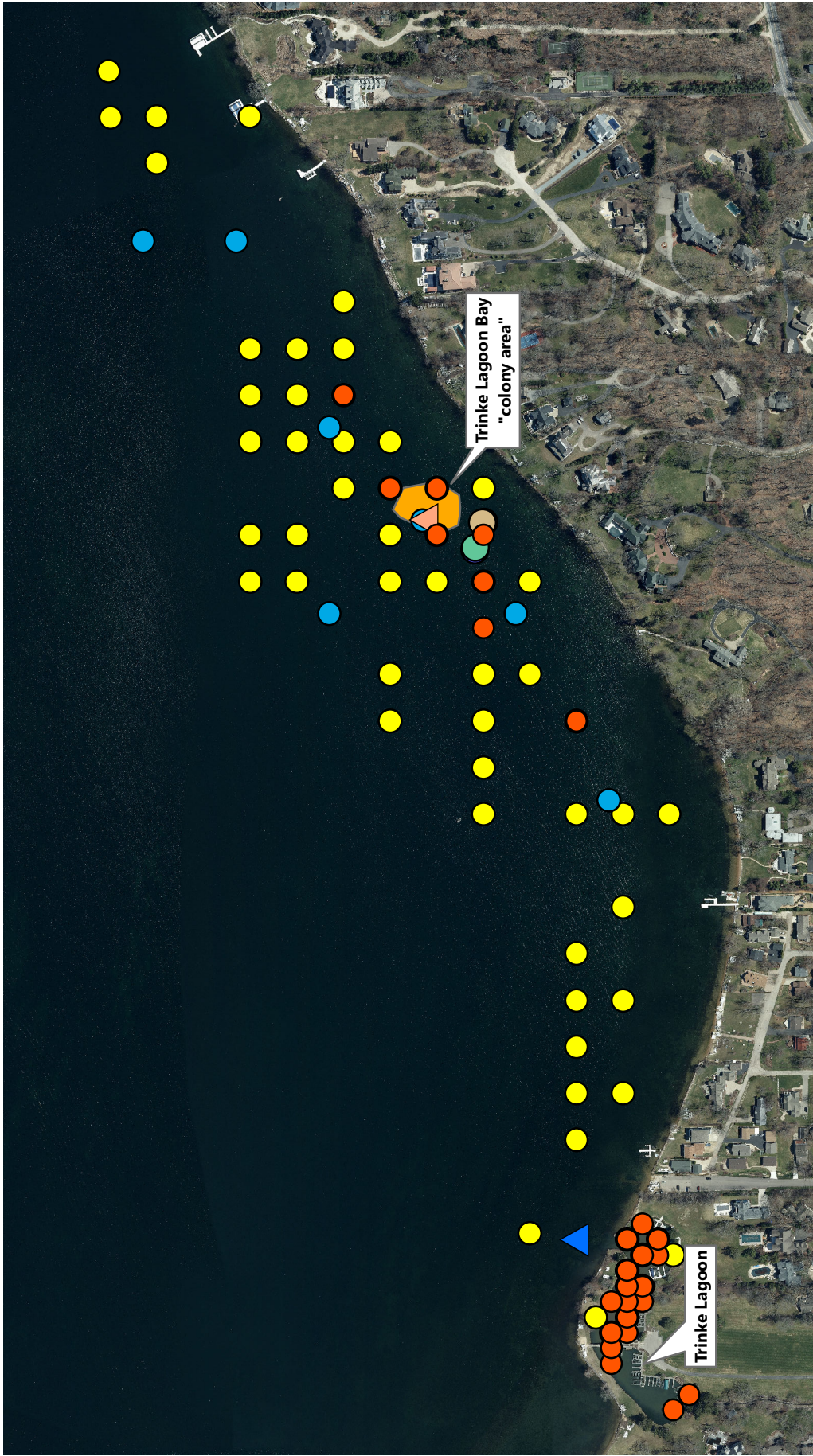
<sup>7</sup> Note that some plants were only identified to genus rather than species, e.g., muskgrass.

<sup>8</sup> These missing species may reflect differences in survey effort, survey grid, population cycles over years, and the random chance of observing infrequently observed species within the Lake rather than indicating that the species is no longer present in the Lake.

<sup>9</sup> WDNR Chemical Aquatic Plant Control Permit SE-2023-65-17162, May 2023.



**Map 2**  
**Starry Stonewort Observations in Geneva Lake: 2019 - 2023**



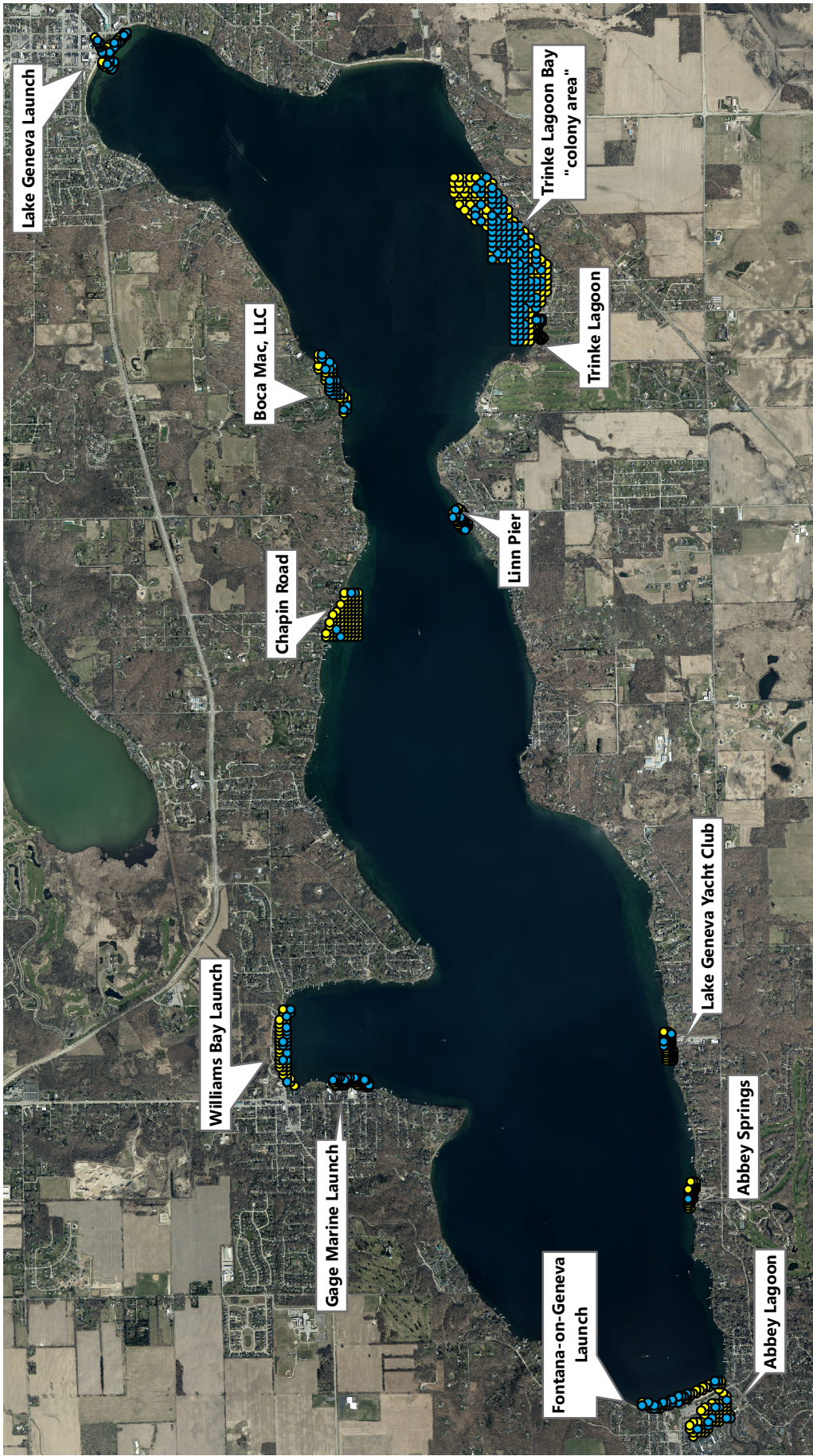
- 2023: STARRY STONEWORT OBSERVATION
- 2022: STARRY STONEWORT OBSERVATION
- 2021: STARRY STONEWORT OBSERVATION
- ▲ 2020: STARRY STONEWORT OBSERVATION
- 2020: STARRY STONEWORT COLONY
- ▲ 2019: STARRY STONEWORT OBSERVATION

Note: This map illustrates where SSW was first observed at each location. Sub-Pl points where SSW was first observed in 2021 and 2023 will show as 2021.

Source: Onterra LLC, WDNR, and SEWRPC



**Map 3**  
**Geneva Lake Sub-Point-Intercept Points with Forked Duckweed (*Lemna trisulca*): July 2023**



- 2023 SUB-POINT-INTERCEPT POINT
- FORKED DUCKWEED OBSERVATION

**Table 2**  
**Ecological Significance of Aquatic Plant Species in Geneva Lake: July 2023**

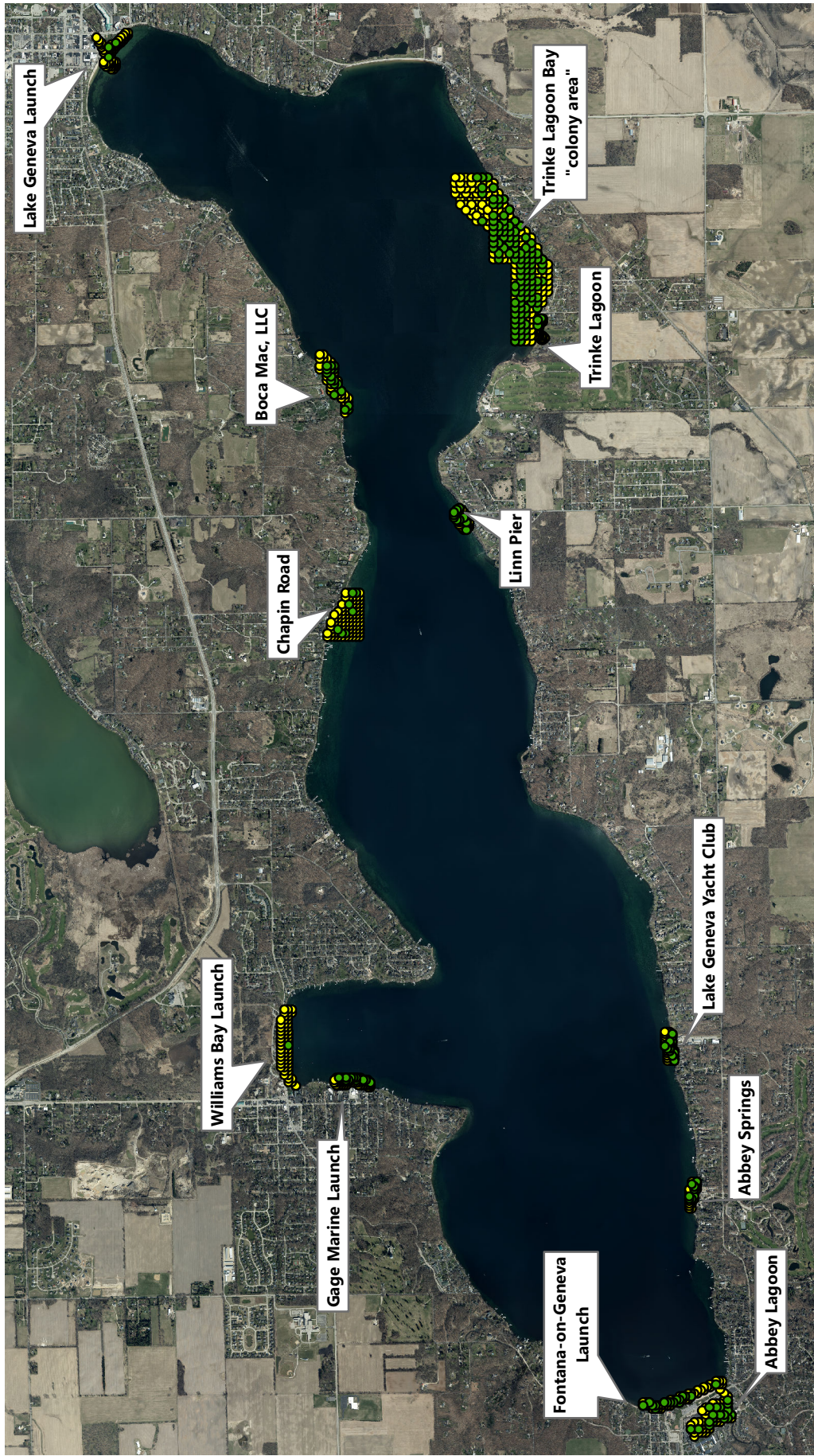
Species Name	Ecological Significance
<i>Ceratophyllum demersum</i> (coontail)	Provides good shelter for young fish and supports insects valuable as food for fish and ducklings.
<i>Chara</i> spp. (muskgrass)	Excellent producer of fish food, especially for young trout, bluegills, small and largemouth bass; stabilizes bottom sediments; and precipitates phosphorus.
<i>Elodea canadensis</i> (waterweed)	Provides shelter and support for insects which are valuable as fish food.
<i>Heteranthera dubia</i> (water stargrass)	Provides food and shelter for fish, locally important food for waterfowl.
<i>Lemna</i> spp. (duckweed)	Provides food for fish and waterfowl; provides habitat for fish and herptiles. Readily uptakes available nitrogen and phosphorus in water column.
<i>Myriophyllum sibiricum</i> (northern watermilfoil)	Leaves and fruit provide food for waterfowl and shelter and foraging for fish.
<i>Myriophyllum spicatum</i> (Eurasian watermilfoil)	Can form large floating mats on lake surface that shade out native vegetation and become nuisance for boating and fishing.
<i>Myriophyllum verticillatum</i> (whorled watermilfoil)	Leaves and fruit provide food for waterfowl and shelter and foraging for fish.
<i>Najas flexilis</i> (slender naiad)	Stems, foliage, and seeds important wildfowl food and produces good food and shelter for fish.
<i>Najas guadalupensis</i> (southern naiad)	Stems, foliage, and seeds important wildfowl food and produces good food and shelter for fish.
<i>Najas marina</i> (spiny naiad)	Can grow as dense mats that outcompete native vegetation and become a nuisance for boating and fishing.
<i>Nitella flexilis</i> (slender nitella)	Provides habitat for macroinvertebrates.
<i>Nitellopsis obtusa</i> (starry stonewort)	Can form dense mats that reduce available fish spawning habitat and outcompete native vegetation.
<i>Nuphar variegata</i> (spatterdock)	Provides food for waterfowl and mammals; provides habitat for fish and aquatic invertebrates.
<i>Nymphaea odorata</i> (white water lily)	Seeds consumed by waterfowl while rhizoids consumed by mammals.
<i>Potamogeton crispus</i> (curly-leaf pondweed)	Forms dense mats that can become a nuisance for boating and fishing as well as outcompete native species. Dies off in summer which can release bioavailable phosphorus into the water column and stimulate algal growth.
<i>Potamogeton friesii</i> (Fries' pondweed)	Provides food for waterfowl, muskrat, turtle, and macroinvertebrates; habitat for small fish and macroinvertebrates.
<i>Potamogeton gramineus</i> (variable-leaf pondweed)	Provides habitat for fish and food for waterfowl, muskrat, beaver, and deer.
<i>Potamogeton illinoensis</i> (Illinois pondweed)	Provides shade and shelter for fish; harbor for insects; seeds are eaten by waterfowl.
<i>Potamogeton natans</i> (floating-leaf pondweed)	Provides food for waterfowl, muskrat, beaver, and deer.
<i>Potamogeton nodosus</i> (long-leaf pondweed)	Provides food for waterfowl, muskrat, beaver, and deer; good fish habitat.
<i>Potamogeton praelongus</i> (white-stem pondweed)	Provides food for waterfowl, muskrat, beaver, and deer; good fish habitat.
<i>Potamogeton pusillus</i> (small pondweed)	Provides food for waterfowl, muskrat, turtle, and macroinvertebrates; habitat for small fish and macroinvertebrates.
<i>Potamogeton richardsonii</i> (clasping-leaf pondweed)	Provides shade and shelter for fish; harbor for insects; seeds are eaten by waterfowl.
<i>Potamogeton strictifolius</i> (stiff pondweed)	Provides food for waterfowl, muskrat, turtle, and macroinvertebrates; habitat for small fish and macroinvertebrates.
<i>Potamogeton zosteriformis</i> (flat-stem pondweed)	Provides some food for ducks and habitat for fish and macroinvertebrates.
<i>Ranunculus aquatilis</i> (white water crowfoot)	Provides habitat for fish and macroinvertebrates.
<i>Ruppia cirrhosa</i> (widgeon grass)	Provides some food for ducks and habitat for fish and macroinvertebrates.
<i>Sagittaria</i> sp. (arrowhead)	Provide pollinator habitat as well as food for macroinvertebrates, waterfowl, muskrats, and turtles.
<i>Spirodela polyrhiza</i> (large leaf pondweed)	Provides food for fish and waterfowl; provides habitat for fish and herptiles.
<i>Stuckenia pectinata</i> (Sago pondweed)	This plant is the most important pondweed for ducks, in addition to providing food and shelter for young fish.
<i>Vallisneria americana</i> (water celery/eel-grass)	Provides good shade and shelter, supports insects, and is valuable fish food.
<i>Utricularia vulgaris</i> (common bladderwort)	Provides cover and foraging for fish. Carnivorous plant that can eat zooplankton and insect larvae.
<i>Zannichellia palustris</i> (horned pondweed)	Provides some food for ducks and habitat for fish and macroinvertebrates.

Note: Invasive species are listed in red text. Information obtained from A Manual of Aquatic Plants by Norman C. Fassett, University of Wisconsin Press; Guide to Wisconsin Aquatic Plants, Wisconsin Department of Natural Resources; Through the Looking Glass: A Field Guide to Aquatic Plants, Wisconsin Lakes Partnership, University of Wisconsin – Extension; and U.S. Forest Service.

Source: SEWRPC



**Map 4**  
**Geneva Lake Sub-Point-Intercept Points with Filamentous Algae: July 2023**



- 2023 SUB-POINT-INTERCEPT POINT
- FILAMENTOUS ALGAE OBSERVATION

0 1,050 2,100 4,200 Feet  
 Source: SEWRPC



## IMPLICATIONS FOR MANAGEMENT

### Starry Stonewort

As discussed in the 2021 report, SSW is a difficult species to control, and no Wisconsin lake organizations have successfully eradicated an SSW infestation once established.<sup>10</sup> Techniques such as hand-pulling and diver-assisted suction harvesting can provide temporary relief, but SSW populations can recover or even exceed their pre-treatment levels.<sup>11</sup> Consequently, published WDNR guidance on managing SSW focuses on monitoring the population and preventing its spread to other waterbodies while more effective management techniques are researched and evaluated.<sup>12</sup> Until further guidance regarding SSW treatment is provided, Commission staff offer the following recommendations on how to mitigate further spread of SSW within Geneva Lake.

- Discuss SSW treatment options with WDNR staff. As most of the SSW population is intermixed with native species, minimizing disturbance in the SSW areas, and allowing native plants to compete with SSW may be the best option.
- Consider placing “invasive species” advisory buoys around the SSW populations in the Trinke Bay “colony area” and restrict anchoring or using wake-enhanced boating in this area to reduce further SSW dispersal.
- Continue to participate in Clean Boats, Clean Waters and provide AIS signage and removal tools at all public launches on the Lake. Communicate with private launches and marinas about the importance of AIS monitoring and removal.
- Conduct lake management activities that foster a healthy and diverse native aquatic plant community. Ensuring that barren substrate is covered by native plants will limit establishment and spread of SSW in these areas.
- Maintain a regular aquatic plant monitoring program to continue to evaluate the health of the plant community and the Lake overall. Regular monitoring enables early detection and response to adverse changes in the aquatic plant community before these issues become too large and expensive to manage.

### Forked Duckweed

As discussed earlier in this report, the increasing abundance of forked duckweed within Geneva Lake is likely a symptom of increasing nutrient availability (“eutrophication”) in the Lake. This eutrophication may be caused by increased nitrogen and phosphorus loading from the Lake’s watershed or from internal loading where phosphorus from the lake sediment is released into the water column. Determining whether eutrophication is occurring is beyond the scope of this report but will be addressed in the forthcoming lake comprehensive management plan. Reducing nutrient loading to or within the Lake would likely reduce the abundance of forked duckweed within the Lake. In the meantime, the forked duckweed is utilizing nutrients that would otherwise stimulate the growth of lake algae and cause declines in the lake’s water quality.

Options for short-term control of forked duckweed includes both chemical and manual removal. Chemical control of forked duckweed is possible but would require a WDNR permit. However, Commission staff would not recommend chemical treatment of forked duckweed in the main body of the Lake for the following reasons:

- The treatment would need to cover large areas and thus be prohibitively expensive

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<sup>10</sup> SEWRPC, 2021, op. cit.

<sup>11</sup> Starry Stonewort Management Guide: Control, Monitoring, and Resource Guide, *Starry Stonewort Collaborative, 2022. See [fingerlakesinvasives.org/wp-content/uploads/2022/01/SSW-Management-guide-final-010522.pdf](https://fingerlakesinvasives.org/wp-content/uploads/2022/01/SSW-Management-guide-final-010522.pdf) for more information.*

<sup>12</sup> Permitting Guidance for Starry Stonewort Management, *Wisconsin Department of Natural Resources, March 2021. See [dnr.wisconsin.gov/sites/default/files/topic/Wastewater/SSWPermittingGuidance2021\\_PublicReview.pdf](https://dnr.wisconsin.gov/sites/default/files/topic/Wastewater/SSWPermittingGuidance2021_PublicReview.pdf) for more information.*

- There could be negative impacts to non-target native species
- Phosphorus and nitrogen within the forked duckweed tissue would be re-released into the water column, potentially facilitating the growth of algae and additional forked duckweed

If forked duckweed is causing navigational hazards, then manual removing via hand-pulling or mechanical harvesting would be recommended. These means would result in removal of nitrogen and phosphorus within the forked duckweed from the lake ecosystem, which would ultimately help reduce their availability within the Lake. Mechanical harvesting would require a WDNR permit.