Hickory Hills Lake and Little Hickory Lake

2018 Vegetation Assessment and Water Quality Evaluation Report

SŌLITUDE LAKE MANAGEMENT

590 Lake St.
Shrewsbury, MA 01545
Phone: 508-865-1000
www.solitudelakemanagement.com

Contents

2018 Vegetation Assessment and Water Quality Evaluation Report

Hickory Hills Lake
Lunenburg, Massachusetts

Introduction

SŌLitude Lake Management (SŌLitude) was contracted by the Lake Management Group to assess the macrophyte growth extent at Hickory Hills Lake, with emphasis on fanwort (*Cabomba caroliniana*) distribution, in addition to investigating current water quality conditions. Fanwort has been managed at the lake since 2011, utilizing various strategies to mitigate the spread of fanwort. The focus of this assessment was to better understand the current extent of the non-native and native plant assemblage.

Site Description

Hickory Hills Lake is an approximately 314-acre impounded waterbody with a maximum depth of 20 feet and an average depth of 8.9 feet. The shoreline shape is irregular, and encompasses over 9 linear miles with a multitude of shallow coves that support abundant plant growth. Mulpus Brook is the primary inlet to the lake, where sediment deposits have accumulated to create a 'delta' of dense emergent and floating-leaf vegetation. Numerous smaller inlets also flow into the lake.

The outlet structures are located at the southeast corner of the lake and consist of an approximately 100-foot concrete spillway and nine 6-ft wide and 18-in deep stop-log bays. Additional water level control is supplied by a low-level gate valve. The outlet continues eastward as Mulpus Brook and through a series of small ponds and wetlands before emptying into the Nashua River.

The following report will discuss: methodology, vegetation assemblage and Phragmites management, water quality & sediment conditions, and management recommendations concentrated on nutrient remediation.

Methodology

Point Intercept Macrophyte Mapping

The Point Intercept Method (PIM) of sampling macrophytes is designed to determine the extent of aquatic growth within an area of concern. The 206 sample sites visited were consistent with previous years – established by placing a georeferenced 80-m grid data layer over an orthophoto of Hickory Hills and Little Hickory Lakes and placing data collection sites at each vertex (Appendix B – Sample Location map). A handheld Garmin GPS unit was used to locate each data point in the field.

The point-intercept survey methodology allows for quantitative analysis of the present vegetation. The relative bottom cover and biomass were recorded for each plant species observed at each data point through the use of visual observation, underwater camera, or throw-rake. The throw-rake was not used in areas of known fanwort infestation or in locations where visible fanwort growth was observed. Percent cover is an estimate of the extent of growth per unit area for a certain species, and is determined from visual observations, not exact physical measurement. While a subjective measurement, percent cover is quantitative and can be reasonably accurate and consistent across the data points when used by an experienced surveyor.

While percent bottom cover gives a measurement of the proportion of lake bottom covered with plants, the parameter of biomass relates to the height and amount of growth in the water column. It is measured on a scale of 0-4, where:

- 0 No plants
- 1 Low-growing bottom cover
- 2 Growth halfway through the water column
- 3 Growth within 1-2 feet of surface
- 4 Growth at or near the surface

Water depth was also recorded through the use of an on-board depth finder at each sample location, when possible.

Macrophyte specimens not readily identifiable in the field were collected and bagged with corresponding sample site information. The collected vegetation samples were then placed in a cooler and transported to SŌLitude for further inspection and positive identification. Regionally appropriate taxonomic keys were used to identify the aquatic macrophytes to the lowest practical taxa – typically to species.

Visual Fanwort Survey

A visual survey was performed outside of the established PIM in order to document specific locations of the infestations and therefore guiding removal practices occurring on the lake. The on-board sonar system was used to determine areas of vegetation growth outside of the PIM survey area. At any locations of potential growth, an underwater camera was used to identify the growth with reduced potential for fragmenting and spread any fanwort growth, if present. Fanwort growth outside of the PIM were recorded with GPS locations and provided to the Hickory Hills LMG immediately following the completion of the survey (Appendix B – All Fanwort Locations map).

Water Quality Sampling

Water quality and algae samples were collected at three locations – one near the lake outlet, one from the Mulpus Brook inlet and one from Little Hickory Lake. Field measurement of temperature, dissolved oxygen, and water clarity were also performed at each sample location. One zooplankton sample was collected at the lake outlet station for identification/enumeration.

In 2018, additional samples were taken at the request of program stakeholders, specifically Total Phosphorus in Hemlock Beach and Proctor Cove and algae samples in Hemlock Beach, Turtle Cove, and Little Hickory Lake.

Results & Discussion

Vegetation Inventory

On July 13th and 16th, 2018 a two-biologist crew from SŌLitude conducted the point-intercept survey at Hickory Hills Lake. On the second day of the survey, the client requested that coves and areas containing fanwort not be navigated, and therefore sites within those locations were not accessed and are not reflected in the data: 13, 32-33, 40-41, 56-58, 78, and 188-189. Calculations were completed based on the 195 accessed sites.

Table 1 (below) lists the macrophytes that have been identified at Hickory Hills Lake (including Little Hickory Lake), and includes lake-wide cover and frequency of occurrence for each species since the 2012 survey. Lake-wide cover is calculated as an average percent for each species documented during the survey, whereas Frequency of Occurrence (FOC) is calculated from the presence of each species across the survey points. Raw data and respective maps are provided in Appendices A and B, respectively.

Table 1. Macrophyte Inventory and Occurrence at Hickory Hills Lake

Scientific Name	Common Name	Lake-wide Cover (Average %)				Frequency of Occurrence (%)			
		2012	2014	2016	2018	2012	2014	2016	2018
Brasenia schreberi	Watershield	2.40	1.70	1.15	0.90	13.8	10.5	5.34	6.15
Cabomba caroliniana	Fanwort	0	0	0.44	0.64	0	0	5.34	6.15
Ceratophyllum sp.	Coontail	0.10	0.10	0	0	0.50	1.00	0	0
Chara/Nitella	Macro-algae	18.7	9.8	20.7	10.7	52.4	46.9	31.6	40.0
Eleocharis sp.	Spikerush	1.10	0.40	0.32	0	1.10	1.90	2.91	0
Eriocaulon sp.	Pipewort	0	0	0.02	0.13	0	0	0.49	2.05
Fontinalis sp.	Aquatic Moss	0	0	0	0.03	0	0	0	0.51
Gratiola aurea	Golden Hedge-hyssop	0	0	0	0.15	0	0	0	2.05
Isoetes sp.	Quillwort	0.05	0	0	0	0.50	0	0	0
Lemna minor	Common Duckweed	0.02	0	0	0	0.50	0	0	0
Najas flexilis	Slender Naiad	0.48	1.60	0.93	2.99	21.6	13.9	4.37	17.4
Nuphar variegata	Yellow Waterlily	0.10	0	0.05	0.13	0.50	0	0.97	3.08
Nymphaea odorata	White Waterlily	0.88	1.00	1.61	0.52	6.70	9.10	3.40	6.15
Polygonum amphibium	Water Smartweed	0	0	0	0.08	0	0	0	1.03
Potamogeton amplifolius	Large-leaf Pondweed	1.50	2.60	1.70	1.73	19.0	24.9	18.0	17.9
Potamogeton bicupulatus	Snail-seed Pondweed	0.20	0.10	0	0	1.00	0.50	0	0
Potamogeton epihydrus	Ribbon-leaf Pondweed	1.30	0.70	1.70	0.46	15.2	8.10	14.6	8.21
Potamogeton natans	Floating-leaf Pondweed	0	0.20	0	0.13	7.60	3.80	0	2.05
Potamogeton oaksiensis	Oakes' Pondweed	0	0	0	0.05	0	0	0	1.03
Potamogeton pusillus	Small Pondweed	0.50	0.20	0.15	0.85	8.60	3.80	2.43	13.8
Potamogeton robbinsii	Robbin's Pondweed	6.80	9.40	12.8	9.41	75.4	62.7	47.1	32.8
Proserpinaca palustris	Mermaidweed	0.14	0.40	0.27	0.39	1.40	2.40	0.97	1.03
Sagittaria sp.	Submersed arrowhead	0.34	0.40	0	0	3.30	2.90	0	0

Schoenoplectus subterminalis	Grassy Bulrush	0	0	0	2.76	0	0	0	10.8
Utricularia intermedia	Flat-leaf Bladderwort	15.6	12.4	0.05	0.15	64.3	50.7	0.97	2.05
Utricularia gibba	Creeping Bladderwort			0.01	0.08			1.46	1.54
Utricularia minor	Lesser Bladderwort			0	0.03			0	0.51
Utricularia purpurea	Purple Bladderwort			9.80	8.12			43.7	39.5
Utricularia radiata	Little Floating Bladderwort			0.32	0.41			2.43	7.69
Utricularia vulgaris	Common Bladderwort			0.005	0.26			0.49	3.59
Vallisneria sp.	Tapegrass	8.20	10.8	20.3	11.3	37.1	44.5	48.5	36.9
Various	Filamentous Algae	4.35	0.80	0.29	0.07	11.9	6.70	1.94	2.05

*Bladderwort sp. category 2012-2014 was broken into individual species for 2016-2018.
Red colored text indicates non-native species

The 2018 survey documented 26 aquatic species – only one of which was non-native to the state of Massachusetts, fanwort (*Cabomba caroliniana*). Of the twenty-five (25) native macrophytes, eighteen (17) are submersed, one is classified as a bryophyte, six (6) are floating-leaf species, and two (2) are considered algae. Comparatively, only 20 aquatic species were documented in 2016.

The majority of the sample locations (86%) supported vegetation, where the lake supported an average richness of 2.7 species across the sample sites. The maximum richness was eleven species observed at Point 1, in the Hemlock Beach cove. Other sites supporting high richness were: Proctor Cove (Site 34), near Turtle Cove (Site 100), Mulpus Brook inlet and cove (Sites 190 & 197), and the inlet cove from Little Hickory Lake (Sites 203 & 206). Considering the low average richness compared to the high total number of species, few species are specific to certain areas of the lake such as coves and protected zones; the species are not evenly distributed across the lake.

Fanwort was documented at twelve (12) of the sample sites, similar to the 2016 survey. However, numerous locations were also observed outside of the point-intercept site locations (Appendix B – All Fanwort Locations map). Fanwort was also observed at an increased average percent cover when compared with the 2016 survey, suggesting that fanwort was observed at similar distribution but at an overall higher abundance than previous surveys.

Additional non-native plant growth was observed outside of the sample areas, most notably a moderate to dense patch of American lotus (*Nelumbo lutea*) at the shoreline adjacent to site 59 and scattered growth of pink waterlilies (*Nymphaea tuberosa*) in the Mulpus Brook inlet cove. Both species are not considered native to Massachusetts and are usually introduced through plantings rather than wildlife transport.

Macroalgae and purple bladderwort were the most commonly observed macrophytes assemblage at 37.9% and 37.4% occurrence, respectively (Table 1). Tapegrass and Robbin's pondweed were also commonly observed throughout the sample sites, at 35.0% and 31.1% respectively. While not the most common plant, tapegrass was supported at the highest average percent cover within the lake. Tapegrass appears to grow at higher abundance than macroalgae and purple bladderwort when observed in Hickory Hills Lake. A similar observation can be made when comparing Robbin's pondweed and purple bladderwort.

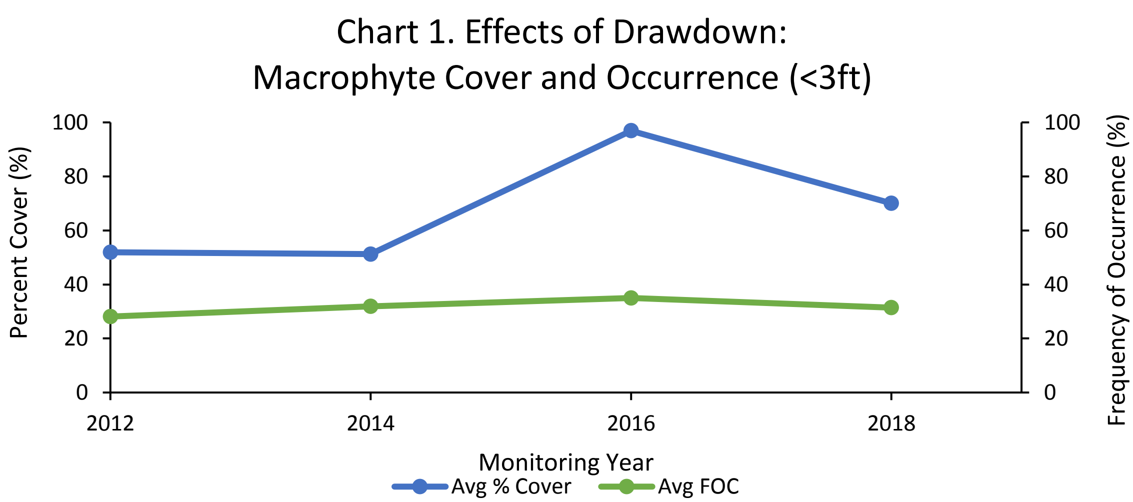
Excluding macroalgae, which is a low-growing, beneficial bottom cover, the lake exhibits an average of 42% plant cover across the survey area. Comparatively, 49% was observed in 2016 and 43% in 2014, and 40% in 2012. The average percent cover remains within a higher end of the ideal range of 20-40% but appears to be trending upwards over time.

Little Hickory Lake

The four sample points within Little Hickory Lake – 186, 187, 194, and 202 – have maintained Robbin's pondweed dominance. Lesser amounts of slender naiad, golden hedge-hyssop, creeping bladderwort, ribbon-leaf pondweed, purple bladderwort, large-leaf pondweed, and macro-algae were also supported in Little Hickory Lake. No fanwort was observed in Little Hickory Lake. A large algal bloom was noted concentrated on the surface of the northwestern portion of the basin – dying back, considering the bubbling of the surface mat. At the time of the survey, residents around the pond voiced concern for public safety in the event of a cyanobacteria bloom.

Effects of Drawdown

Multiple years of variable drawdown (1.5-3 feet) have been performed at Hickory Hills Lake since 2012. Based on observed water depths, eight sample sites from the point-intercept survey are located in areas potentially effected by drawdown (Chart 1). Frequency of Occurrence is calculated as an average of all occurrences of plants documented in the eight sample sites.



By compiling areas less than the extent of the drawdown (1.5 - 3 feet), data trends suggest that overall macrophyte growth is marginally affected. Frequency of Occurrence remains relatively consistent between the four survey years, and overall percent cover appears to be positively trending; plant growth appears to be at higher densities within areas of growth. Longer-term and frequent monitoring is required to determine impacts on fanwort cover and frequency of occurrence.

Water Chemistry and Plankton Sampling

Water chemistry samples were collected from the Outlet, Mulpus Brook, and Little Hickory on July 13th, 2018, which included algae samples and a zooplankton tow. An additional algae sampling was performed on August 7th, 2018 at Little Hickory Hemlock Beach, and Turtle Cove.

Water Chemistry

At the time of the sampling, all locations fell within acceptable ranges for multiple parameters: pH, Color, Turbidity, Conductivity, Total Kjeldahl Nitrogen, Total Phosphorus, Dissolved Phosphorus, Chlorophyll *a*, and E. coli (Table 2). However, some sample locations experienced elevated or concerning concentrations of Nitrate and Ammonia. Historically, Little Hickory Lake has also supported elevated levels of Total Phosphorus.

Table 2: Water Quality Sampling Results Collected 7/13/18

Parameter (unit)	Main Lake/Outlet	Mulpus Brook Cove	Little Hickory Lake	Proctor Cove	Hemlock Beach Cove
pH (SU)	7.2	7.3	7.2	7.0	7.7
True Color (Pt-Co)	14	14	15	--	--
Apparent Color (Pt-Co)	17	15	18	--	--
Turbidity (NTU)	0.49	0.61	0.64	0.87	0.84
Conductivity (umhos/cm)	160	160	330	--	--
Nitrate (mg/L)	ND at 0.100 mg/L	ND at 0.100 mg/L	ND at 0.100 mg/L	2.78	ND at 0.100 mg/L
Ammonia (mg/L)	ND at 0.075 mg/L	0.091	ND at 0.075 mg/L	--	--
Total Kjeldahl Nitrogen (mg/L)	0.357	0.539	0.527	--	--
Total Phosphorus (mg/L)	ND at 0.010 mg/L	ND at 0.010 mg/L	0.010	ND at 0.010 mg/L	0.014
Dissolved Phosphorus (mg/L)	ND at 0.010 mg/L	ND at 0.010 mg/L	ND at 0.010 mg/L	ND at 0.010 mg/L	ND at 0.010 mg/L
Chlorophyll *a* (mg/m3)	ND at 2.00 mg/m3	2.86	ND at 2.00 mg/m3	--	--
E. coli (MPN/100mL)	<1	3.1	38	--	--
Clarity (ft)*	8.5	To bottom – 3.7	To bottom – 4.5	--	--
Temperature (C)*	Chart 2	30.3	30.1	--	--
Dissolved Oxygen (mg/L)*	Chart 2	7.88	8.13	--	--

*Indicates in-situ measurement

Based off of the sampling locations, Hickory Hills Lake and Little Hickory Lake are considered 'clear' color and contain mostly dissolved organic matter (DOM). Minimally elevated turbidity measured in Proctor Cove and Hemlock Beach are likely due to the increased plant abundance and still fall within an appropriate range.

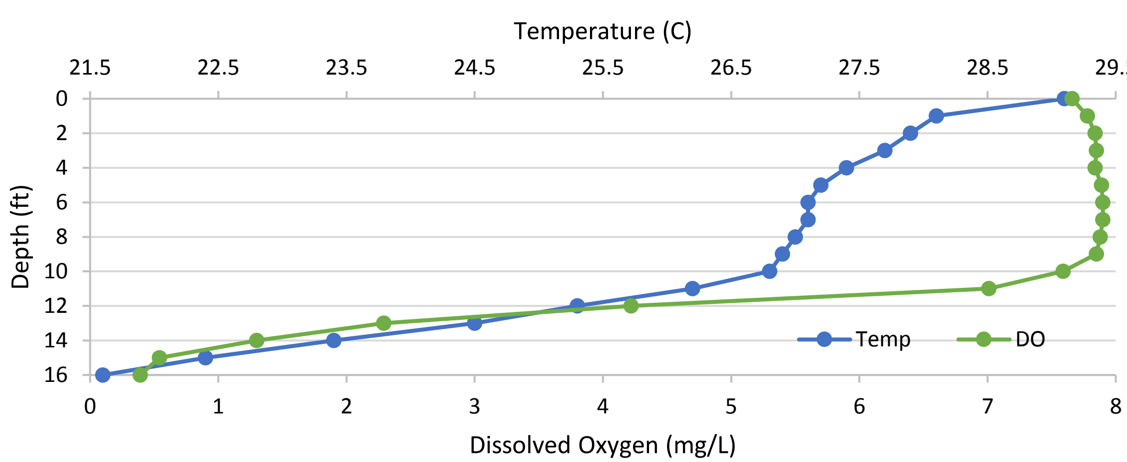
Nitrogen is a vital nutrient in a lake environment for plant and algae growth. Nitrogen exists in water as various compounds, with relative amounts of governed by such things as atmospheric influence, precipitation, biological activity, and water chemistry. A range of 2.0-6.0 mg/L of Total Nitrogen is considered acceptable.

Nitrate and Ammonia are two components of the overall nitrogen measurement. Nitrate is a form of nitrogen that is usually the most prevalent form of inorganic nitrogen in the water and results from things such as aerobic bacterial activity, fertilizer use, and air-water exchange. It is also the form that is most readily available for plant and algae growth. Levels of nitrate (as N) are ideal at <0.30 mg/L, *where Proctor Cove far exceeds that threshold at 2.78 mg/L. Such high levels are suggestive of inflowing effluent and high biological breakdown.*

Ammonia is a measure of two constituents, NH_3 and NH_4^+, and is a transitional product in the breakdown of organic nitrogen (from plants, waste, etc.) into nitrate. It is typically short-lived in the pond environment except under conditions of low dissolved oxygen. Waterbodies that have a high pH and temperature are susceptible to high ammonia concentrations; the higher the pH, the more ammonia will be present within the water column. External sources of ammonia include: fertilizer, wastewater effluent/discharge, animal waste, and runoff from agricultural lands. Levels higher than 0.100 mg/L can be problematic for aquatic biota, however, available dissolved oxygen, pH, and temperature are key factors in toxic levels of ammonia. *While Mulpus Brook sample location does not exceed the accepted threshold, the concentration is approaching a concerning level.*

The temperature of a waterbody is one of the limiting factors for algae and plant growth; as temperature increases, biological activity (photosynthesis, respiration, and decomposition) increases to a point. Temperature is directly related to the amount of available dissolved oxygen, where warmer water holds less oxygen. In deeper waterbodies, temperature stratification occurs; a thermocline occurs at depth where the top layer is warmer and actively exchanges gases with the air. The bottom layer is distinctly cooler and isolated from surface impacts. Turn-over, or mixing, typically occurs in spring and late fall; depending on the size and depth of the waterbody, turn-over can occur multiple times throughout a season. *At the time of the sampling, the Main Basin/Outlet profile appears to be weakly stratified at approximately 10 feet deep, if at all (Chart 2).*

Chart 2. Main Basin Temperature & Dissolved Oxygen Profiles



Dissolved oxygen is a crucial component of systems supporting aquatic fauna; organisms such as fish and zooplankton breath the water containing dissolved oxygen for survival. Oxygen enters the water through flow, atmosphere, and photosynthesizers (plants and algae). And, fluctuations in oxygen will occur based on the amount of photosynthesizers present in the water (more sunlight = more oxygen). However, with high volumes of plant and algae decay, dissolved oxygen is consumed and causes oxygen deficient environments (eutrophy, anoxia, etc). Dissolved oxygen is also inversely related to temperature, where high temperatures coincide with low dissolved oxygen.

Somewhat predictable levels of oxygen are available throughout the water column, where the dissolved oxygen can be measured vertically from surface to bottom for a profile. This profile can identify waterbody stratification and habitat availability for fish. Values above 5.0 mg/L are desirable for most aquatic life, including most fish species, however lower values commonly occur near the sediment layer where oxygen exchange is at a minimum. *The main basin experiences low oxygen levels after approximately 10 feet, the majority of the water column.*

The clarity at the outlet was approximately 8.5 feet, which is congruent with the majority of vegetation growth within the littoral zone. However, some plant growth (including macroalgae) occurs out to depths of 16-17, suggesting that the clarity of the lake is typically deeper.

Historical Comparison

Comparatively, water quality at the Hickory Hills Lake outlet appears to be relatively consistent year-over-year (Table 3).

Table 3: Historical Main Lake Station Water Quality Sampling Results

Parameter (unit)	2018	2016	2014	2012	2010	2008	2006	2003
pH (SU)	7.2	6.9	6.8	6.53	7.14	6.91	6.28	7.4
Alkalinity (mg CaCO3/mL)	NS	12	10	14.5	10.6	8.6	11	11
Turbidity (NTU)	0.49	1.1	0.64	0.490	0.48	0.43	0.75	0.61
Conductivity (umhos/cm)	160	190	170	117	NS	NS	NS	NS
Nitrate (mg/L)	ND at 0.100 mg/L	ND at 0.050 mg/L	ND at 0.050 mg/L	ND at 0.100 mg/L	ND at 0.100 mg/L	ND at 0.100 mg/L	0.12	0.22
Ammonia (mg/L)	ND at 0.075 mg/L	0.056	0.10	ND at 0.100 mg/L	ND at 0.050 mg/L	NS	NS	ND at 0.020 mg/L
Total Kjeldahl Nitrogen (mg/L)	0.357	0.37	ND at 0.050 mg/L	0.200	NS	NS	NS	NS
Total Phosphorus (mg/L)	ND at 0.010 mg/L	ND at 0.010 mg/L	0.012	ND at 0.010 mg/L	ND at 0.010 mg/L	ND at 0.020 mg/L	0.007	0.013
Dissolved Phosphorus (mg/L)	ND at 0.010 mg/L	ND at 0.010 mg/L	0.007	ND at 0.010 mg/L	NS	NS	NS	NS
Chlorophyll *a* (mg/m3)	ND at 2.00 mg/m3	NS	NS	ND at 0.100 mg/m3	NS	NS	NS	NS
True Color (Pt-Co)	14	10	10	10	8	14	0	16
Apparent Color (Pt-Co)	17	20	10	10	10	20	34	24
E. coli (MPN/100mL)	<1	<10	<10	10	NS	NS	NS	NS

NS – Not Sampled
ND – Non-detect

Results for all parameters show relatively stable levels over the sampling period, with no discernable trends apparent. Any fluctuations over time can be attributed to sampling date and time, in addition to relative storm/rain events and general weather conditions. Samplings such as this provide a snapshot of water quality, and should be analyzed with the understanding that seasonal and diel fluctuations are not captured. Moreover, fluctuations and areas of potential impairment within the lake, such as coves, are not captured within this type of sampling.

Regarding the biannual temperature and dissolved oxygen profiles since 2012, long-term (seasonal) stratification may not occur at Hickory Hills Lake, and the lake may mix multiple times throughout the year. Primarily, this suggests overall warmer water temperatures which can be influential in the production within the lake (e.g. fishery, plant growth, algae growth). Since only one deep-water profile has been completed during each monitoring year, more frequent temperature and dissolved oxygen monitoring would be crucial in founding these implications and further understanding the cycling of the lake.

Algae and Zooplankton

Both zooplankton and algae were collected on July 13, 2018 simultaneous as the vegetation survey and water chemistry sampling. An additional algae sampling was performed on August 7th, 2018 due to concerns of heightened algae growth, with special regard to isolated cyanobacteria blooms. Full reports for algae and zooplankton can be found in Appendix C. Low algae counts were observed at all sample locations at all dates (Table 4).

Table 4: Algae (phytoplankton) Identification and Enumeration

Parameter (unit)	Hickory Hills Lake (Composite)	Little Hickory Lake		Hemlock Beach	Turtle Cove
	7/13/18	7/13/18	8/7/18	8/7/18	8/7/18
Total Natural Unit	178	840	1692	1435	805
Cyanobacteria (Cell/mL)	1024	2900	2030	4580	5860
Non-cyanobacteria Natural Unit	107	525	1517	1050	280
Prominent Species	Cyclotella (Diatom) Microcystis (Cyano)	Ulothrix (Green) Oscillatoria (Cyano)	Melosira Cyclotella (Diatom)	Ulothrix (Green) Cyclotella (Diatom)	Cyclotella (Diatom) Chroococcus (Cyano) Gomphosphaeria (Cyano) Microcystis (Cyano)
Species Richness	8	6	13	11	7

Diatoms and green algae were most prevalent in all samples of Hickory Hills Lake and Little Hickory Lake; however, cyanobacteria species were still present and based on individual species counts, can be considered prominent as well. Considering EPA and MA DEP standards, cell count for cyanobacteria was low and non-concerning for both sample dates across all respective locations. It is likely that bloom periods may occur for various species outside of the sample dates and/or locations. Considering the decaying mat of algae present in Little Hickory Lake at the time of the first sampling, the respective sampling likely occurred post-bloom.

One zooplankton sample was collected from Hickory Hills Lake, using a tow method. A cylindrical net with an 80-um mesh aperture was dragged along the 30m of surface water, resulting in a concentrated sample representing the zooplankton. Samples were examined under a microscope to determine genera presence and abundance through enumeration (Figure 2). The preserved samples were analyzed by a SŌLitude Biologist.

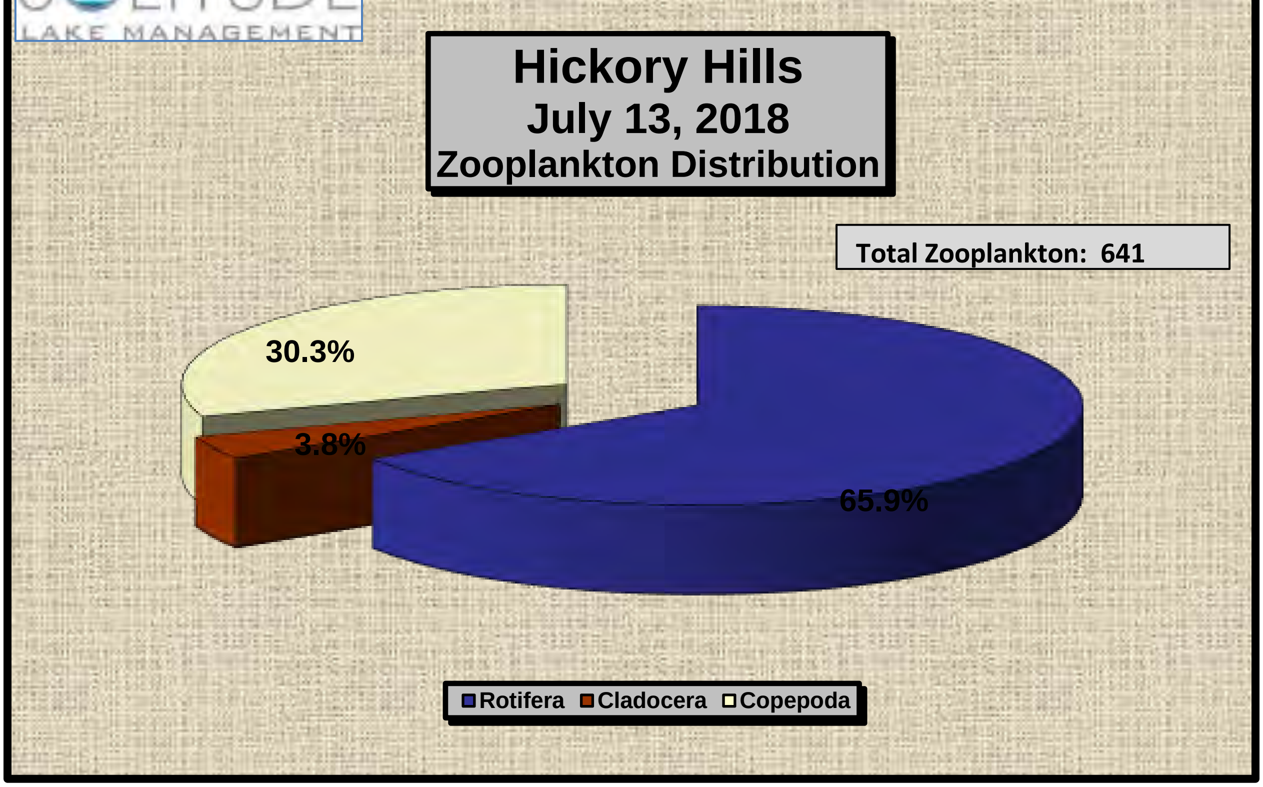


Figure 2. 2018 Zooplankton Abundance

The sample contained 641 organisms per liter, which is a higher density than collected in 2016. Rotifera was the highest abundance group representing nearly 66% of the total species recorded, followed by Copepoda (30%) and Cladocera (4%). The dominant zooplankton recorded from the 2018 sampling was *Keratella*. Commonly, rotifers are the most dominant group in freshwater systems, and find eutrophic conditions favorable. Rotifers can be used as biological indicators as they respond to environmental changes. Cladocera and Copepoda are generally larger in size and are primary targets for fish predation; lower abundance of the Cladocera and Copepoda may also be allowing greater growth of smaller species such as the Rotifera.

Comparatively, the Copepoda was dominant in both 2014 and 2016 samplings. 2012 also experienced dominant Rotifera. In general, changes in dominance are dependent on food availability and predation; zooplankton cycle sinuously throughout the year, where species composition is a factor of food and predation. For example, copepods are typically omnivorous and consume organisms ranging in size from mosquito larvae to suspended organic particulates (including phytoplankton). If copepod abundance is high enough, other zooplankton are often out-competed.

Overall, zooplankton species distribution and abundance in Hickory Hills Lake are influenced by various environmental factors. Further understanding of zooplankton population dynamics would require additional sampling locations at multiple times throughout the season.

Summary of Findings

- 26 species were documented during the vegetation survey, of which fanwort was the only non-native species. Two non-native species were noted outside the survey area: American lotus and pink waterlilies.
- The low average richness compared to the high overall richness indicates the species are not evenly distributed across the littoral zone.
- Fanwort was located throughout the lake, at an overall higher abundance and distribution than previous surveys.
- Macroalgae and purple bladderwort were most common, but tapegrass was the most abundant. Similarly, Robbin's pondweed was also less common but more abundant than purple bladderwort.
- Robbin's pondweed remains the dominant macrophyte in Little Hickory Lake.
- Large, dying algae bloom noted in the northwestern portion of the Little Hickory basin.
- Effects of drawdown are inconclusive; however, plants may be growing at higher densities within the affected areas of growth.
- General water quality fell within acceptable limits. High levels of nitrate in Proctor cove are suggestive of effluent and high biomass breakdown.
- The main basin water quality appears stable over time; however, the sampling omits potential seasonal and diel fluctuations in addition to impairment within other areas of the lake.
- Weak lake stratification is apparent in the deepest portion of the lake, which can be beneficial for a warm water fishery. However, eutrophic conditions can also be promoted.
- Algae counts were low at all dates at all sites. Green algae, diatoms, and cyanobacteria were often dominant,
- Zooplankton distribution appeared typical, with dominance of Rotifera. Eutrophic conditions are generally preferred by the dominant groups of Hickory Hills Lake.

Management Recommendations

Aquatic plants are an important component of a lake's ecosystem, and provide valuable fish and wildlife habitat. Current literature supports that an overall cover of 20-40% is ideal for warm water fisheries such as Hickory Hills Lake. Excluding macroalgae, which is a low-growing, beneficial bottom cover, the lake exhibits an average of 42% cover across the survey area. This is similar to previous survey years and remains at the higher end of the ideal range. Non-native species are also not considered suitable habitat and are generally considered a threat to the ecosystem.

Non-native species like fanwort or American lotus should be actively managed in order to limit their population and spread in the lake and to minimize adverse effects on native flora and fauna. In some cases, managing native species may also be necessary when present in excess. The most common plants in the lake are native species, but can become a nuisance under promoting growth conditions. Residence have expressed concern about the abundance of growth of both fanwort and other native species (bladderwort, tapegrass, Robbin's pondweed, and waterlilies) within areas of lake. Primarily, coves and high-use areas are notably concerning. Plant abundance can vary from year to year based on numerous environmental factors such as water clarity, temperature, water level, and other climatic patterns and conditions.

In consequence, algae and zooplankton populations can experience fluctuations in population based on the same environmental factors. Short life cycles paired with available nutrients allow for bloom events which can be problematic for ecosystem balance, in addition to a potential human and wildlife health hazard depending on the species causing the bloom. Cyanobacteria species are the primary culprit for concern.

Considering the presence of fanwort, localized areas of American lotus and nuisance growth, and previously documented algae blooms, there are a number of in-lake management techniques that may be appropriate for Hickory Hills Lake. A management plan should also include monitoring to document the condition of the lake, guide and evaluate the program, and identify any changes or new infestations of non-native species (e.g. 2018 American lotus infestation).

Drawdown

Variable levels of drawdown have been utilized at Hickory Hills Lake, ranging between 18 inches and 3 feet. While drawdown is not likely to be a stand-alone solution for fanwort due to its depth of growth, an increased depth of drawdown could provide an improved degree of nuisance plant control along the exposed shoreline (higher-use) areas of the lake providing a sufficient volume of water remains to support fish and wildlife populations through the winter

Previous reports have gone into more detail on potential drawdown recommendations and we understand that the Lake Management Group has recently pursued a deeper drawdown with regulatory agencies.

Hand-harvesting & Diver-assisted Suction Harvesting (DASH)

Hand-harvesting or DASH can be appropriately used for infestations that are sporadic and thinly-spread across large areas of growth. The efficiency and efficacy of these control strategies often limit their application to newly discovered, pioneer infestations, or as follow-up to a larger infestation management strategy such as chemical treatment or extensive drawdown.

The LMG has expended considerable effort with these and other activities over the years. The few American lotus plants can also be manually removed, with care taken to remove the entire tuberous root system. With the continued expansion of fanwort in the lake, a point may be reached where these techniques are no longer feasible, however, with their extensive, direct experience this determination is best made by the LMG.

Herbicide Treatment

Several USEPA/State registered herbicides are available for localized control of the plants and algae present in Hickory Hills Lake and Little Hickory Lake. Herbicide and algaecide selection is based on the target plants and configuration of the treatment area.

If the LMG determines that DASH is no longer meeting their goals for fanwort management or in the event of nuisance algal growth, we recommend considering the use of herbicides and algaecides as needed in Hickory Hills Lake. Desirable densities of native species are maintained in Little Hickory Lake, with the most recent Sonar (fluridone) treatment performed in 2013. The following table describes the active ingredients available for use in lakes and ponds.

Table 5: Aquatic Herbicide Matrix

Active Ingredient	Trade Names	Plants Controlled	Irrigation Restriction Label
Copper (algaecides & herbicides)	Copper sulfate; K-Tea; Cutrine Plus; Captain; Komeen, Nautique	Algae – filamentous & microscopic; curlyleaf pondweed other submersed	None
Sodium Carbonate Peroxyhydrate	Phycomycin; GreenClean	Algae – filamentous & microscopic	None
Diquat	Reward	Milfoil & other submersed plants; duckweed & watermeal	3-5 days
Endothall	Aquathol K (herbicide); Hydrothol 191 (algaecide)	Pondweeds and algae	7-14 days
Fluridone	Sonar & generics	Watermeal, duckweed, milfoil, fanwort and other submersed plants	30-day min (often 60-90 days with multiple applications
Glyphosate	Rodeo & generics	Cattails, phragmites, purple loosestrife, waterlilies, etc.	None
2,4-D	Navigate	Milfoil, water chestnut, waterlilies	~30 days. If known uses are present, residue testing is required
Triclopyr	Renovate 3; Renovate OTF	Milfoil, purple loosestrife	180 days or required residue testing
Imazapyr	Habitat	Phragmites and mose emergent vegetation/lilies	Up to 120 days; requires residue testing
Imazamox	Clearcast	Pondweed, milfoil, hydrilla	Residue Testing Required
Flumioxazin	Clipper	Fanwort, milfoil, other submersed and floating plants (watermeal)	~5 days

Specifically for fanwort, Sonar (fluridone) and Clipper (Flumioxazin) are the only two herbicides shown to provide effective control. Sonar has been used extensively in other waterbodies for many years to provide systemic control of fanwort under various treatment conditions. Typically, treatments are conducted with both liquid and slow-release pellet formulations to provide the needed target concentration and exposure time (typically at least 60 days for target area).

With a long contact time, Sonar can be challenging to use in smaller treatment areas and areas subject to high dilution (near inlets, small sections of shoreline, etc.). It is best suited for confined, isolated coves/areas, larger areas, or areas of little to no water exchange. The systemic properties of Sonar make it the preferred option over the Clipper herbicide when suitable treatment conditions can be maintained.

Reportedly and through experience, Clipper has provided excellent seasonal control of fanwort in New England lakes. It is a contact herbicide that affects a wide range of plant species, and some regrowth is usually seen in the year after treatment. Fanwort is highly susceptible to the Clipper herbicide and cumulative reductions in the extent and density of infestation is observed after multiple years of treatment. Clipper works very quickly and only requires a contact time measured in hours, making it a viable alternative to Sonar herbicide in otherwise challenging situations.

Dense or abundant areas of fanwort growth within the lake are ideal for herbicide use: Island Road Beach, Boat Launch, Hemlock Beach Cove, Mulpus Brook Cove. However, the extent of fanwort throughout the lake warrants the consideration for a whole-lake treatment. A whole-lake treatment would eliminate some of the challenges of using partial-lake approach (dilution, flushing, etc.). Implementing a whole-lake treatment would allow for future and more-effective use of DASH practices.

Control of algae through the use of copper-based algaecides should be considered, especially in the event of bloom indicative conditions (cyanobacteria cell count >20,000).

Monitoring

Ongoing monitoring (vegetation, water quality, algae/zooplankton, etc.) is the life-blood of successful lake management and should therefore be a part of any responsible long-term management plan. The LMG should consider annual monitoring on some level in order to further identify changing conditions in response to management, but also for the continued early detection of possible new management concerns/issues. As such, we recommend replicating the point-intercept and water/plankton sampling on an annual basis at minimum. Additional sampling locations and dates should be established in order to monitor and adequately manage algal populations. Any additional sampling supports the ability to manage the health and preservation of Hickory Hills Lake and Little Hickory Lake.

~

We hope you find this information helpful in making your lake management decisions. If you have any questions or need anything further, please contact our office.

Appendix A: Raw Data Tables

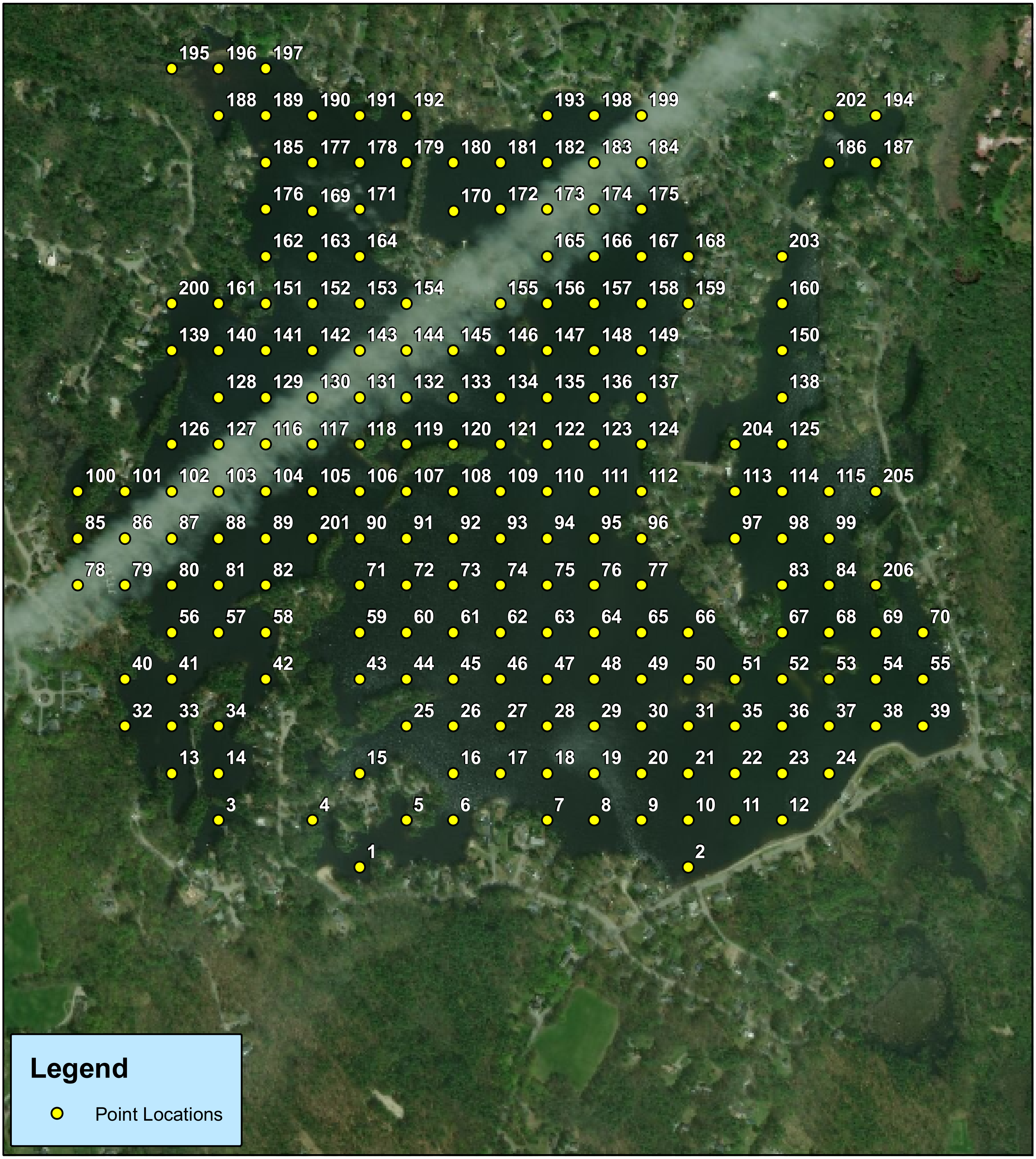
Point	Lat	Long	Tapegrass		Large-leaf Pondweed		Ribbon-leaf Pondweed		Purple Bladderwort		Robbin's Pondweed		Fanwort		Macro-algae		Filamentous Algae		Slender Naiad		Spikerush		Lesser Bladderwort		Watershield		Yellow Waterlily		White Waterlily		Little Floating Bladderwort		Thin-leaf Pondweed		Pipewort		Mermaidweed		Flatleaf Bladderwort		Common Bladderwort		Grassy Bulrush		Aquatic Moss		Water Smartweed		Floating-leaf Pondweed		Creeping Bladderwort		Oakes' Pondweed		Golden Hedge-hyssop		Total% (all)
			%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	%	B	
1	42.605531	-71.709828	15	3	0	0	0	0	15	2	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4	20	4	5	1	0	0	5	1	0	0	10	1	5	1	10	3	0	0	0	0	0	0	0	0	0	0	5	1	100
2	42.605543	-71.702977	0	0	0	0	0	0	0	0	0	0	0	0	25	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
3	42.606248	-71.712766	5	3	5	4	0	0	5	2	5	2	0	0	0	0	0	0	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	70	4	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
4	42.606252	-71.710809	0	0	0	0	0	0	0	0	20	2	0	0	0	0	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	3	0	0	0	0	10	2	10	1	25	3	0	0	0	0	0	0	5	1	0	0	0	0	100
5	42.606255	-71.708851	40	4	5	3	0	0	30	2	10	2	15	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	0	0	0	0	0	0	0	0	100
6	42.606257	-71.707873	0	0	0	0	0	0	0	0	50	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	0	0	0	0	0	0	0	0	0	0	50
7	42.606260	-71.705916	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	0	5
8	42.606262	-71.704937	0	0	0	0	0	0	0	0	0	0	0	0	15	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	0	0	0	0	0	0	15
9	42.606264	-71.703958	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	42.606266	-71.702980	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	42.606267	-71.702001	0	0	0	0	0	0	0	0	0	0	0	0	15	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	0	0	0	0	0	0	15
12	42.606269	-71.701022	0	0	0	0	0	0	0	0	0	0	0	0	50	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	0	0	0	0	0	0	50
13	42.606969	-71.713747																																																							
14	42.606971	-71.712768	0	0	0	0	0	0	75	3	15	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
15	42.606976	-71.709832	25	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	4	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	1	55
16	42.606980	-71.707875	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
17	42.606982	-71.706897	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	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
18	42.606983	-71.705918	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	42.606985	-71.704939	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	42.606987	-71.703961	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	0	5
21	42.606989	-71.702982	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	0	5
22	42.606990	-71.702003	0	0	0	0	0	0	0	0	0	0	0	0	10	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	0	0	0	0	0	0	10
23	42.606992	-71.701025	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
24	42.606994	-71.700046	10	2	40	3	0	0	20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80
25	42.607701	-71.708856	55	2	15	4	0	0	30	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	0	0	0	0	0	0	0	0	0	0	0	0	100
26	42.607703	-71.707878	0	0	0	0	0	0	0	0	15	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	0	0	0	0	0	0	0	0	0	0	15
27	42.607705	-71.706899	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
28	42.607706	-71.705920	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
29	42.607708	-71.704942	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
30	42.607710	-71.703963	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	0	5
31	42.607712	-71.702984	0	0	0	0	0	0	0	0	0	0	0	0	15	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	0	0	0	0	0	0	15
32	42.607690	-71.714728																																																							
33	42.607692	-71.713749																																																							
34	42.607694	-71.712771	10	2	0	0	0	0	10	3	0	0	5	2	0	0	0	0	0	0	0	0	0	0	10	4	0	0	15	1	5	1	0	0	0	0	5	1	0	0	0	0	30	2	0	0	0	0	0	0	0	0	0	0	0	0	90
35	42.607713	-71.702006	0	0	5	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
36	42.607715	-71.701027	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	42.607717	-71.700048	40	2	5	1	0	0	40	1	0	0	0	0	0	0	0	0	10	1	0	0	0	0	0	0	0	0	0	0	5	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	100
38	42.607718	-71.699070	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
39	42.607720	-71.698091	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	0	5
40	42.608413	-71.714730																																																							
41	42.608415	-71.713752																																																							
42	42.608419	-71.711795	20	3	0	0	0	0	40	2	20	2	10	3	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	10	2	0	0	0	0	0	0	0	0	0	0	0	0	100
43	42.608422	-71.709837	0	0	0	0	0	0	15	1	5	2	0	0	20	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	0	0	0	0	0	0	40
44	42.608424	-71.708859	0	0	0	0	0	0	0	0	0	0	0	0	75	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	0	0	0	0	0	0	75
45	42.608426	-71.707880	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	42.608427	-71.706901	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
47	42.608429	-71.705923	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
48	42.608431	-71.704944	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
49	42.608433	-71.703965	50	2	10	3	5	3	0	0	0	0	0	0	0	0	0	0	5	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	0	0	70
50	42.608434	-71.702987	20	2	0	0	0	0	0	0	5	1	0	0	0	0	0	0	20	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	0	0	45
51	42.608436	-71.702008	10	2	0	0	0	0	0	0	5	1	0	0	0	0	0	0	20	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	0	0	35
52	42.608438	-71.701029	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	42.608440	-71.700051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	5
54	42.608441	-71.699072	0	0	0	0	0	0	0	0	0	0	0	0	10	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	0	0	0	0	0	0	10
55	42.608443	-71.698093	0	0	0	0	0	0	0	0	0	0	0	0	25	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
56	42.609138	-71.713754																																																							
57	42.609140	-71.712776																																																							
58	42.609142	-71.711797																																																							
59	42.609145	-71.709840	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	0	5
60	42.609147	-71.708861	0	0	0	0	0	0	0	0	0	0	0	0	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
61	42.609149	-71.707882	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	42.609150	-71.706904	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	42.609152	-71.705925	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
64	42.609154	-71.704946	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	42.609156	-71.703968	25	2	5	3	0	0	25	1	20	2	0	0	10	1	0	0	10	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	0	0	95
66	42.609157	-71.702989	0	0	0	0	0	0	20	1	50	2	0	0	10	1	0	0	5	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	0	0	85
67	42.609161	-71.701032	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	42.609162	-71.700053	0	0	0	0	0	0	0	0	80	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	0	0	0	0	0	0	0	0	0	0	80
69	42.609164	-71.699074	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	0	0	0	50	2	0	0	0	0	0	0	0	0	0	0	0	0	50
70	42.609166	-71.698096	20	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
71	42.609868	-71.709842	0	0	0	0	0	0	0	0	10	1	0	0	10	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	0	0	0	0	0	0	20
72	42.609870	-71.708863	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	0	5
73	42.609872	-71.707885	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
74	42.609873	-71.706906	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
75	42.609875	-71.705927	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	42.609877	-71.704949	0	0	0	0	0	0	0	0	0	0	0	0	50	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	0	0	0	0	0	0	50
77	42.609879	-71.703970	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	42.609857	-71.715714																																																							
79	42.609859	-71.714735	0	0	0	0	0	0	10	1	65	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	0	0	0	0	0	0	0	0	0	0	75
80	42.609861	-71.713757	0	0	0	0	0	0	50	2	50	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	0	0	0	0	0	0	0	0	0	0	100
81	42.609863	-71.712778	0	0	0	0	0	0	25	2	25	2	0	0	20	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	0	0	0	0	0	0	70
82	42.609864	-71.711799	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	42.609884	-71.701034	70	2	0	0	5	4	10	1	0	0	0	0	0	0	0	0	5	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	0	0	90
84	42.609885	-71.700055	0	0	0	0	0	0	10	1	0	0	0	0	0	0	0	0	10	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	0	0	20
85	42.610580	-71.715717	0	0	0	0	0	0	5	1	70	2	5	2	0	0	0	0	10	1	0	0	5	1	5	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	100
86	42.610582	-71.714738	0	0	0	0	0	0	5	1	95	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	0	0	0	0	0	0	0	0	0	0	100
87	42.610584	-71.713759	0	0	0	0	0	0	10	1	90	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	0	0	0	0	0	0	0	0	0	0	100
88	42.610586	-71.712780	0	0	0	0	0	0	0	0	25	2	0	0	50	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	0	0	0	0	0	0	75
89	42.610587	-71.711802	0	0	0	0	0	0	0	0	30	2	0	0	45	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	0	0	0	0	0	0	75
90	42.610591	-71.709844	10	2	5	3	0	0	0	0	0	0	0	0	15	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	0	0	0	0	0	0	30
91	42.610593	-71.708866	85	2	5	3	0	0	10	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	0	0	0	0	0	0	0	0	0	0	0	0	100
92	42.610594	-71.707887	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	0	5
93	42.610596	-71.706908	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	0	5
94	42.610598	-71.705930	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	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	5
95	42.610600	-71.704951	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
96	42.610601	-71.703972	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	42.610605	-71.702015	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	0	0	0	80	2	0	0	0	0	0	0	0	0	0	0	0	0	80
98	42.610607	-71.701036	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	0	5
99	42.610608	-71.700058	0	0	0	0	0	0	0	0	0	0	0	0	80	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	0	0	0	0	0	0	80
100	42.611303	-71.715719	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	20	1	0	0	0	0	0	0	0	0	5	4	5	1	0	0	5	1	0	0	0	0	0	0	50	2	0	0	0	0	5	4	0	0	5	4	0	0	100
101	42.611305	-71.714740	10	3	0	0	0	0	10	1	15	2	5	2	0	0	0	0	0	0	0	0	0	0	50	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
102	42.611307	-71.713762	0	0	0	0	0	0	10	1	80	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	0	0	0	0	0	0	0	0	0	0	90
103	42.611308	-71.712783	0	0	0	0	0	0	0	0	85	2	0	0	5	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	0	0	0	0	0	0	90
104	42.611310	-71.711804	0	0	0	0	0	0	0	0	10	2	0	0	90	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	0	0	0	0	0	0	100
105	42.611312	-71.710826	0	0	0	0	0	0	0	0	10	2	0	0	50	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	0	0	0	0	0	0	60
106	42.611314	-71.709847	0	0	0	0	0	0	0	0	0	0	0	0	10	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	0	0	0	0	0	0	10
107	42.611316	-71.708868	0	0	0	0	0	0	0	0	10	1	0	0	5	1	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25
108	42.611317	-71.707889	0	0	0	0	0	0	0	0	0	0	0	0	35	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	0	0	0	0	0	0	35
109	42.611319	-71.706911	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	0	5
110	42.611321	-71.705932	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
111	42.611323	-71.704953	0	0	0	0	0	0	0	0	0	0	0	0	20	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	0	0	0	0	0	0	20
112	42.611324	-71.703975	15	2	5	3	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	0	0	0	0	0	0	0	0	0	0	0	0	0	20
113	42.611328	-71.702017	0	0	0	0	0	0	0	0	0	0	0	0	50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55
114	42.611329	-71.701039	0	0	0	0	0	0	0	0	20	2	0	0	80	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	0	0	0	0	0	0	100
115	42.611331	-71.700060	50	2	25	4	0	0	25	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	0	0	0	0	0	0	0	0	0	0	0	0	100
116	42.612033	-71.711807	0	0	0	0	0	0	0	0	0	0	0	0	95	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100

117	42.612035	-71.710828	10	1	0	0	0	0	0	0	20	2	0	0	25	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	0	0	0	0	0	0	55
118	42.612037	-71.709849	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
119	42.612038	-71.708871	10	2	0	0	5	1	0	0	0	0	0	0	0	0	0	0	10	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	0	0	25
120	42.612040	-71.707892	0	0	0	0	0	0	0	0	0	0	0	0	60	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	0	0	0	0	0	0	60
121	42.612042	-71.706913	0	0	0	0	0	0	10	1	0	0	0	0	10	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	0	0	0	0	0	0	20
122	42.612044	-71.705934	0	0	0	0	0	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	1
123	42.612046	-71.704956	0	0	0	0	0	0	0	0	0	0	0	0	15	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	0	0	0	0	0	0	15
124	42.612047	-71.703977	25	2	5	1	0	0	10	1	0	0	0	0	10	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	0	0	0	0	0	0	50
125	42.612052	-71.701041	0	0	0	0	0	0	0	0	0	0	0	0	65	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	0	0	0	0	0	0	65
126	42.612030	-71.713764	70	2	0	0	5	4	20	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	0	0	0	0	0	0	0	0	0	0	0	0	95
127	42.612031	-71.712785	0	0	0	0	0	0	0	0	35	2	0	0	20	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	0	0	0	0	0	0	55
128	42.612754	-71.712788	0	0	0	0	0	0	35	2	10	2	0	0	20	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	0	0	0	0	0	0	65
129	42.612756	-71.711809	0	0	0	0	0	0	0	0	20	2	0	0	50	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	0	0	0	0	0	0	70
130	42.612758	-71.710830	0	0	5	4	0	0	0	0	65	2	0	0	5	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	0	0	0	0	0	0	75
131	42.612760	-71.709852	0	0	0	0	0	0	0	0	0	0	0	0	80	1	0	0	20	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	0	0	100
132	42.612761	-71.708873	25	2	5	3	5	3	0	0	0	0	0	0	0	0	0	0	25	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	0	0	60
133	42.612763	-71.707894	0	0	0	0	0	0	25	2	0	0	0	0	30	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	0	0	0	0	0	0	55
134	42.612765	-71.706916	0	0	0	0	0	0	0	0	10	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	0	0	0	0	0	0	0	0	0	0	10
135	42.612767	-71.705937	0	0	0	0	0	0	0	0	0	0	0	0	40	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	0	0	0	0	0	0	40
136	42.612768	-71.704958	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
137	42.612770	-71.703979	5	2	0	0	0	0	0	0	0	0	0	0	0	40	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	0	0	0	0	0	6
138	42.612775	-71.701043	0	0	0	0	0	0	10	1	85	2	0	0	0	0	0	0	5	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	0	0	100
139	42.613475	-71.713769	45	2	0	0	0	0	25	2	0	0	5	1	0	0	0	0	25	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	0	0	100
140	42.613477	-71.712790	40	2	0	0	0	0	20	1	35	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
141	42.613479	-71.711812	0	0	0	0	0	0	0	0	0	0	0	0	100	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	0	0	0	0	0	0	100
142	42.613481	-71.710833	0	0	15	3	0	0	35	2	10	2	0	0	40	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	0	0	0	0	0	0	100
143	42.613483	-71.709854	10	2	0	0	0	0	15	2	0	0	0	0	20	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	0	0	0	0	0	0	45
144	42.613484	-71.708875	10	2	10	3	0	0	0	0	0	0	0	0	80	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	0	0	0	0	0	0	100
145	42.613486	-71.707897	15	2	5	3	0	0	15	2	20	2	0	0	25	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	0	0	0	0	0	0	80
146	42.613488	-71.706918	0	0	0	0	0	0	0	0	5	1	0	0	45	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	0	0	0	0	0	0	50
147	42.613490	-71.705939	30	2	0	0	5	2	10	1	0	0	0	0	5	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	0	0	0	0	0	0	50
148	42.613491	-71.704960	0	0	0	0	0	0	0	0	5	1	0	0	10	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	0	0	0	0	0	0	15
149	42.613493	-71.703982	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
150	42.613498	-71.701046	5	2	0	0	0	0	75	1	0	0	0	0	0	0	0	0	10	1	0	0	0	0	0	0	0	0	0	0	10	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	100
151	42.614202	-71.711814	5	2	0	0	0	0	75	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	4	5	4	0	0	5	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	100
152	42.614204	-71.710835	55	2	15	3	0	0	25	2	0	0	5	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	0	0	0	0	0	0	0	0	100
153	42.614205	-71.709856	25	2	15	3	0	0	50	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	0	0	0	0	0	0	0	0	0	0	0	0	90
154	42.614207	-71.708878	0	0	0	0	0	0	20	1	50	2	0	0	0	0	0	0	30	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	0	0	100
155	42.614211	-71.706920	25	2	0	0	0	0	10	1	5	1	0	0	10	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	0	0	0	0	0	0	50
156	42.614213	-71.705942	0	0	0	0	0	0	5	1	5	1	0	0	10	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	0	0	0	0	0	0	20
157	42.614214	-71.704963	0	0	0	0	0	0	0	0	5	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	0	0	0	0	0	0	0	0	0	0	5
158	42.614216	-71.703984	0	0	0	0	0	0	0	0	0	0	0	0	10	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	0	0	0	0	0	0	10
159	42.614218	-71.703005	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
160	42.614221	-71.701048	15	2	5	3	0	0	75	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	3	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	100
161	42.614200	-71.712793	50	2	5	3	0	0	25	2	0	0	0	0	0	0	0	0	20	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	0	0	100
162	42.614925	-71.711816	50	2	25	3	0	0	5	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	0	0	0	0	0	0	0	0	0	0	0	0	80
163	42.614927	-71.710838	60	2	10	4	0	0	5	1	0	0	0	0	0	0	0	0	20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
164	42.614928	-71.709859	5	2	0	0	0	0	0	0	70	2	0	0	0	0	0	0	25	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	0	0	100
165	42.614935	-71.705944	10	1	0	0	0	0	10	1	0	0	0	0	0	75	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5	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	26
166	42.614937	-71.704965	0	0	0	0	0	0	5	1	5	1	0	0	35	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	0	0	0	0	0	0	45
167	42.614939	-71.703986	0	0	0	0	0	0	0	0	0	0	0	0	80	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	0	0	0	0	0	0	80
168	42.614941	-71.703008	15	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
169	42.615623	-71.710839	65	3	5	4	0	0	10	1	10	1	0	0	0	0	0	0	10	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	0	0	100
170	42.615628	-71.707899	75	2	5	2	0	0	0	0	5	1	0	0	15	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	0	0	0	0	0	0	100
171	42.615651	-71.709861	40	2	10	4	0	0	5	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	5	1	40	2	0	0	0	0	0	0	0	0	0	0	0	0	100
172	42.615657	-71.706925	50	2	0	0	0	0	5	1	20	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	0	0	0	0	0	0	0	0	0	0	75
173	42.615658	-71.705946	50	2	10	3	0	0	30	1	0	0	0	0	5	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	5	1	0	0	0	0	0	0	0	0	0	0	0	0	100
174	42.615660	-71.704967	10	1	0	0	0	0	0	0	10	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	0	0	0	0	0	0	0	0	0	0	20
175	42.615662	-71.703989	80	2	5	3	0	0	10	1	5	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	0	0	0	0	0	0	0	0	0	0	100
176	42.615648	-71.711819	50	4	0	0	0	0	20	3	5	1	0	0	0	0	0	0	0	0	0	0	0	0	5	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	80
177	42.616372	-71.710842	50	4	0	0	0	0	15	2	0	0	0	0	0	0	0	0	10	1	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	20	3	0	0	0	0	0	0	0	0	0	0	0	0	100
178	42.616374	-71.709864	40	2	0	0	0	0	30	2	0	0	0	0	0	0	0	0	20	1	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
179	42.616376	-71.708885	15	2	0	0	0	0	10	10	0	0	50	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	25	2	0	0	0	0	0	0	0	0	0	0	0	0	100
180	42.616378	-71.707906	60	3	5	4	0	0	10	1	10	1	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1	0	0	0	0	0	0	0	0	0	0	0	0	100
181	42.616379	-71.706927	75	3	0	0	0	0	10	1	15	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	0	0	0	0	0	0	0	0	0	0	100
182	42.616381	-71.705949	50	2	10	2	0	0	10	1	20	1	0	0	0	0	0	0	5	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	0	0	95
183	42.616383	-71.704970	0	0	0	0	0	0	20	1	0	0	10	1	20	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	0	0	0	0	0	0	50
184	42.616385	-71.703991	75	2	10	3	0	0	10	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	0	0	0	0	0	0	0	0	0	0	0	0	95
185	42.616371	-71.711821	30	3	0	0	15	2	10	2	0	0	0	0	0	0	0	0	30	1	0	0	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	10	2	0	0	0	0	0	0	0	0	0	0	0	0	100
186	42.616392	-71.700076	0	0	15	3	5	3	35	0	40	0	0	0	5	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	0	0	0	0	0	0	100
187	42.616393	-71.699097	0	0	0	0	0	0	0	0	40	3	0	0	0	0	0	0	5	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	5	1	50
188	42.617092	-71.712802																																																							
189	42.617094	-71.711824																																																							
190	42.617095	-71.710845	5	4	0	0	5	4	10	2	0	0	0	0	0	0	0	0	55	2	0	0	0	0	5	4	0	0	0	0	5	4	5	1	0	0	0	0	0	0	0	0	5	3	0	0	0	0	5	4	0	0	0	0	0	0	100
191	42.617097	-71.709866	15	4	0	0	0	0	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2	0	0	0	0	0	0	0	0	0	0	50	2	0	0	0	0	10	4	0	0	0	0	0	0	85
192	42.617099	-71.708887	25	3	5	2	0	0	5	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	50	2	0	0	0	0	0	0	0	0	0	0	0	0	85
193	42.617104	-71.705951	20	2	0	0	5	3	50	1	5	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	20	1	0	0	0	0	0	0	0	0	0	0	0	0	100
194	42.617116	-71.699100	0	0	0	0	5	4	0	0	50	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	0	0	0	0	5	1	0	0	0	0	60
195	42.617813	-71.713784	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50	4	50	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	100
196	42.617815	-71.712805	5	4	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4	10	4	5	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	30
197	42.617816	-71.711826	5	4	0	0	5	4	10	2	0	0	0	0	0	0	0	0	50	2	0	0	0	0	0	0	5	4	10	4	5	2	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
198	42.617106	-71.704972	15	3	5	3	5	2	40	1	35	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	0	0	0	0	0	0	0	0	0	0	100
199	42.617108	-71.703993	0	0	0	0	0	0	5	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	10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
200	42.614198	-71.713771	25	3	0	0	0	0	20	2	5	2	0	0	0	0	0	0	25	1	0	0	0	0	25	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	100
201	42.610589	-71.710823	0	0	0	0	0	0	0	0	0	0	0	0	50	1	0	0	40	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	0	0	90
202	42.617114	-71.700078	0	0	0	0	5	1	0	0	95	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100
203	42.614944	-71.701050	20	3	0	0	0	0	20	1	0	0	0	0	0	0	0	0	10	1	0	0	0	0	15	4	0	0	0	0	5	3	0	0	0	0	0	0	0	0	10	1	10	2	0	0	0	0	0	0	5	1	5	4	0	0	100
204	42.612051	-71.702020	20	3	0	0	0	0	40	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	4	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	10	2	0	0	5	4	5	4	0	0	0	0	0	0	100
205	42.611333	-71.699081	20	2	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	35
206	42.609887	-71.699077	20	3	0	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	4	5	4	15	4	0	0	0	0	0	0	0	0	0	0	0	0	20	3	0	0	10	4	0	0	0	0	0	0	5	1	100

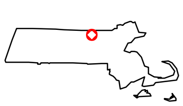
Appendix B: Distribution Maps

Point-Intercept Locations

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

0 860 1,720 Feet

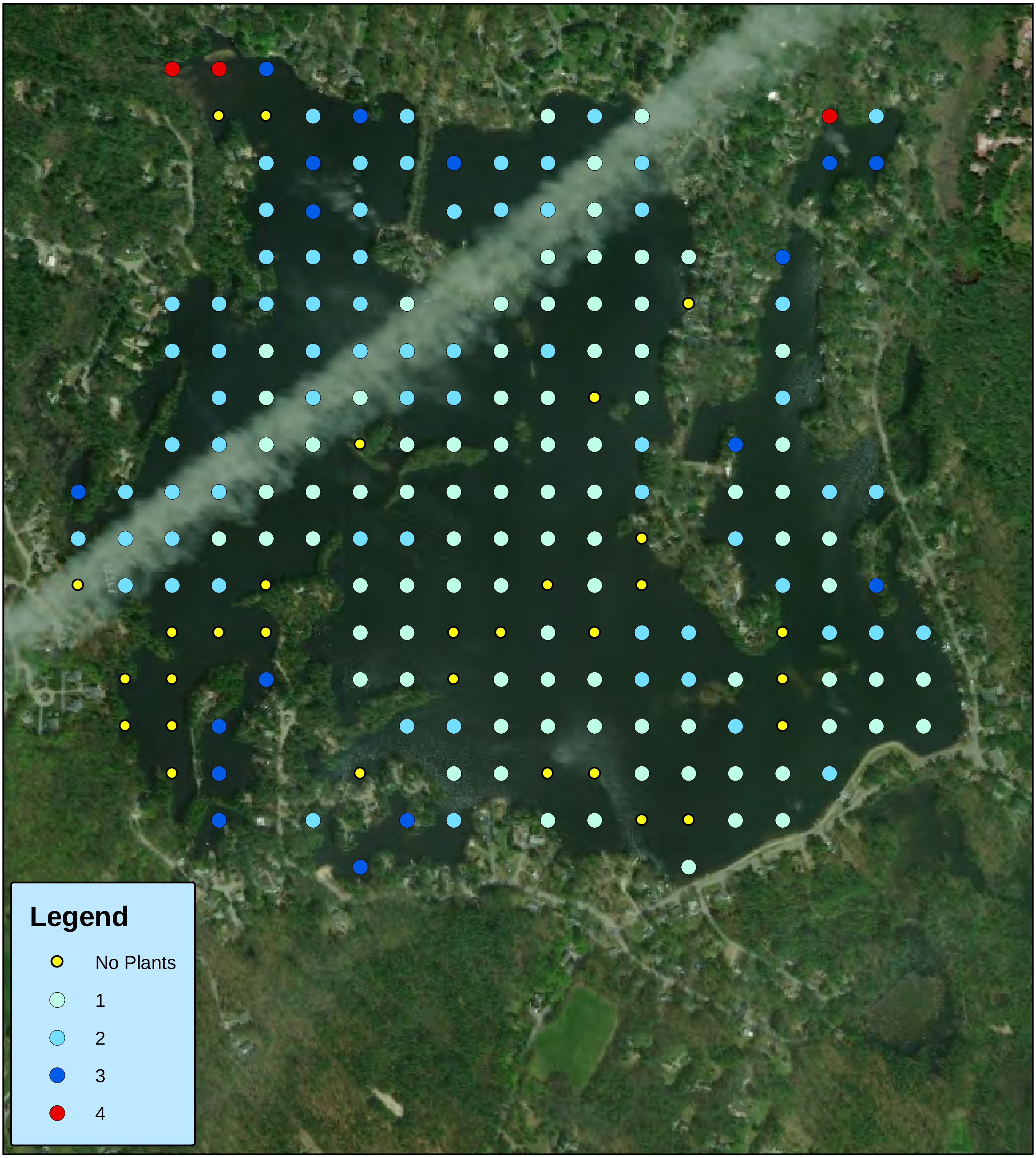
1:9,000

N

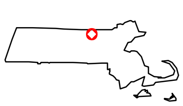
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Overall Biomass
July 2018

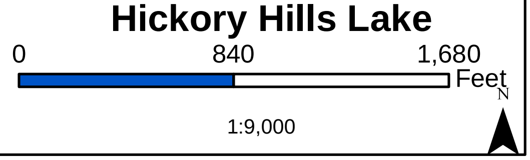
SOLITUDE
LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



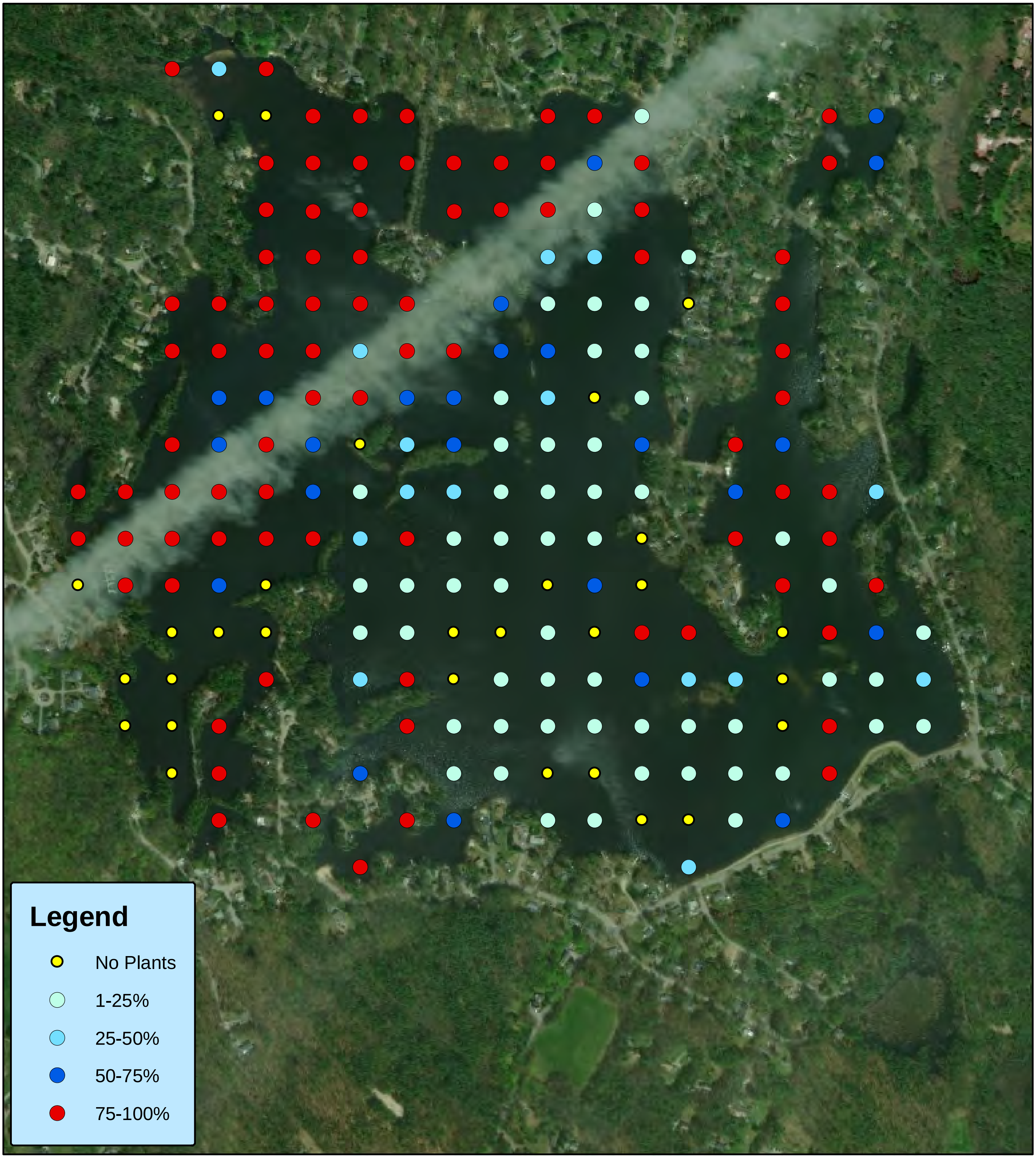
Hickory Hills Lake



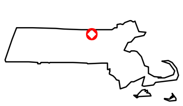
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Overall Percent Cover
July 2018

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

0 840 1,680 Feet

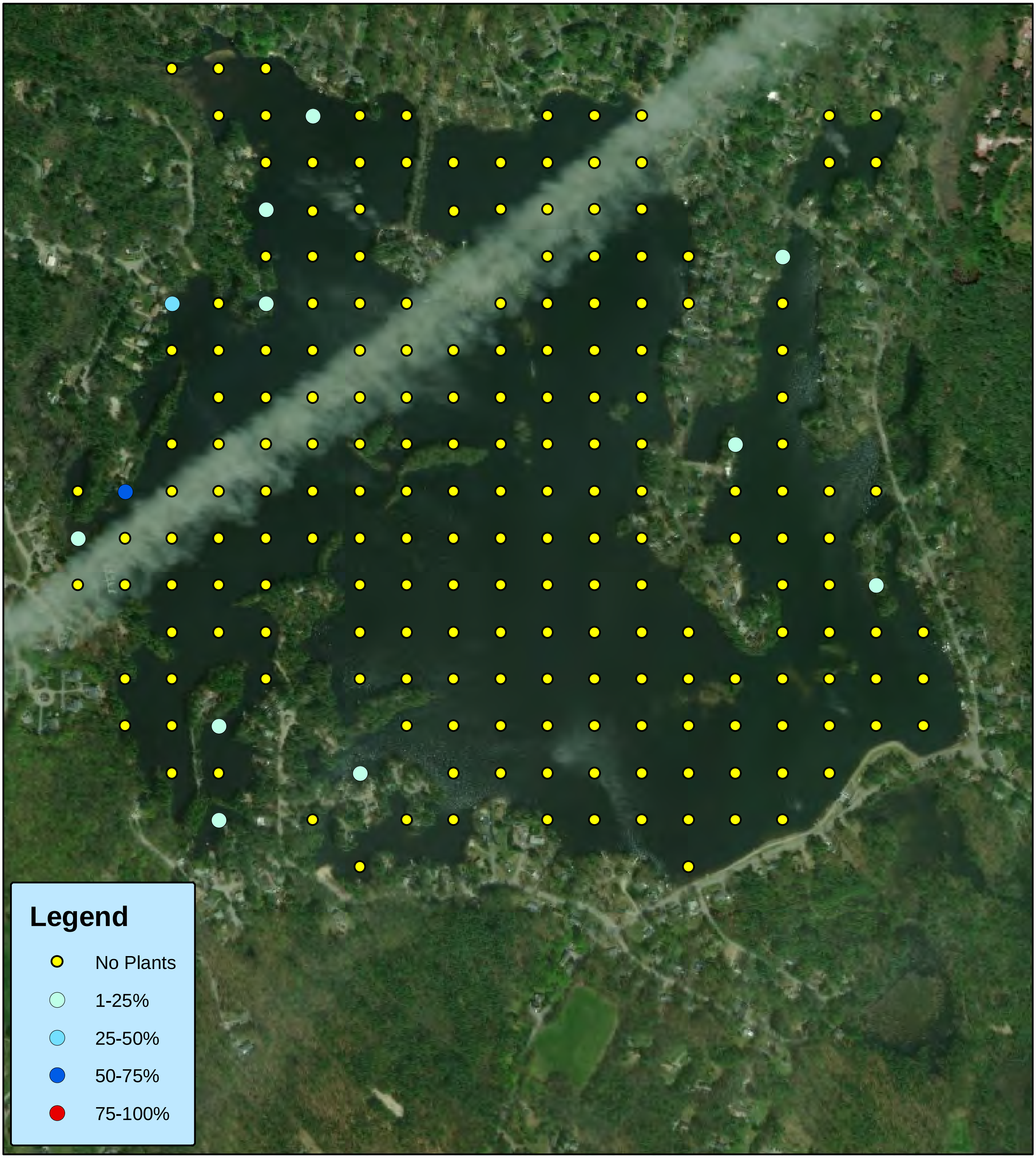
1:9,000

N

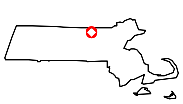
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Watershield (*Brasenia schreberi*) Percent Cover
July 2018

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

0 840 1,680 Feet

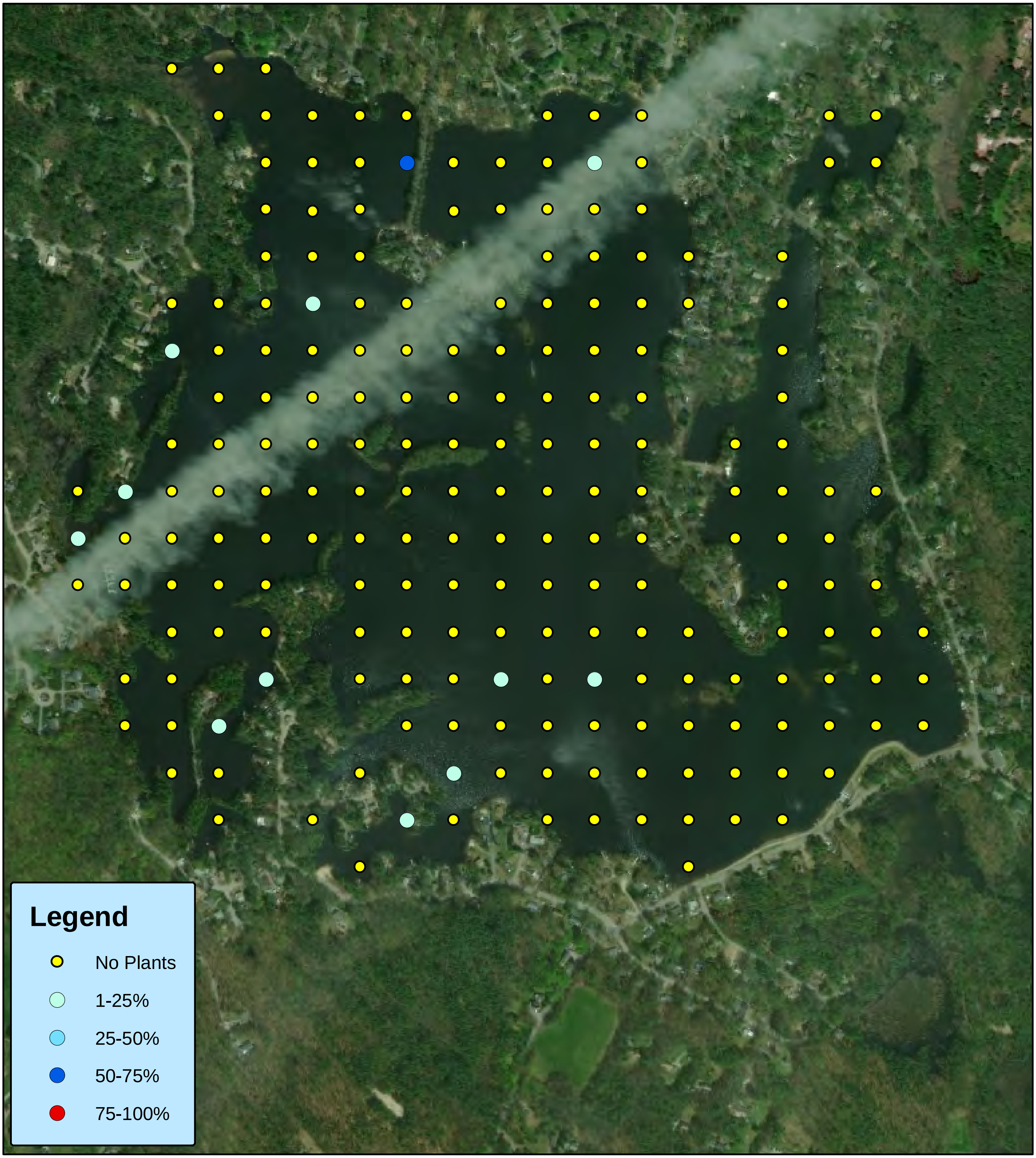
1:9,000

N

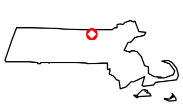
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Fanwort (*Cabomba caroliniana*) Percent Cover
July 2018

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

0 840 1,680 Feet

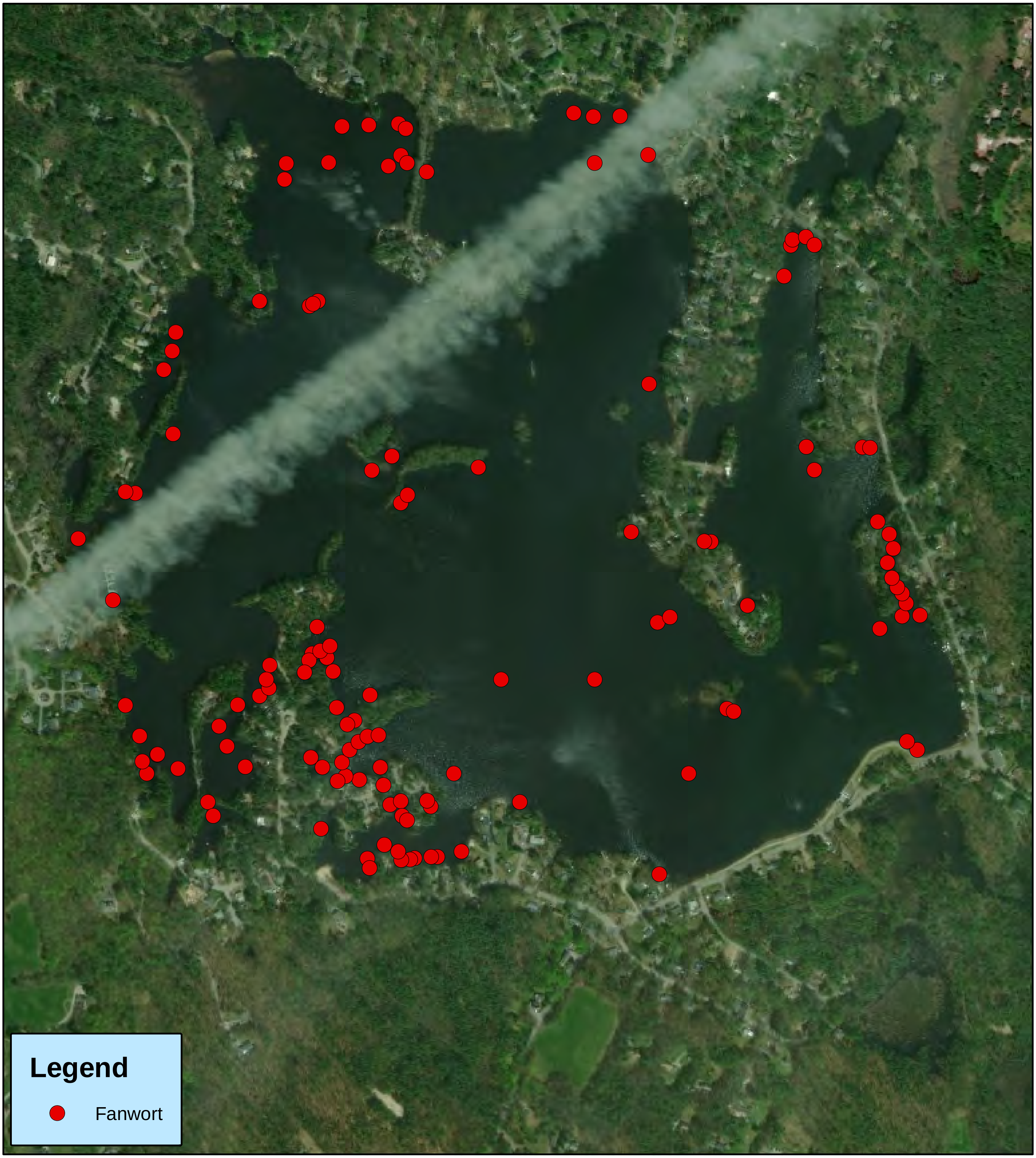
N

1:9,000

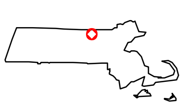
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

All Fanwort Locations (Including Point-Intercept)
July 2018

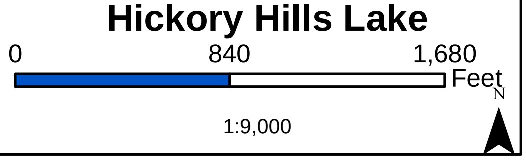
SOLITUDE
LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

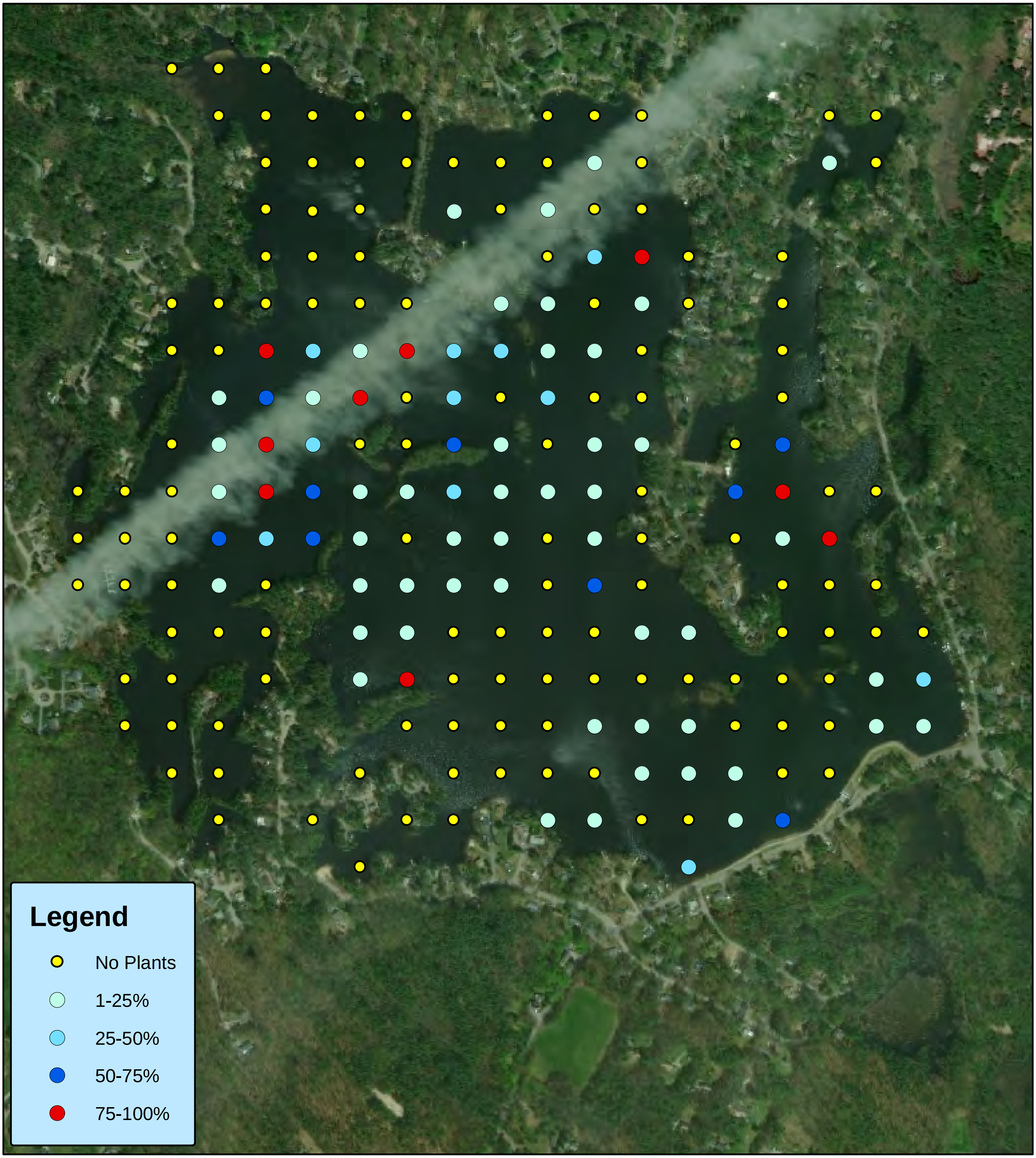


1:9,000

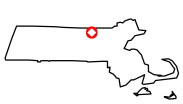
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Macroalgae (*Nitella sp. or Chara sp.*) Percent Cover
July 2018

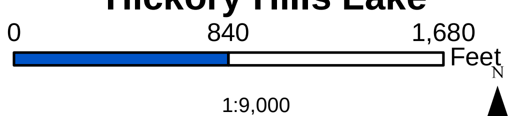
SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

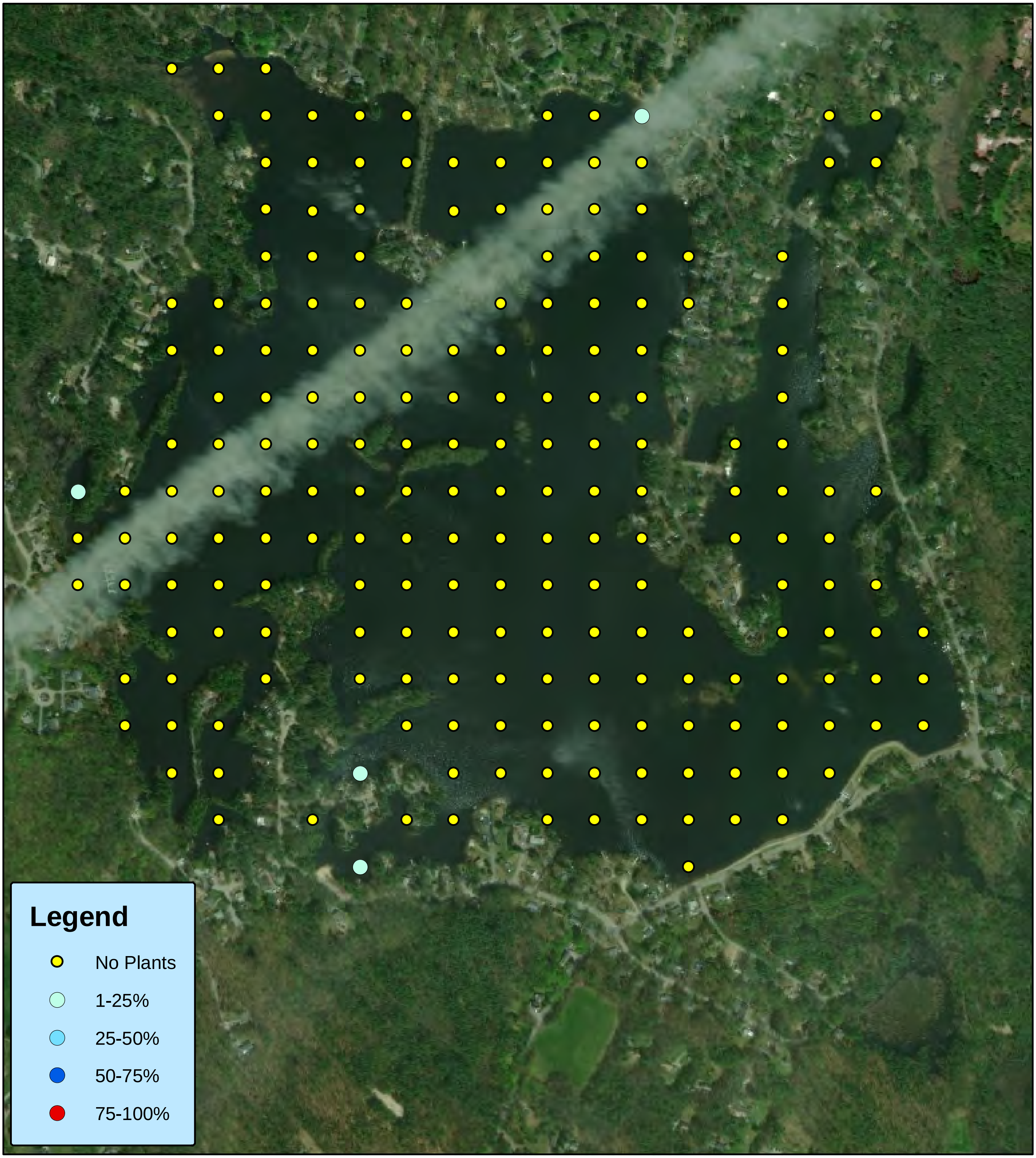


1:9,000

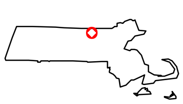
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Pipewort (*Eriocaulon aquaticum*) Percent Cover
July 2018

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

0 840 1,680 Feet

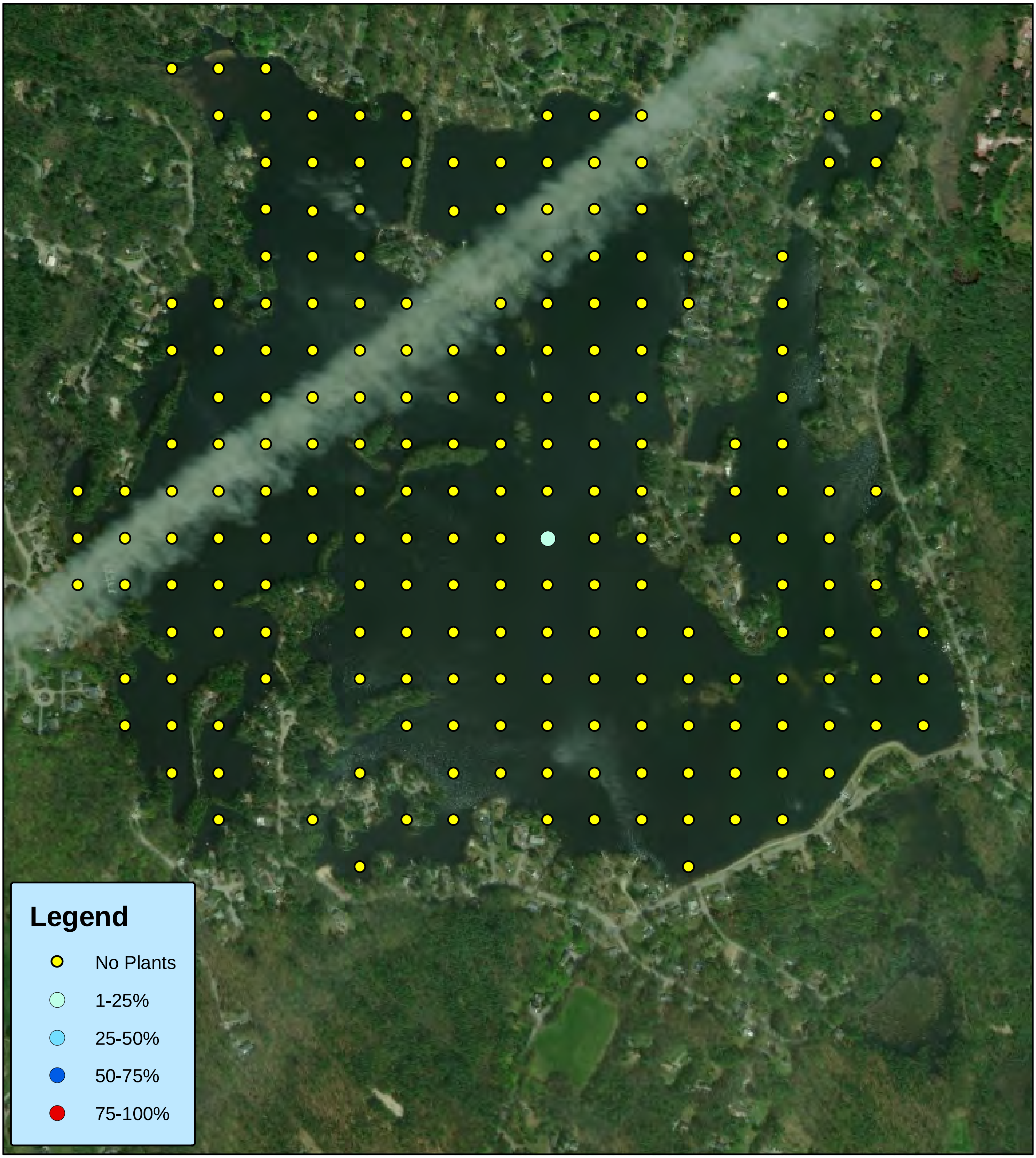
1:9,000

N

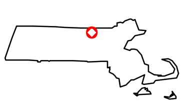
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Aquatic Moss (*Fontinalis sp.*) Percent Cover
July 2018

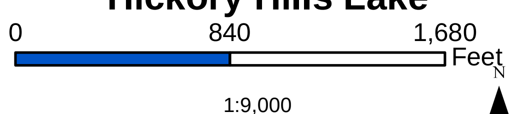
SOLITUDE
LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

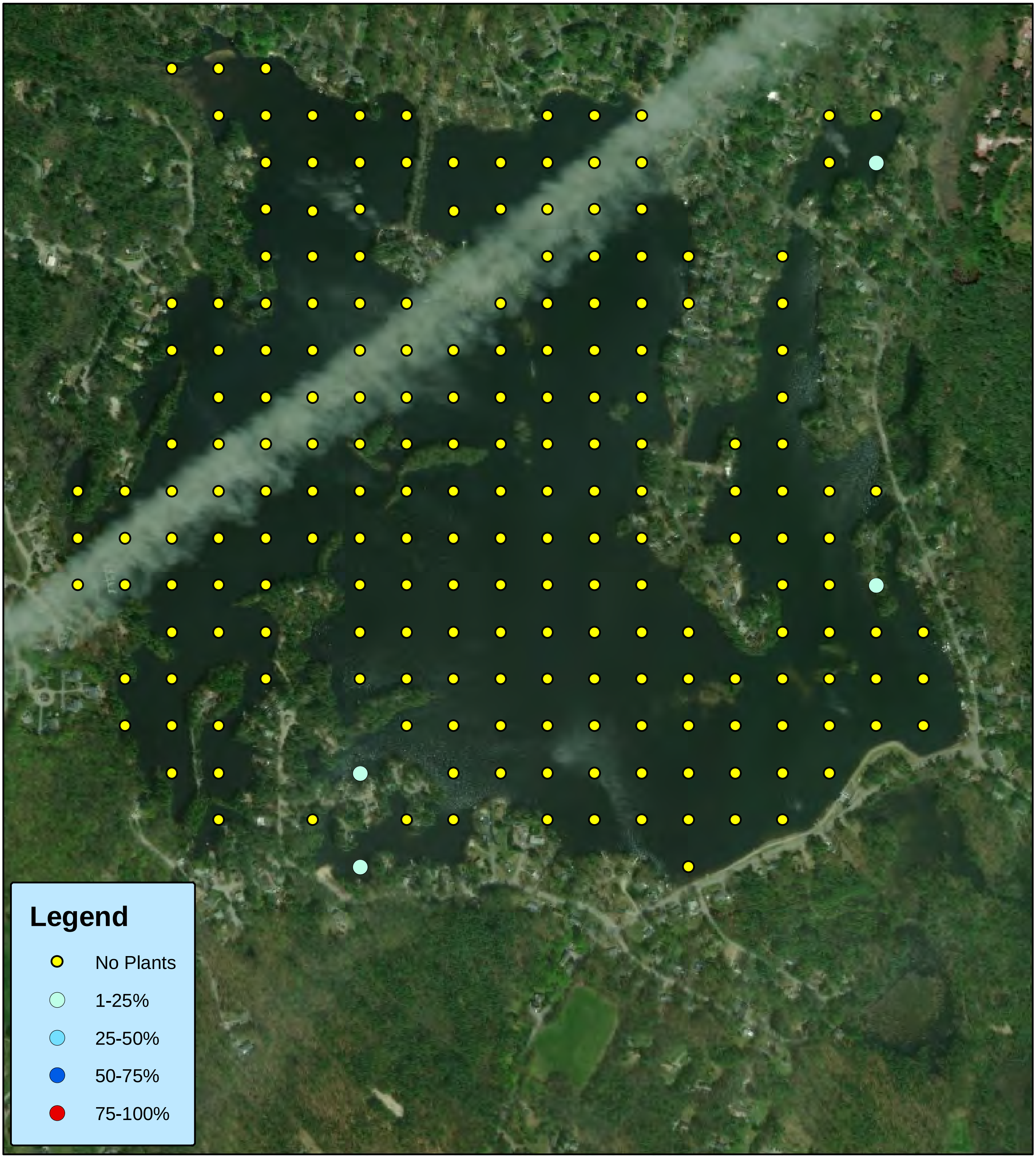


1:9,000

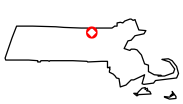
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Golden Hedge-hyssop (*Gratiola aurea*) Percent Cover
July 2018

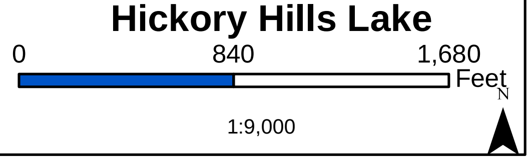
SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



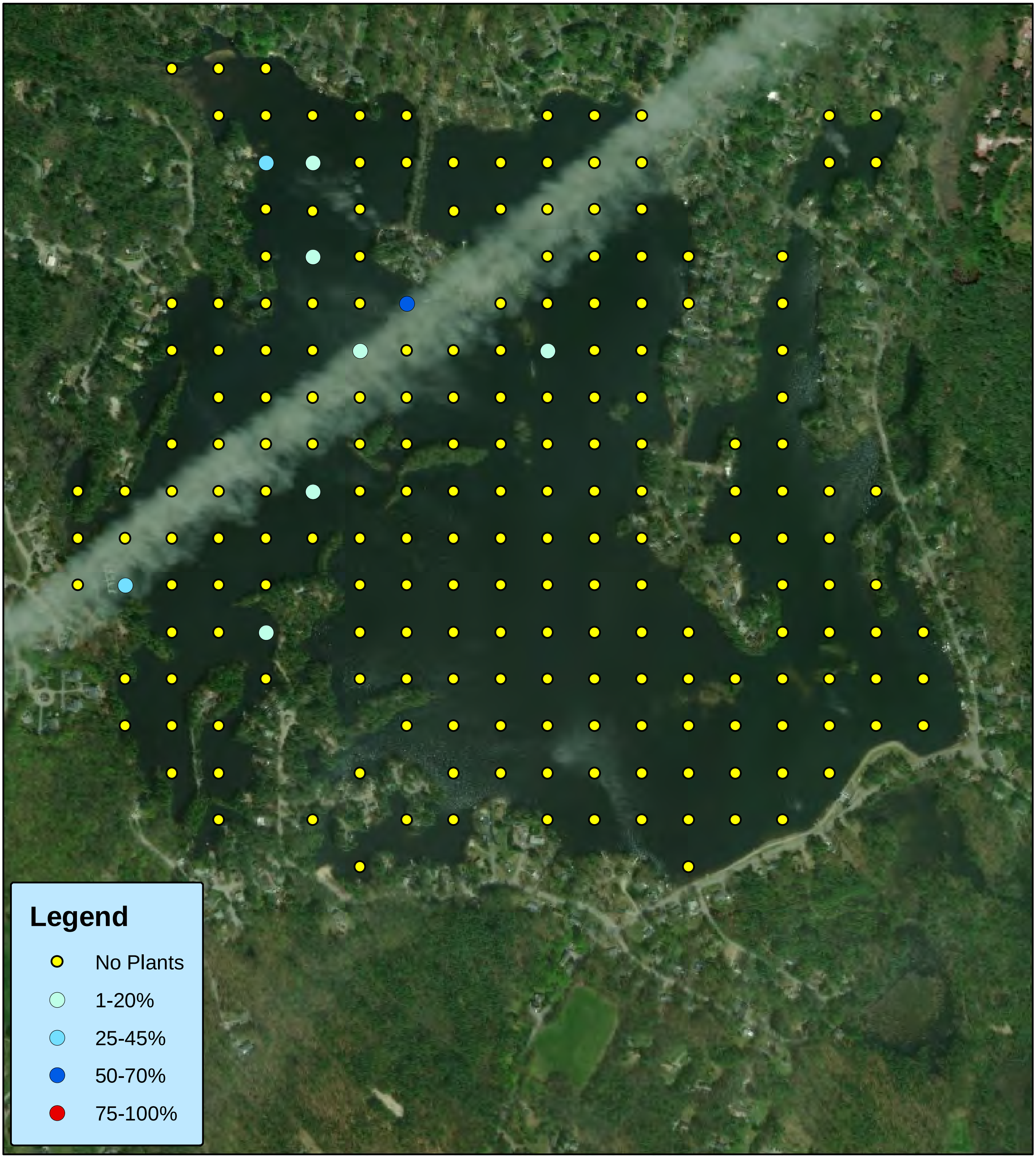
Hickory Hills Lake



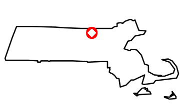
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

SLENDER NAIAD (*Najas flexilis*) COVER
July 2018

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

0 840 1,680 Feet

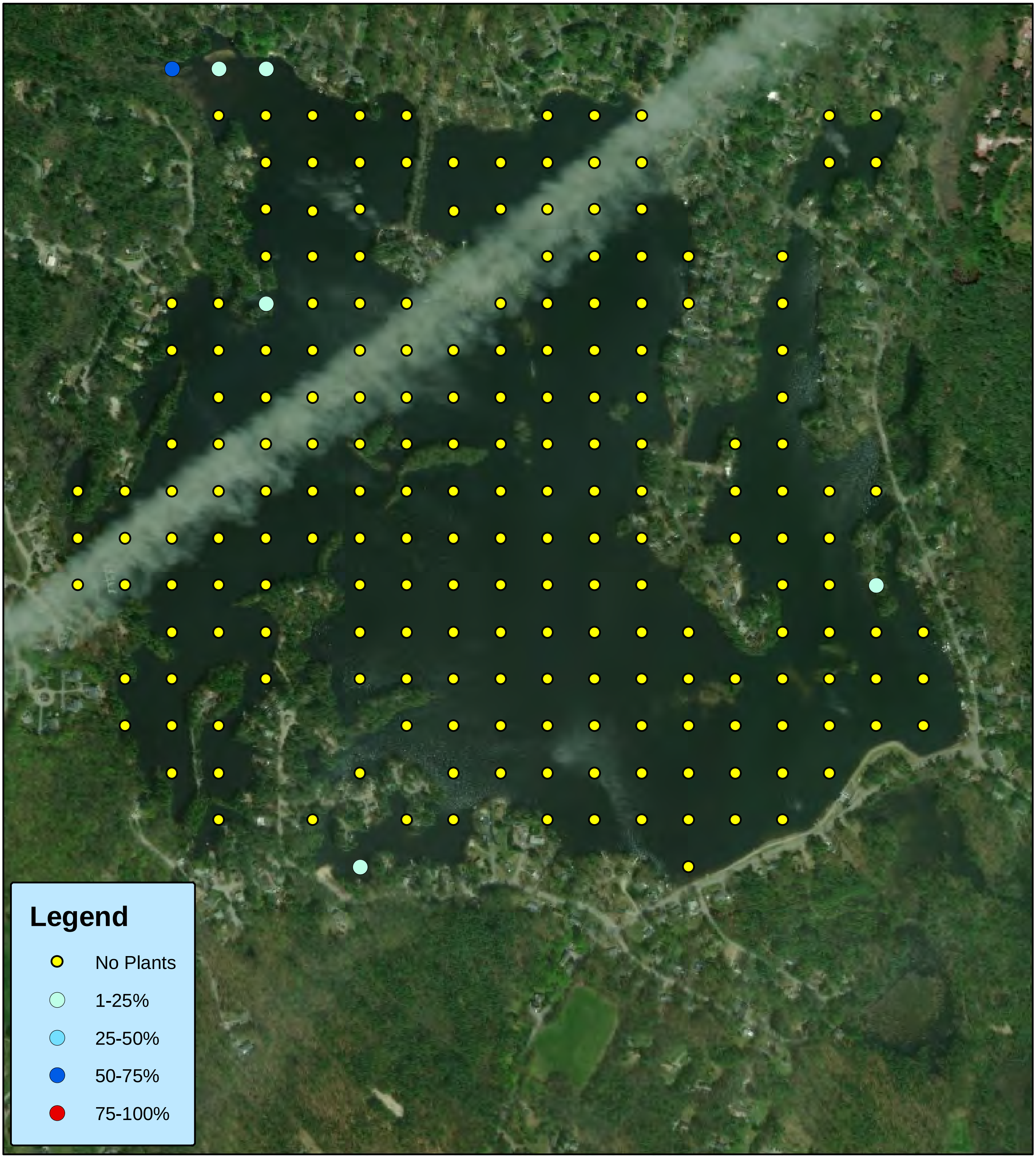
N

1:9,000

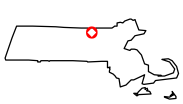
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Yellow Waterlily (*Nuphar variegata*) Percent Cover
July 2018

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA

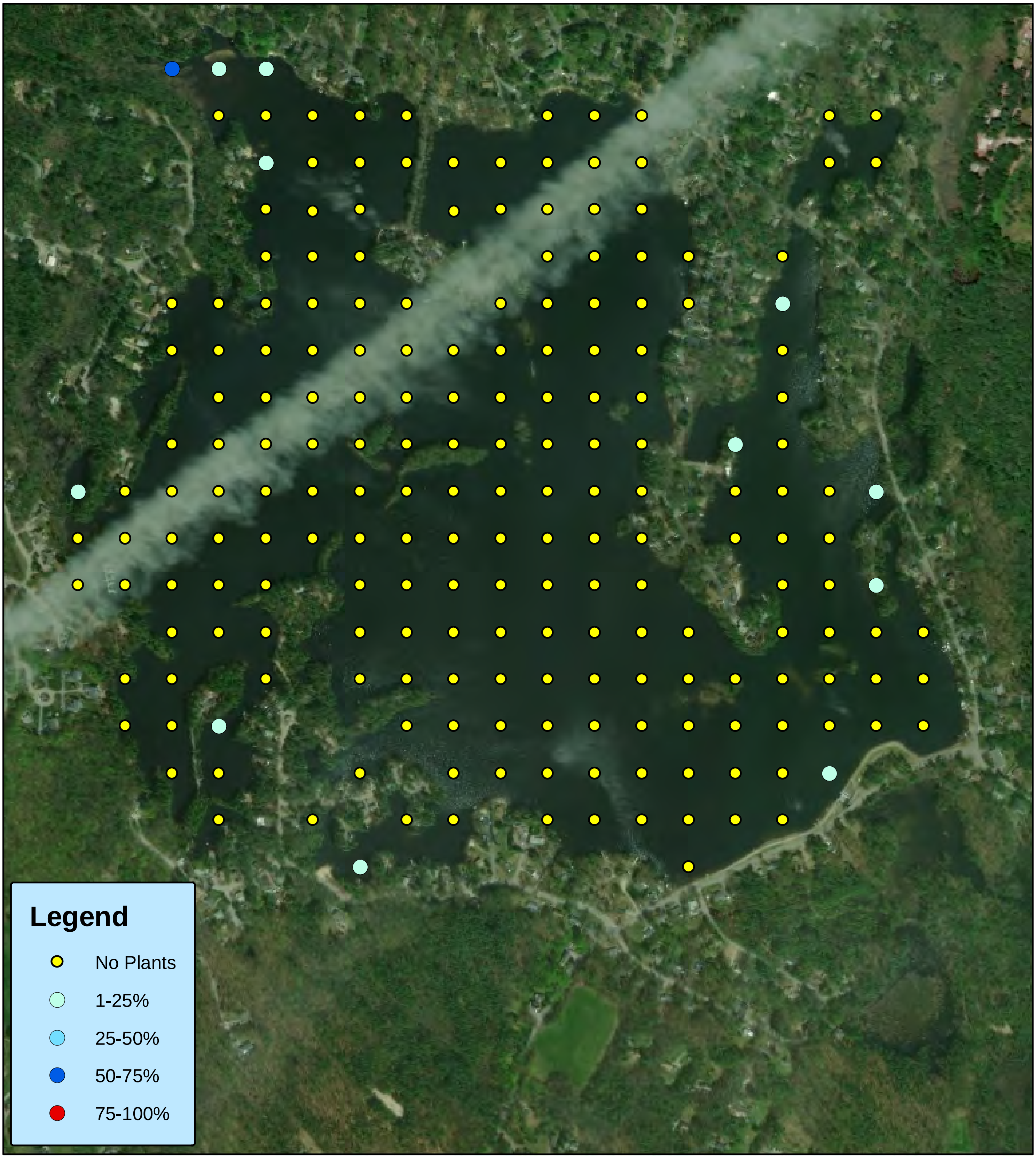


Hickory Hills Lake
0 840 1,680 Feet
1:9,000
N

Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

White Waterlily (*Nymphaea odorata*) Percent Cover
July 2018

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA

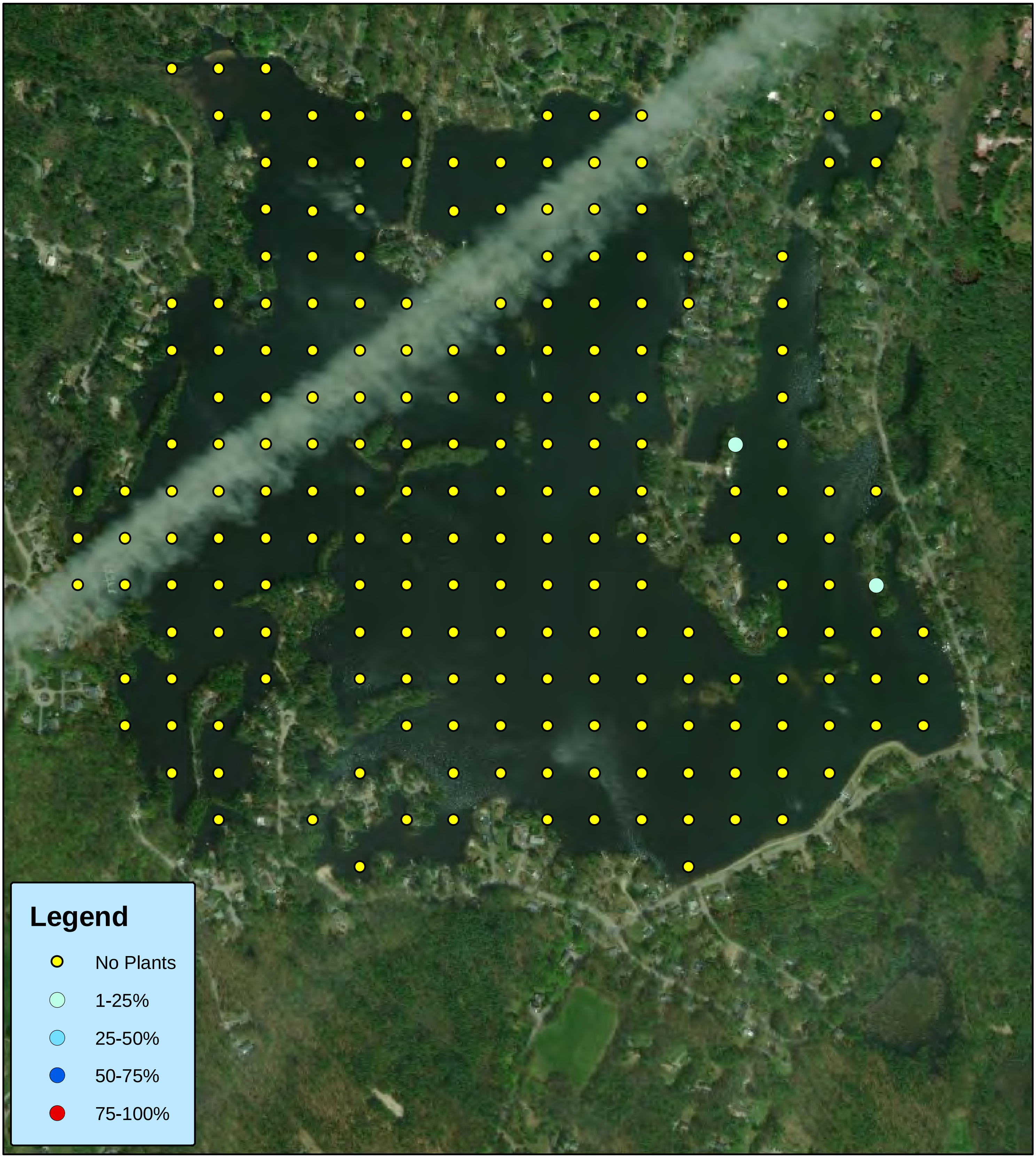
Hickory Hills Lake

0 840 1,680 Feet
N
1:9,000

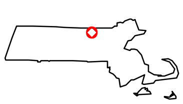
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Water Smartweed (*Polygonum amphibium*) Percent Cover
July 2018

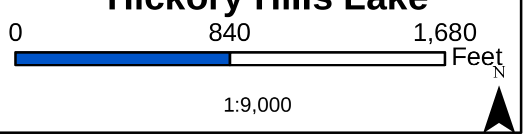
SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

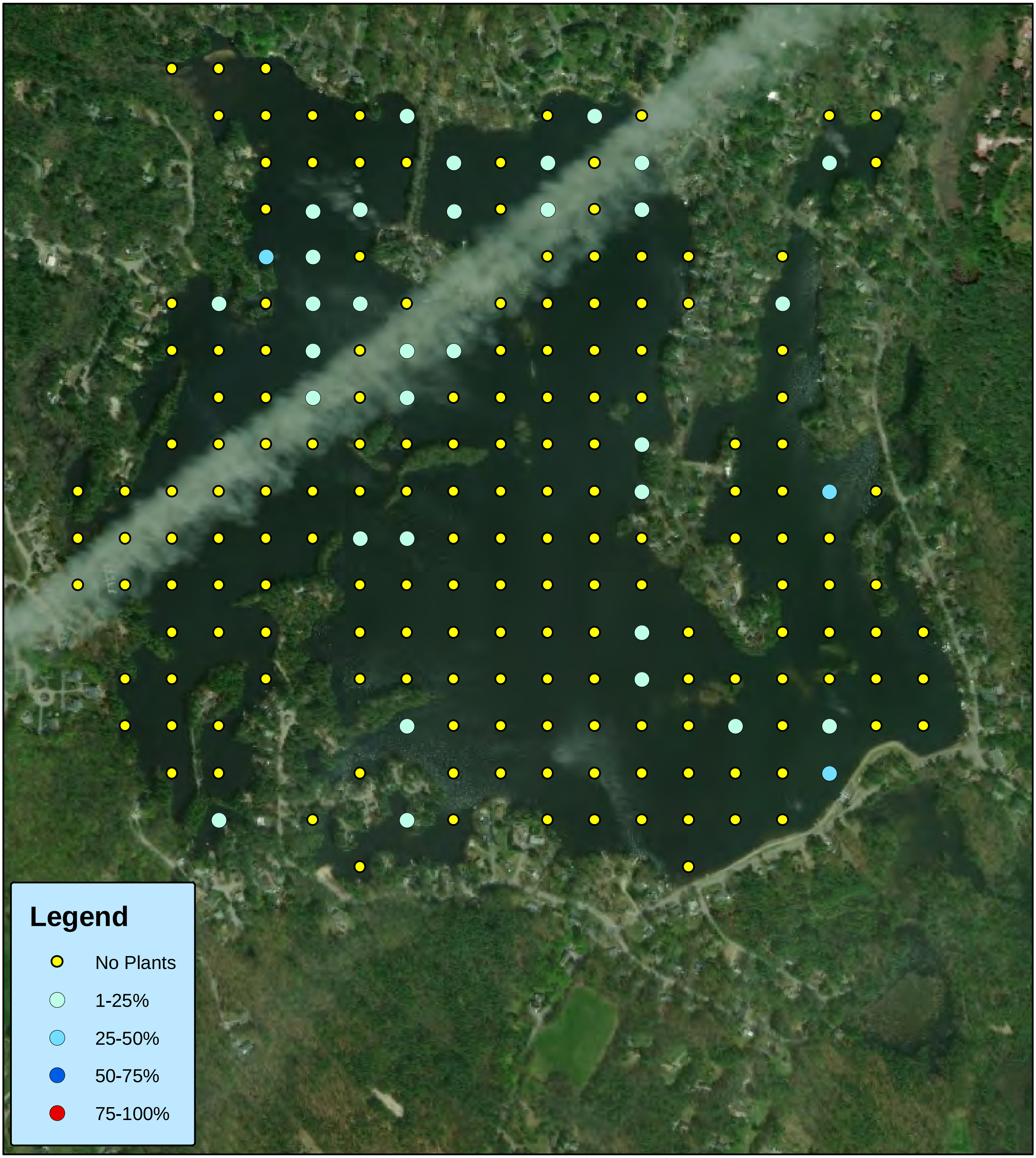


1:9,000

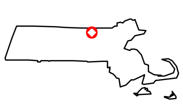
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Large-leaf Pondweed (*Potamogeton amplifolius*) Percent Cover
July 2018

SŌLITUDE
LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

0 840 1,680 Feet

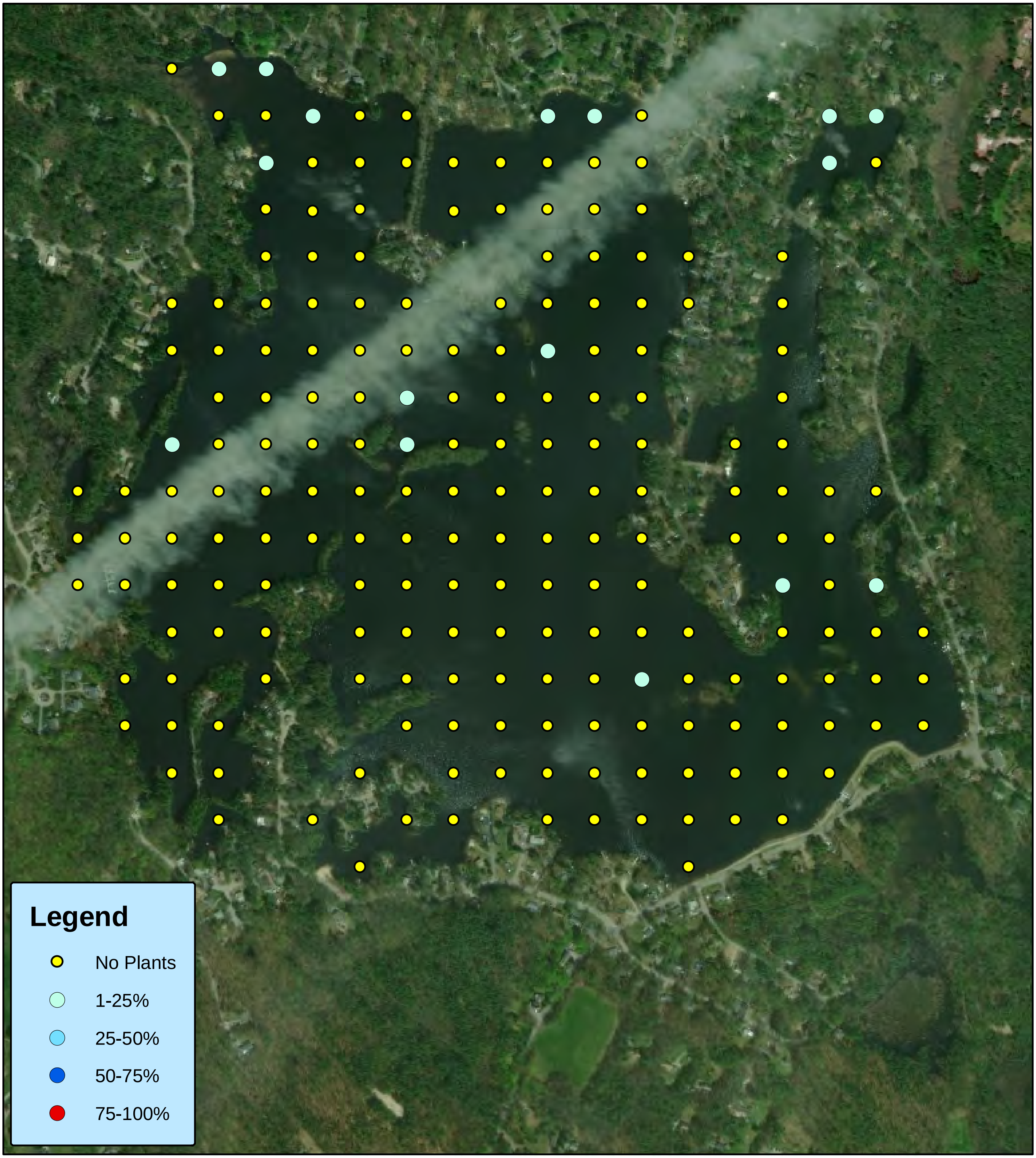
1:9,000

N

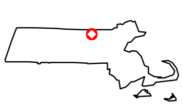
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Ribbon-leaf Pondweed (*Potamogeton epihydrus*) Percent Cover
July 2018

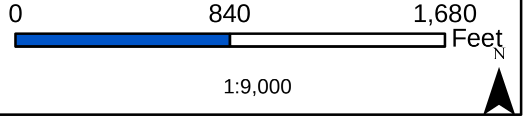
SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

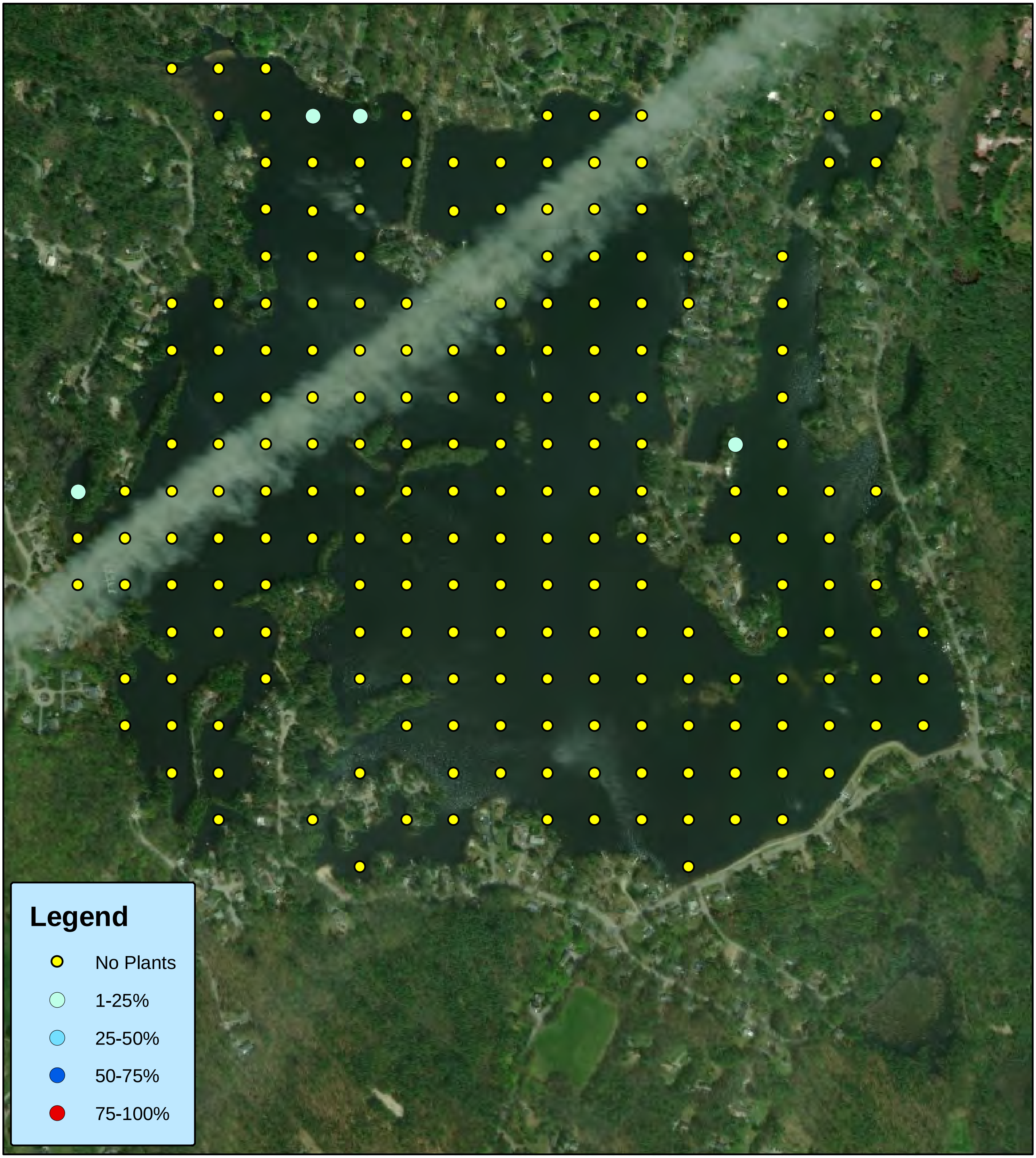


1:9,000

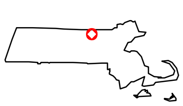
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Floating-leaf Pondweed (*Potamogeton natans*) Percent Cover
July 2018

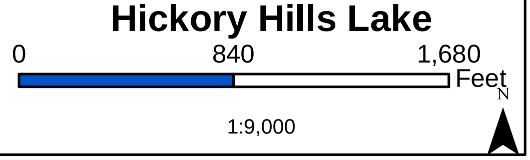
SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

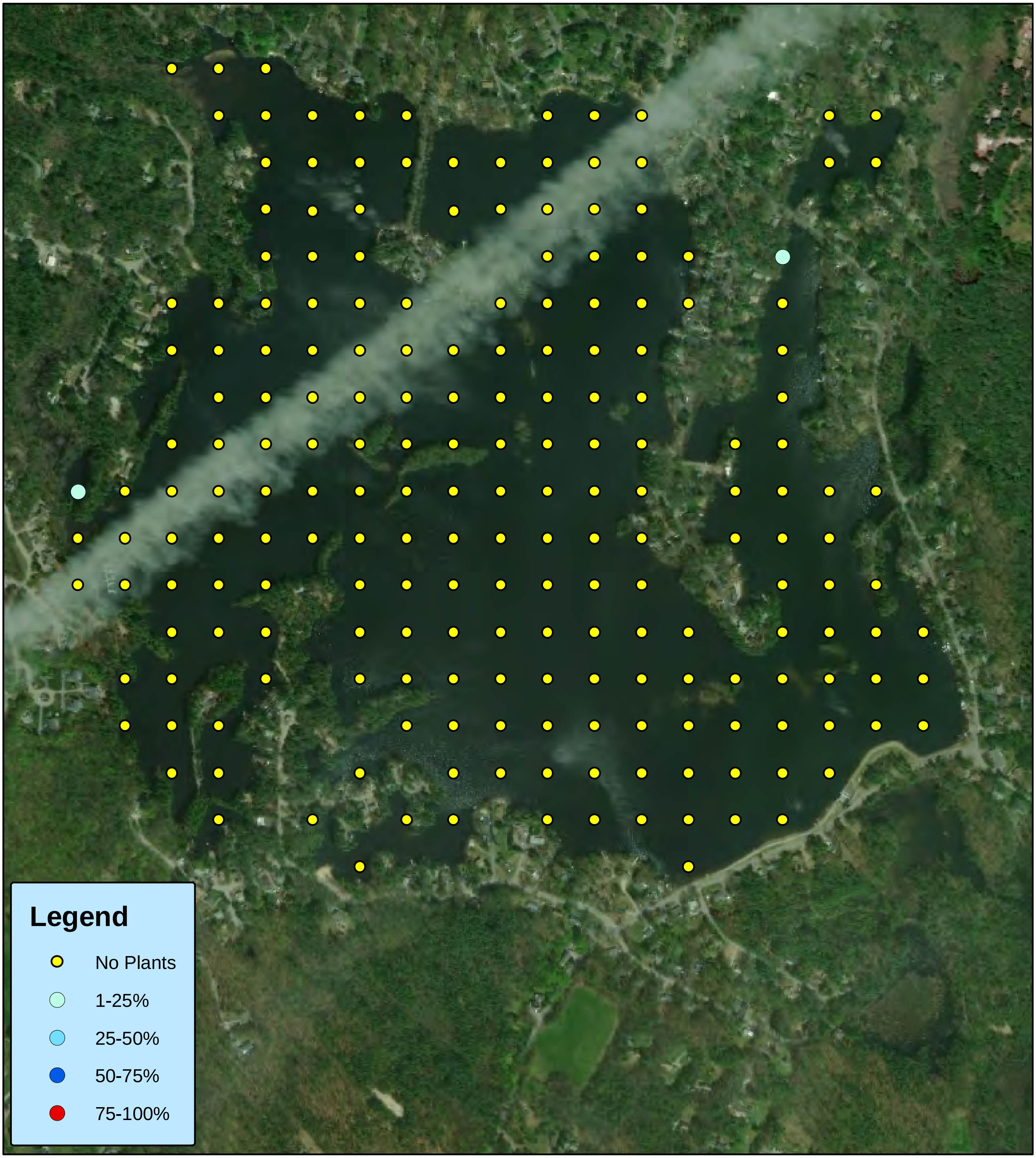


1:9,000

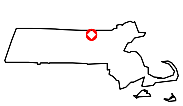
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Oakes' Pondweed (*Potamogeton oaksiensis*) Percent Cover
July 2018

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

0 840 1,680 Feet

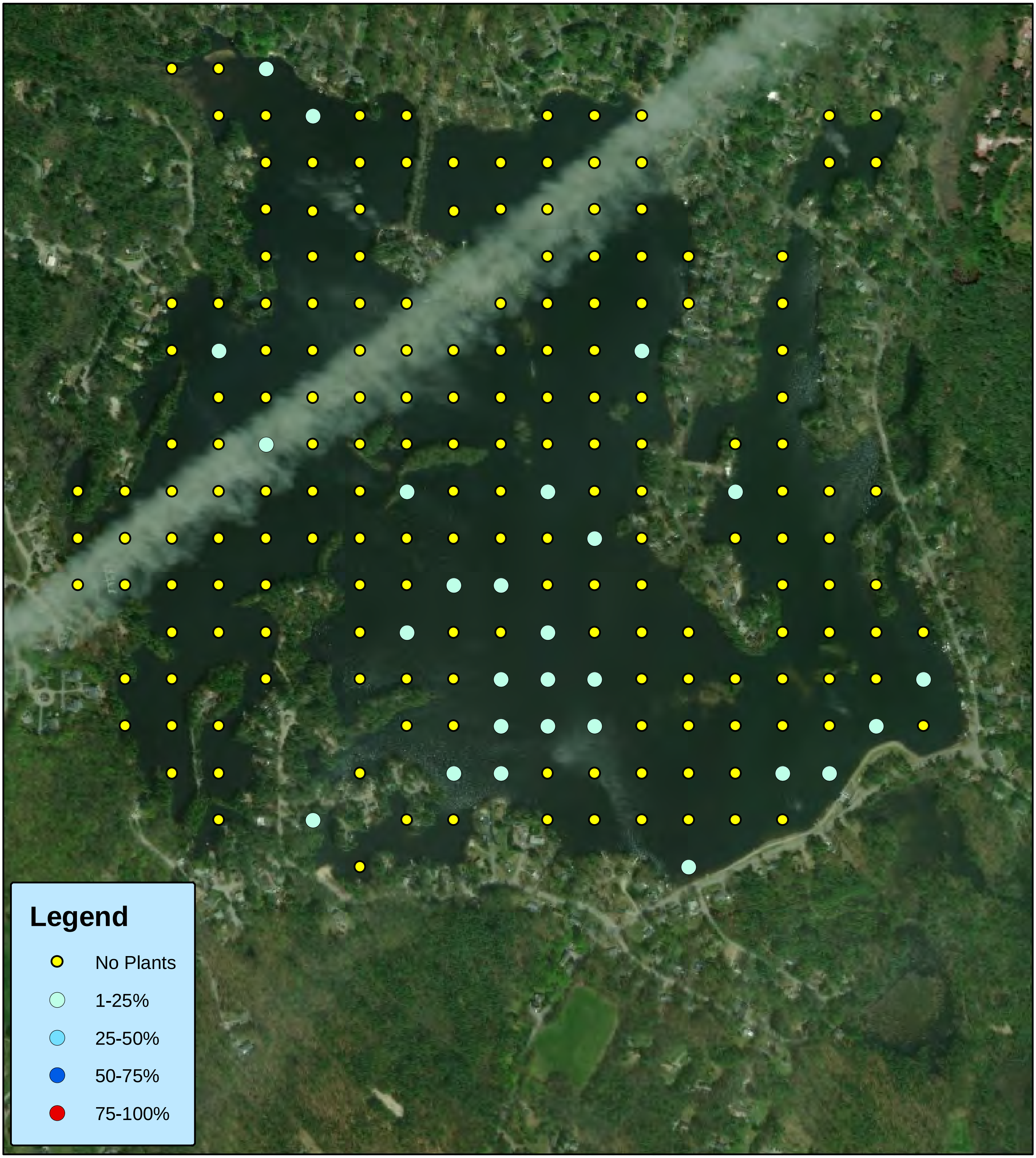
N

1:9,000

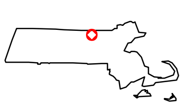
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Thin-leaf Pondweed (*Potamogeton sp.*) Percent Cover
July 2018

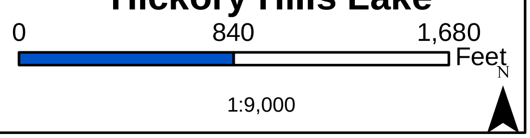
SŌLITUDE
LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



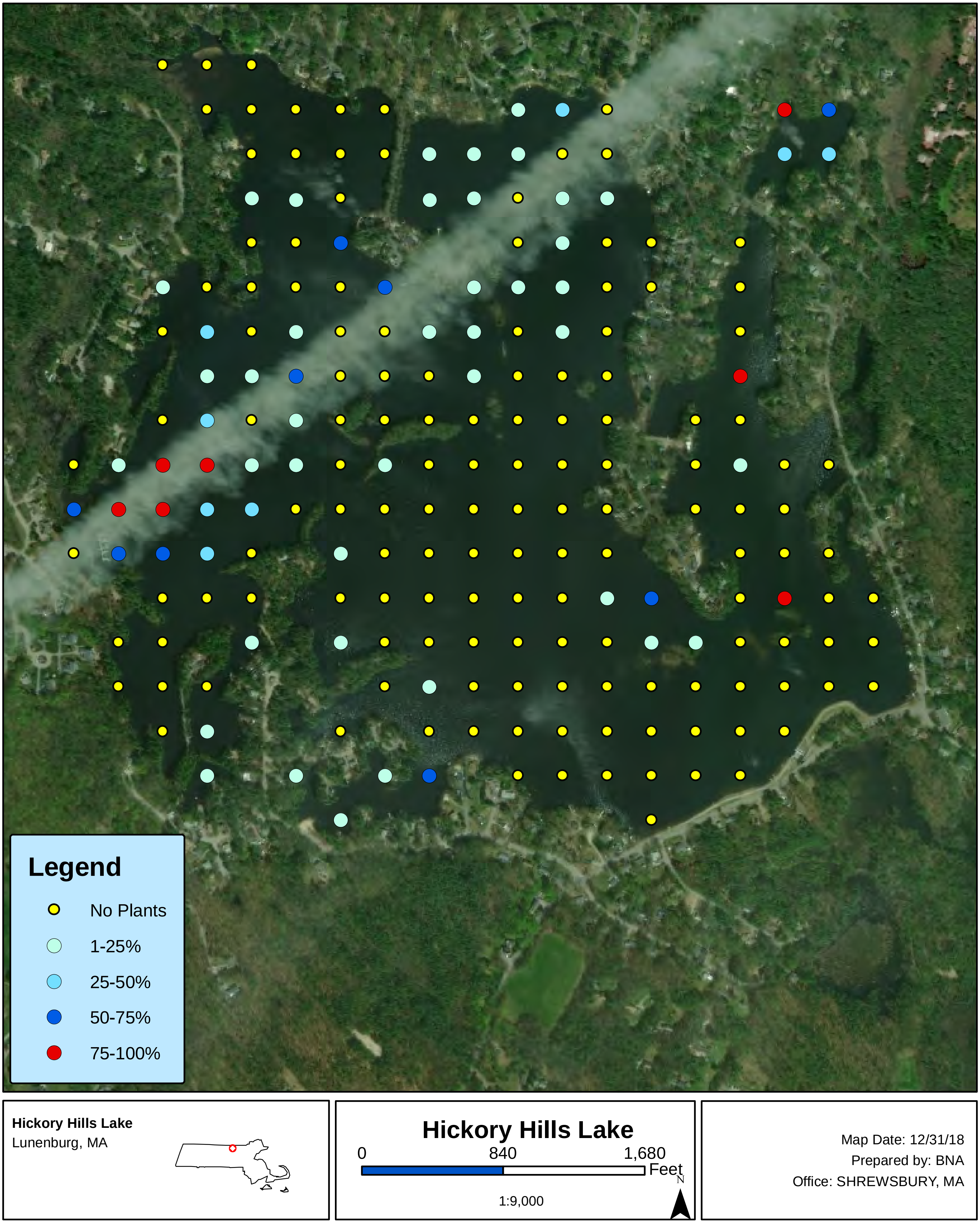
Hickory Hills Lake



Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Robbin's Pondweed (*Potamogeton robbinsii*) Percent Cover
July 2018

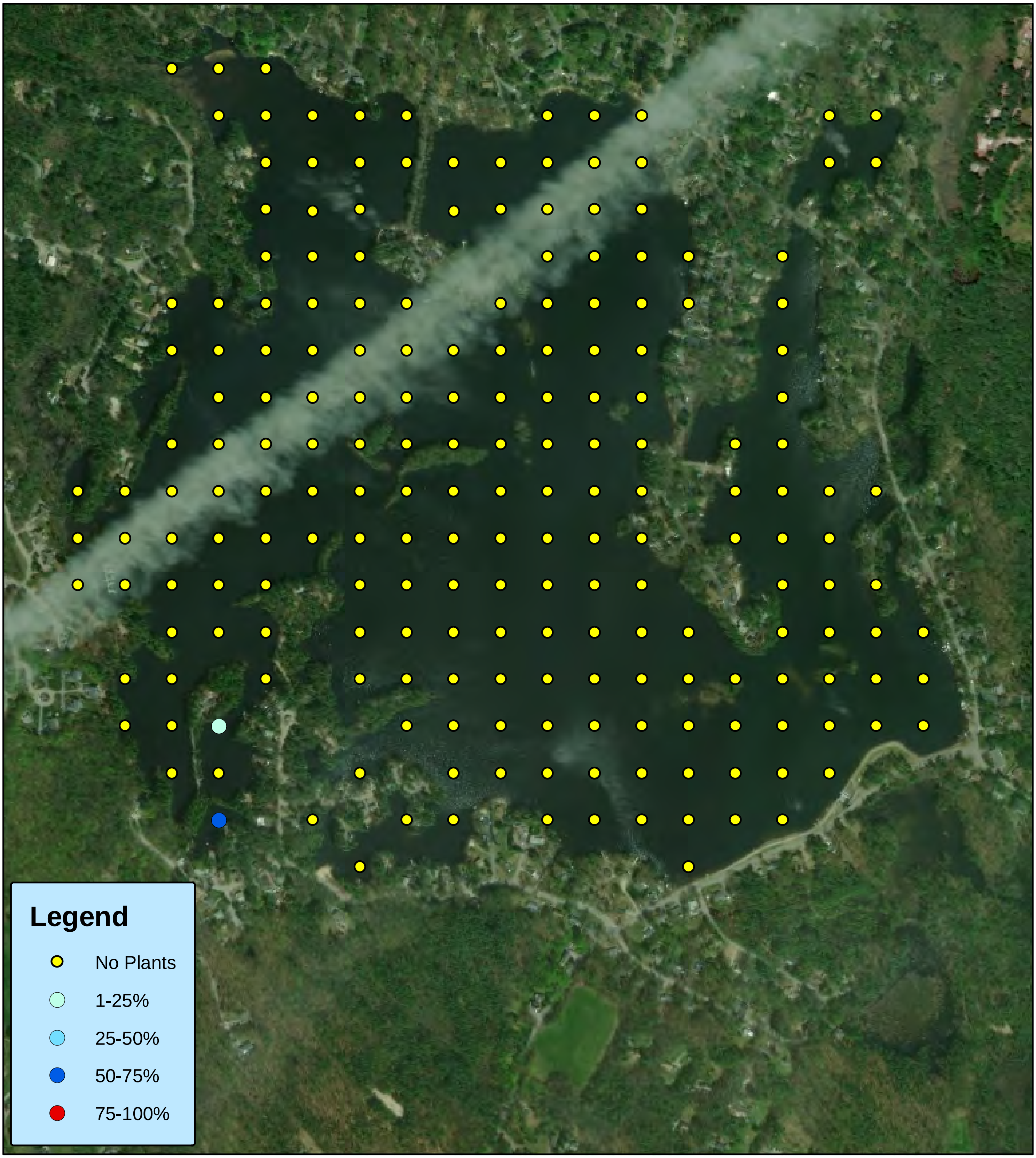
SŌLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Mermaidweed (*Proserpinaca palustris*) Percent Cover
July 2018

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA

Hickory Hills Lake

0 840 1,680 Feet

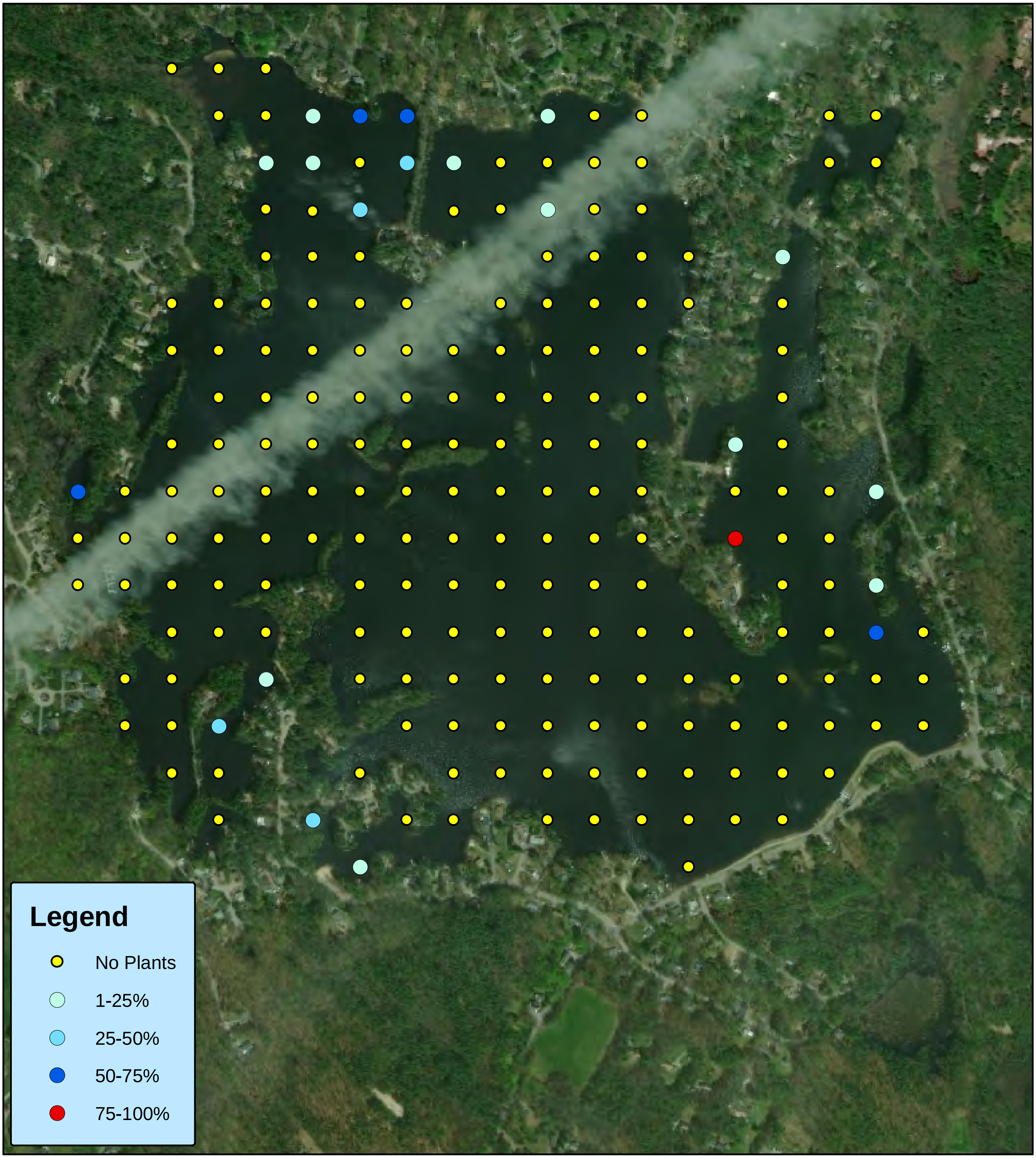
1:9,000

N

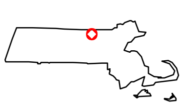
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Grassy Bulrush (*Schoenoplectus subterminalis*) Percent Cover
July 2018

SOLITUDE
LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

0 840 1,680 Feet

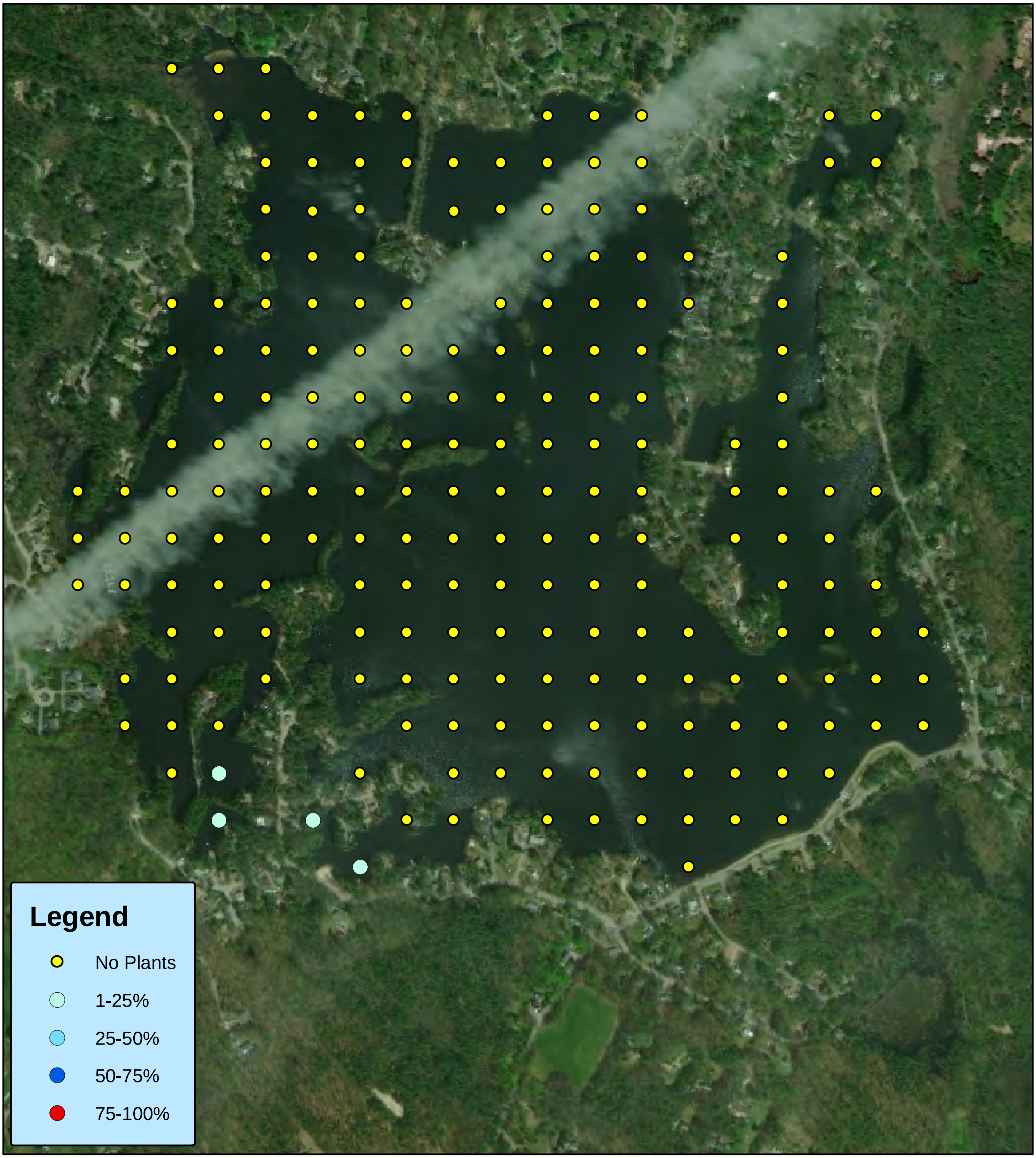
N

1:9,000

Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Flatleaf Bladderwort (*Utricularia intermedia*) Percent Cover
July 2018

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Legend

- No Plants
- 1-25%
- 25-50%
- 50-75%
- 75-100%

Hickory Hills Lake
Lunenburg, MA

Hickory Hills Lake

0 840 1,680 Feet

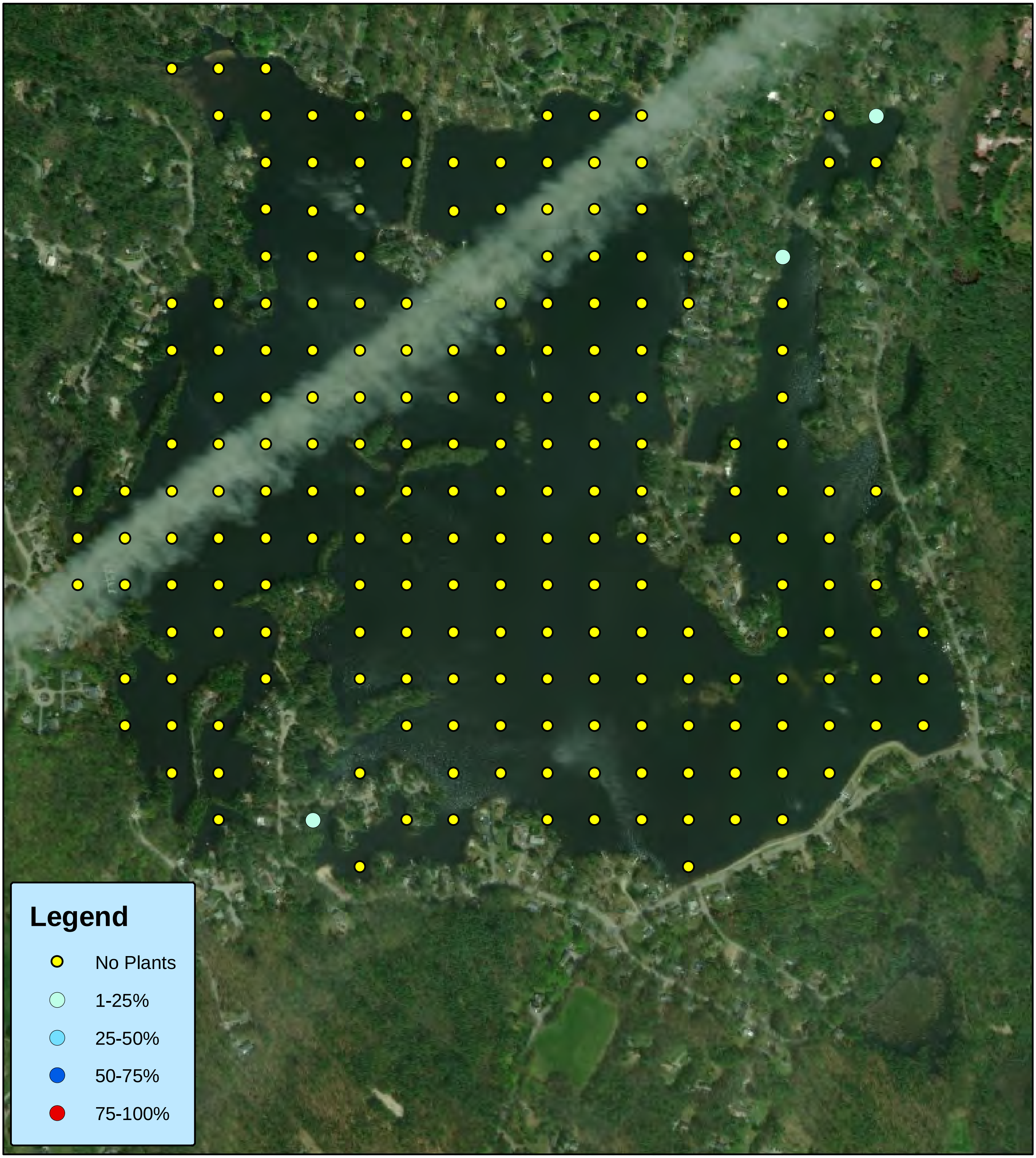
1:9,000

N

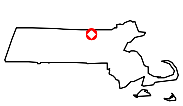
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Creeping Bladderwort (*Utricularia gibba*) Percent Cover
July 2018

SOLITUDE
LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



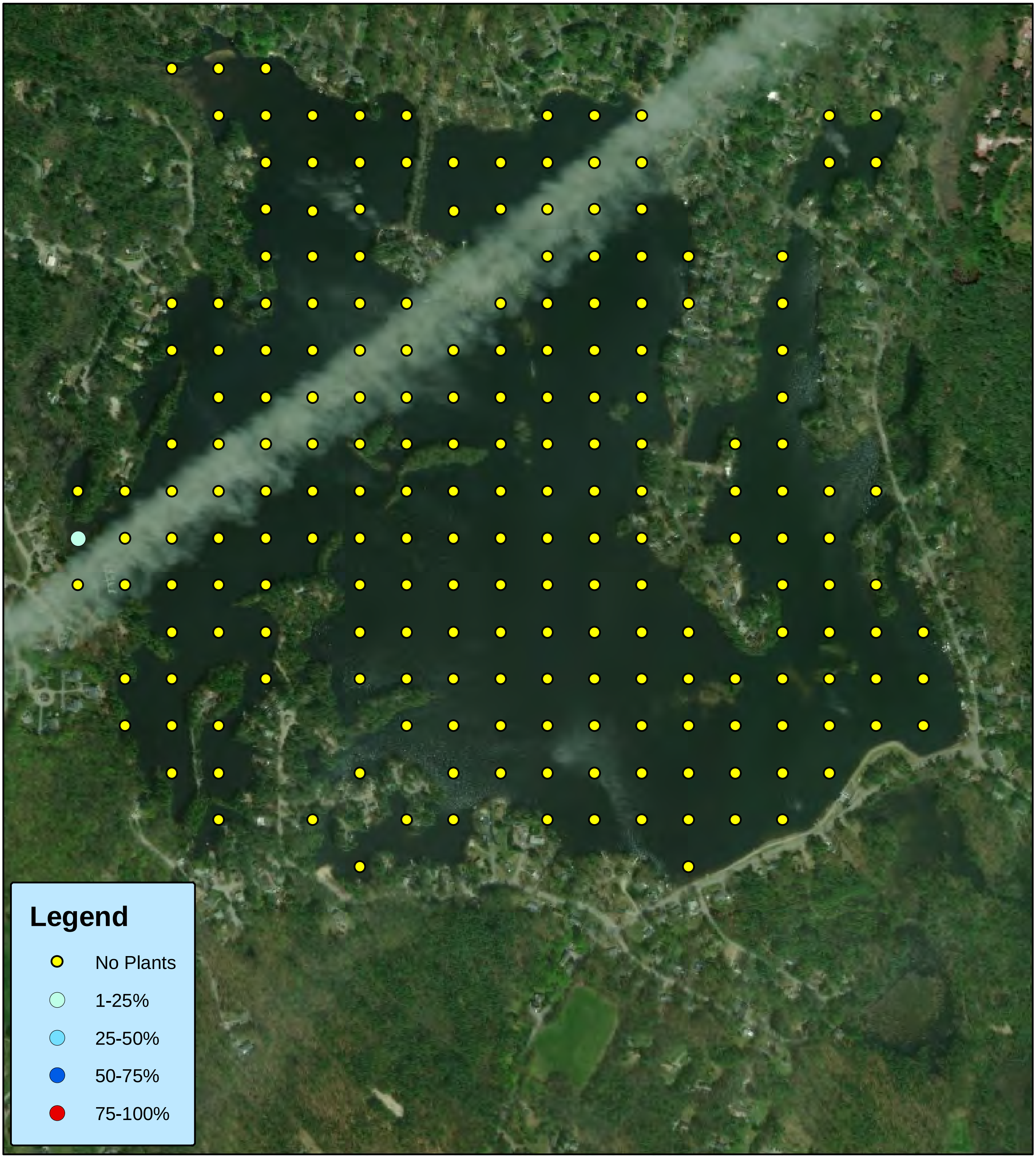
Hickory Hills Lake

0 840 1,680 Feet
N
1:9,000

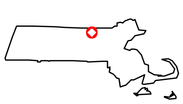
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Lesser Bladderwort (*Utricularia minor*) Percent Cover
July 2018

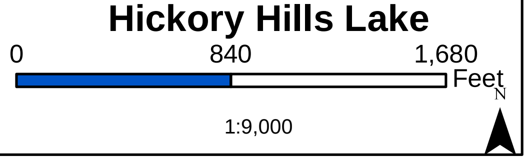
SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake

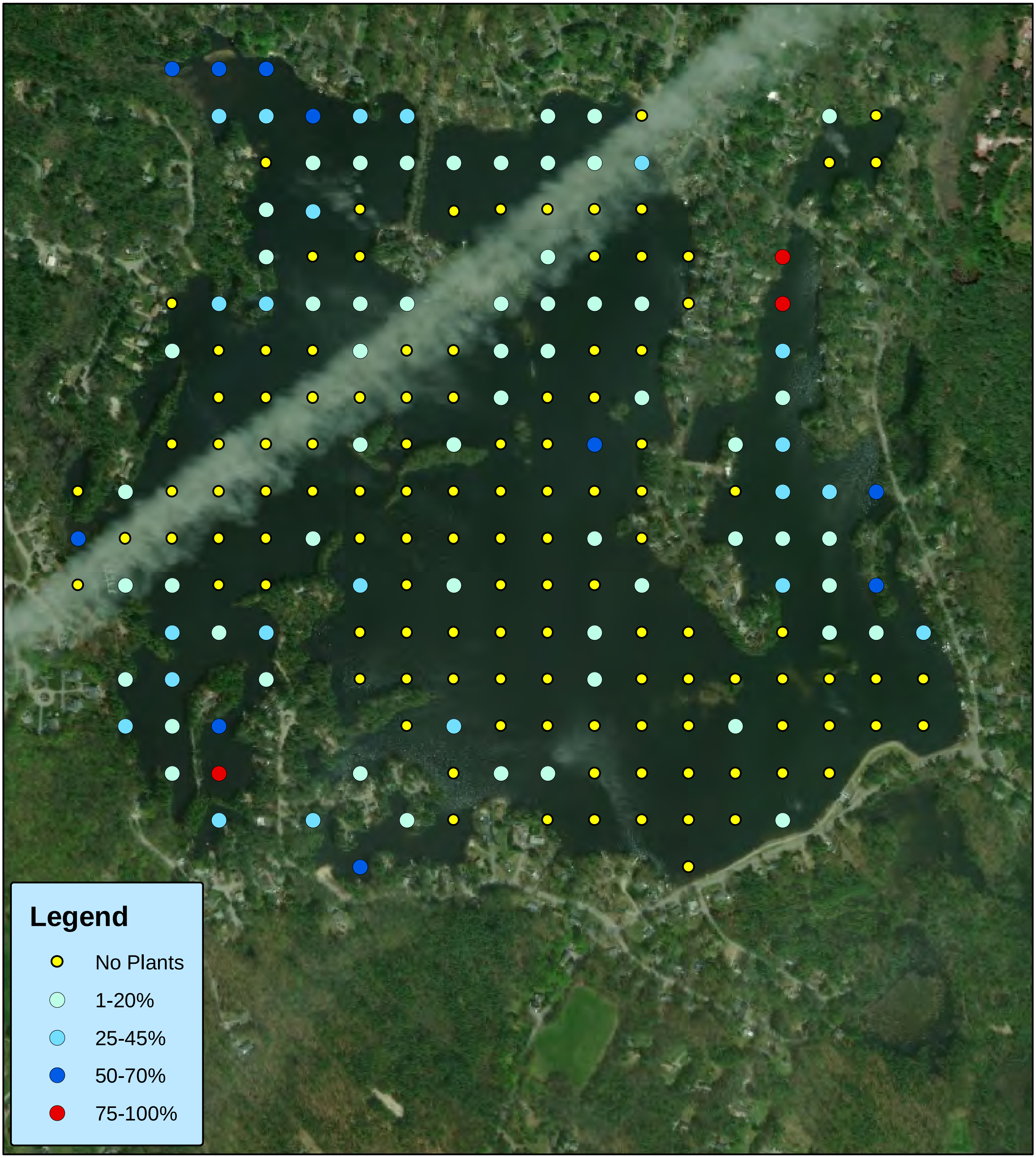


1:9,000

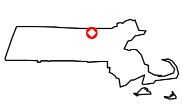
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

PURPLE BLADDERWORT (*Utricularia purpurea*) COVER
July 2018

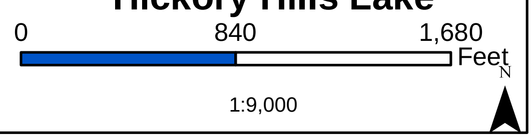
SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



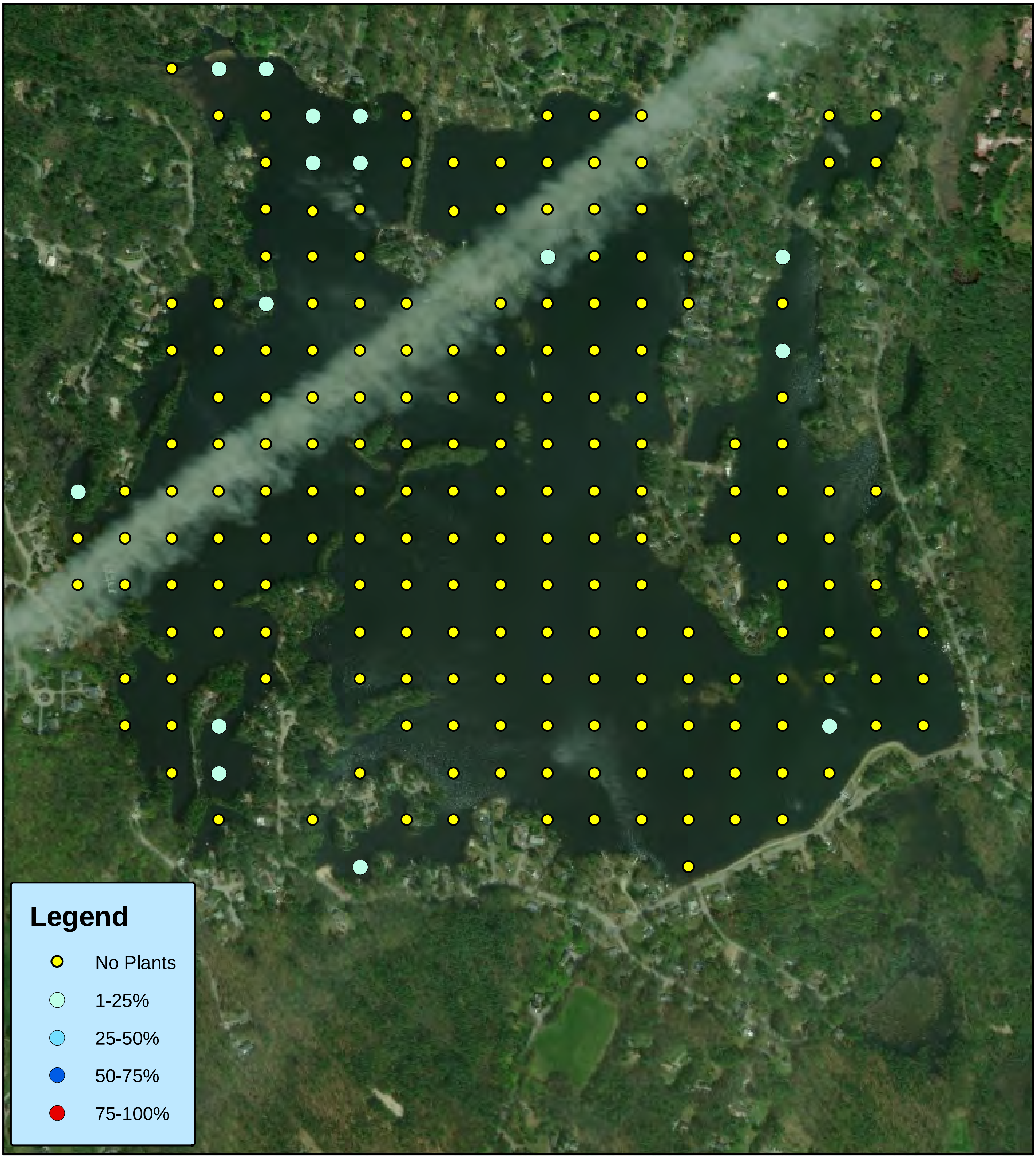
Hickory Hills Lake



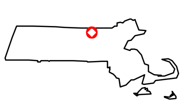
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Little Floating Bladderwort (*Utricularia radiata*) Percent Cover
July 2018

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA

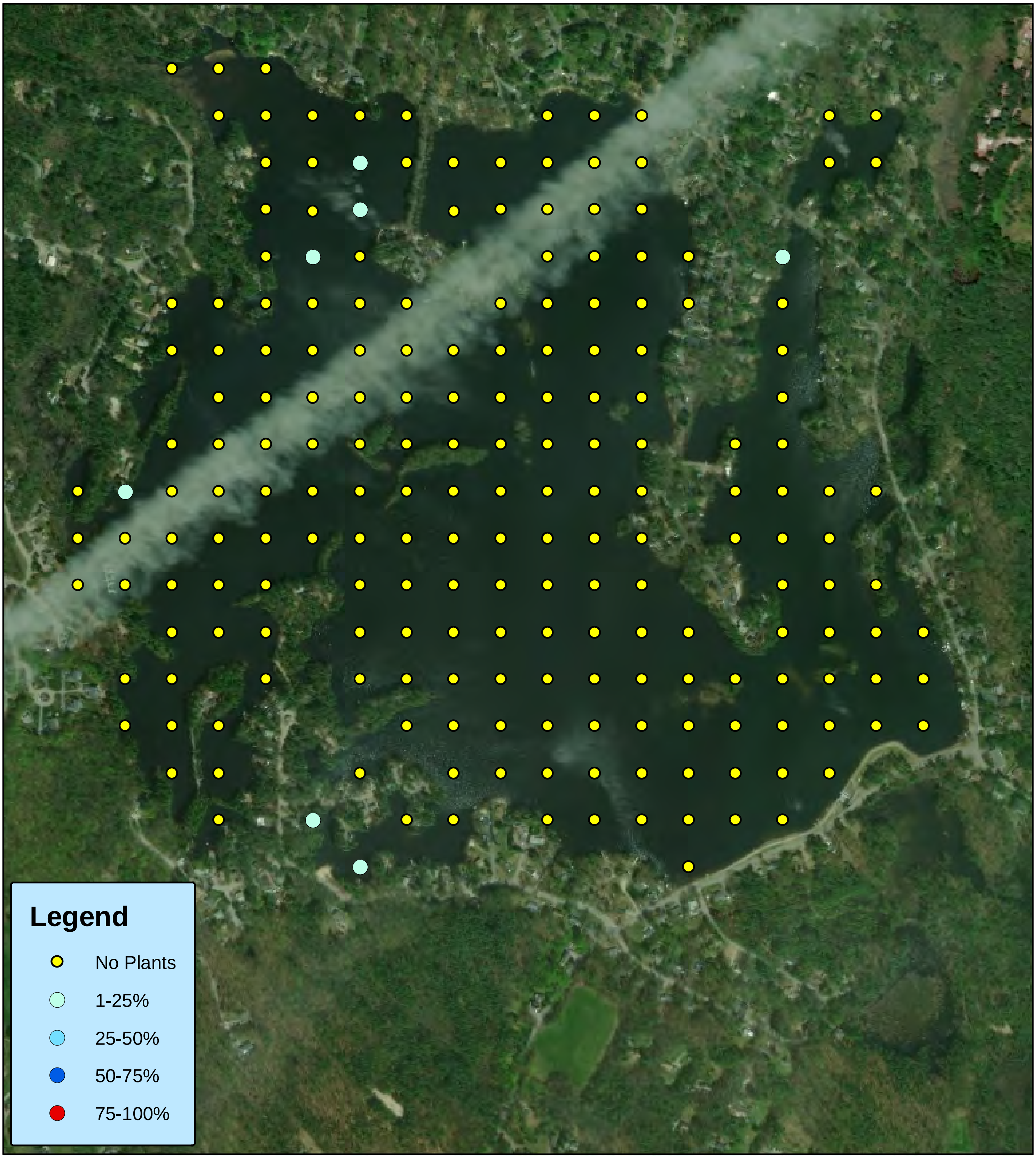


Hickory Hills Lake
0 840 1,680 Feet
N
1:9,000

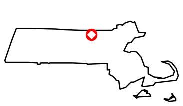
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Common Bladderwort (*Utricularia vulgaris*) Percent Cover
July 2018

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



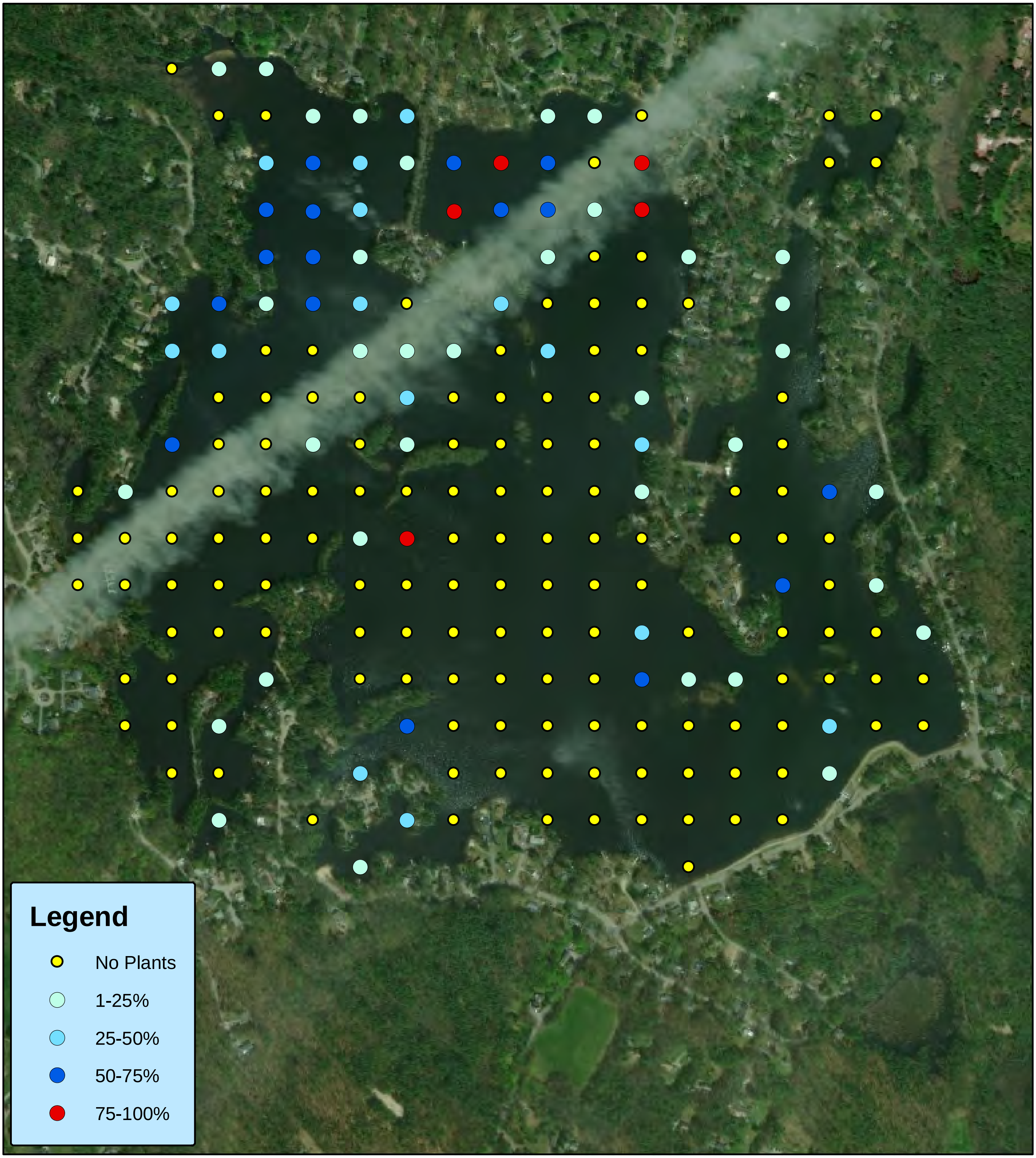
Hickory Hills Lake

1:9,000

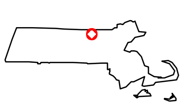
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Tapegrass (*Vallisneria sp.*) Percent Cover
July 2018

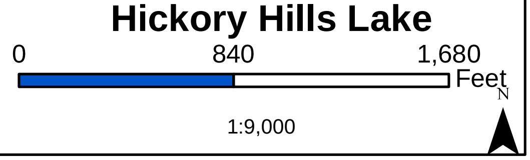
SOLITUDE
LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



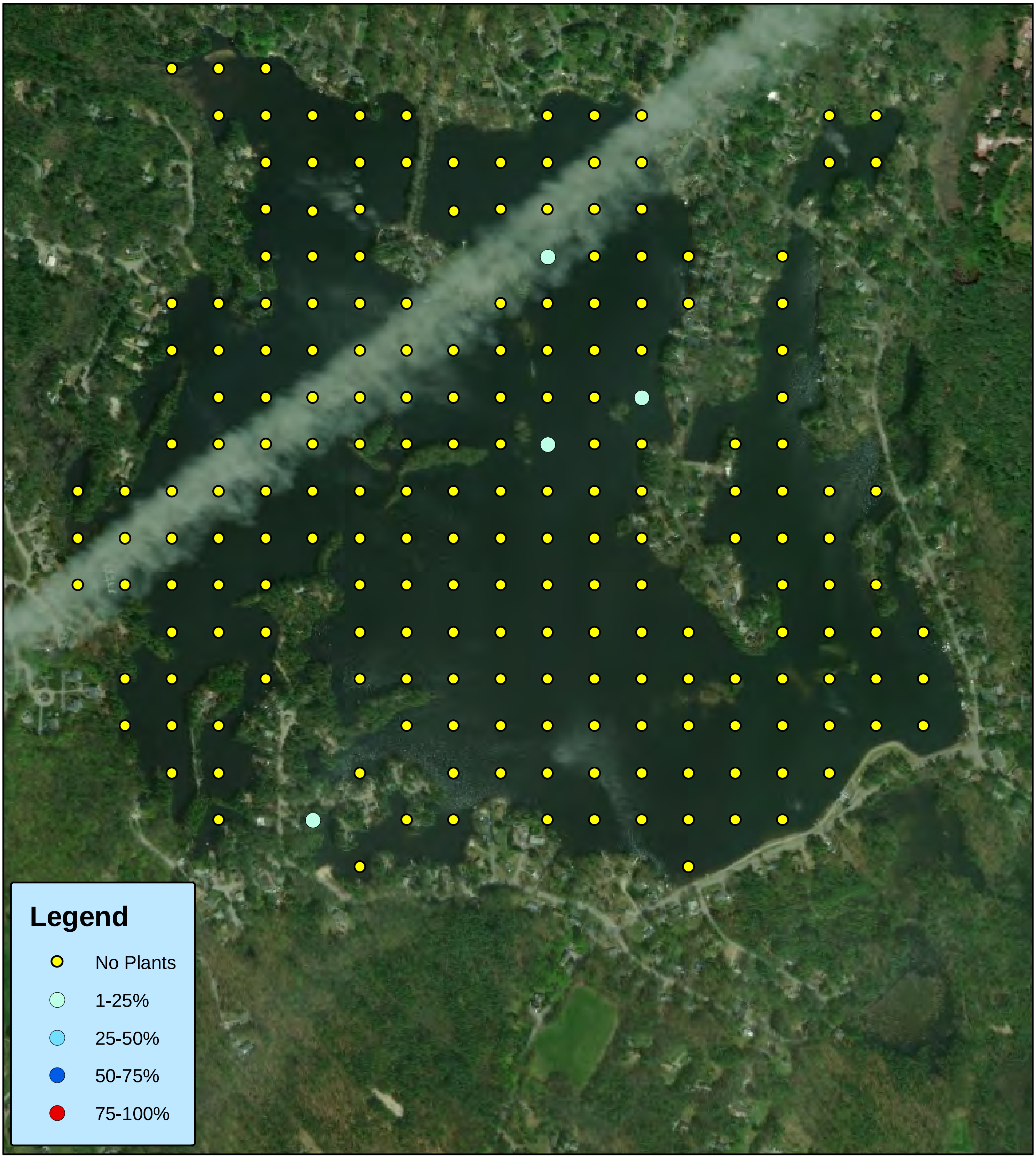
Hickory Hills Lake



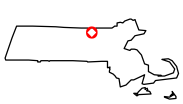
Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Filamentous Algae (*Various*) Percent Cover
July 2018

SŌLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Hickory Hills Lake
Lunenburg, MA



Hickory Hills Lake
0 840 1,680 Feet
1:9,000
N

Map Date: 12/31/18
Prepared by: BNA
Office: SHREWSBURY, MA

Appendix C: Algae and Zooplankton Reports

Northeast Laboratories, Inc. # ANALYTICAL REPORT

SOLitude Lake Management
590 Lake Street
Shrewsbury, MA 01545

EMAIL ADDRESS: BArvidson@solitudelake.com

Report Date:	**7/27/2018**	Date Sampled:	**7/13/2018**
Laboratory ID#:	**1874528 - 01**	Date Received:	**7/19/2018**
		Date Tested:	**7/25/2018**

Sample Site: SURFACE WATER HICKORY HILLS LAKE, COMPOSITE
LUNEBURG MA

MICROSCOPIC EXAMINATION == Natural Units Count & Blue/Green Cell Counts

ORGANISM	#/ml	ORGANISM	#/ml	ORGANISM	Cell #/ml	#/ml	ORGANISM	#/ml
Diatomaceae		**Chlorophyceae**		**Cyanophyceae**			**Protozoa**	
Amphora		Actinastrum		Anabaena*			Actinophrys	
Asterionella*		Arthrodesmus		Anabaenopsis			Amoeba	
Amphiprora		Ankistrodesmus		Aphanocapsa			Arcella	
Cocinodiscus		Chlorella		Aphanizomenon*			Bursaria*	
Cyclotella*	35	Closterium		Aphanothece			Ceratium	18
Cymbella		Coelastrum		Aulosira			Cercomonas	
Diatoma*	18	Cosmarium		Arthrospira			Chilomonas	
Frustulia		Dictyosphaerium*		Chroococcus			Chlamydomonas	
Fragilaria		Eudorina*		Clathrocystis*			Codonella	
Gyrosigma		Elakatothrix		Coelosphaerium*			Cryptomonas*	
Gomphonema		Gleocystis		Cylindrospermum			Difflugia	
Melosira	18	Micrasterias		Cuspidothrix			Dinobryon*	
Meridion*		Mougeotia		Dactylococcopsis			Euglena	
Navicula		Pandorina*		Eucapsis			Glenodinium*	
Nitzschia		Pediastrum		Gleocapsa	144	18	Gonium	
Pleurosigma		Protococcus		Galucocystis			Halteria	
Stephanodiscus		Quadrigula		Gloeothece			Mallomonas*	
Surirella		Scenedesmus		Gomphosphaeria	180	18	Monas	
Synedra		Sphaerocystis		Hydrocoleum			Peridinium*	
Tabellaria*	18	Sphaerozosma		Microcystis	700	35	Synura*	
		Spirogyra		Merismopedia			Trachelomonas	
		Staurastrum		Nostoc			Uroglenopsis*	
		Tetraspora		Nodularia			Vorticella	
Rotifera		Westella		Oscillaria				
Anuraea		Ulothrix		Pseudanabaena				
Asplanchna		Volvox*		Spirulina				
Brachionus		Xanthidium		Rivularia*				
Conochilus		Zygnema		Xenococcus				
Euchlanis								
Keratella								
Notholca				**Miscellaneous**				
Polyarthra				Acarina				
Rotifer				Anguillula				
Synchaeta				Bosmina				
Kellicottia				Canthocamptus			* Odor Producing	
				Cyclops				
				Daphnia				
				Diaptomus				

TOTAL NATURAL UNIT COUNT:	**180 / ml**	**BLUE GREEN CELL COUNT:**	**1,000 / ml**

Comments: Results are based on sample, as submitted to Northeast Laboratories, Inc. on: 7/19/2018

Approved by: Alan C. Johnson

Alan C. Johnson, Lab Director

SOLitude Lake Management
590 Lake Street
Shrewsbury, MA 01545

EMAIL ADDRESS: BArvidson@solitudelake.com

Report Date:	**7/27/2018**	Date Sampled:	**7/13/2018**
Laboratory ID#:	**1874528 - 02**	Date Received:	**7/19/2018**
		Date Tested:	**7/25/2018**

Sample Site: SURFACE WATER LITTLE HICKORY
LUNEBURG MA

MICROSCOPIC EXAMINATION == Natural Units Count & Blue/Green Cell Counts

ORGANISM	#/ml	ORGANISM	#/ml	ORGANISM	Cell #/ml	#/ml	ORGANISM	#/ml
Diatomaceae		**Chlorophyceae**		**Cyanophyceae**			**Protozoa**	
Amphora		Actinastrum		Anabaena*			Actinophrys	
Asterionella*		Arthrodesmus		Anabaenopsis			Amoeba	
Amphiprora		Ankistrodesmus		Aphanocapsa			Arcella	
Cocinodiscus		Chlorella		Aphanizomenon*			Bursaria*	
Cyclotella*	35	Closterium		Aphanothece			Ceratium	
Cymbella		Coelastrum		Aulosira			Cercomonas	
Diatoma*		Cosmarium	35	Arthrospira			Chilomonas	
Frustulia		Dictyosphaerium*		Chroococcus			Chlamydomonas	
Fragilaria		Eudorina*		Clathrocystis*			Codonella	
Gyrosigma		Elakatothrix		Coelosphaerium*			Cryptomonas*	
Gomphonema		Gleocystis		Cylindrospermum			Difflugia	
Melosira		Micrasterias		Cuspidothrix			Dinobryon*	
Meridion*		Mougeotia		Dactylococcopsis			Euglena	
Navicula		Pandorina*		Eucapsis			Glenodinium*	
Nitzschia		Pediastrum		Gleocapsa	1100	140	Gonium	
Pleurosigma		Protococcus		Galucocystis			Halteria	
Stephanodiscus		Quadrigula		Gloeothece			Mallomonas*	
Surirella		Scenedesmus		Gomphosphaeria			Monas	
Synedra		Sphaerocystis		Hydrocoleum			Peridinium*	
Tabellaria*		Sphaerozosma		Microcystis			Synura*	
		Spirogyra		Merismopedia			Trachelomonas	
		Staurastrum	35	Nostoc			Uroglenopsis*	
		Tetraspora		Nodularia			Vorticella	
Rotifera		Westella		Oscillaria	1800	175		
Anuraea		Ulothrix	420	Pseudanabaena				
Asplanchna		Volvox*		Spirulina				
Brachionus		Xanthidium		Rivularia*				
Conochilus		Zygnema		Xenococcus				
Euchlanis								
Keratella								
Notholca				**Miscellaneous**				
Polyarthra				Acarina				
Rotifer				Anguillula				
Synchaeta				Bosmina				
Kellicottia				Canthocamptus			* Odor Producing	
				Cyclops				
				Daphnia				
				Diaptomus				

TOTAL NATURAL UNIT COUNT: 840 / ml

BLUE GREEN CELL COUNT: 2,900 / ml

Comments: Results are based on sample, as submitted to Northeast Laboratories, Inc. on: 7/19/2018

Approved by:
Alan C. Johnson, Lab Director

SOLitude Lake Management
590 Lake Street
Shrewsbury, MA 01545

EMAIL ADDRESS: BArvidson@solitudelake.com

Report Date:	**8/09/2018**	Date Sampled:	**8/07/2018**
Laboratory ID#:	**1874713-01**	Date Received:	**8/07/2018**
		Date Tested:	**8/07/2018**

Sample Site: SURFACE WATER LITTLE HICKORY HILL LAKE- LUNENBURG MA

MICROSCOPIC EXAMINATION == Natural Units Count & Blue/Green Cell Counts

ORGANISM	#/ml	ORGANISM	#/ml	ORGANISM	Cell #/ml	#/ml	ORGANISM	#/ml
Diatomaceae		**Chlorophyceae**		**Cyanophyceae**			**Protozoa**	
Amphora		Actinastrum		Anabaena*			Actinophrys	
Asterionella*	140	Arthrodesmus		Anabaenopsis			Amoeba	
Amphiprora		Ankistrodesmus		Aphanocapsa			Arcella	
Cocinodiscus		Chlorella		Aphanizomenon*			Bursaria*	
Cyclotella*	390	Closterium		Aphanothece			Ceratium	
Cymbella		Coelastrum	35	Aulosira			Cercomonas	
Diatoma*	105	Cosmarium		Arthrospira			Chilomonas	
Frustulia		Dictyosphaerium*		Chroococcus	280	70	Chlamydomonas	
Fragilaria		Eudorina*		Clathrocystis*			Codonella	
Gyrosigma		Elakatothrix		Coelosphaerium*			Cryptomonas*	
Gomphonema		Gleocystis		Cylindrospermum			Difflugia	
Melosira	460	Micrasterias	35	Cuspidothrix			Dinobryon*	
Meridion*		Mougeotia		Dactylococcopsis			Euglena	
Navicula		Pandorina*		Eucapsis			Glenodinium*	
Nitzschia		Pediastrum		Gleocapsa			Gonium	
Pleurosigma		Protococcus		Galucocystis			Halteria	
Stephanodiscus		Quadrigula		Gloeothece			Mallomonas*	140
Surirella		Scenedesmus		Gomphosphaeria	350	35	Monas	
Synedra		Sphaerocystis		Hydrocoleum			Peridinium*	
Tabellaria*	140	Sphaerozosma		Microcystis	1400	70	Synura*	
		Spirogyra		Merismopedia			Trachelomonas	
		Staurastrum	70	Nostoc			Uroglenopsis*	
		Tetraspora		Nodularia			Vorticella	
Rotifera		Westella		Oscillaria				
Anuraea		Ulothrix	2	Pseudanabaena				
Asplanchna		Volvox*		Spirulina				
Brachionus		Xanthidium		Rivularia*				
Conochilus		Zygnema		Xenococcus				
Euchlanis								
Keratella								
Notholca				**Miscellaneous**				
Polyarthra				Acarina				
Rotifer				Anguillula				
Synchaeta				Bosmina				
Kellicottia				Canthocamptus			* Odor Producing	
				Cyclops				
				Daphnia				
				Diaptomus				

TOTAL NATURAL UNIT COUNT: 1700 / ml

BLUE GREEN CELL COUNT: 2000 / ml

Comments: Results are based on sample, as submitted to Northeast Laboratories, Inc. on: 8/07/2018

Approved by:
Alan C. Johnson, Lab Director

SOLitude Lake Management
590 Lake Street
Shrewsbury, MA 01545

EMAIL ADDRESS: BArvidson@solitudelake.com

Report Date:	8/09/2018	Date Sampled:	8/07/2018
Laboratory ID#:	1874713-02	Date Received:	8/07/2018
		Date Tested:	8/07/2018

Sample Site: SURFACE WATER HEMLOCK BEACH, HICKORY HILL LAKE- LUNENBURG MA

MICROSCOPIC EXAMINATION == Natural Units Count & Blue/Green Cell Counts

ORGANISM	#/ml	ORGANISM	#/ml	ORGANISM	Cell #/ml	#/ml	ORGANISM	#/ml
Diatomaceae		**Chlorophyceae**		**Cyanophyceae**			**Protozoa**	
Amphora		Actinastrum		Anabaena*			Actinophrys	
Asterionella*		Arthrodesmus		Anabaenopsis			Amoeba	
Amphiprora		Ankistrodesmus	70	Aphanocapsa			Arcella	
Cocinodiscus		Chlorella		Aphanizomenon*			Bursaria*	
Cyclotella*	280	Closterium		Aphanothece			Ceratium	70
Cymbella		Coelastrum		Aulosira			Cercomonas	
Diatoma*		Cosmarium		Arthrospira			Chilomonas	
Frustulia		Dictyosphaerium*		Chroococcus	280	70	Chlamydomonas	
Fragilaria		Eudorina*		Clathrocystis*			Codonella	
Gyrosigma		Elakatothrix		Coelosphaerium*			Cryptomonas*	
Gomphonema		Gleocystis		Cylindrospermum			Difflugia	
Melosira		Micrasterias		Cuspidothrix			Dinobryon*	
Meridion*		Mougeotia		Dactylococcopsis			Euglena	
Navicula		Pandorina*		Eucapsis			Glenodinium*	
Nitzschia		Pediastrum		Gleocapsa			Gonium	
Pleurosigma		Protococcus		Galucocystis			Halteria	
Stephanodiscus		Quadrigula		Gloeothece			Mallomonas*	70
Surirella		Scenedesmus	35	Gomphosphaeria	1100	105	Monas	
Synedra	105	Sphaerocystis		Hydrocoleum			Peridinium*	
Tabellaria*		Sphaerozosma		Microcystis	2100	105	Synura*	
		Spirogyra		Merismopedia			Trachelomonas	
		Staurastrum		Nostoc			Uroglenopsis*	
		Tetraspora		Nodularia			Vorticella	
Rotifera		Westella		Oscillaria	1100	105		
Anuraea		Ulothrix	420	Pseudanabaena				
Asplanchna		Volvox*		Spirulina				
Brachionus		Xanthidium		Rivularia*				
Conochilus		Zygnema		Xenococcus				
Euchlanis								
Keratella								
Notholca				**Miscellaneous**				
Polyarthra				Acarina				
Rotifer				Anguillula				
Synchaeta				Bosmina				
Kellicottia				Canthocamptus			* Odor Producing	
				Cyclops				
				Daphnia				
				Diaptomus				

TOTAL NATURAL UNIT COUNT: 1400 / ml

BLUE GREEN CELL COUNT: 4600 / ml

Comments: Results are based on sample, as submitted to Northeast Laboratories, Inc. on: 8/07/2018

Approved by: Alan C. Johnson
Alan C. Johnson, Lab Director

Northeast Laboratories, Inc.

ANALYTICAL REPORT

SOLitude Lake Management
590 Lake Street
Shrewsbury, MA 01545

EMAIL ADDRESS: BArvidson@solitudelake.com

Report Date:	**8/09/2018**	Date Sampled:	**8/07/2018**
Laboratory ID#:	**1874713-03**	Date Received:	**8/07/2018**
		Date Tested:	**8/08/2018**

Sample Site: SURFACE WATER TURTLE COVE, HICKORY HILL LAKE- LUNENBURG MA

MICROSCOPIC EXAMINATION == Natural Units Count & Blue/Green Cell Counts

ORGANISM	#/ml	ORGANISM	#/ml	ORGANISM	Cell #/ml	#/ml	ORGANISM	#/ml
Diatomaceae		**Chlorophyceae**		**Cyanophyceae**			**Protozoa**	
Amphora		Actinastrum		Anabaena*			Actinophrys	
Asterionella*	35	Arthrodesmus		Anabaenopsis			Amoeba	
Amphiprora		Ankistrodesmus		Aphanocapsa			Arcella	
Cocinodiscus		Chlorella		Aphanizomenon*			Bursaria*	
Cyclotella*	140	Closterium		Aphanothece			Ceratium	
Cymbella		Coelastrum		Aulosira			Cercomonas	
Diatoma*		Cosmarium		Arthrospira			Chilomonas	
Frustulia		Dictyosphaerium*		Chroococcus	560	140	Chlamydomonas	
Fragilaria		Eudorina*		Clathrocystis*			Codonella	
Gyrosigma		Elakatothrix		Coelosphaerium*			Cryptomonas*	
Gomphonema		Gleocystis		Cylindrospermum			Difflugia	
Melosira		Micrasterias		Cuspidothrix			Dinobryon*	
Meridion*		Mougeotia		Dactylococcopsis			Euglena	
Navicula		Pandorina*		Eucapsis			Glenodinium*	
Nitzschia		Pediastrum		Gleocapsa			Gonium	
Pleurosigma		Protococcus		Galucocystis			Halteria	
Stephanodiscus		Quadrigula		Gloeothece			Mallomonas*	
Surirella		Scenedesmus		Gomphosphaeria	1400	140	Monas	
Synedra	105	Sphaerocystis		Hydrocoleum			Peridinium*	
Tabellaria*		Sphaerozosma		Microcystis	2800	140	Synura*	
		Spirogyra		Merismopedia			Trachelomonas	
		Staurastrum		Nostoc			Uroglenopsis*	
		Tetraspora		Nodularia			Vorticella	
Rotifera		Westella		Oscillaria	1100	105		
Anuraea		Ulothrix		Pseudanabaena				
Asplanchna		Volvox*		Spirulina				
Brachionus		Xanthidium		Rivularia*				
Conochilus		Zygnema		Xenococcus				
Euchlanis								
Keratella								
Notholca				**Miscellaneous**				
Polyarthra				Acarina				
Rotifer				Anguillula				
Synchaeta				Bosmina				
Kellicottia				Canthocamptus			* Odor Producing	
				Cyclops				
				Daphnia				
				Diaptomus				

TOTAL NATURAL UNIT COUNT: 800 / ml

BLUE GREEN CELL COUNT: 5900 / ml

Comments: Results are based on sample, as submitted to Northeast Laboratories, Inc. on: 8/07/2018

Approved by: Alan C. Johnson

Alan C. Johnson, Lab Director

Zooplankton Count Results

Site: Hickory Hills (Mid Lake Tow) **Date: 7/13/2018**

Group	Order	Family	Genus	Replicate A	Replicate B	Replicate C	Total/3 (# per mL)	x1000 mL (= 1 L)	Water sampled (L)	# organisms per L
Rotifera	**Ploima**	Brachionidae	*Keratella*	25	30	22	25.67	25667	68.8	373
		Trichocercidae	*Trichocerca*	6	2	1	3.00	3000	68.8	44
	Flosculariacea	Hexarthridae	*Hexarthra*	1			0.33	333	68.8	5
									Total:	**422**
Cladocera	**Cladocera**	Bodminidae	*Eubosmina*	2		1	1.00	1000	68.8	15
		Daphniidae	*Daphnia*	2			0.67	667	68.8	10
									Total:	**25**
Copepoda	**Cyclopoida**	Cyclopoidae	*Microcyclops*	13	11	10	11.33	11333	68.8	165
			Cyclopoid	2	2	2	2.00	2000	68.8	29
									Total:	**194**

Total Organisms per L	Rotifera	%	Cladocera	%	Copepoda	%
641	422	65.8%	25	3.8%	194	30.2%