The Connecticut Agricultural Experiment Station

123 Huntington Street

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Pachaug Pond

Griswold, CT

Aquatic Vegetation Survey
Water Chemistry
Aquatic Plant Management Options

2023

Summer E. Stebbins

Riley S. Doherty

Gregory J. Bugbee

Department of
Environmental Science & Forestry

The Connecticut Agricultural Experiment Station

Putting Science to Work for Society since 1875

The Connecticut Agricultural Experiment Station was founded in 1875. It is chartered by the General Assembly to make scientific inquiries and conduct experiments regarding plants and their pests, insects, soil and water, and to perform analyses for state agencies. Station laboratories are in New Haven and Windsor, and research farms in Hamden and Griswold.

CAES

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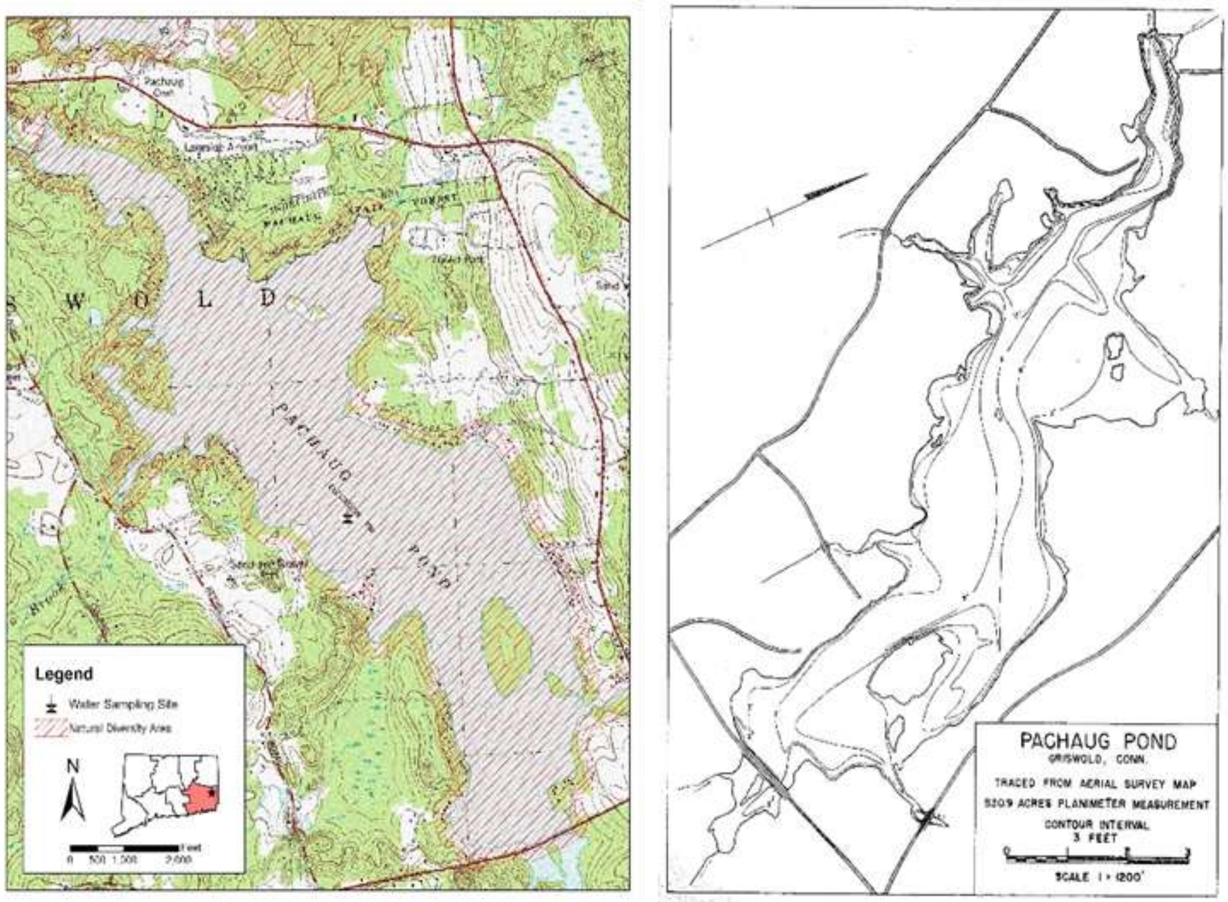


Figure 1. Topographic map of Pachaug Pond including location of state-listed species (Natural Diversity Area) (left) and bathymetry map circa 1959 (right).

Introduction:

Since 2004, the Connecticut Agricultural Experiment Station (CAES) Office of Aquatic Invasive Species (OAIS; formerly the Invasive Aquatic Plant Program) has completed over 400 surveys of aquatic vegetation and water chemistry in Connecticut's lakes, ponds, and rivers. A total of 261 waterbodies have been mapped with many, such as Pachaug Pond, receiving multiple resurveys to monitor change (CAES OAIS, 2024). Of these lakes and ponds, 56% contain one or more invasive, non-native plant species capable of causing rapid deterioration of aquatic ecosystems and recreational value. The presence of invasive species is related to water chemistry, public boat launches, random events, and climate change (Rahel and Olden, 2008). A CAES OAIS database is available online where stakeholders can view digitized vegetation maps, detailed transect data, temperature and dissolved oxygen profiles, and water test results for clarity, pH, alkalinity, conductivity, total phosphorus, and total nitrogen (portal.ct.gov/caes-oais). In addition, the database contains digitized herbarium mounts of each waterbody's plant species. This information allows citizens, government officials, and scientists to view past conditions, compare them with the present, and make informed management decisions.

Pachaug Pond is an 817-acre waterbody located in Griswold, CT. It is Connecticut's largest body of freshwater east of the Connecticut River and offers important wildlife habitat and recreational opportunities such as fishing, swimming, boating, cross-country skiing, and snowmobiling. The pond is home to a marina, a campground, a state boat launch, and a fish and game club. Stocked with northern pike, the pond is the site of many fishing tournaments (PPWCA, 2022). It is a relatively shallow waterbody with a maximum depth of about 16 feet and an average depth of around six feet. This creates a large littoral zone that favors aquatic plant growth. State-listed species are present (Figure 1, left; CT DEEP, 2022) and their protection requires withholding information on species and location without Connecticut Department of Energy and Environmental Protection (CT DEEP) Natural Diversity Database (NDBB) approval. Public access is via a state boat launch on the northern shore. There are no motor restrictions; however, numerous shoals and shallows require caution.

Previous work on Pachaug Pond dates to the 1950's when the State Board of Fisheries and Game (1959) described the lake as being shallow and fertile with abundant emergent and submergent vegetation (Figure 1, right; see appendix for full description). The specific plant species were not mentioned, but the bottom was described as mud, swampy ooze, and sand. A dense algal bloom was observed that reduced the water clarity to two feet. Bass fishing was described as excellent with fish over five pounds common. The 1959 description mentioned frequent

Figure 2. Heavily vegetated cove in Pachaug Pond consisting primarily of water lily, fanwort, and water smartweed.

severe summer drawdowns that may have been controlling aquatic vegetation. These drawdowns were stated as needed for “industrial” purposes, which was likely power generation (personal communication). Apparently, drawdowns were lessening as of 1959, and aquatic vegetation was increasing. CAES studied Pachaug Pond in 1979 as part of a statewide investigation into changes in lake water chemistry (Frink and Norvell, 1984). In addition to detailed water chemistry, the study mentions Pachaug Pond as having moderately dense aquatic weeds in shallow areas and watermilfoil near the boat launch. Interestingly, pioneer infestations of invasive species might first be noticed at boat launches if the plant arrived on a boat or trailer. The 1979 CAES water tests found a water clarity of 3.5 m (12 feet), an alkalinity of 15 mg/L $CaCO_3$ and a total phosphorus concentration of 16 µg/L at the surface and 13 µg/L at the bottom. These results suggest an oligo-mesotrophic condition where nutrients are not excessive.

Aquatic plant management is organized by the Pachaug Pond Weed Control Association (PPWCA). In response to concerns of increasing nuisance aquatic vegetation, the PPWCA commissioned CAES OAIS to begin annual vegetation surveys in 2017. The surveys confirmed a robust plant community of 29-35 native and 5-6 invasive species. Large shallow areas had nuisance vegetation that reached the surface (Figure 2); yet similar areas were either unvegetated or had dense vegetation that did not reach the surface. Reasons for this could include lake level drawdowns that occurred for dam repairs from 2021 -2022 and the limited water transparency from decaying organic matter causing the water's brown coloration. The most troublesome invasive species were Eurasian watermilfoil and fanwort. Native species creating the greatest nuisance included white water lily (*Nymphaea odorata*), eelgrass (*Vallisneria americana*), and water smartweed (*Polygonum amphibium*).

The following 2023 report describes the seventh consecutive survey of Pachaug Pond by CAES OAIS.

Objectives:

- Perform a seventh survey of Pachaug Pond for aquatic vegetation and test water to quantify water chemistry.
- Compare with previous surveys and add vegetation maps and water chemistry information to the CAES OAIS website. Special attention to possible changes caused by lowered water levels during dam repairs.
- Update aquatic plant management options.

Materials and Methods:

Aquatic Plant Surveys and Mapping:

CAES OAIS surveyed Pachaug Pond for aquatic vegetation on August 9-10, 2023. The survey utilized methods established by CAES OAIS and is consistent with the past surveys of Pachaug Pond. Surveys were conducted from 16 and 18-foot motorized boats traveling over areas that could support aquatic plants. Plant species were recorded based on visual observation or collections with a long-handled rake or grapple. Lowrance® Hook 5 and HDS 5 sonar systems as well as ground-truthing with occasional grapple tosses were used to identify vegetated areas in deep water. Quantitative information on plant abundance was obtained by resurveying 10 transects that were positioned perpendicular to the shoreline in 2017, representing the variety of habitats occurring in the lake. Transect points were located using Trimble® R1 GNSS global positioning systems with sub-meter accuracy. Ten sampling data points were taken along each transect at 0.5, 5, 10, 20, 30, 40, 50, 60, 70, and 80 m from the shore. Depth was measured with a rake handle, drop line, or digital depth finder, and sediment type was estimated. Abundances of species present at each point were ranked on a scale of 1 – 5 (1 = very sparse, 2 = sparse, 3 = moderately abundant, 4 = abundant, 5 = very abundant). When field identifications of plants were questionable, samples were brought back to the lab for review using the taxonomy of Crow and Hellquist (2000*a*, 2000*b*). One specimen of each species collected in the lake was dried and mounted in the CAES OAIS aquatic plant herbarium. Digitized mounts can be viewed online (portal.ct.gov/caes-oais). Plant species are referred to by common name in the text of this report; however, corresponding scientific names can be found in Table 2. Cattail and phragmites are wetland plants included in our survey at the request of the PPWCA. Phragmites is an invasive wetland species and is marked as such in our report. We post-processed the GPS data in Pathfinder® 5.85 (Trimble Navigation Limited, Sunnyvale, CA) and then imported it into ArcGIS® Pro 3.2.1 (ESRI Inc., Redlands, CA).

Data were then overlaid onto recent high-resolution (1m or better) aerial imagery for the continental United States made available by the USDA Farm Services Agency.

Water Analysis:

Water was analyzed from the deepest part of the lake in the same location as the previous six surveys. Water temperature and dissolved oxygen were measured 0.5 m beneath the surface and at 1 m intervals to the bottom. Water was tested for temperature and dissolved oxygen using a YSI 58® meter. Water clarity was measured by lowering a six-inch diameter black and white Secchi disk into the water and determining to what depth it could be viewed. Water samples (250 mL) for pH, alkalinity, conductivity, total phosphorus, and total nitrogen testing were obtained from 0.5 m beneath the surface and 0.5 m above the bottom. The samples were stored at 38˚C until testing. A Fisher AR20® meter was used to determine pH and conductivity. Alkalinity (expressed as mg/L $CaCO_3$) was quantified by titration with 0.016 N H_2SO_4 to an end point of pH 4.5. We determined total phosphorus using the ascorbic acid method preceded by digestion with potassium persulfate (APHA, 1995). Phosphorus was quantified using a Milton Roy Spectronic 20D® spectrometer with a light path of 2 cm and a wavelength of 880 nm. Total Nitrogen was determined with an O-I Analytical 1080® Total Organic Carbon Analyzer (data pending).

Table 1. Aquatic plant species richness (number of species) in Pachaug Pond from 2017 – 2023.

	2017	2018	2019	2020	2021	2022	2023
Number of Species	34	34	35	36	40	36	39
Number of Native Species	29	29	30	31	35	30	33
Number of Invasive Species	5	5	5	5	5	6	6

Table 2. Frequency of occurrence of aquatic plants on transects from 2017 – 2023.

Frequency of Occurrence on Transect Points in Pachaug Pond

Native Species	2017	2018	2019	2020	2021	2022	2023
Arrowhead (*Sagittaria* species)	9%	13%	6%	13%	6%	8%	19%
Bur-reed (*Sparganium* species)	12%	—[a]	4%	4%	8%	17%	6%
Cattail (*Typha* species)	0%	0%	0%	0%	0%	2%	0%
Clasping-leaf pondweed (*Potamogeton perfoliatus*)	2%	—	1%	1%	1%	—	2%
Common bladderwort (*Utricularia macrorhiza*)	8%	54%	1%	—	—	0%	8%
Common duckweed (*Lemna minor*)	—	—	0%	—	8%	6%	0%
Coontail (*Ceratophyllum demersum*)	17%	17%	16%	10%	7%	6%	9%
Eelgrass (*Vallisneria americana*)	65%	59%	53%	72%	53%	46%	67%
Flat-leaf bladderwort (*Utricularia intermedia*)	—	—	—	—	0%	—	1%
Floating bladderwort (*Utricularia radiata*)	48%	—	32%	1%	10%	4%	19%
Floating-leaf pondweed (*Potamogeton natans*)	3%	1%	0%	2%	1%	5%	3%
Golden hedge-hyssop (*Gratiola aurea*)	5%	1%	—	—	0%	2%	1%
Great duckweed (*Spirodela polyrhiza*)	—	4%	9%	7%	5%	—	6%
Humped bladderwort (*Utricularia gibba*)	1%	8%	9%	16%	21%	0%	1%
Large-leaf pondweed (*Potamogeton amplifolius*)	9%	19%	8%	19%	31%	5%	11%
Leafy pondweed (*Potamogeton foliosus*)	1%	3%	1%	2%	—	4%	—
Lesser bladderwort (*Utricularia minor*)	—	1%	—	—	0%	—	—
Little floating heart (*Nymphoides cordata*)	—	9%	10%	6%	10%	3%	10%
Low watermilfoil (*Myriophyllum humile*)	8%	4%	—	2%	8%	4%	3%
Mudmat (*Glossostigma cleistanthum*)	1%	7%	3%	8%	2%	10%	2%
Pickerelweed (*Pontederia cordata*)	12%	22%	13%	17%	17%	24%	16%
Pondweed (*Potamogeton* species)	—	—	—	7%	—	—	—
Primrose-willow (*Ludwigia* species)	2%	5%	4%	1%	3%	32%	4%
Purple bladderwort (*Utricularia purpurea*)	1%	3%	6%	6%	15%	0%	1%
Quillwort (*Isoetes* species)	—	3%	—	0%	0%	—	4%
Ribbon-leaf pondweed (*Potamogeton epihydrus*)	35%	13%	14%	29%	21%	0%	12%
Robbins' pondweed (*Potamogeton robbinsii*)	35%	41%	40%	32%	38%	18%	18%
Slender naiad (*Najas flexilis*)	11%	19%	18%	32%	10%	12%	12%
Small pondweed (*Potamogeton pusillus*)	—	—	—	12%	0%	0%	—
Small-leaved pond-lily (*Nuphar microphylla*)	0%	—	—	—	—	—	—
Snailseed pondweed (*Potamogeton bicupulatus*)	10%	13%	7%	8%	4%	—	2%
Spikerush (*Eleocharis* species)	8%	11%	14%	16%	19%	23%	25%
Water smartweed (*Polygonum amphibium*)	4%	12%	11%	9%	9%	9%	9%
Water starwort (*Callitriche* species)	—	—	—	—	—	0%	—
Watermeal (*Wolffia* species)	1%	—	—	—	3%	—	—
Watershield (*Brasenia schreberi*)	31%	30%	32%	35%	32%	8%	11%
Waterwort (*Elatine* species)	—	7%	1%	3%	0%	1%	1%
Western waterweed (*Elodea nuttallii*)	—	1%	1%	—	5%	—	11%
White water lily (*Nymphaea odorata*)	18%	22%	26%	24%	27%	14%	29%
Yellow water lily (*Nuphar variegata*)	13%	14%	6%	11%	11%	19%	10%

Invasive Species	2017	2018	2019	2020	2021	2022	2023
Eurasian watermilfoil (*Myriophyllum spicatum*)	31%	45%	28%	26%	45%	33%	48%
Fanwort (*Cabomba caroliniana*)	48%	42%	42%	39%	68%	10%	39%
Minor naiad (*Najas minor*)	4%	20%	3%	30%	—	35%	10%
Phragmites (*Phragmites australis*)	1%	2%	0%	3%	1%	3%	3%
Swollen bladderwort (*Utricularia inflata*)[b]	—	—	—	—	43%	3%	37%
Variable-leaf watermilfoil (*Myriophyllum heterophyllum*)	8%	9%	20%	29%	47%	6%	15%

[a] "—" = Species not found in Pachaug Pond; 0% indicates found in the waterbody but not on any transect points

[b]Swollen bladderwort is easily confused with common bladderwort. DNA analysis identified swollen bladderwort in 2021. It is possible common bladderwort plants found in the past were swollen bladderwort.

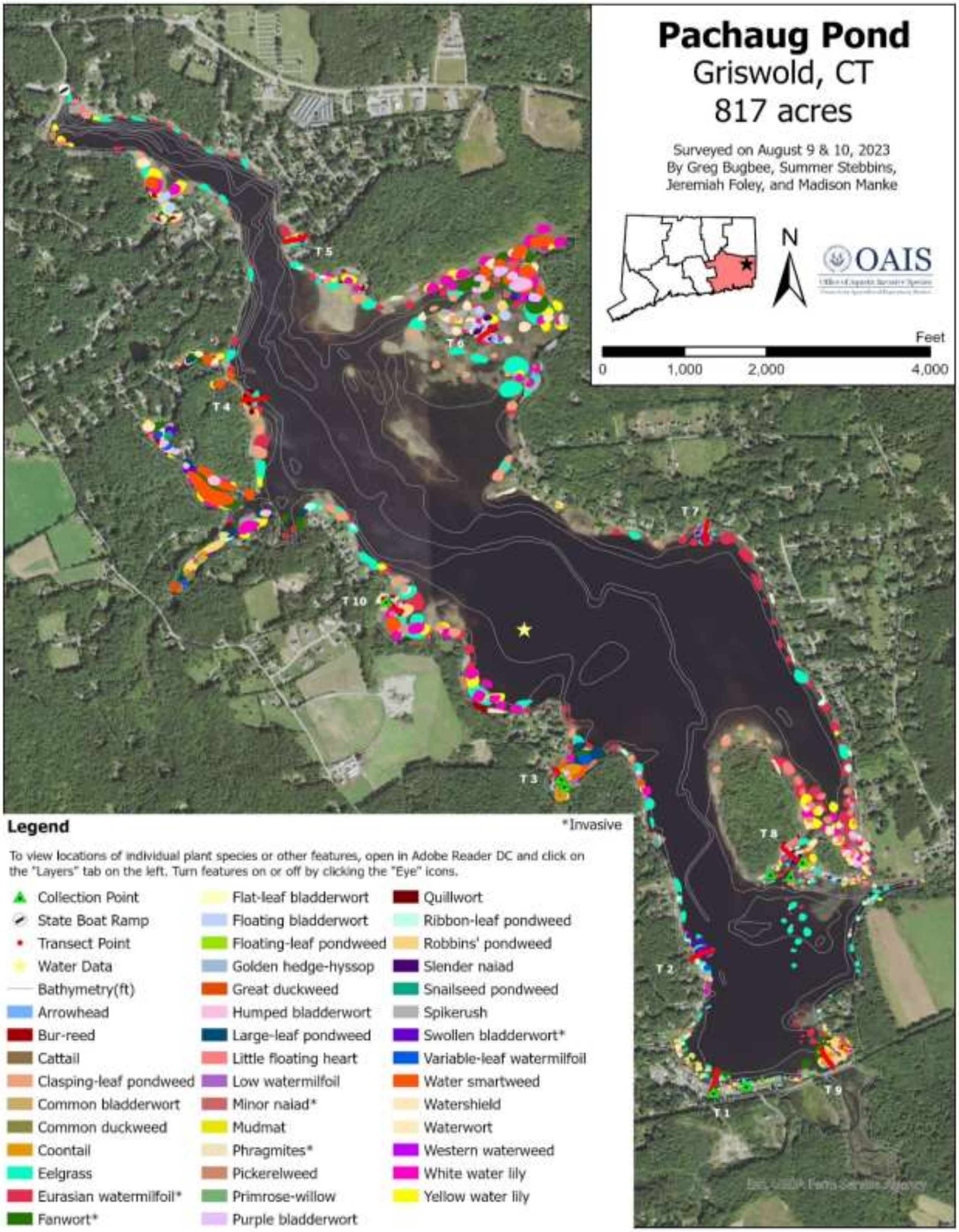


Figure 3. Map of aquatic vegetation in Pachaug Pond in 2023.

Results and Discussion:

General Aquatic Plant Surveys and Transects:

We found six invasive and 33 native plant species in Pachaug Pond in 2023. This compares to six invasive and 30 native species found in 2022 (Table 1). Clasping-leaf pondweed, quillwort, snailseed pondweed, and western waterweed returned in 2023 after not being found in 2022 (Table 2). The increase in native plant species in 2023 was likely the result of recovery from the 2021/22 drawdown for dam repairs. Pachaug Pond contains among the greatest number of plant species found in any waterbody surveyed by CAES OAIS (2024). Providing details on the specifics of the native plants is beyond the scope of this report; however, information is available at the USDA "About PLANTS" website (https://plants.usda.gov/home).

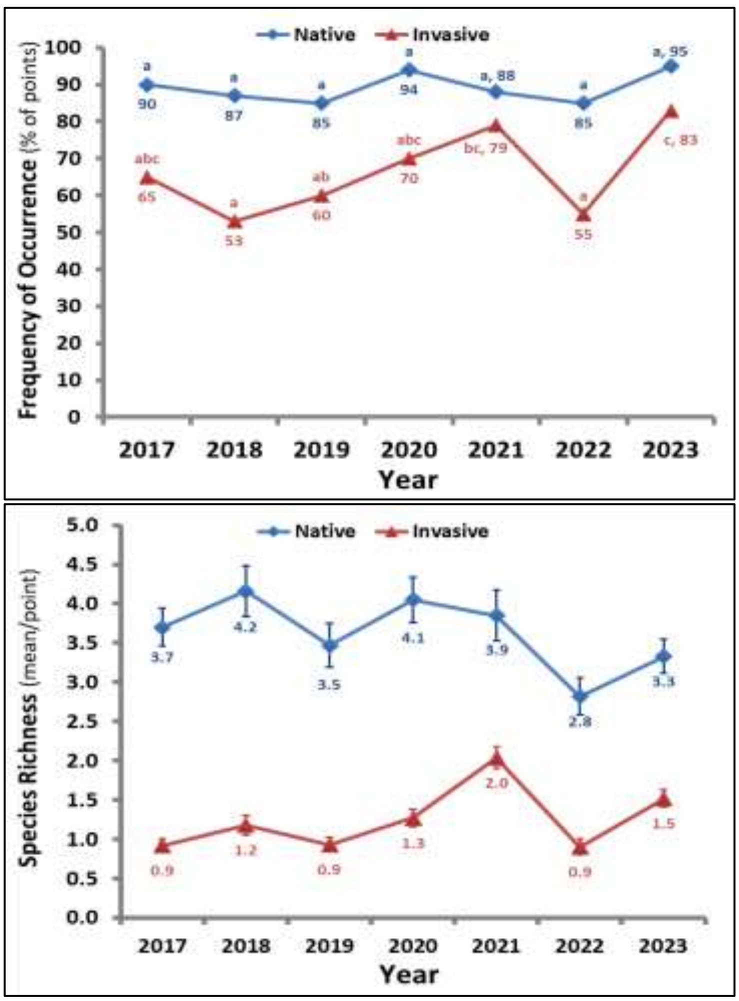


Figure 4. Frequency of occurrence (top) and species richness (bottom) of native and invasive vegetation on transects from 2017 – 2023.

Eurasian watermilfoil, fanwort, minor naiad, phragmites, variable-leaf watermilfoil, and swollen bladderwort comprised the invasive species found in 2023 (see descriptions in appendix). Swollen bladderwort was first documented in 2021 by confirmation with genetic testing. Because it is easily mistaken for other native bladderworts it may have been overlooked in previous years. Many of the shallow coves contained nuisance vegetation such as fanwort, water smartweed, and various water lilies that reached the surface (Figure 3). Much of the lake, however, did not have problematic vegetation reaching the surface despite it being shallow enough to support luxuriant growth. In these areas, the bottom either did not support plant growth or was covered with native eelgrass and/or

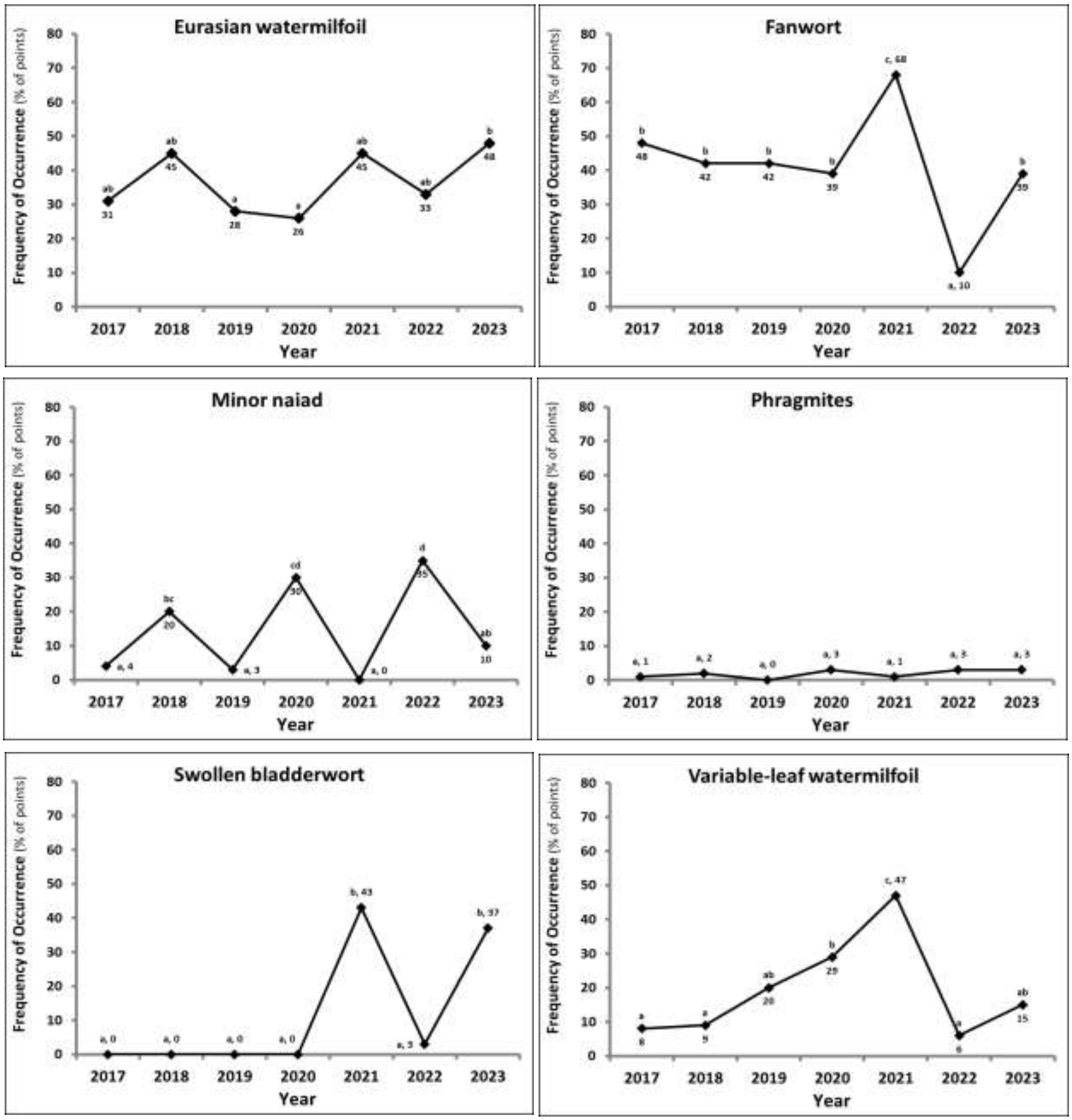


Figure 5. Frequency of occurrence of invasive species on transects in Pachaug Pond from 2017 – 2023.

Figure 6. Diverse shoreline plant community in Pachaug Pond in 2023. Species include bladderworts, bur-reed, little floating heart, pickerelweed, spikerush, water lilies, and watershield.

Robbins' pondweed. Reasons for this may include light limitation caused by tea-colored water, infertile substrate, previous drawdowns, or factors yet to be determined.

Although many of the coves had lower densities of nuisance emergent vegetation such as white and yellow water lily and water smartweed, possibly due to mechanical harvesting, the total coverage of aquatic vegetation increased from roughly 107 acres in 2022 to 129 acres in 2023 (see appendix for maps). Most notably, fanwort increased from 7 to 22 acres, Eurasian watermilfoil from 23 to 29 acres, and eelgrass from 30 to 36 acres. Although we are confident these numbers indicate a trend, they should not be taken as absolute (a more detailed survey would be necessary for this level of accuracy). There were fewer instances of plant populations towards the center of the lake compared to previous years. This could be from the tannic water coloring and change from the lower water levels occurring during the 2021/22 drawdown. There were still many patches of plants dense enough to restrict navigation; however, similar to 2021 and 2022, the northwestern cove and the southwestern cove near transect 3 each had a boat path through the vegetation. These paths seem to be actively managed with harvesting. The CAES OAIS website contains digitized survey maps where individual plant layers can be viewed separately (portal.ct.gov/caes-oais).

Comparisons of our frequency of occurrence (FOQ) data for transects from 2017 – 2023, found little overall change in total native species (Figure 4, see appendix for transect data). Meanwhile, invasive species FOQ significantly increased (Tukey $p \leq 0.05$) from 55% in 2022 to 83% in 2023. This is likely explained by recovery from the 2021/22 drawdown; however, 2023 also had the highest FOQ for both invasive and native species in all seven survey years. Native and invasive species richness also increased significantly from 2022 to 2023 (Figure 4).

From 2022-2023, there were statistically significant increases in the FOQ of fanwort and swollen bladderwort and a significant decrease in minor naiad (Figure 5, Table 2). The native plants found most frequently on transects in 2023 were eelgrass (67%), spikerush (25%), arrowhead (19%), floating bladderwort (19%), and Robbins' pondweed (18%) (Table 2). Compared to 2022, some native species were found less frequently on transects in 2023. These included arrowhead (17% to 6%), common duckweed (6% to 0%), floating-leaf pondweed (5% to 3%), golden hedge-hyssop (2% to 1%), low watermilfoil (4% to 3%), mudmat (10% to 2%), pickerelweed (24% to 16%), and primrose-willow (32% to 4%). Many of these species are emergent plants that flourished during the 2021/22 drawdown, so it is expected to see slight decreases as the water level returned to normal. Overall, native and invasive species increased compared to 2022, but were consistent with the six previous surveys.

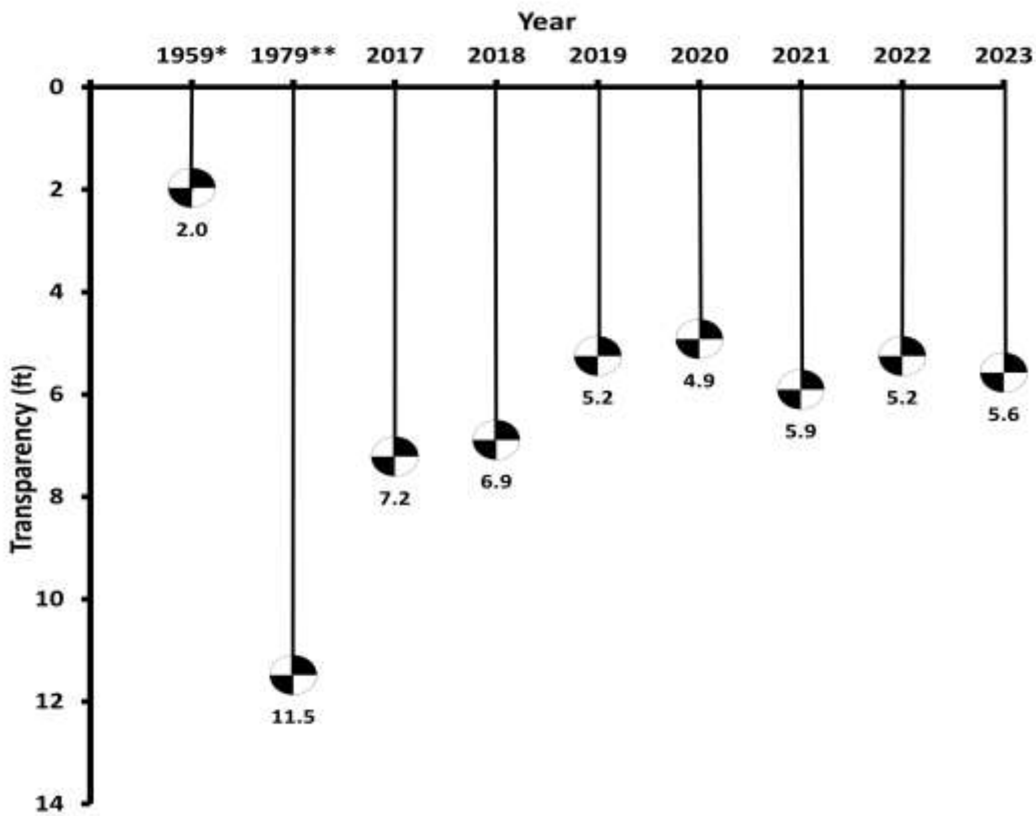
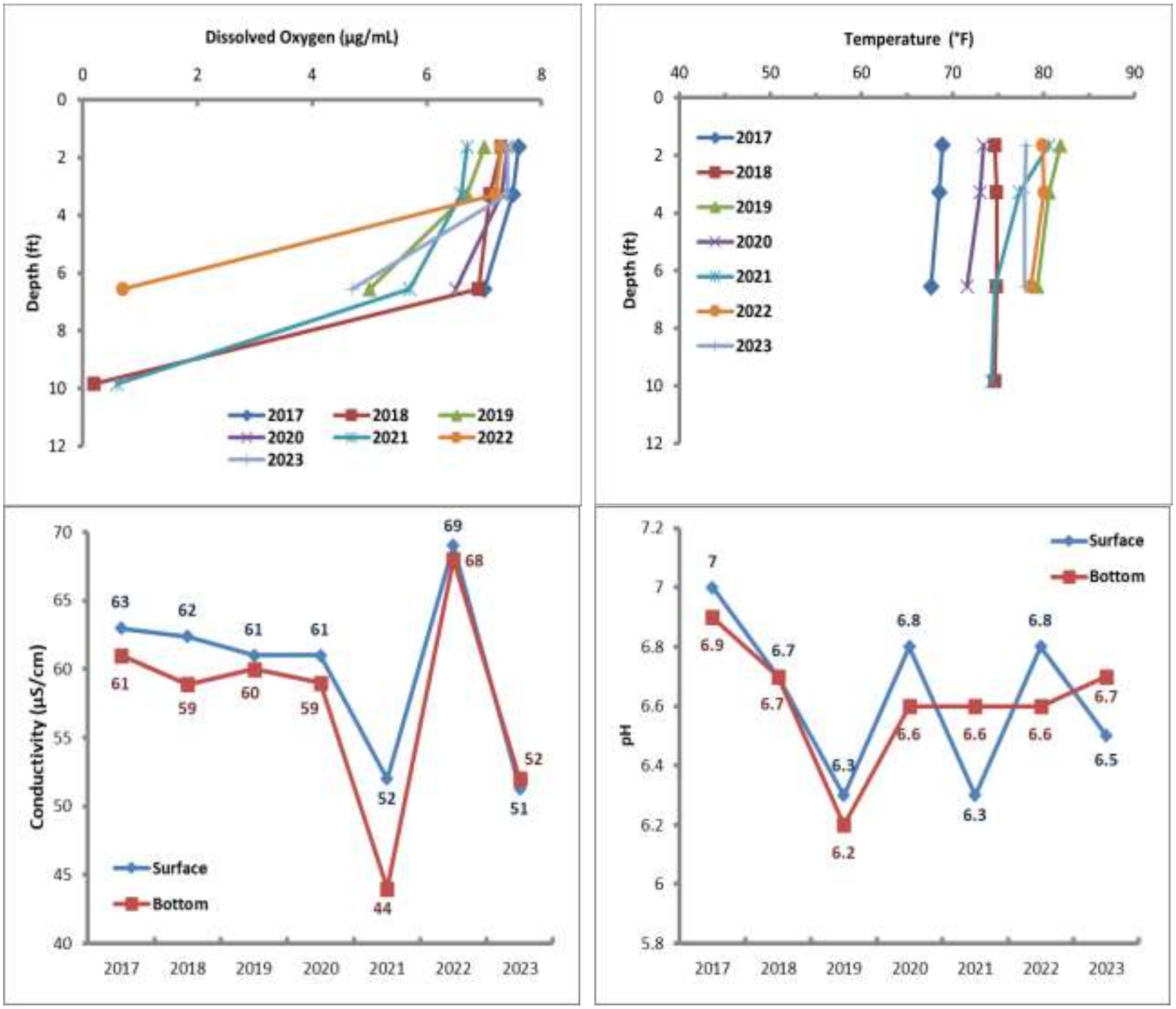


Figure 7. Water clarity in Pachaug Pond as measured with a Secchi disk from 1959 to 2023. *State Board of Fisheries and Game Lake and Pond Survey Unit, 1959. **Norvell and Frink, 1984.

Water Chemistry:

Water clarity in Connecticut's lakes ranges from 1-33 feet with an average of 7 feet (CAES OAIS, 2024). Pachaug Pond had a water clarity of 5.6 feet in 2023, which is similar to 2019 – 2022 (4.9 – 5.9 ft) but lower than 2017 -2018 (6.8- 7.2 ft) (Figure 7). Measurements in 1979 found a much higher transparency of 12 feet (Frink and Norvell, 1984) while in the 1950's it was only 2.0 feet (State Board of Fisheries and Game, 1959). The poor water clarity in the 1950's was attributed to an algal bloom. This could have been due to the reported industrial use of the water. Our 2023 observation was consistent with previous years, with water clarity not reduced by algal blooms but rather the brown coloration caused by naturally occurring organic derivatives.



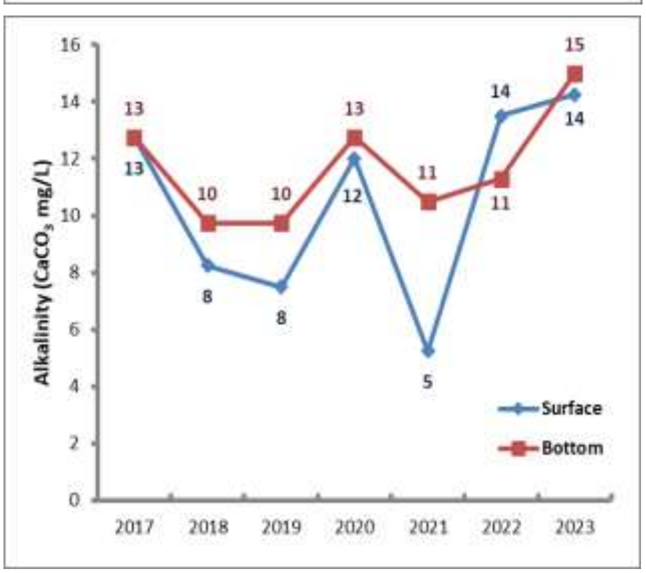


Figure 8. Water chemistry of Pachaug Pond from 2017 - 2023.

The shallow nature of Pachaug Pond results in no summertime temperature stratification and therefore no thermocline. In 2023, the water temperature was near 78˚F throughout the water column with a range from the upper 60˚F to the lower 80˚F in previous years (Figure 8). Because our measurements are taken at 3 ft intervals and the sampling site depth was approximately 9 ft, in some years our measurements stopped at 6 ft to avoid the probe penetrating the sediment. This was based on surveyor judgment and resulted in the differences in sampling depth from year to year. In 2023, dissolved oxygen levels remained high from the surface to a depth of 6 ft. In previous year's surveys, dissolved oxygen ranged from 7.4 mg/L at the surface to 5.4 mg/L near the bottom (Figure 8). This is similar to all previous years except 2022, when dissolved oxygen declined to near zero at a depth of 6 ft. In 2018 and 2021, near zero dissolved oxygen levels occurred at a depth of 9 ft. When dissolved oxygen falls below 5 mg/L, most fish will need to seek more oxygenated areas. In addition, anoxic conditions promote the liberation of sediment phosphorus that if mixed with surface water can promote algal blooms. Since 2017, water pH has remained near neutral, between 6.2 and 7.0. Alkalinity has measured between 5 and 15 mg/L $CaCO_3$, with a slight upward trend in recent years. Alkalinity in Connecticut lakes range from near 0 to >170 mg/L $CaCO_3$, therefore Pachaug Pond's alkalinity is considered relatively low (CAES OAIS, 2024). Low alkalinity waterbodies are more prone to pH change due to

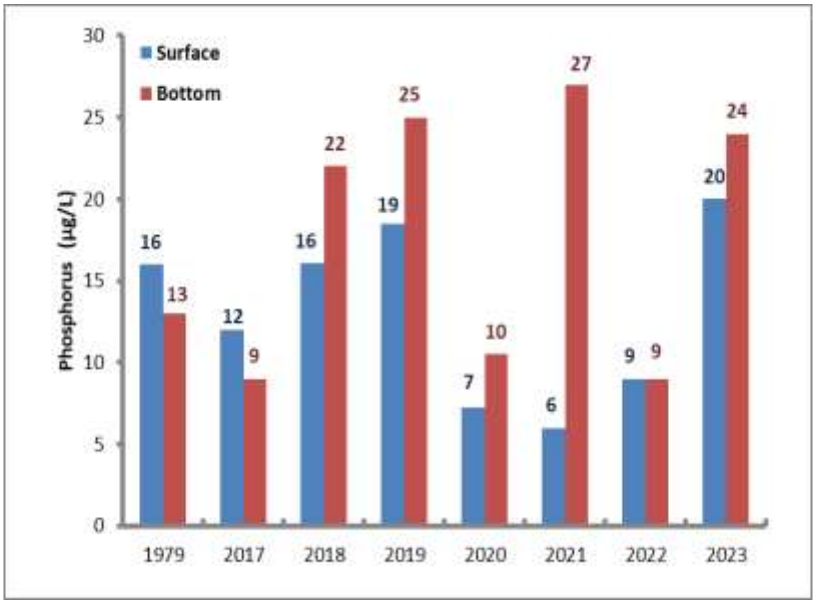


Figure 9. Phosphorus concentrations in Pachaug Pond in 1979 (Frink and Norvell) and from 2017 - 2023.

outside influences such as watershed activities and acid rain. Conductivity is an indicator of dissolved ions that come from natural and man-made sources (mineral weathering, organic matter decomposition, fertilizers, septic systems, road salts, etc.). Connecticut waterbodies have conductivities that range from 50 - 250 µS/cm. In 2023, Pachaug Pond's conductivity measured 51 µS/cm at the surface and 52 µS/cm at the bottom, which is a slight decrease from 2022. This may be related to the increased flushing from the many high rainfall events in 2023 or possibly the reduced use of road salts because of the lack of snow in the winter.

A key parameter used to categorize a lake's trophic state is phosphorus (P) in the water column. High levels of P can lead to nuisance or toxic algal blooms (Frink and Norvell, 1984; Wetzel, 2001). Rooted macrophytes are considered to be less dependent on P from the water column as they obtain a majority of their nutrients from the hydrosoil (Bristow and Whitcombe, 1971). Lakes with P levels from 0 - 10 µg/L are considered nutrient-poor or oligotrophic. When P concentrations reach 15 - 25 µg/L, lakes are classified as moderately fertile or mesotrophic and when P reaches 30 - 50 µg/L they are considered fertile or eutrophic (Frink and Norvell, 1984). Lakes with P concentrations >50 µg/L are categorized as extremely fertile or hypereutrophic. Pachaug Pond's P concentration in 2023 was 20 µg/L at surface and 24 µg/L near the bottom, which classifies the lake as mesotrophic (Figure 9). Analysis of the water by CAES in 1979 (Frink and Norvell, 1984) found lower P concentrations of 16 µg/L at surface and 13 µg/L near the bottom.

CAES OAIS has found that the occurrence of invasive plants in lakes can be attributed to specific water chemistries (June-Wells et al., 2013). For instance, lakes with higher alkalinities and conductivities are more likely to support Eurasian watermilfoil, minor naiad, and curlyleaf pondweed while lakes with lower values support fanwort and variable-leaf watermilfoil. Pachaug Pond's water chemistry appears to be an outlier to this trend as its low alkalinity and conductivity suggests Eurasian watermilfoil and minor naiad should be less abundant than observed.

Aquatic Vegetation Management Options:

Figure 10. Eco-Harvester used in Pachaug Pond since 2022.

Managing nuisance aquatic vegetation in Pachaug Pond will be challenging because the lake has extensive areas of desirable native vegetation, and state-listed species may need protection. In addition, large numbers of residents utilize the lake for recreational activities, particularly fishing, boating, and swimming. Options include water level drawdown, harvesting, herbicides, biological controls, and benthic barriers (Cooke et al., 2005). Dredging may also be employed but is usually impractical for large lakes like Pachaug.

Water level drawdown can be an effective and economical means of controlling nuisance vegetation in large shallow lakes like Pachaug Pond. The vegetation reductions reported in 2022 were likely a side effect of the drawdown needed for the 2021/22 dam repairs (Grahn, 2021). Fortunately, the new dam has an outlet suitable for the technique and future utilization for weed management is possible with CT DEEP approval.

In July 2023, the eco-harvester, purchased by the PPWCA in 2022, was used for the second year (Figure 10). Mechanical issues caused periods of inactivity in 2023. Major benefits of mechanical harvesting include quick results, the ability to target areas and avoid damage to species needing protection, avoidance of aquatic herbicides, and removal of nutrients contained in the harvested vegetation. Drawbacks include the initial expense of the machine, maintenance costs, rapid regrowth, the need for follow-up work, and costs for vegetation removal and

Figure 11. Grass carp were introduced into Candlewood Lake in 2015 to control invasive Eurasian watermilfoil (left). After near complete elimination of all aqutic vegetation, CT DEEP began a grass carp removal program in 2023 (right).

disposal. In addition, if emergent vegetation such as waterlilies are removed, sunlight reaching the bottom could promote the growth of submersed species. This may be occurring in Pachaug Pond and as was mentioned earlier in this report where an increase in fanwort and Eurasian watermilfoil coverage was documented. Results of the Pachaug Pond harvesting program will provide important information for others considering a similar weed management approach.

Herbicides can be effective in controlling unwanted aquatic vegetation. Aquatic herbicide use requires clearance from the CT DEEP Pesticides Unit and the Natural Diversity Database. Herbicides must be chosen carefully as some have efficacy on certain target species and not others. Also, any desirable plants, including state-listed species, may need to be tolerant. Specifics on the use of aquatic herbicides in Connecticut are found in the CT DEEP publication entitled “Nuisance Aquatic Vegetation Management: A Guidebook” (CTDEP, 2005). In 2018, CAES OAIS tested a new herbicide called ProcellaCOR to control variable-leaf watermilfoil in Bashan Lake with excellent results.

Although efforts are underway to find biological controls for nuisance aquatic vegetation, breakthroughs have been limited. To date the only biological control used in Connecticut is sterile grass carp (*Ctenopharyngodon Idella*; Figure 11).

Figure 12. CAES OAIS found short-term benthic barriers provide excellent short-term control of nuisance aquatic vegetation in confined areas like public beaches.

Grass carp are herbivorous fish that feed on most submersed aquatic plants. The introduction of grass carp into Connecticut lakes requires approval by CT DEEP, and only sterile (triploid) grass carp are permitted. Introducing grass carp in

Pachaug Pond could cause damage to non-target plants necessary to maintain the current fishery. Grass carp primarily feed on submergent vegetation, so the water lilies and water smartweed impacting many of the coves would likely be unaffected. Grass carp introductions in Connecticut waterbodies such as Candlewood Lake, Taunton Lake, and Squantz Pond have resulted in an undesirable situation where near total elimination of aquatic vegetation occurred (Figure 11). CAES has worked with officials from the United States Department of Agriculture to find new plant pathogens and insects to control nuisance aquatic plants with little success.

Benthic barriers or “bottom blankets” are effective at eliminating nuisance vegetation in small areas such as swim zones, around docks, and pioneer infestations. CAES OAIS has tested short-term placement (<30 days) of the barriers in Lake Quonnipaug, Bashan Lake, and Lake Beseck (Figure 12). Season-long control for Eurasian watermilfoil and fanwort was achieved. Although labor intensive, benthic barriers can be moved from place to place during a season for effective control. They can also be used over multiple years, reducing the cost of materials.

Conclusions:

Our 2023 survey of Pachaug Pond found an increase in aquatic vegetation from 2022. This was likely due to recovery from the 2021/22 drawdown needed for dam repairs. A total of 39 plant species were documented of which six were invasive. This places Pachaug Pond among the most plant species rich lakes in Connecticut. The invasive species found were Eurasian watermilfoil, fanwort, minor naiad, swollen bladderwort, and variable-leaf watermilfoil. Removal of emersed vegetation by harvesting might be promoting submersed vegetation such as fanwort and Eurasian watermilfoil. Many of the coves contained nuisance vegetation such as fanwort, water smartweed, and/or water lilies that reached the surface. Much of the remainder of Pachaug Pond, in areas less than six feet deep, contained a mixture of non-nuisance invasive and native species that did not reach the surface. If limiting conditions such as light limitation, infertile substrate, water level, and control from previous drawdowns change nuisance vegetation could expand dramatically.

Aquatic plant management and monitoring is critical to ensure a potential rapid decline in the quality of Pachaug Pond is avoided. Documenting the effects of the mechanical harvester, commissioned into service in 2022, on Pachaug Pond will provide valuable information for others. Water level drawdowns via the new dam's outlet have potential to be a cost-effective means of aquatic plant control. Other management practices with potential include herbicides, benthic barriers, and grass carp. Grass carp introductions may face increased scrutiny from CT DEEP regulators as excessive plant removal has occurred in several Connecticut lakes. Our water tests found Pachaug Pond to be mesotrophic with low alkalinity and minimal stratification. Water clarity was limited by the water's brown coloration. Changes over the course of our surveys have been minimal.

Acknowledgments:

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Funding:

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Appendix

Narrative from State Board of Fisheries and Game Lake and Pond Survey Unit – 1959

Pachaug Pond

Pachaug Pond is a large, artificial impoundment located in New London County in the township of Griswold. This shallow, fertile pond was formed by impounding the Pachaug River. It has a surface area of 830.9 acres, a maximum depth of 18 feet and an average depth of 6.1 feet. Much of the well-wooded shoreline is in the Pachaug State Forest. Submerged and emergent vegetation is abundant, particularly in the shoal areas and shallow areas. The pond bottom is of mud, swampy ooze and sand. A dense algal bloom reduces transparency to two feet. The waters of this pond are not thermally stratified.

Shoreline development is very light and there are only a few cottages present. Boats are available for rental at a livery at the southern end of the pond. There is a state-owned right-of-way present, but this is poorly developed and is unuseable.

Pachaug Pond has been stocked with smallmouth bass and yellow perch.

Largemouth bass are common in abundance and exhibit excellent growth. Yellow perch are common in abundance. This species grows at a rate equal to the state average. Bluegill sunfish are abundant and grow at a rate well above the state average. Chain pickerel are scarce and exhibit an above-average growth rate. Calico bass are common in abundance. The growth rate of this species is equal to the state average. Bullheads are common in abundance and golden shiners are abundant.

This pond has the reputation of producing excellent bass fishing. Bass over five pounds are relatively common. Fishing for panfish such as perch, bluegill sunfish, calico bass and bullheads should be excellent.

In the past, this body of water was subject to severe drawdown during late June, July and August. This drawdown took place after the game species had reproduced and did not destroy their nests or young. As a result of the drawdown, the game fish and panfish were crowded into a smaller area and the panfish were more readily available to the game fish as forage. The resultant increase in predation aided in controlling the numbers of panfish and helped to keep these fish within the limits of the food supply and, at the same time, helped to provide numerous fast-growing game fish. The drawdown process also helped to control aquatic vegetation and this resulted in considerable open water relatively free from water weeds. For the past several years, the water has not been used for industrial purposes and, as a result, the water level has remained fairly stable. Aquatic vegetation is becoming more abundant and the amount of open water more restricted. This increase in the abundance of "water weeds" may provide excessive escape cover for panfish and can well result in stunted populations of yellow perch and bluegill sunfish.

The drawdown and exposure of considerable areas of the pond bottom also allowed smartweed and other semi-terrestrial plants to grow on the exposed shoals. These terrestrial plants furnished excellent food for waterfowl and attracted large numbers of ducks during the fall shooting season.

It is recommended that a control structure be installed in the dam so that the pond can be lowered three to four feet every summer. Such a drawdown should be started in June and the reduced water level should be held until the end of August.

No special regulations are recommended at this time.

Invasive Plant Descriptions

Cabomba caroliniana

Common names:
Fanwort
Carolina fanwort

Origin:
Southeast United States
South America

Key features:
Plants are submersed

Stems: Can be 6 feet (2 m) long

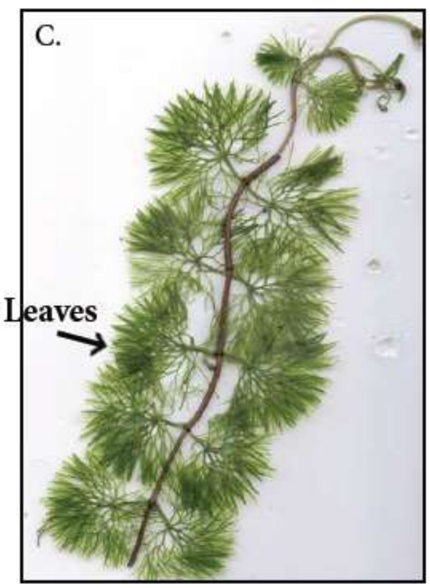
Leaves: Dissected, opposite leaves 0.8-2 inches (2-5 cm) are fan-like and made up of forked leaflets attached to the stem by a petiole. Floating leaves 0.2-0.8 inches (6-20 mm) wide are oblong and produced on flower shoots

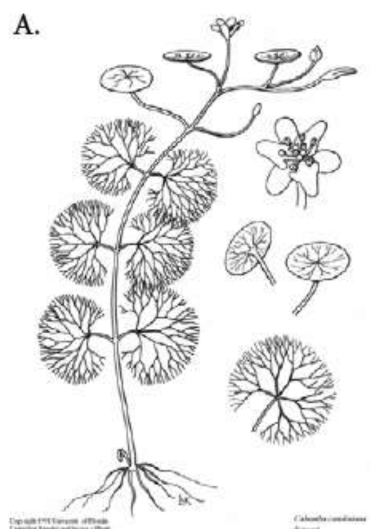
Flowers: Small, solitary flowers are usually white to pinkish

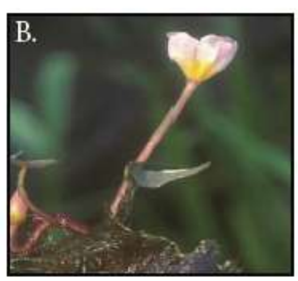
Fruits/Seeds: Flask shaped

Reproduction: Seed and fragmentation

Easily confused species:
Watermilfoils: *Myriophyllum* spp.
White water crowfoot: *Ranunculus longirostris*
Water marigold: *Megalodonta beckii*







A. Copyright 1991 Univ. of Florida, Center for Aquatic and Invasive Plants
B. Copyright 2002 Univ. of Florida, Photo by A. Murray
C. Photo by A. Smagula

Myriophyllum heterophyllum


Photo by CAES IAPP

Common names:
Variable-leaf watermilfoil
Variable watermilfoil
Two-leaf watermilfoil

Origin:
Southern United States

Key features:
Plants are submersed

Stems: Dark brown stems extend to the water's surface and spread to form large mats

Leaves: Triangular with ≤ 11 pairs of leaflets. Leaves are dissected and whorled (4-6 leaves/whorl) resulting in a feathery appearance with leaf whorls < 1 inch apart giving it a ropy appearance

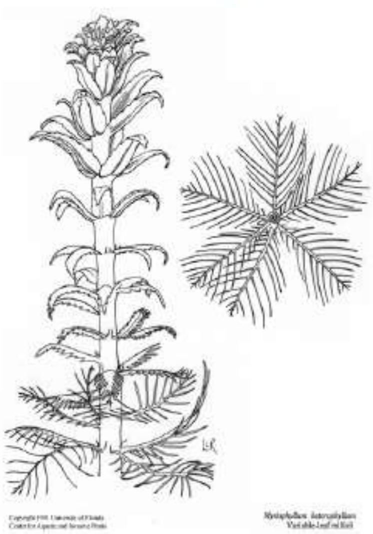
Flowers: Inflorescence spike 2-14 inches (5-35 cm) long extend beyond the water's surface with flowers in whorls of four with reddish petals

Fruits/Seeds: Fruits are almost round, with a rough surface

Reproduction: Fragmentation and seeds


Photo by CAES IAPP

Easily confused species:
Eurasian watermilfoil: *Myriophyllum spicatum*
Low watermilfoil: *Myriophyllum humile*



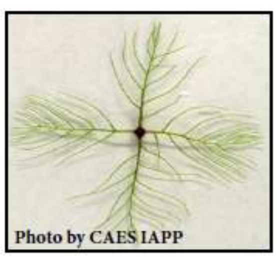


Photo by CAES IAPP


Leaves collapse out of water

Photo by CAES IAPP

Myriophyllum spicatum


Photo by CAES IAPP

Common name:
Eurasian watermilfoil

Origin:
Europe and Asia

Key features:

Plants are submersed

Stems: Stem diameter below the inflorescence is greater with reddish stem tips

Leaves: Leaves are rectangular with ≥ 12 pairs of leaflets per leaf and are dissected giving a feathery appearance, arranged in a whorl, whorls are 1 inch (2.5 cm) apart

Flowers: Small pinkish male flowers that occur on reddish spikes, female flowers lack petals and sepals and have 4 lobed pistil

Fruits/Seeds: Fruit are round 0.08-0.12 inches (2-3 mm) and contain 4 seeds

Reproduction: Fragmentation and seeds


Copyright 1991 Univ. of Florida
Center forAquatic and Invasive Plants

Easily confused species:
Variable-leaf watermilfoil: *Myriophyllum heterophyllum*
Low watermilfoil: *Myriophyllum humile*
Northern watermilfoil: *Myriophyllum sibiricum*
Whorled watermilfoil: *Myriophyllum verticillatum*


Photo by CAES IAPP


Photo by CAES IAPP


Photo by CAES IAPP

Najas minor

Common names:
Minor naiad
Brittle waternymph
Spiny leaf naiad
Eutrophic waternymph

Origin:
Europe

Key features:
Plants are submersed

Stems: Branched stems can grow up to 4-8 inches (10-20 cm) long

Leaves: Opposite and lance shaped on branched stems with easily visible toothed leaf edges and leaves appear curled under, basal lobes of leaf are also serrated, 0.01-0.02 inches (0.3-0.5 mm)

Flowers: Monoecious (male and female flowers on same plant)

Fruits/Seeds: Fruits are purple-tinged and seeds measure 0.03-0.06 inches (1.5-3 mm)

Reproduction: Seeds and fragmentation

Easily confused species:
Other naiads (native): *Najas* spp.

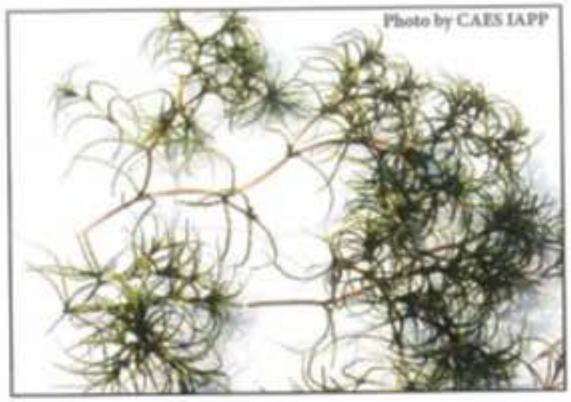


Photo by CAES IAPP


Photo by CAES IAPP


Photos by CAES IAPP


Photo by CAES IAPP

Utricularia inflata

Common names:
Swollen bladderwort

Origin:
Southern and Eastern North America

Key features:
Plants floating in water, sometimes appearing anchored

Stems: Stem is submersed, slender and elongated

Leaves: Submersed leaves (<18 cm) are alternate, bushy, repeatedly forked with bladders along the sides. Uppermost leaves are whorled and inflated, floating on the water's surface (3-8 cm).

Flowers: Flowers located at the center of inflated leaves and have five bright yellow petals

Fruits/Seeds: Fruit is dry and splits open when dry (3-6 mm)

Reproduction: Fragmentation and Tubers

Easily confused species:
Common bladderwort: *Utricularia macrorhiza*

Floating bladderwort: *Utricularia radiata*

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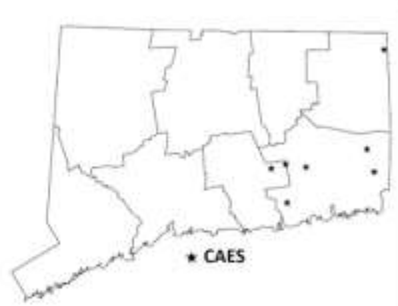
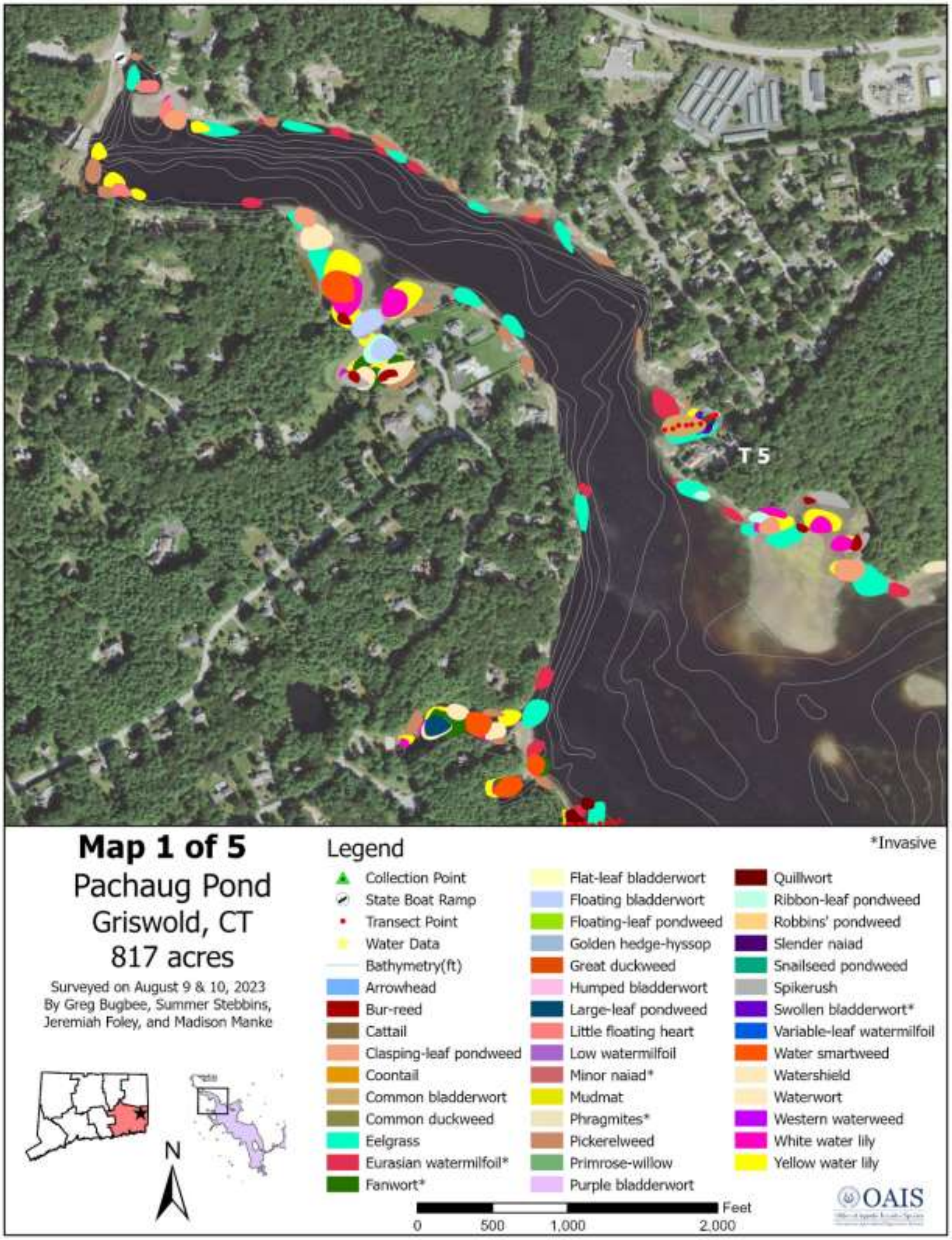


Aquatic Plant Survey Maps by Section


T 5
Map 1 of 5
Pachaug Pond
Griswold, CT
817 acres
Surveyed on August 9 & 10, 2023
By Greg Bugbee, Summer Stebbins,
Jeremiah Foley, and Madison Manke
N
Legend
*Invasive
Collection Point
State Boat Ramp
Transect Point
Water Data
Bathymetry(ft)
Arrowhead
Bur-reed
Cattail
Clasping-leaf pondweed
Coontail
Common bladderwort
Common duckweed
Eelgrass
Eurasian watermilfoil*
Fanwort*
Flat-leaf bladderwort
Floating bladderwort
Floating-leaf pondweed
Golden hedge-hyssop
Great duckweed
Humped bladderwort
Large-leaf pondweed
Little floating heart
Low watermilfoil
Minor naiad*
Mudmat
Phragmites*
Pickerelweed
Primrose-willow
Purple bladderwort
Quillwort
Ribbon-leaf pondweed
Robbins' pondweed
Slender naiad
Snailseed pondweed
Spikerush
Swollen bladderwort*
Variable-leaf watermilfoil
Water smartweed
Watershield
Waterwort
Western waterweed
White water lily
Yellow water lily
Feet
0
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1,000
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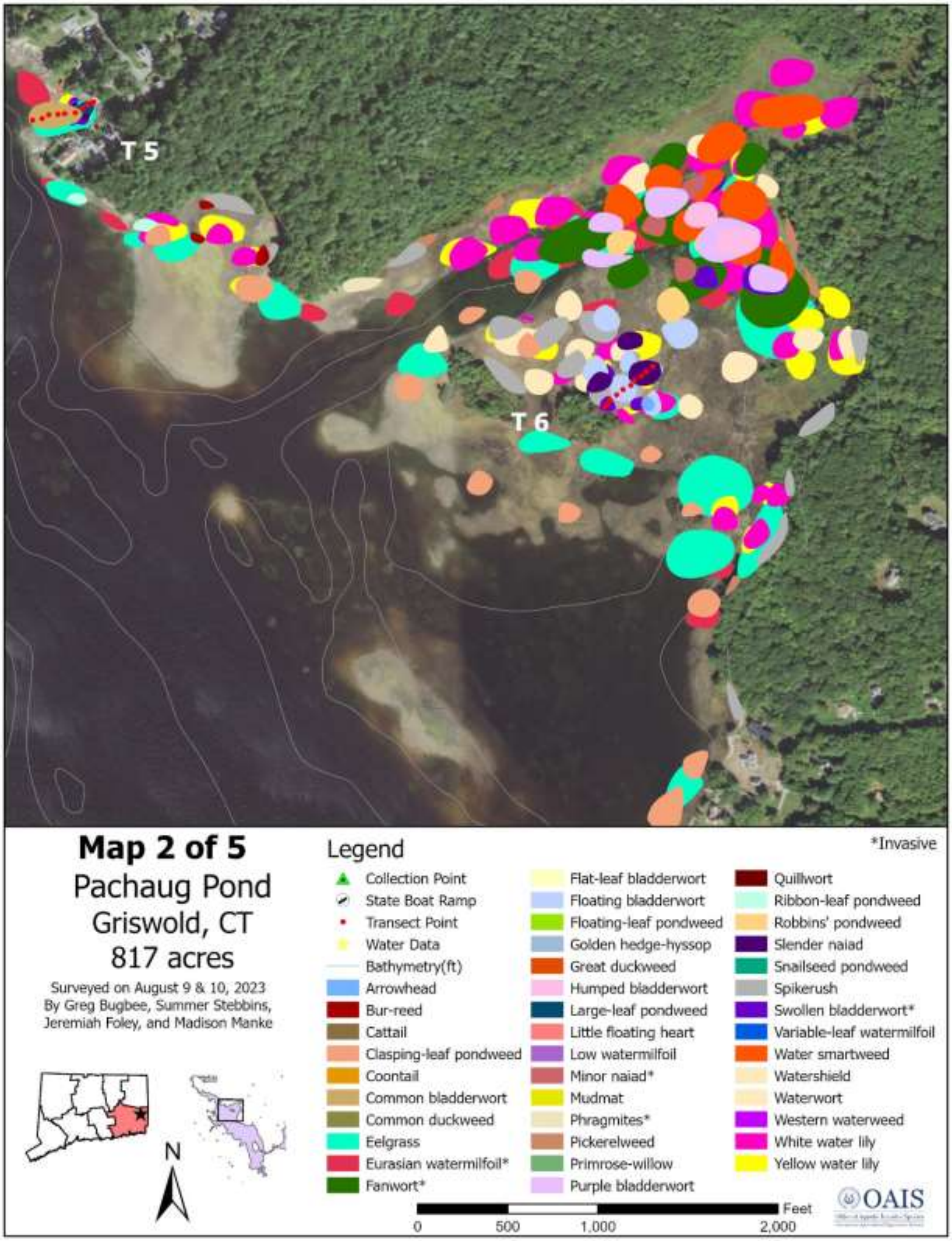
OAIS


T 5
T 6
Map 2 of 5
Pachaug Pond
Griswold, CT
817 acres
Surveyed on August 9 & 10, 2023
By Greg Bugbee, Summer Stebbins,
Jeremiah Foley, and Madison Manke
N
Legend
*Invasive
Collection Point
State Boat Ramp
Transect Point
Water Data
Bathymetry(ft)
Arrowhead
Bur-reed
Cattail
Clasping-leaf pondweed
Coontail
Common bladderwort
Common duckweed
Eelgrass
Eurasian watermilfoil*
Fanwort*
Flat-leaf bladderwort
Floating bladderwort
Floating-leaf pondweed
Golden hedge-hyssop
Great duckweed
Humped bladderwort
Large-leaf pondweed
Little floating heart
Low watermilfoil
Minor naiad*
Mudmat
Phragmites*
Pickerelweed
Primrose-willow
Purple bladderwort
Quillwort
Ribbon-leaf pondweed
Robbins' pondweed
Slender naiad
Snailseed pondweed
Spikerush
Swollen bladderwort*
Variable-leaf watermilfoil
Water smartweed
Watershield
Waterwort
Western waterweed
White water lily
Yellow water lily
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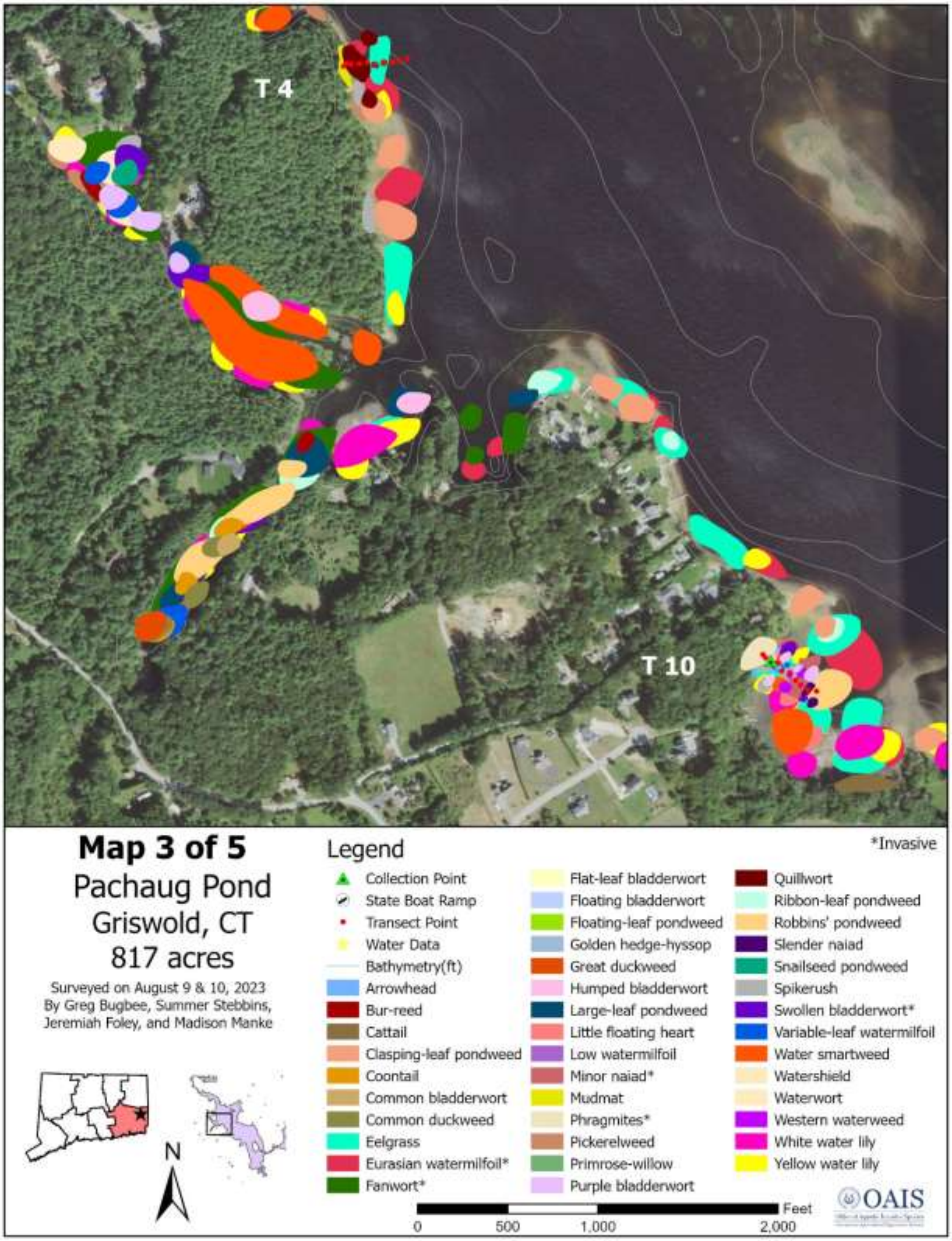

T 4
T 10
Map 3 of 5
Pachaug Pond
Griswold, CT
817 acres
Surveyed on August 9 & 10, 2023
By Greg Bugbee, Summer Stebbins,
Jeremiah Foley, and Madison Manke
Legend
*Invasive
Collection Point
State Boat Ramp
Transect Point
Water Data
Bathymetry(ft)
Arrowhead
Bur-reed
Cattail
Clasping-leaf pondweed
Coontail
Common bladderwort
Common duckweed
Eelgrass
Eurasian watermilfoil*
Fanwort*
Flat-leaf bladderwort
Floating bladderwort
Floating-leaf pondweed
Golden hedge-hyssop
Great duckweed
Humped bladderwort
Large-leaf pondweed
Little floating heart
Low watermilfoil
Minor naiad*
Mudmat
Phragmites*
Pickerelweed
Primrose-willow
Purple bladderwort
Quillwort
Ribbon-leaf pondweed
Robbins' pondweed
Slender naiad
Snailseed pondweed
Spikerush
Swollen bladderwort*
Variable-leaf watermilfoil
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Feet
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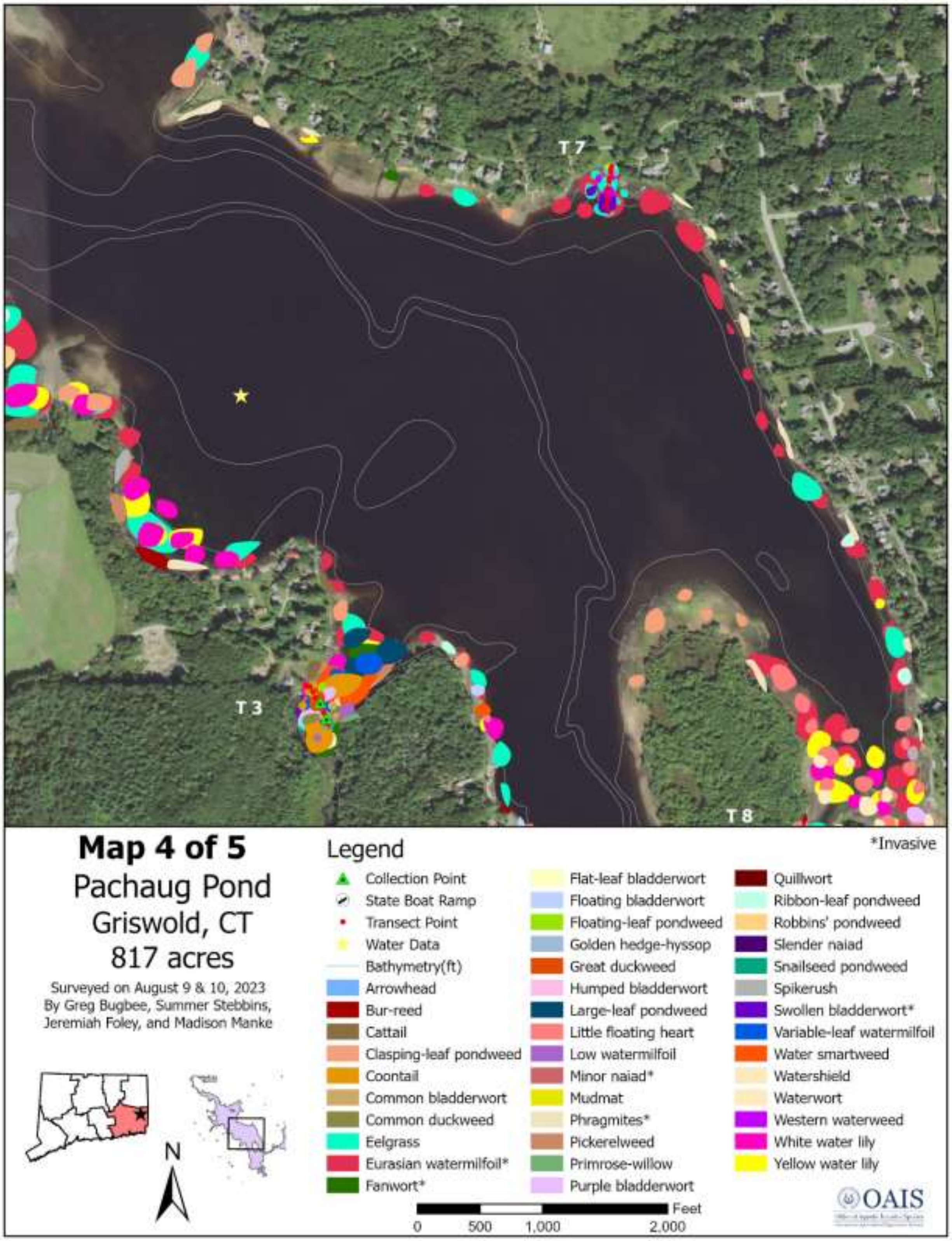
OAIS


T 7
T 3
T 8
Map 4 of 5
Pachaug Pond
Griswold, CT
817 acres
Surveyed on August 9 & 10, 2023
By Greg Bugbee, Summer Stebbins,
Jeremiah Foley, and Madison Manke
N
Legend
*Invasive
Collection Point
State Boat Ramp
Transect Point
Water Data
Bathymetry(ft)
Arrowhead
Bur-reed
Cattail
Clasping-leaf pondweed
Coontail
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Eurasian watermilfoil*
Fanwort*
Flat-leaf bladderwort
Floating bladderwort
Floating-leaf pondweed
Golden hedge-hyssop
Great duckweed
Humped bladderwort
Large-leaf pondweed
Little floating heart
Low watermilfoil
Minor naiad*
Mudmat
Phragmites*
Pickerelweed
Primrose-willow
Purple bladderwort
Quillwort
Ribbon-leaf pondweed
Robbins' pondweed
Slender naiad
Snailseed pondweed
Spikerush
Swollen bladderwort*
Variable-leaf watermilfoil
Water smartweed
Watershield
Waterwort
Western waterweed
White water lily
Yellow water lily
Feet
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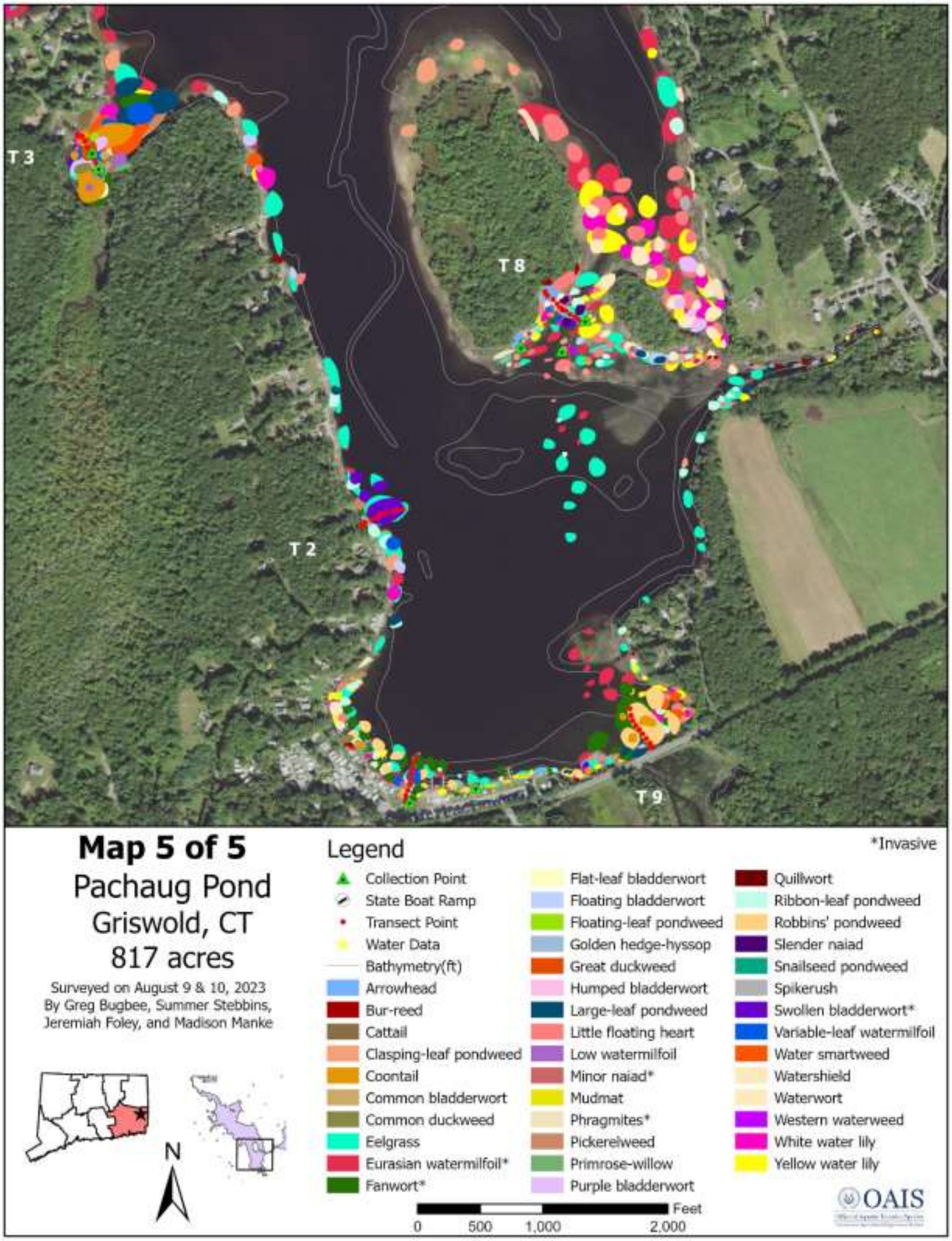
OAIS



T 3
T 8
T 2
T 9
Map 5 of 5
Pachaug Pond
Griswold, CT
817 acres
Surveyed on August 9 & 10, 2023
By Greg Bugbee, Summer Stebbins,
Jeremiah Foley, and Madison Manke
N
Legend
*Invasive
Collection Point
State Boat Ramp
Transect Point
Water Data
Bathymetry(ft)
Arrowhead
Bur-reed
Cattail
Clasping-leaf pondweed
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Eurasian watermilfoil*
Fanwort*
Flat-leaf bladderwort
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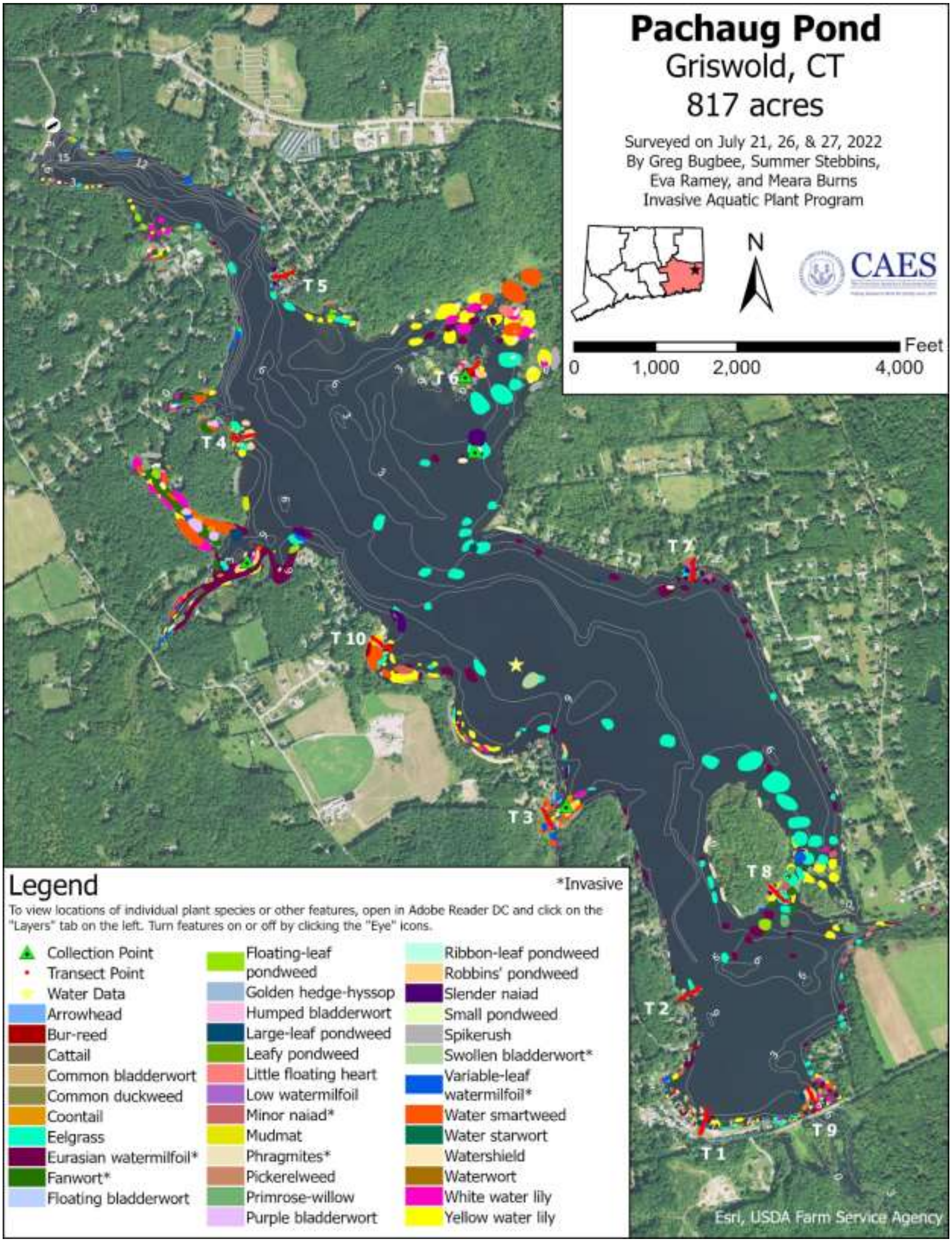
Floating-leaf pondweed
Golden hedge-hyssop
Great duckweed
Humped bladderwort
Large-leaf pondweed
Little floating heart
Low watermilfoil
Minor naiad*
Mudmat
Phragmites*
Pickerelweed
Primrose-willow
Purple bladderwort
Quillwort
Ribbon-leaf pondweed
Robbins' pondweed
Slender naiad
Snailseed pondweed
Spikerush
Swollen bladderwort*
Variable-leaf watermilfoil
Water smartweed
Watershield
Waterwort
Western waterweed
White water lily
Yellow water lily
Feet
0 500 1,000 2,000
OAIS

Previous Years Aquatic Plant Survey Maps


Pachaug Pond
Griswold, CT
817 acres
Surveyed on July 21, 26, & 27, 2022
By Greg Bugbee, Summer Stebbins,
Eva Ramey, and Meara Burns
Invasive Aquatic Plant Program
N
CAES
Feet
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4,000
T 1
T 2
T 3
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T 5
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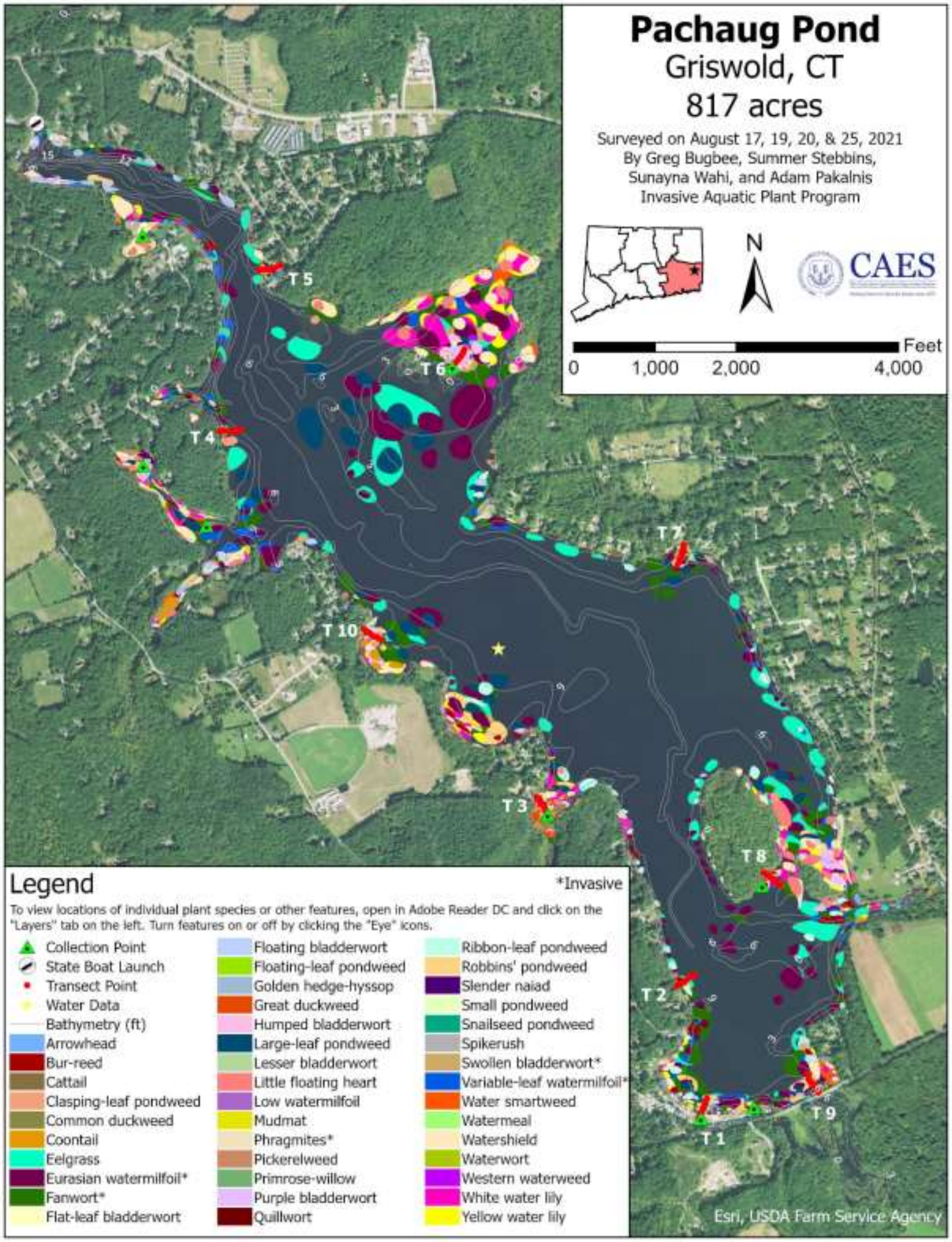
T 10
Legend
*Invasive
To view locations of individual plant species or other features, open in Adobe Reader DC and click on the "Layers" tab on the left. Turn features on or off by clicking the "Eye" icons.
Collection Point
Transect Point
Water Data
Arrowhead
Bur-reed
Cattail
Common bladderwort
Common duckweed
Coontail
Eelgrass
Eurasian watermilfoil*
Fanwort*
Floating bladderwort
Floating-leaf pondweed
Golden hedge-hyssop
Humped bladderwort
Large-leaf pondweed
Leafy pondweed
Little floating heart
Low watermilfoil
Minor naiad*
Mudmat
Phragmites*
Pickerelweed
Primrose-willow
Purple bladderwort
Ribbon-leaf pondweed
Robbins' pondweed
Slender naiad
Small pondweed
Spikerush
Swollen bladderwort*
Variable-leaf watermilfoil*
Water smartweed
Water starwort
Watershield
Waterwort
White water lily
Yellow water lily
Esri, USDA Farm Service Agency


Pachaug Pond
Griswold, CT
817 acres
Surveyed on August 17, 19, 20, & 25, 2021
By Greg Bugbee, Summer Stebbins,
Sunayna Wahi, and Adam Pakalnis
Invasive Aquatic Plant Program
N
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Feet
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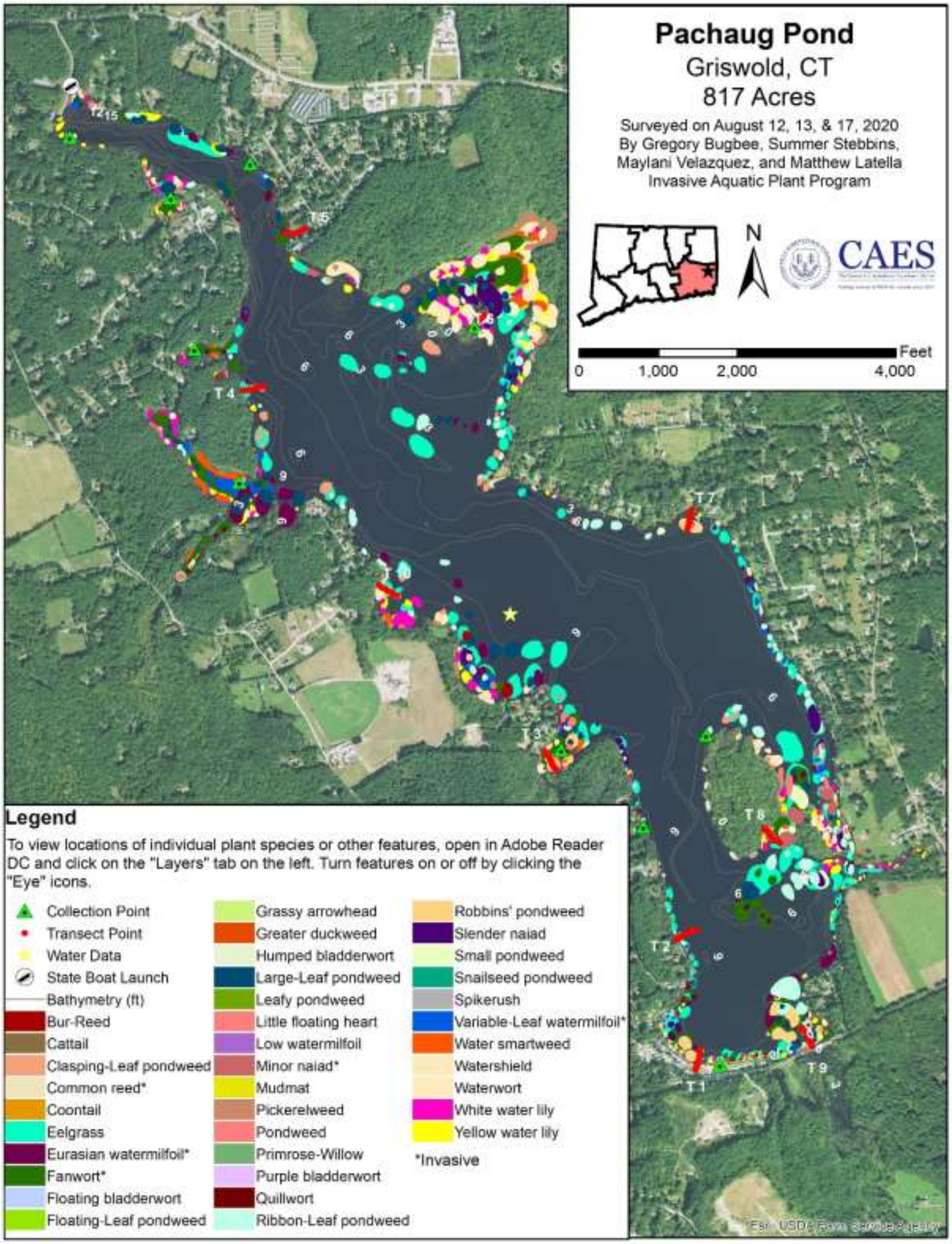
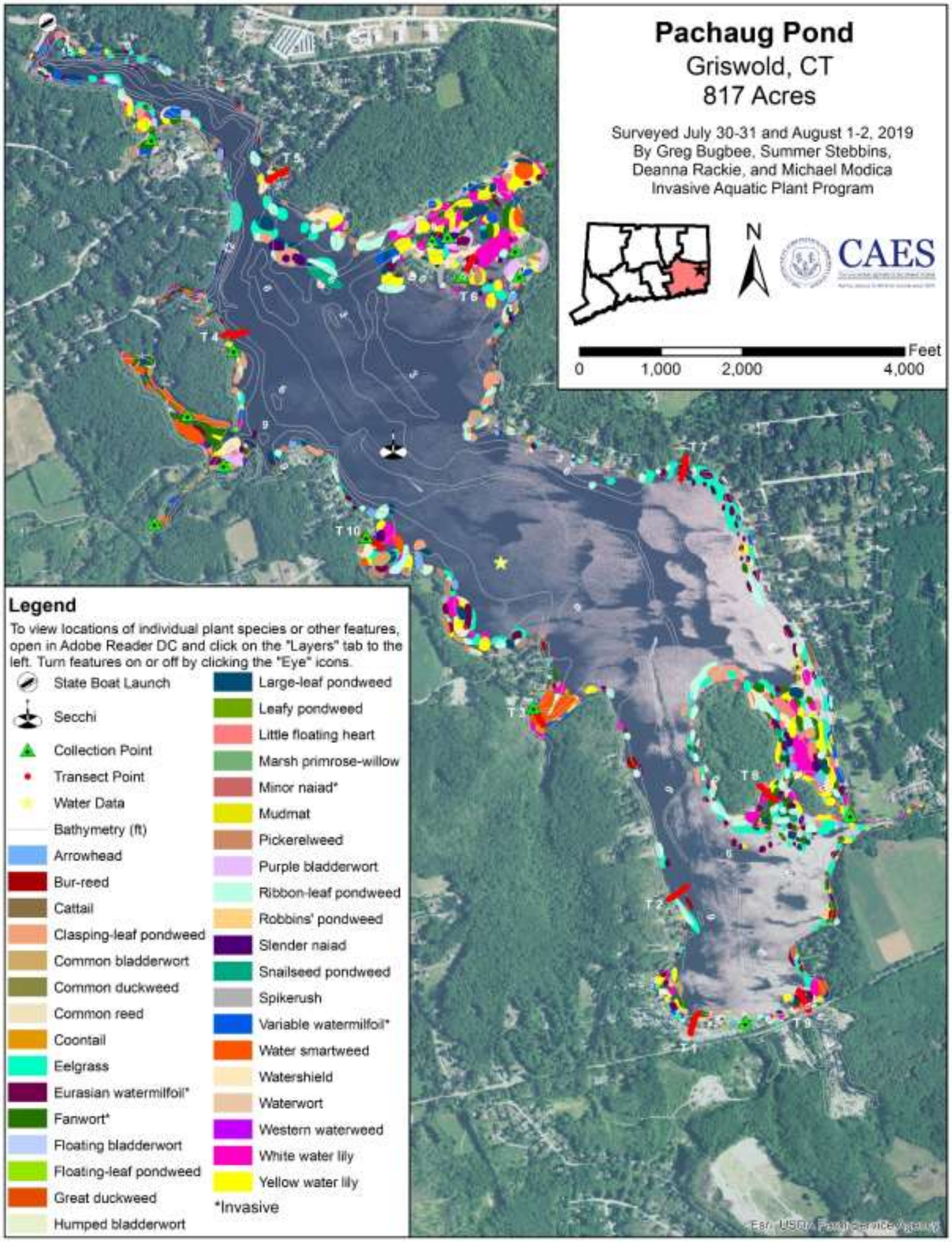
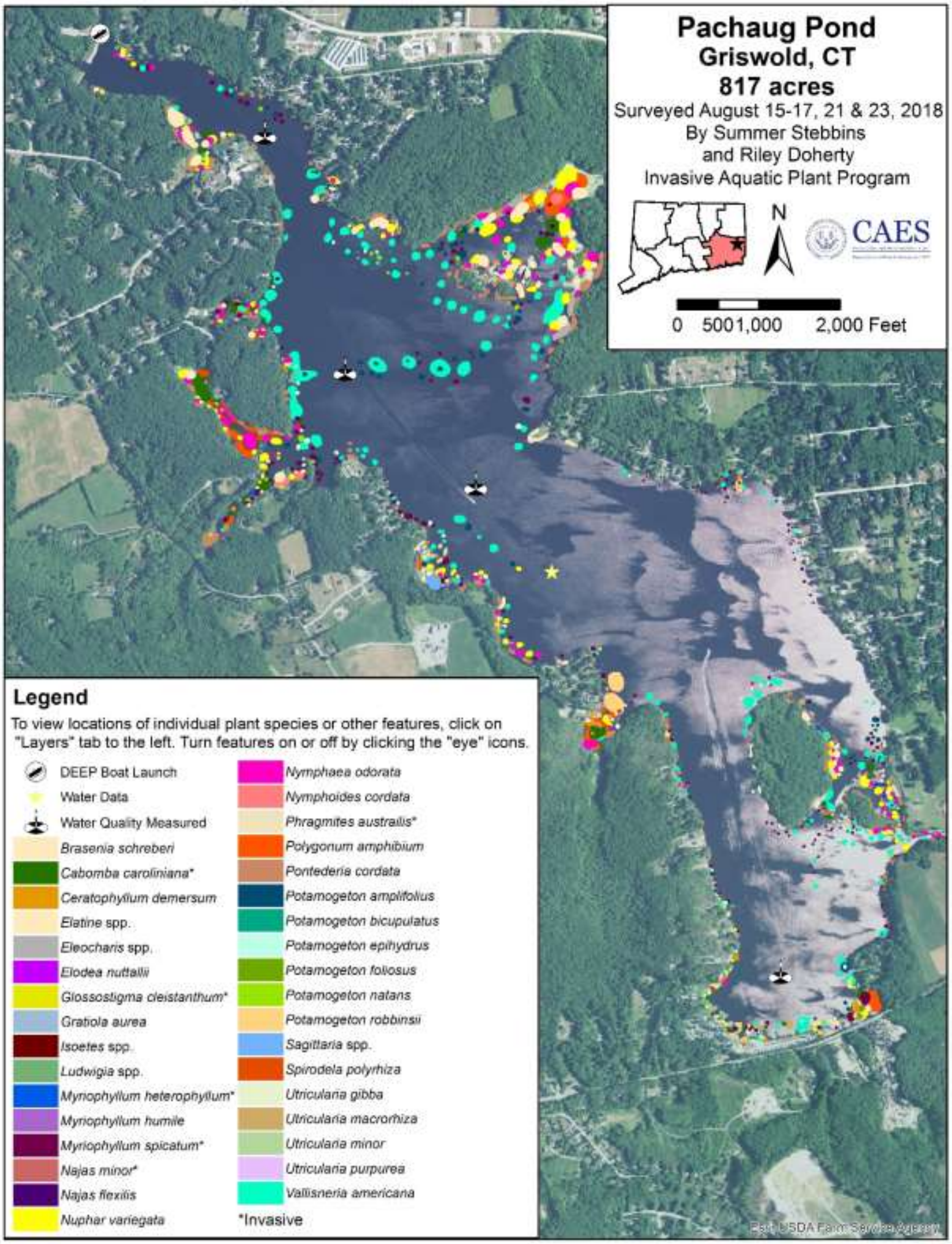
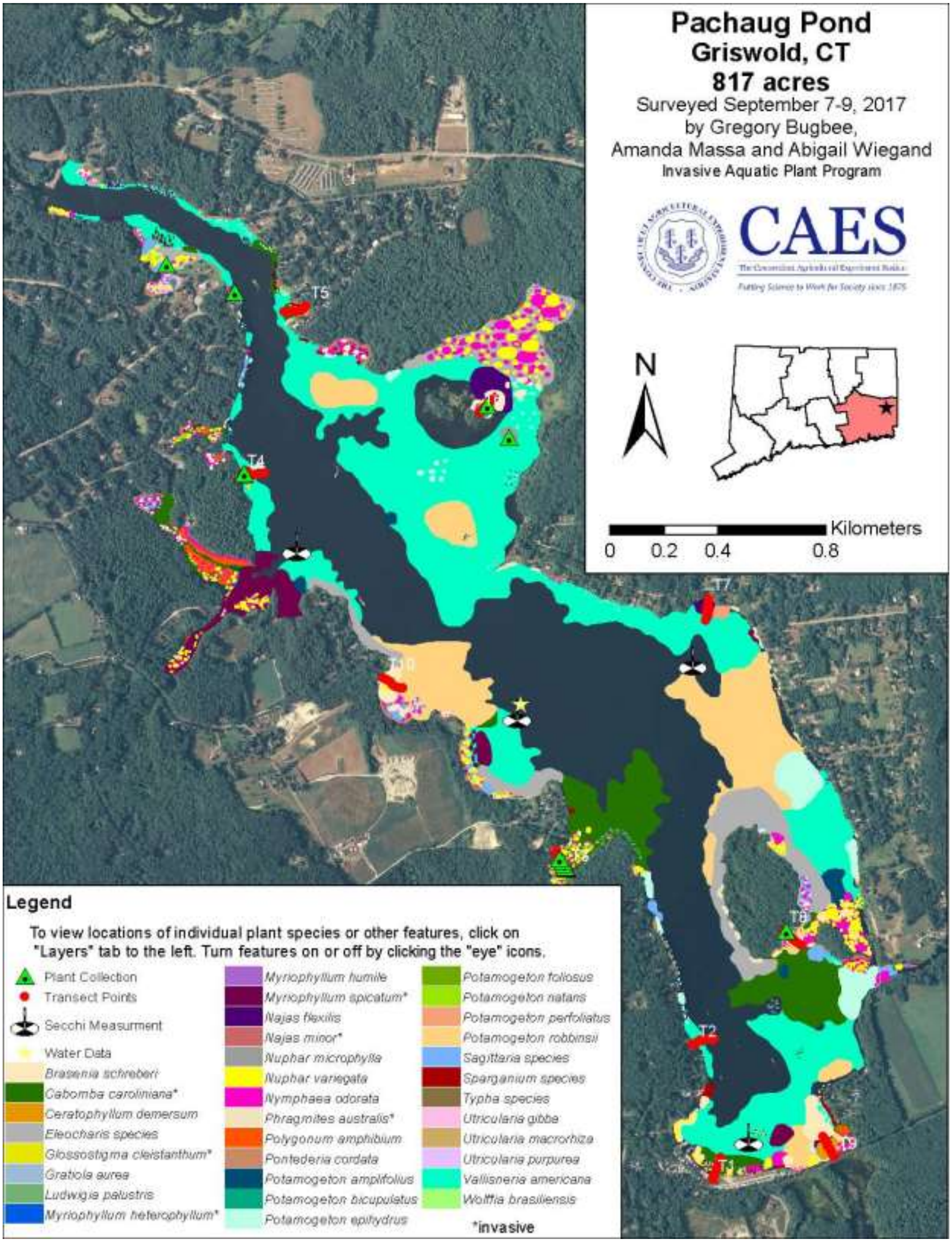
Legend
*Invasive
To view locations of individual plant species or other features, open in Adobe Reader DC and click on the "Layers" tab on the left. Turn features on or off by clicking the "Eye" icons.
Collection Point
State Boat Launch
Transect Point
Water Data
Bathymetry (ft)
Arrowhead
Bur-reed
Cattail
Clasping-leaf pondweed
Common duckweed
Coontail
Eelgrass
Eurasian watermilfoil*
Fanwort*
Flat-leaf bladderwort
Floating bladderwort
Floating-leaf pondweed
Golden hedge-hyssop
Great duckweed
Humped bladderwort
Large-leaf pondweed
Lesser bladderwort
Little floating heart
Low watermilfoil
Mudmat
Phragmites*
Pickerelweed
Primrose-willow
Purple bladderwort
Quillwort
Ribbon-leaf pondweed
Robbins' pondweed
Slender naiad
Small pondweed
Snailseed pondweed
Spikerush
Swollen bladderwort*
Variable-leaf watermilfoil*
Water smartweed
Watermeal
Watershield
Waterwort
Western waterweed
White water lily
Yellow water lily
Esri, USDA Farm Service Agency


Pachaug Pond
Griswold, CT
817 Acres
Surveyed on August 12, 13, & 17, 2020
By Gregory Bugbee, Summer Stebbins, Maylani Velazquez, and Matthew Latella
Invasive Aquatic Plant Program
N
CAES
Feet
0
1,000
2,000
4,000
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T12
T15
Legend
To view locations of individual plant species or other features, open in Adobe Reader DC and click on the "Layers" tab on the left. Turn features on or off by clicking the "Eye" icons.
Collection Point
Transect Point
Water Data
State Boat Launch
Bathymetry (ft)
Bur-Reed
Cattail
Clasping-Leaf pondweed
Common reed*
Coontail
Eelgrass
Eurasian watermilfoil*
Fanwort*
Floating bladderwort
Floating-Leaf pondweed
Grassy arrowhead
Greater duckweed
Humped bladderwort
Large-Leaf pondweed
Leafy pondweed
Little floating heart
Low watermilfoil
Minor naiad*
Mudmat
Pickerelweed
Pondweed
Primrose-Willow
Purple bladderwort
Quillwort
Ribbon-Leaf pondweed
Robbins' pondweed
Slender naiad
Small pondweed
Snailseed pondweed
Spikerush
Variable-Leaf watermilfoil*
Water smartweed
Watershield
Waterwort
White water lily
Yellow water lily
*Invasive
Esri, USDA Farm Service Agency


Pachaug Pond
Griswold, CT
817 Acres
Surveyed July 30-31 and August 1-2, 2019
By Greg Bugbee, Summer Stebbins, Deanna Rackie, and Michael Modica
Invasive Aquatic Plant Program
N
CAES
Feet
0
1,000
2,000
4,000
T 1
T 2
T 3
T 4
T 5
T 6
T 7
T 8
T 9
T 10
Legend
To view locations of individual plant species or other features, open in Adobe Reader DC and click on the "Layers" tab to the left. Turn features on or off by clicking the "Eye" icons.
State Boat Launch
Secchi
Collection Point
Transect Point
Water Data
Bathymetry (ft)
Arrowhead
Bur-reed
Cattail
Clasping-leaf pondweed
Common bladderwort
Common duckweed
Common reed
Coontail
Eelgrass
Eurasian watermilfoil*
Fanwort*
Floating bladderwort
Floating-leaf pondweed
Great duckweed
Humped bladderwort
Large-leaf pondweed
Leafy pondweed
Little floating heart
Marsh primrose-willow
Minor naiad*
Mudmat
Pickerelweed
Purple bladderwort
Ribbon-leaf pondweed
Robbins' pondweed
Slender naiad
Snailseed pondweed
Spikerush
Variable watermilfoil*
Water smartweed
Watershield
Waterwort
Western waterweed
White water lily
Yellow water lily
*Invasive
Esri, USDA Farm Service Agency


Pachaug Pond
Griswold, CT
817 acres
Surveyed August 15-17, 21 & 23, 2018
By Summer Stebbins
and Riley Doherty
Invasive Aquatic Plant Program
N
CAES
0 5001,000 2,000 Feet
Legend
To view locations of individual plant species or other features, click on "Layers" tab to the left. Turn features on or off by clicking the "eye" icons.
DEEP Boat Launch
Water Data
Water Quality Measured
Brasenia schreberi
Cabomba caroliniana*
Ceratophyllum demersum
Elatine spp.
Eleocharis spp.
Elodea nuttallii
Glossostigma cleistanthum*
Gratiola aurea
Isoetes spp.
Ludwigia spp.
Myriophyllum heterophyllum*
Myriophyllum humile
Myriophyllum spicatum*
Najas minor*
Najas flexilis
Nuphar variegata
Nymphaea odorata
Nymphoides cordata
Phragmites australis*
Polygonum amphibium
Pontederia cordata
Potamogeton amplifolius
Potamogeton bicupulatus
Potamogeton epihydrus
Potamogeton foliosus
Potamogeton natans
Potamogeton robbinsii
Sagittaria spp.
Spirodela polyrhiza
Utricularia gibba
Utricularia macrorhiza
Utricularia minor
Utricularia purpurea
Vallisneria americana
*Invasive
Esri, USDA Farm Service Agency


Pachaug Pond
Griswold, CT
817 acres
Surveyed September 7-9, 2017
by Gregory Bugbee,
Amanda Massa and Abigail Wiegand
Invasive Aquatic Plant Program
CAES
N
Kilometers
0 0.2 0.4 0.8
T5
T4
T7
T10
T6
T8
T2
T1
Legend
To view locations of individual plant species or other features, click on "Layers" tab to the left. Turn features on or off by clicking the "eye" icons.
Plant Collection
Transect Points
Secchi Measurment
Water Data
Brasenia schreberi
Cabomba caroliniana*
Ceratophyllum demersum
Eleocharis species
Glossostigma cleistanthum*
Gratiola aurea
Ludwigia palustris
Myriophyllum heterophyllum*
Myriophyllum humile
Myriophyllum spicatum*
Najas flexilis
Najas minor*
Nuphar microphylla
Nuphar variegata
Nymphaea odorata
Phragmites australis*
Polygonum amphibium
Pontederia cordata
Potamogeton amplifolius
Potamogeton bicupulatus
Potamogeton epihydrus
Potamogeton foliosus
Potamogeton natans
Potamogeton perfoliatus
Potamogeton robbinsii
Sagittaria species
Sparganium species
Typha species
Utricularia gibba
Utricularia macrorhiza
Utricularia purpurea
Vallisneria americana
Wolffia brasiliensis
*invasive

Transect Data

Appendix Pachaug Pond Transect Data (1 of 2)

Transect	Point	Distance from Shore (m)	Surveyor	Latitude	Longitude	Date	Depth (m)	Substrate	Brasch	CabCar	CerDem	ElaSp	EleSp	EloNut	GloCle	GraAur	IsoSp	LudSp	MyrHet	MyrHum	MyrSpi	NajFle	NajMin	NupVar	NymOdo	NymCor	PhrAus	PolAmp	PonCor	PotAmp	PotBic	PotEpi	PotNat	PotPer	PotRob	SagSp	SpaSp	SpiPol	UtrGib	UtrInf	UtrInt	UtrMac	UtrPur	UtrRad	ValAme
1	1	0.5	Greg Bugbee	41.54862	-71.90053	8/10/2023	0.5	Gravel	0	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
1	2	5	Greg Bugbee	41.54867	-71.90051	8/10/2023	1.5	Muck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
1	3	10	Greg Bugbee	41.54871	-71.90052	8/10/2023	1.8	Muck	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3
1	4	20	Greg Bugbee	41.54879	-71.90047	8/10/2023	1.5	Gravel	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3
1	5	30	Greg Bugbee	41.54889	-71.90043	8/10/2023	2.1	Muck	0	3	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
1	6	40	Greg Bugbee	41.54898	-71.90039	8/10/2023	1.8	Muck	0	2	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3
1	7	50	Greg Bugbee	41.54907	-71.90037	8/10/2023	2.0	Muck	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	2	2	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
1	8	60	Greg Bugbee	41.54915	-71.90035	8/10/2023	2.0	Muck	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
1	9	70	Greg Bugbee	41.54926	-71.90034	8/10/2023	2.0	Muck	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1	10	80	Greg Bugbee	41.54935	-71.90026	8/10/2023	2.1	Muck	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2	1	0.5	Greg Bugbee	41.55313	-71.90134	8/10/2023	0.2	Sand	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	5	Greg Bugbee	41.55317	-71.90133	8/10/2023	1.0	Sand	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2	3	10	Greg Bugbee	41.55320	-71.90128	8/10/2023	1.0	Sand	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	4	20	Greg Bugbee	41.55324	-71.90115	8/10/2023	1.8	Sand	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
2	5	30	Greg Bugbee	41.55327	-71.90102	8/10/2023	1.8	Organic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
2	6	40	Greg Bugbee	41.55334	-71.90095	8/10/2023	2.4	Organic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
2	7	50	Greg Bugbee	41.55334	-71.90082	8/10/2023	2.6	Organic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
2	8	60	Greg Bugbee	41.55337	-71.90068	8/10/2023	2.7	Organic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	4
2	9	70	Greg Bugbee	41.55338	-71.90057	8/10/2023	2.7	Organic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	4
2	10	70	Greg Bugbee	41.55340	-71.90044	8/10/2023	2.7	Organic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
3	1	0.5	Greg Bugbee	41.55961	-71.90740	8/10/2023	0.2	Muck	0	0	0	0	0	1	0	0	0	1	2	0	2	0	2	0	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0
3	2	5	Greg Bugbee	41.55962	-71.90734	8/10/2023	0.2	Muck	0	3	2	0	2	0	0	0	0	0	2	0	3	0	0	0	2	0	0	0	2	0	0	0	2	0	0	0	2	0	0	2	0	0	0	0	0
3	3	10	Greg Bugbee	41.55962	-71.90729	8/10/2023	1.2	Muck	0	3	2	0	0	0	0	0	0	0	0	0	3	0	0	0	4	0	0	0	2	0	0	0	2	0	0	0	0	2	0	2	0	0	0	0	0
3	4	20	Greg Bugbee	41.55953	-71.90723	8/10/2023	1.3	Muck	0	2	2	0	0	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	2	2	0	0	0	0	2	0	0	0	0	0	0	0
3	5	30	Greg Bugbee	41.55944	-71.90719	8/10/2023	1.8	Muck	0	2	2	0	0	0	0	0	0	0	3	0	2	0	0	0	2	0	0	2	2	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0
3	6	40	Greg Bugbee	41.55936	-71.90710	8/10/2023	1.5	Muck	0	2	2	0	0	2	0	0	0	0	3	0	2	0	0	3	2	0	0	2	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0
3	7	50	Greg Bugbee	41.55928	-71.90703	8/10/2023	1.3	Muck	0	2	0	0	0	0	0	0	0	0	2	0	2	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0
3	8	60	Greg Bugbee	41.55918	-71.90701	8/10/2023	1.2	Muck	0	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	4	0	0	3	2	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0
3	9	70	Greg Bugbee	41.55910	-71.90696	8/10/2023	1.5	Bedrock	0	2	0	0	0	0	0	0	0	2	2	2	2	0	3	0	2	0	0	0	1	0	2	2	0	0	0	0	0	0	0	0	0	2	0	0	2
3	10	80	Greg Bugbee	41.55901	-71.90693	8/10/2023	0.4	Bedrock	0	2	0	0	0	0	0	0	0	1	2	2	2	0	2	0	1	0	0	0	2	0	1	2	0	0	0	2	0	0	0	2	0	0	0	0	2
4	1	0.5	Greg Bugbee	41.57230	-71.92113	8/11/2023	0.3	Sand	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4	2	0.5	Greg Bugbee	41.57233	-71.92108	8/11/2023	1.0	Sand	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
4	3	10	Greg Bugbee	41.57232	-71.92101	8/11/2023	1.2	Sand	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4	4	20	Greg Bugbee	41.57232	-71.92088	8/11/2023	1.5	Sand	0	0	0	0	2	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	5	30	Greg Bugbee	41.57233	-71.92077	8/11/2023	1.9	Sand	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	6	40	Greg Bugbee	41.57231	-71.92065	8/11/2023	2.6	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4	7	50	Greg Bugbee	41.57233	-71.92052	8/11/2023	3.2	Silt	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4	8	60	Greg Bugbee	41.57233	-71.92038	8/11/2023	3.5	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	9	70	Greg Bugbee	41.57235	-71.92028	8/11/2023	3.6	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	10	80	Greg Bugbee	41.57237	-71.92016	8/11/2023	3.7	Silt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	0.5	Greg Bugbee	41.57788	-71.91824	8/11/2023	0.3	Sand	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	3	0	0	2	0	0	0	2	0	0	0	0	0	0	0	2	0
5	2	5	Greg Bugbee	41.57787	-71.91828	8/11/2023	1.0	Muck	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0	0	0	2	0	0	0	2	2
5	3	10	Greg Bugbee	41.57785	-71.91834	8/11/2023	1.2	Sand	0	2	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	2	3
5	4	20	Greg Bugbee	41.57781	-71.91842	8/11/2023	1.2	Sand	0	0	0	0	2	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	2	0	0	0	0	3
5	5	30	Greg Bugbee	41.57776	-71.91853	8/11/2023	1.3	Organic	0	0	0	0	0	0	0	0	0	0	2	0	1	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	2	0	0	3
5	6	40	Greg Bugbee	41.57775	-71.91869	8/11/2023	1.1	Organic	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	3
5	7	50	Greg Bugbee	41.57774	-71.91879	8/11/2023	1.5	Organic	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	4
5	8	60	Greg Bugbee	41.57775	-71.91893	8/11/2023	1.5	Organic	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	3
5	9	70	Greg Bugbee	41.57770	-71.91903	8/11/2023	1.5	Organic	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	3
5	10	80	Greg Bugbee	41.57769	-71.91918	8/11/2023	1.5	Organic	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	2	3

Appendix Pachaug Pond Transect Data (2 of 2)

Transect	Point	Distance from Shore (m)	Surveyor	Latitude	Longitude	Date	Depth (m)	Substrate	BraSch	CabCar	CerDem	ElaSp	EleSp	EloNut	GloCle	GraAur	IsoSp	LudSp	MyrHet	MyrHum	MyrSpi	NajFle	NajMin	NupVar	NymOdo	NymCor	PhrAus	PolAmp	PonCor	PotAmp	PotBic	PotEpi	PotNat	PotPer	PotRob	SagSp	SpaSp	SpiPol	UtrGib	UtrInf	UtrInt	UtrMac	UtrPur	UtrRad	ValAme
6	1	0.5	Greg Bugbee	41.57429	-71.91058	8/10/2023	0.2	Sand	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	2	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0
6	2	5	Greg Bugbee	41.57433	-71.91053	8/10/2023	0.5	Sand	0	0	0	0	4	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	0	0	0	0
6	3	10	Greg Bugbee	41.57437	-71.91049	8/10/2023	0.6	Sand	0	0	0	0	4	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3	0	0	0	0	0
6	4	20	Greg Bugbee	41.57442	-71.91039	8/10/2023	0.7	Sand	2	0	0	0	4	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
6	5	30	Greg Bugbee	41.57448	-71.91029	8/10/2023	0.6	Sand	2	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
6	6	40	Greg Bugbee	41.57453	-71.91017	8/10/2023	0.6	Sand	3	0	0	0	3	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	2
6	7	50	Greg Bugbee	41.57459	-71.91012	8/10/2023	1.0	Sand	2	0	0	0	3	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	3	0	0	0	2	3
6	8	60	Greg Bugbee	41.57463	-71.91001	8/10/2023	1.0	Sand	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	3	0	0	0	0	3
6	9	70	Greg Bugbee	41.57468	-71.90994	8/10/2023	1.0	Sand	0	0	0	0	2	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0
6	10	80	Greg Bugbee	41.57474	-71.90983	8/10/2023	12.0	Sand	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0
7	1	0.5	Greg Bugbee	41.56804	-71.90046	8/11/2023	0.1	Gravel	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
7	2	5	Greg Bugbee	41.56798	-71.90048	8/11/2023	1.0	Gravel	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	2
7	3	10	Greg Bugbee	41.56794	-71.90048	8/11/2023	1.0	Sand	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
7	4	20	Greg Bugbee	41.56784	-71.90052	8/11/2023	1.2	Sand	0	0	0	0	0	2	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
7	5	30	Greg Bugbee	41.56778	-71.90052	8/11/2023	1.2	Organic	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
7	6	40	Greg Bugbee	41.56768	-71.90055	8/11/2023	1.3	Organic	0	0	0	0	0	2	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
7	7	50	Greg Bugbee	41.56757	-71.90057	8/11/2023	1.3	Organic	0	0	0	0	0	2	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
7	8	60	Greg Bugbee	41.56748	-71.90056	8/11/2023	1.4	Organic	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
7	9	70	Greg Bugbee	41.56739	-71.90058	8/11/2023	1.6	Organic	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
7	10	80	Greg Bugbee	41.56729	-71.90055	8/11/2023	1.6	Organic	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
8	1	0.5	Greg Bugbee	41.55692	-71.89724	8/11/2023	0.2	Organic	0	2	0	2	3	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	1	0	1	0	3	2	0	0	0	0	0	0	2	2
8	2	5	Greg Bugbee	41.55689	-71.89723	8/11/2023	0.6	Organic	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	0	0	3	0	0	0	0	0	2	0	0	0	3	0	0	0	0	0	0	0	2	2
8	3	10	Greg Bugbee	41.55685	-71.89719	8/11/2023	1.0	Organic	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	0	0	0	2	0	0	0	3	0	0	0	0	0	0	0	2	2
8	4	20	Greg Bugbee	41.55678	-71.89706	8/11/2023	1.1	Organic	2	0	0	0	0	0	0	0	0	0	0	0	2	3	0	2	2	3	0	0	0	0	0	2	0	0	0	3	2	0	0	0	0	0	0	2	2
8	5	30	Greg Bugbee	41.55671	-71.89698	8/11/2023	1.5	Organic	2	2	0	0	0	0	0	0	0	0	2	0	2	0	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
8	6	40	Greg Bugbee	41.55664	-71.89691	8/11/2023	1.5	Organic	1	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
8	7	50	Greg Bugbee	41.55660	-71.89679	8/11/2023	1.6	Organic	1	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
8	8	60	Greg Bugbee	41.55653	-71.89670	8/11/2023	1.4	Organic	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
8	9	70	Greg Bugbee	41.55649	-71.89660	8/11/2023	1.6	Organic	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
8	10	80	Greg Bugbee	41.55643	-71.89651	8/11/2023	1.5	Organic	2	2	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
9	1	0.5	Greg Bugbee	41.54941	-71.89511	8/11/2023	1.0	Gravel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	2	5	Greg Bugbee	41.54944	-71.89513	8/11/2023	1.5	Organic	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	2	2
9	3	10	Greg Bugbee	41.54948	-71.89515	8/11/2023	1.8	Organic	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	2	2
9	4	20	Greg Bugbee	41.54956	-71.89523	8/11/2023	2.0	Organic	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	2
9	5	30	Greg Bugbee	41.54964	-71.89531	8/11/2023	2.0	Organic	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	2
9	6	40	Greg Bugbee	41.54971	-71.89537	8/11/2023	2.0	Organic	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	2
9	7	50	Greg Bugbee	41.54978	-71.89545	8/11/2023	2.0	Organic	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
9	8	60	Greg Bugbee	41.54986	-71.89552	8/11/2023	2.0	Organic	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
9	9	70	Greg Bugbee	41.54994	-71.89555	8/11/2023	2.0	Organic	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
9	10	80	Greg Bugbee	41.55006	-71.89557	8/11/2023	2.3	Organic	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
10	1	0.5	Greg Bugbee	41.56551	-71.91494	8/10/2023	0.5	Organic	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3	0	3	0	2	0	0	0	0	0	0	2	3	2	0	2	0	0	0	0	0
10	2	5	Greg Bugbee	41.56547	-71.91490	8/10/2023	0.5	Sand	2	0	0	0	4	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
10	3	10	Greg Bugbee	41.56544	-71.91483	8/10/2023	1.0	Organic	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	4	0	0	2	2	0	0	0	0	2
10	4	20	Greg Bugbee	41.56541	-71.91472	8/10/2023	1.3	Organic	2	0	0	0	3	0	0	0	0	0	0	0	2	0	0	2	2	0	0	2	0	0	0	0	0	0	0	3	0	0	0	2	0	0	0	0	3
10	5	30	Greg Bugbee	41.56532	-71.91467	8/10/2023	1.6	Organic	0	0	0	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	0	0	0	2
10	6	40	Greg Bugbee	41.56528	-71.91454	8/10/2023	1.7	Organic	0	0	0	0	2	1	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
10	7	50	Greg Bugbee	41.56521	-71.91446	8/10/2023	1.8	Organic	0	0	0	0	2	0	0	0	0	0	0	0	2	0	2	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
10	8	60	Greg Bugbee	41.56515	-71.91438	8/10/2023	1.8	Organic	0	0	0	0	2	2	0	0	0	0	0	0	2	0	2	2	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	4
10	9	70	Greg Bugbee	41.56510	-71.91428	8/10/2023	1.8	Organic	0	0	0	0	0	0	0	0	0	0	0	0	3	2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
10	10	80	Greg Bugbee	41.56508	-71.91414	8/10/2023	2.0	Organic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0	0	0