Aquatic Invasive Species Management Plan

For

Big & Little Newton Lakes

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Newton Lakes Aquatic Invasive Species Management Plan

Big and Little Newton Lakes are located in the Town of Stephenson (T33N, R19E, S3&4) in Marinette County, Wisconsin. A small portion of Big Newton Lake is located in the Town of Athelstane. The lakes are separated by a narrow strip of land on which Newton Lake Road is located. Both Lakes are heavily developed and both have public access.

The purpose of this report is to develop a plan for managing of Eurasian watermilfoil (*Myriophyllum spicatum*) in Little Newton Lake with the goal of eventual eradication of the species. The document also provides a plan for preventing the spread of Eurasian watermilfoil (EWM) and other aquatic invasive species between and among area lakes and flowages.

Newton Lakes Association

The Newton Lakes Association has been active in tracking and protecting water quality. Volunteers on both lakes have been monitoring water quality through the Citizen Lakes Monitoring Network for the past 12 years. The Association also promotes lake friendly practices, is active in managing increasingly heavy public use, and works to improve the fishery of both lakes.

Overview of Physical & Chemical Characteristics of the Newton Lakes

Little Newton Lake is a 59-acre seepage lake with a maximum depth of 52 feet. Big Newton Lake is a 67-acre seepage lake with a maximum depth of 44 feet. Both lakes have hard water, excellent water clarity, and historically low phosphorus levels resulting in good water quality.

Seepage lakes receive most their water through groundwater seepage and both lakes experience significant water level fluctuations annually and during dry weather periods. For both lakes the watershed area is relatively small. Soils in the watershed are sandy and excessively drained and most overland runoff reaching the lakes originates on those properties immediately bordering the water.

Due to their relatively small size and great depth, both lakes experience strong thermal stratification, which results in hypolimnetic oxygen depletion during the summer months. Thermal stratification occurs when the surface water warms quickly and forms a distinct layer above a much cooler bottom layer called the hypolimnion. Once established, density differences prevent the layers from mixing until the surface water cools in the fall. Oxygen in the hypolimnion can fall to very low levels during these periods as it is consumed by decomposition in the sediment.

Public Access & Recreational Use

Relative to most small lakes in Marinette County, recreational use on both lakes is high and many would describe weekend recreational use as excessive. Both lakes are popular with water skiers and personal watercraft users from on and off-lake. The town of Stephenson maintains boat landings on Big and Little Newton Lakes. Both consist of a hard surface ramp to the waters edge. No boarding docks are provided. The town also maintains a popular swimming beach on Little Newton Lake. It is common to see hundreds of people using the beach on a seasonable summer day.

Overview of Newton Lakes Fish Communities

Both lakes support cool water fisheries dominated by largemouth bass, northern pike, bluegill, and white sucker with limited numbers of walleye and yellow perch. Most landowners feel that that fishing is better on Little Newton Lake than Big Newton. Both lakes are wanting in shallow-water fish habitat. Littoral areas on both lakes consist primarily of wave washed sand, sparse emergent vegetation and little or no coarse woody cover.

Aquatic Plant Communities

Since the structure of the littoral zone, hydrology and water chemistry are similar in both lakes it follows that the aquatic plant communities of Big and Little Newton Lakes are also very similar. Both lakes have rather limited aquatic plant communities with few species. In both lakes the aquatic plant communities are also impacted by development pressure and the amount of recreational boating.

The Wisconsin DNR completed detailed aquatic plant surveys of both lakes in August of 2005. In July 2009 the Marinette County LWCD repeated the surveys as part of the Aquatic Invasive Species Rapid Response Grant. All surveys were conducted according to Wisconsin DNR survey methodology. In addition, detailed mapping of EWM beds was conducted on Little Newton Lake several times during the project period to guide ongoing eradication efforts.

Survey Methodology

The aquatic plant surveys were conducted using Wisconsin DNR point/intercept sampling protocol with a point spacing interval of 35 meters (115 feet). Coordinates for each of the sample points were loaded onto a Garmin Vista handheld GPS unit for navigation in the field.

At each sample location a special double-headed garden rake on an extendable aluminum pole was used to determine the water depth and sediment type and to sample aquatic plants. Plants were collected for identification by dragging the rake across the bottom for approximately 0.75 meters and bringing it to the surface. For each species of plant found on the rake a relative abundance measurement of 1 to 3 was recorded with 1 being sparse where the species was present and 3 being abundant with a rake "full" of the species. Abundance was also recorded for the total amount of plant material on the rake.

The field survey was completed using a team of three individuals, a "driver" a "sampler" and a "data recorder". The driver navigated to each sample point using the GPS receiver and the data recorder filled out the field sheets. When a survey point was reached the sampler would call out the depth and bottom type and sample the vegetation. Typically the sampler could sort and call out the vegetation data before the next sample point was reached. Sample points that were clearly in excess of the maximum depth of plant colonization were not sampled. At these sites depth was determined with an electronic depth finder and recorded.

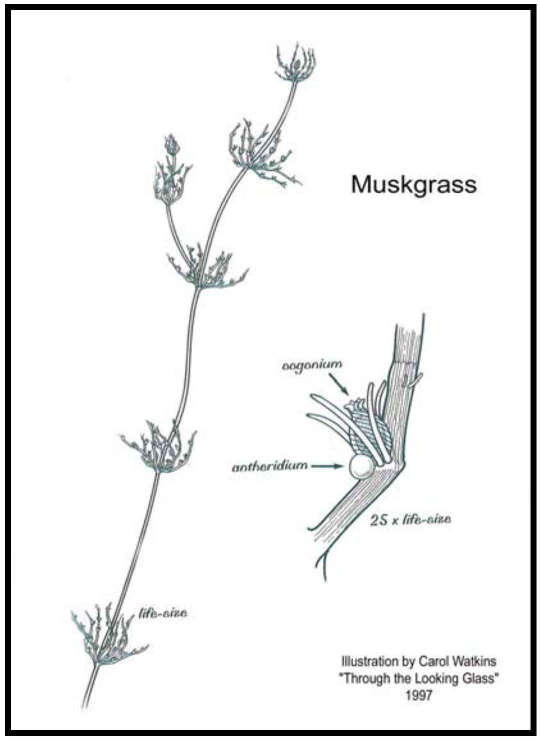
Data was entered and analysis was completed using Microsoft Excel. A full report of the 2009 aquatic plant survey can be found in Appendix A. All sample location and associated data were mapped in the Marinette County Geographic Information Systems (GIS) database. Plant distribution maps for each lake and for each species can also be found in Appendix A.

Common Aquatic Plants

The following aquatic plants were identified during the aquatic plant surveys. The plant descriptions and drawings were taken from "Through the Looking Glass…A Field Guide to Aquatic Plants" (Boreman 1997). Most of the plants were common to both lakes. A detailed discussion of each lakes aquatic plant community follows.

Muskgrass

Muskgrass (*Chara spp.*) is the most widely distributed aquatic plant in both lakes. While outwardly appearing like many other aquatic plants, muskgrass is actually a type of colonial algae. Each "stem" and "leaf segment" is actually a separate algal cell. Muskgrass has branching slender "stems" with whorls of "leaves" at each joint. The main branches have ridges and the entire plant is often encrusted with calcium carbonate giving the plant a gritty or crusty feel. Muskgrass can be easily identified by its smell. When crushed the plant smells like skunk!



Muskgrass is found in hard water lakes and prefers firm sediment. In the Newton Lakes muskgrass shows a strong preference for sandy sediment. Muskgrass does not show a distinct depth preference and can be found in both lakes growing in water from 1 to 15 feet in depth.

Muskgrass is a favorite food of waterfowl and provides excellent fish habitat. In very shallow sandy areas used by newly hatched fry (juvenile fish), muskgrass is often the dominant plant.

Bushy Pondweed

Bushy pondweed was the second most abundant plant in both lakes. This plant varies greatly in growth form. It is often compact and bushy in shallow water but long and wiry with widely scattered leaves in deep water. The leaves are very narrow (1/16th inch wide) with a broad base where they attach to the stem. Plants generally grow no more than 2 feet tall and prefer a firm substrate.

In both lakes bushy pondweed was most abundant in 5 to 12 feet of water. The preferred sediment type was muck.

Bushy pondweed is rather unique in that it's one of the few annual aquatic plants. It dies each winter and depends on seed to grow new plants each year. The plants and the seeds, which are produced in great number each year, are important food for waterfowl. Due to its short stature bushy pondweed is seldom reported as a nuisance plant.

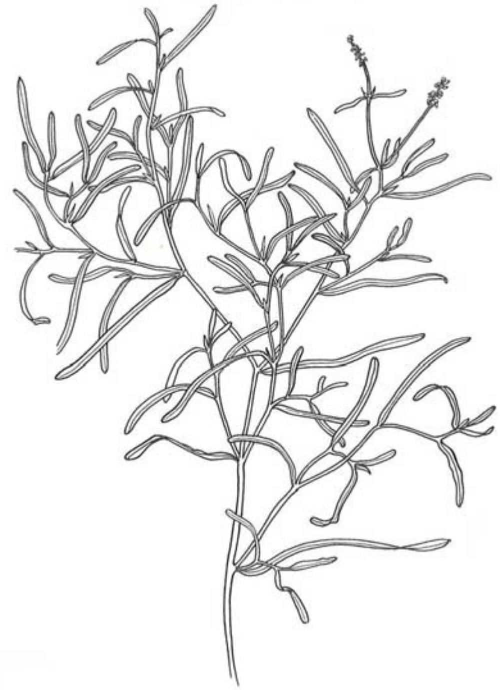
Stiff pondweed

Stiff pondweed (*Potamogeton strictifolius*) is common in both lakes. This is one of a larger group of plants collectively known as "small" pondweeds. Individuals in the group look very similar and are often differentiated based on floating leaves, winter buds, seed shape and other factors. Stiff pondweed has very fine stems with narrow, stiff leaves measuring 1-2 inches long and 1/16th to 1/8th inches wide. The plants produces distinctive winter buds which consist of specialized compressed leaves that over-winter and help spread the plant to new areas of the lake.

Stiff pondweed shows a strong preference for muck sediment. It is most abundant in water more than 5 feet deep.

All of the small pondweeds can be a locally important food source for a variety of ducks and geese. They are also an important source of food and cover for fish and aquatic insects.

Small Pondweed



Graphic courtesy of WI Geological & Natural History Survey - Bulletin 96 - 1999

Common water-weed

Graphic courtesy of Wisconsin and Natural History Survey Bulletin 96 1999

Common waterweed

Common waterweed (*Elodea Canadensis*) has small lance shaped leaves (1/16th to 1/8th inch wide, ¼ to ¾ inches long) attached directly to the stem in whorls of three. The plant branches profusely and often forms tangled mats on the bottom.

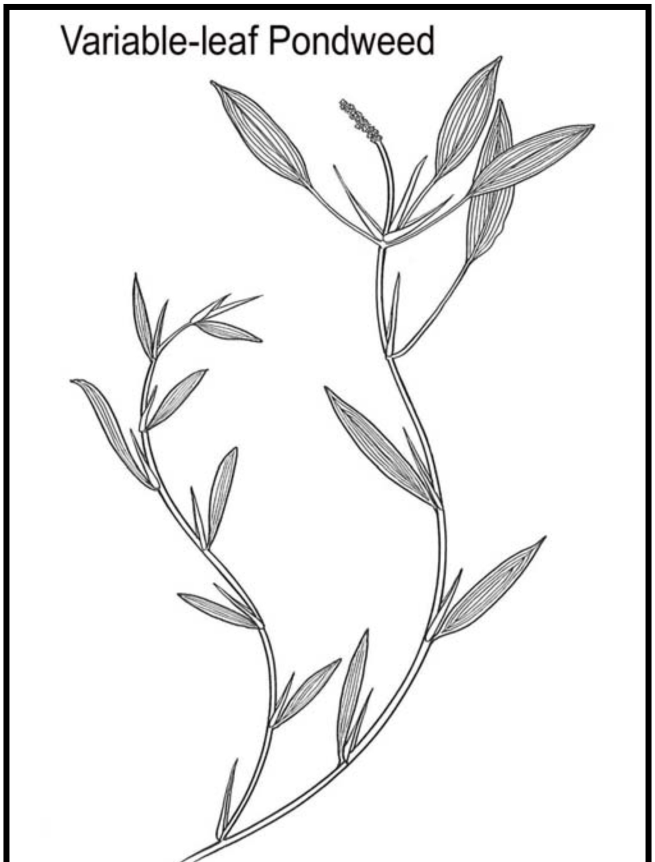
Common waterweed bears male and female flowers on separate plants but seldom produces seed, spreading primarily by fragmentation. In the Newton Lakes it is found almost exclusively in areas with muck sediment. It can be found at almost any depth but prefers water 10 to 14 feet deep.

Common waterweed is important in the lake ecosystem because it over winters green and continues to produce oxygen under the ice in very low light conditions. Waterfowl eat the plant and it provides good winter habitat for fish and aquatic insects.

Variable-leaf pondweed
As the name implies, variable-leaf pondweed (*Potamogeton graminaeus*) varies greatly in growth form between lakes and even within a single lake depending on depth and sediment type. Typically the plant has lance shaped leaves 3-8 cm long and 3-10 mm wide. The plant branches repeatedly and the side braches are very bushy. In the Newton Lakes variable pondweed tends toward smaller leaves.

Like most pondweeds variable-leaf is a perennial plant that dies back in the fall. It also spreads by seeds that are produced on stalks held above the water surface. When flowering it forms small floating leaves that are wider and more ellipse shaped than the submerged leaves.

Variable-leaf pondweed shows no distinct sediment preference. It is most common in water from 4 to 8 feet deep. Where boat traffic is light variable-leaf pondweed often grows in very shallow water where it provides important habitat for juvenile fish.



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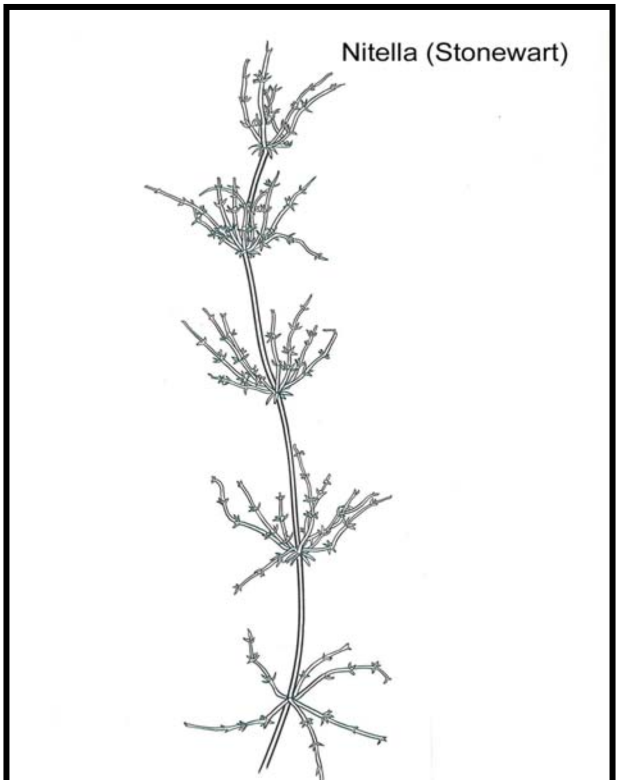


Graphic Courtesy of Through the Looking Glass

Stonewort
Like muskgrass, stonewort (*Nitella sp.*) is actually a type of algae. It has slender branching "stems" with whorls of bright green "leaves". The entire plant is smooth and translucent, looking almost jelly-like. While similar to muskgrass, stonewort typically has longer "leaves" and lacks the gritty calcium carbonate deposits and skunk-like odor.

Stonewort prefers soft sediment and deep water. In both lakes stonewort was found exclusively in water more than 13 feet deep. Stonewort is eaten by waterfowl and offers important deep-water habitat for fish.

Large-leaf pondweed
Large-leaf pondweed (*Potamogeton amplifolius)* is the largest of the pondweeds. The plant is known to fishermen as "cabbage" or "musky-weed" and can be identified by its wide (1-2 in) arching leaves and by its thick seed stalk that is held above the surface. When fruiting the plant produces large egg shaped floating leaves that are held at the surface.

Large-leaf pondweed prefers firm muck sediment and moderately deep water. It was only found in Little Newton Lake. Large-leaf pondweed provides important cover for panfish and, as its name implies, feeding and ambush cover for large predatory fish such as bass, pike, and musky.

Graphic courtesy of WI Geological & Natural History Survey - Bulletin 96 - 1999

White-stem pondweed

White-stem pondweed (*Potamogeton praelongus*) is an infrequent inhabitant of both lakes. Its thick white zig-zag stems are a strong characteristic that helps identify the plant. It has large lance shaped leaves measuring ½-1 ½ inches wide and 3- 10 inches long. No floating leaves are produced.

White stem pondweed is most often found growing in muck sediment in moderate to deep water. It's typically found in very clear lakes and its often seen as an indicator of good water qulaity. Flat-stem pondweed is often grouped together with the other large pondweeds as "musky weed" or "cabbage" and provides important cover for forage species and feeding sites for large predatory fish.

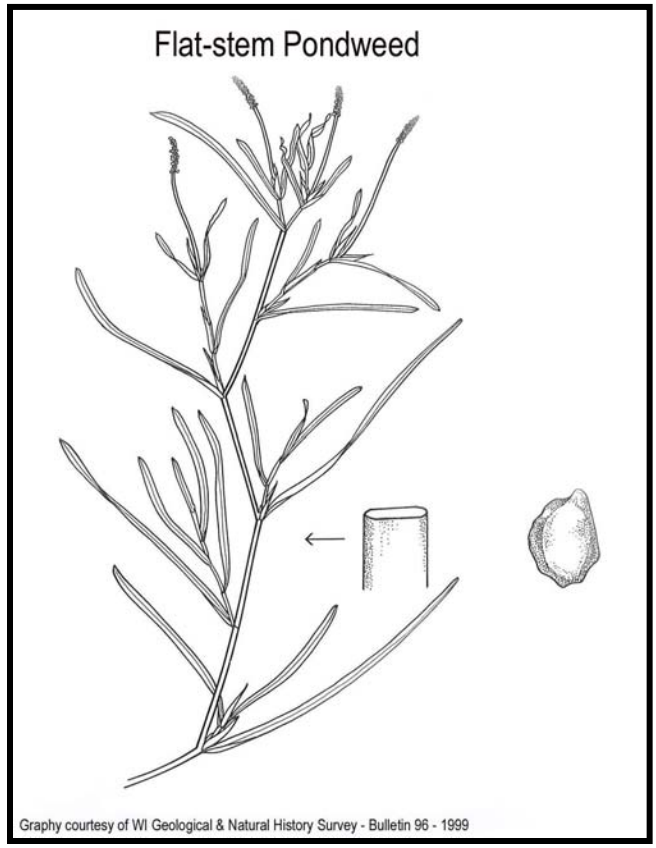
Graphic courtesy of Through the Looking Glass Carol Watkins Illustrator

Flat-stem Pondweed

Flat-stem pondweed (*Potamogeton zosteriformis*) is identified, as the name implies, by its strongly flattened stems. The leaves are long (4"-8"), narrow (1/8"-1/4") and very stiff. The plant produces no floating leaves.

Flat-stem pondweed is a perennial that rarely reproduces by seed. Typically the entire plant dies back each year and re-grows from the root system. Like many of the pondweeds, flat-stem pondweed also spreads by producing winter buds, specialized leaves packed in a tight cluster that form at the end of some side branches. When the plant dies back the winter buds detach and fall to the sediment where they take root.

Flat-stem pondweed was only found in Little Newton Lake. It prefers a firm muck bottom and is most often found in water over 8 feet deep. Due to its affinity for deep water, flat-stem pondweed provides important foraging habitat for panfish and edge cover for gamefish.



Graphy courtesy of WI Geological & Natural History Survey - Bulletin 96 - 1999

It also serves as a food source for waterfowl that graze on its leaves and eat the seeds.

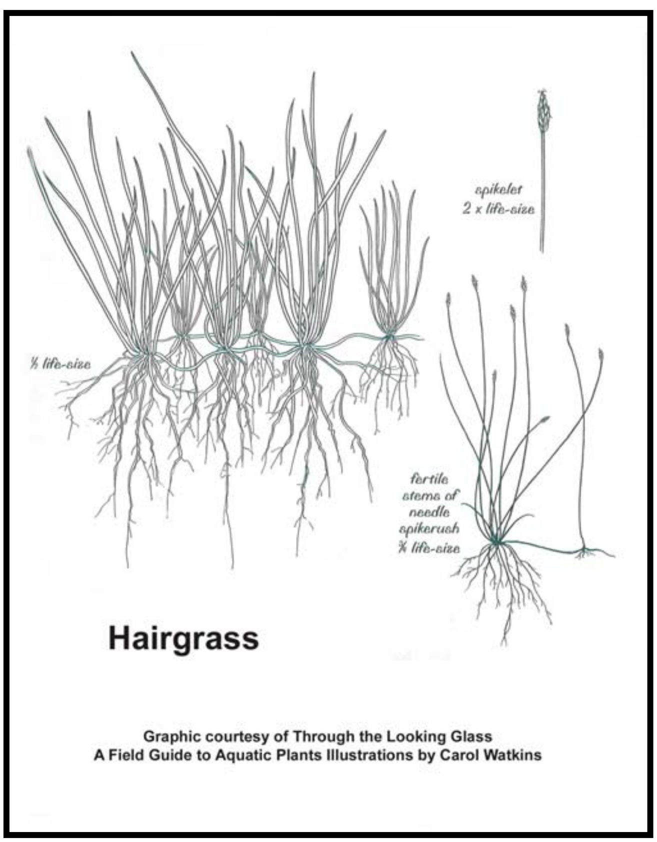
Hairgrass
Hairgrass (*Eleocharis accicularis*) is an "emergent" species that actually rarely emerges from the water. It's fine stems, rarely more than 4 inches tall; grow in tufts from the bottom. As the name implies, it looks very much like grass growing on the bottom of the lake. When exposed by falling water levels hairgrass will produce fertile stems with small spikelets of seeds at the top.

Hairgrass was only found growing in Little Newton Lake where it prefers shallow water and a sandy bottom. This plant provides good shallow-water fish habitat.

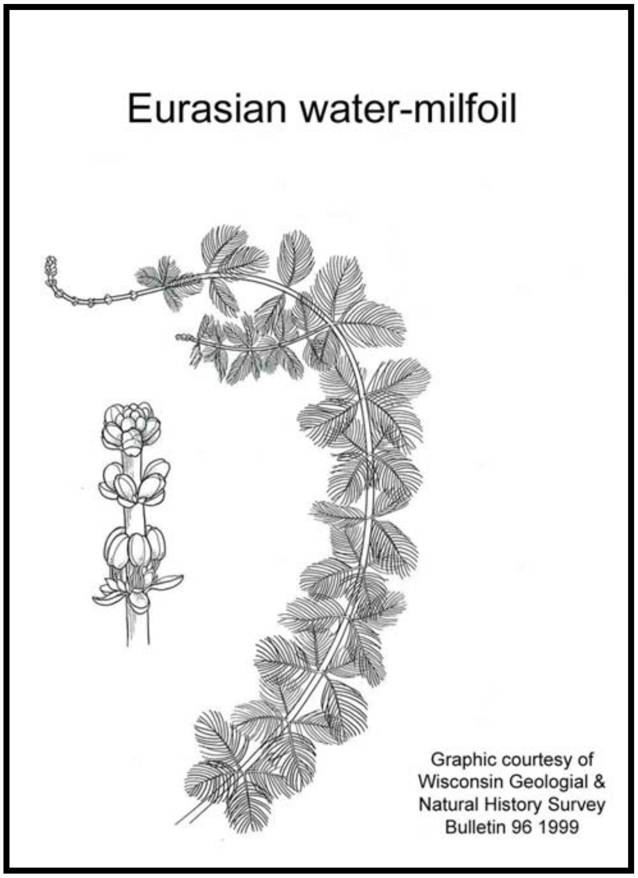
Eurasian watermilfoil (EWM)
Eurasian watermilfoil (*Myriophyllum spicatum*), an invasive exotic species, was found in Little Newton Lake in the fall of 2008. EWM Has soft feather like leaves arranged in groups of four along a long thin stem. Depending on water clarity the plant can grow as tall as 15 feet. In shallow water the plants often reach the surface where they branch profusely and spread out to form a canopy that shades the water beneath. Eurasian watermilfoil is considered invasive since it has a habit of expanding rapidly and eliminating or drastically suppressing other plants.

EWM can over winter green or survive as sprouts on the rootstock. The plant begins rapid growth at a low water temperature and quickly reaches the surface. EWM spreads primarily by fragmentation, a process where even small fragments of the plant separated by boats or wave action drift to a new place and take root. The rapid growth, ease of spread, and its canopy forming habit, allows EWM to out compete many of the slower growing native plants.

In most lakes EWM shows a slight preference for moderately deep water. It also prefers muck sediment. While Eurasian watermilfoil provides some fish and wildlife habitat, studies show that native pondweeds typically have more diversity and greater numbers of insects (Engel 1990).



Graphic courtesy of Through the Looking Glass
A Field Guide to Aquatic Plants Illustrations by Carol Watkins



As a result of aggressive eradication efforts EWM was not found during the 2009 point/intercept survey of Little Newton Lake. Previously it was most abundant in muck sediment in water from 8 to 15 feet deep.

In the summer of 2010 EWM was again found growing in Little Newton Lake. Eradication efforts continue.

Emergent Vegetation

Plants such as cattails, bulrushes and others that reach above the surface of the lake are known as emergent vegetation. Many of these plants grow in the lake or in saturated soil on the shoreline. Most are adapted to fluctuating water levels and are unharmed, or actually stimulated, by low water periods.

Due to their location on the shoreline emergent plants are under-sampled in grid surveys. Those noted growing on the lakes included broad-leaved cattail (*Typha lattifolia*), creeping spikerush (*Eleocharis palustris*), softstem bulrush (*Scirpus validus*), and three-square rush (*Scirpus americanus*). A more intensive survey of shoreline vegetation would certainly show even more species including many sedges and other wetland vegetation.

In general the emergent plant community on both lakes is very sparse and suppressed by boating activity and shoreline grooming practices. Many residents remember when large stands of rushes could be found on shallow sandbars in both lakes. These have been completely eliminated, probably through a combination of excessive boat wakes and physical disruption by boat propellers. Around the shore, many areas that would support rushes and other emergent plants are kept clean by raking and tilling the sand as water levels retreat.

Emergent plants are important in the lake ecosystem because of the habitat they provide for fish and amphibians that spawn on and amongst their underwater stems. Invertebrates (insects) and amphibians living in the shoreline fringe form the base of the aquatic food web and are vital for healthy lakes.

Floristic Quality Index

One measure of aquatic plant community "health" is the Floristic Quality Index (FQI). The FQI is based on the number of native species and their "coefficient of conservatism"; a number assigned to every aquatic plant in the State representing how typical the plant is in pristine conditions. The FQI is based solely on the presence of a plant, not its abundance or dominance. Statewide, the average FQI for lakes is 22.2. The FQI for each lake was calculated based on the aquatic plant survey data.

Big Newton Lake
Aquatic Plant Community

The aquatic plant community of Big Newton Lake is relatively sparse and dominated by low-growing plants that prefer sand and/or a firm muck bottom. The maximum rooting depth was approximately 20 feet. During the aquatic plant survey eight species of aquatic plants were identified, only three of which were found at more than 20% of the sample points shallower than the maximum rooting depth.

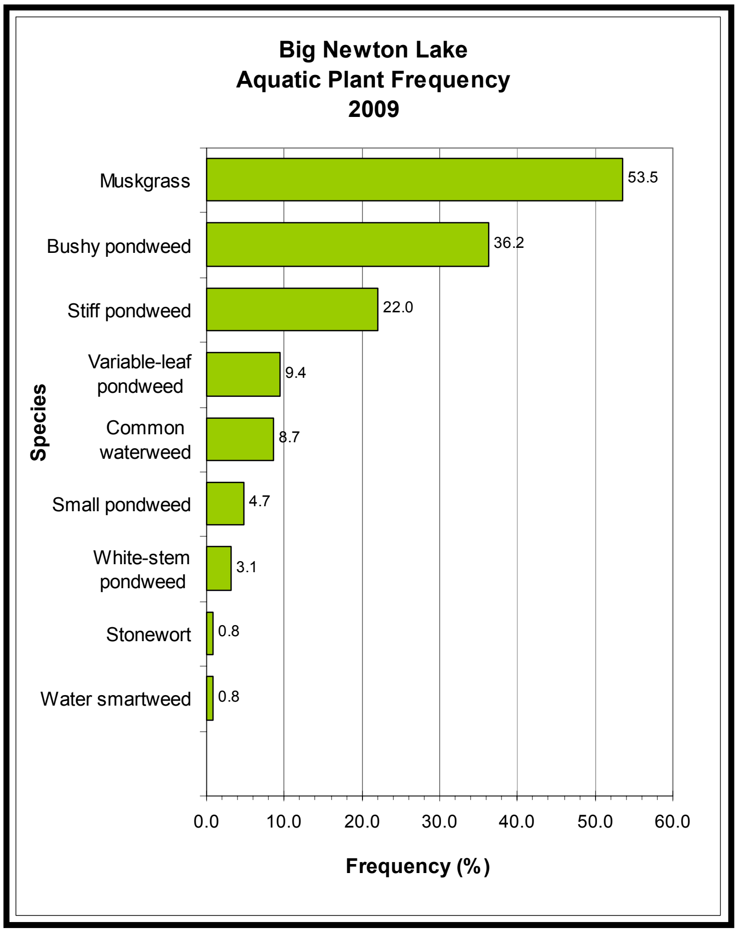


Figure 1. Big Newton Lake aquatic plant frequency.

The most abundant aquatic plant in Big Newton Lake was the colonial algae muskgrass (figure 1). It was found at 53% of the sample points and was most frequent in water between 2 and 7 feet deep. Density was typically sparse in very shallow water (< 2 ft) and increased with depth.

Bushy pondweed was found at 35% of points less than 20 feet deep. It was most frequent in 4 to 11 feet of water. Abundance was typically low, with an average rake fullness rating of 1.2 (sparse).

Stiff pondweed was the only other species that was widespread in the lake. It was found at 22% of the sample points. Stiff pondweed was found almost exclusively in water greater than 6 feet deep in areas with a muck bottom.

Variable pondweed and common waterweed were both found at approximately 9% of the sample points. Variable pondweed was most frequently found in 6 to 9 feet of water where it was typically sparse. Common waterweed was most common in depths greater than 11 feet where it was moderately dense.

Stonewort, water smartweed, and white-stem pondweed were found at less than 5% of the sample locations in Big Newton Lake. Stonewort is found almost exclusively at great depth while water smartweed is typically found in less than two feet of water.

Emergent vegetation is especially sparse on Big Newton Lake. According to lake residents the large sandbar that extends out from the east shore used to support abundant rushes but is now a popular swimming site and is entirely free of vegetation. Along the lakeshore there are a few areas with well-developed emergent plant communities but many more shoreline areas that are maintained plant free through beach grooming activities.

Exotic Species

Despite its proximity to Little Newton Lake, No exotic species were identified during the aquatic plant survey or during earlier reconnaissance surveys of the Big Lake. However, low water has eliminated any direct hydrologic connection between the lakes during the last several years.

Floristic Quality Index

The floristic quality index rating for Big Newton Lake was 18.0. This is below the statewide average FQI of 22.2 and indicates poor aquatic plant diversity. The limited diversity is probably due to natural factors such as lack of diversity in sediment type, and human factors such as shoreline grooming and elevated recreational boating traffic.

Little Newton Lake
Aquatic Plant Community

The aquatic plat community of Little Newton Lake has been studied extensively since Eurasian watermilfoil (EWM) was discovered in the fall of 2007. As part of the initial rapid response efforts, EWM reconnaissance was completed in 2007 and again in 2008 to identify EWM beds and delineate herbicide treatment areas. A complete point/intercept aquatic plant survey was conducted in the summer of 2009.

EWM Eradication Efforts

Immediately after confirmation of the EWM discovery the Little Newton Lake the Lake Association applied for and received a Wisconsin DNR Aquatic Invasive Species Rapid Response Grant to fund an early season herbicide treatment using 2,4-D.

2.7 acres of EWM were treated on May 23, 2008 with 100 lbs/ac of Navigate herbicide (figure 2). Substantial EWM biomass was noted at the time of treatment. Several inspections throughout the year showed the treatment was somewhat successful at reducing EWM density, particularly in shallow areas on the north side of the lake. However, the treatment was not as effective on the deeper, and denser, EWM beds on the south side of the lake.

On May 1, 2009 1.5 acres of EWM were treated using 200 lbs/acre of Navigate herbicide. At the time of treatment EWM was actively growing but biomass was very light. The 2009 herbicide treatment was very successful. A follow-up reconnaissance survey in July found one small clump of

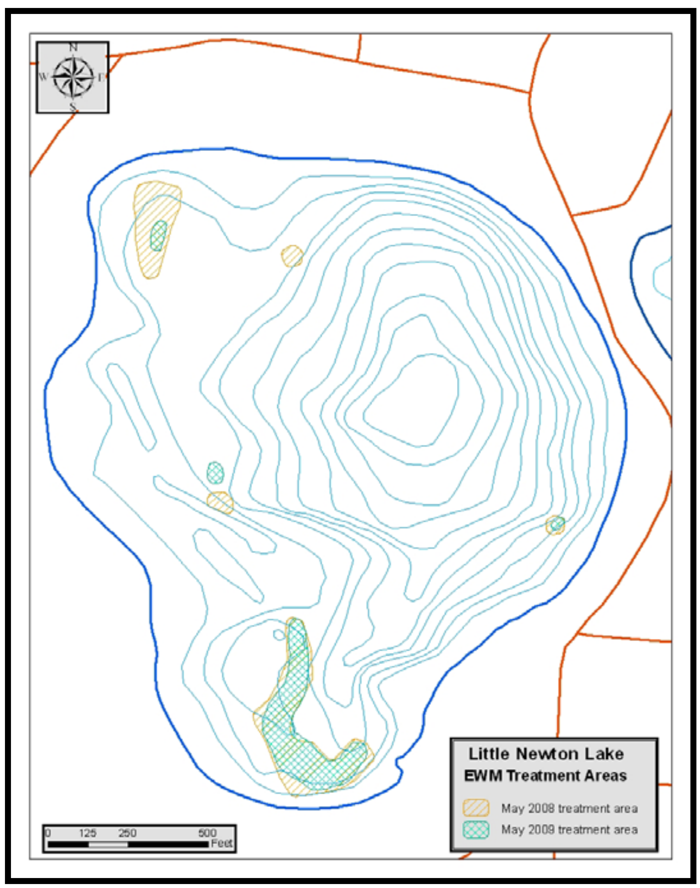


Figure 2. Little Newton Lake EWM treatment areas.

EWM on the edge of the main treatment area, which was manually removed by divers. EWM was not identified during the point/intercept aquatic plant survey conducted in August 2009 or during a thorough inspection of the treatment areas. In June 2010 lake residents again found several isolated EWM plants growing on the south side of the lake adjacent to the largest treatment area. All visible EWM plants were temporarily marked with buoys then removed by divers. Every effort was made to pull up the root systems and collect any loose fragments. Plants and roots were placed in mesh bags and removed from the lake. While no additional EWM was located during the fall of 2010, EWM reconnaissance and manual control will be repeated in the summer of 2011 and 2012 as needed.

Aquatic Plant Survey Results

The aquatic plant community of Little Newton Lake is somewhat more diverse than that of the big lake. Still, throughout most of the lake aquatic vegetation is sparse and dominated by low-growing plants. During the survey ten species of aquatic plants were identified, four of which could be considered common in the lake. In Little Newton Lake the maximum rooting depth was approximately 20 feet.

As seen in the big lake, the three most abundant plants in Little Newton were muskgrass, bushy pondweed, and stiff pondweed (figure 3). Muskgrass was found at 38% of the sample points and was most frequent in water between 1 and 6 feet deep with a firm sand bottom. Density was typically sparse, averaging 1.3 for rake fullness.

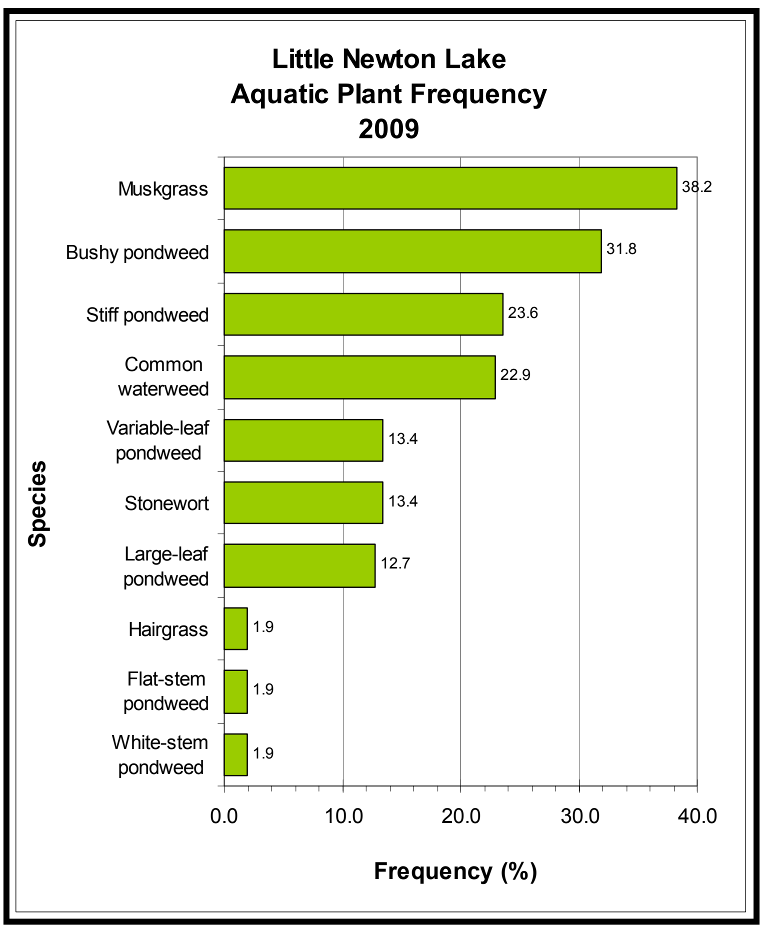


Figure 3. Little Newton Lake aquatic plant frequency.

Bushy pondweed was found at 31% of points less than 20 feet deep. It was most frequent in 5 to 13 feet of water and shows a distinct preference for muck. Abundance was typically moderate, with an average rake fullness rating of 2.1.

Stiff pondweed and common waterweed were found at 23% of the sample points. Stiff pondweed was most abundant in 5 to 12 feet of water in areas with a muck bottom. Common waterweed was most abundant in water more than 10 feet deep with a muck bottom.

Variable pondweed, stonewort, and large-leaf pondweed were all found at approximately 13% of the sample points. Variable pondweed preferred a sandy bottom in water less than 10 feet deep. It was often the only plant found in very shallow sandy areas. Stonewort was found exclusively in deep water (> 12 feet deep) where the sediment is muck. Large-leaf pondweed was most abundant in 3-10 feet of water on muck.

Hairgrass, flat-stem pondweed, and white-stem pondweed were all found at fewer than 2% of the sample locations. The two pondweeds prefer muck bottom and deep water while hairgrass is typically found in very shallow sandy areas.

Since the EWM infestation was discovered early its effect on the lakes native plant community has been minimal. On the south end of the lake where EWM was most abundant it had already displaced many native plants. This was evident during an evaluation of the spring 2009 herbicide treatment conducted in late June when large areas with little or no vegetation were noted in the spray area. However, by August 2009 native vegetation had returned and the same areas supported healthy stands of bushy pondweed and common waterweed. In the summer of 2010 the main treatment area was dominated by common waterweed and was indistinguishable from the surrounding non-treated areas.

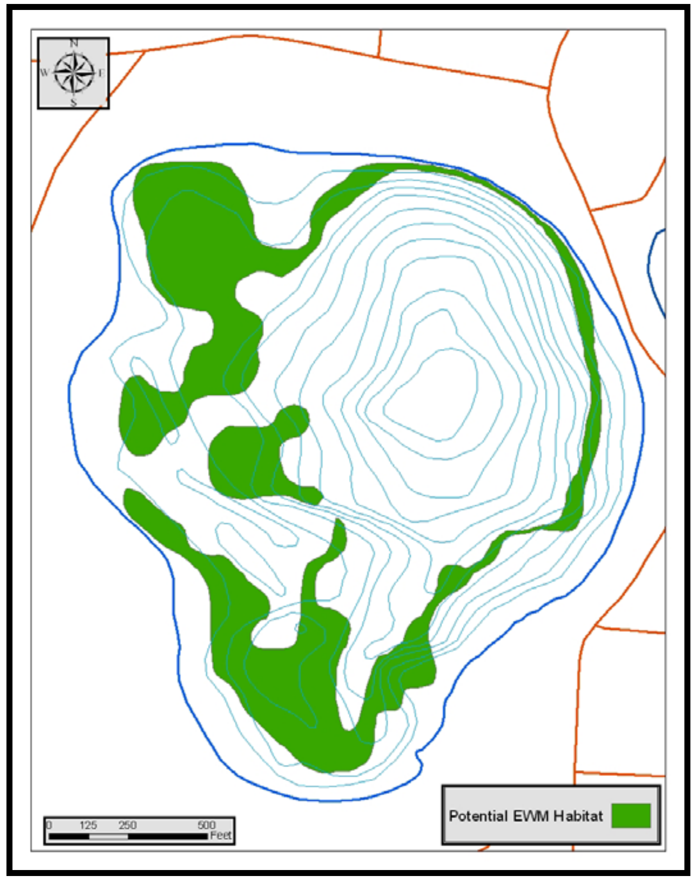


Figure 4. Areas of little Newton Lake that would provide suitable habitat for EWM.

Predicted impacts of EWM expansion in Little Newton Lake

Allowed to go unchecked, EWM would likely replace many of the native plants that share similar depth and sediment preferences. These include bushy pondweed, elodea, and all of the true pondweeds. Given its preference for muck bottom and water depths between 3 and 14 feet EWM could potentially thrive in more than 15 acres of the lake as shown in figure 4.

Floristic Quality Index

The floristic quality index rating for Little Newton Lake was 20.2. This is slightly below the statewide average GQI of 22.2 and indicates slightly low aquatic plant diversity. As in Big Newton the limited diversity is probably due to natural factors such as lack of diversity in sediment type, and human factors such as shoreline grooming and elevated recreational boating traffic.

Changes in the Aquatic Plant Community

The Wisconsin DNR conducted aquatic plant surveys of Big and Little Newton Lakes in 2005 using the same grid points and methodology employed in the 2009 survey. In Big Newton Lake the same five species that were most abundant in 2005 were also dominant in 2009. However, the frequency of occurrence was significantly higher in 2009 for every major species.

Likewise in Little Newton Lake the aquatic plant community did not change much in composition between 2005 and 2009. As in the big lake most plants were significantly more frequent in 2009. The exception was bushy pondweed, which saw a decrease in frequency of occurrence. EWM was not identified in Big or Little Newton Lake during the 2005 aquatic plant survey.

Identification of Problems and Threats to the Newton Lakes

Eurasian watermilfoil

The most pressing issue confronting Big and Little Newton Lakes is obviously the recent EWM infestation. Although EWM is currently found only in Little Newton Lake, the proximity of the lakes to one another, the amount of public use they receive, and the hydrologic connection make it almost certain that EWM will eventually make the "jump" to the big lake if it is not eliminated from Little Newton.

Other aquatic invasive species

Future threats to the Newton Lakes include new introductions of aquatic invasive species. Currently several nearby waters are infested with zebra mussels (*Dreissena polymorpha*) and the Bay of Green Bay is home to numerous invasive aquatic species, all of which have the potential to impact both lakes. In 2007 hydrilla (*Hydrilla verticillata*) was also discovered in a private pond within 3 miles of Big Newton Lake. The plant apparently traveled to Marinette County by mail, attached to ornamental water garden plants. While the infestation appears to have been successfully eradicated, its discovery underscores the continuing threat of invasive species.

Nutrient enrichment and declining lake levels

The triple threat of increasing nutrient enrichment, falling water levels and longer growing season is one shared by most area lakes. As the shoreline of any lake is developed the volume of runoff increases, as does the amount of phosphorus in that runoff. Many studies have shown that phosphorus loading is directly correlated to the amount of development in a watershed and that phosphorus loading from lawns was eight times higher than from forested areas (WDNR 2003).

The effect of increased phosphorus loading is compounded by long-term climate trends. The Wisconsin Initiative on Climate Change Impacts predicts slightly warmer summers, a continuing trend of less precipitation during the summer months and slightly warmer winters. Annual precipitation is not predicted to change greatly but the distribution is. The prediction is for a wetter spring and winter but a drier summer. The net effect of these changes on lakes is a shorter period of ice cover, a longer and warmer growing season, and declining summer water levels. All favoring increased aquatic plant and/or algae production.

Aquatic Invasive Species Management Goals & Objectives

The goal of the Newton Lakes Association is to: **Aggressively manage EWM in Little Newton Lake with the goal of eradicating the invasive species, and to prevent the spread of EWM and other invasive species into Big and Little Newton Lakes.** To achieve this goal specific management objectives have been identified and targets have been set to gauge success and guide selection of management options.

Goal: Aggressively manage EWM in Little Newton Lake with the goal of eradicating the invasive species.

Since the EWM invasion was detected early and the extent of the infestation is rather limited it makes sense to aggressively target EWM with the goal of eradicating the species before it can gain a permanent foothold in the lake. This will require persistence in searching out EWM in the lake, using all available options to target EWM growth, preserving a strong native plant community, and educating lake residents and visitors to the challenge at hand.

Objective: Remain vigilant in searching out EWM in Little Newton Lake.

Although very successful, the 2009 herbicide application did not eradicate EWM from the lake. Lake residents identified scattered EWM plants in the summer of 2009 and again in the summer of 2010. These plants were marked and removed by divers. Since EWM spreads by fragmentation it is likely that EWM will continue to "pop up" throughout the lake for several years. To have a real chance at eradicating EWM lake residents need to adopt a strategy to actively search for the plant and mark EWM for prompt removal as soon as it's discovered.

> ***Target – Form an invasive species committee to search for EWM and coordinate eradication efforts.***

The Association should appoint an aquatic invasive species committee to regularly search out EWM and work with local resource agencies to coordinate EWM reconnaissance and management/eradication efforts.

> ***Target – Conduct routine EWM reconnaissance on Little Newton Lake to locate scattered EWM plants and mark for removal.***

EWM reconnaissance should be conducted on a schedule to make sure it is completed in timely manner. When EWM is discovered in the lake residents need to have a plan in place to deal with the new discovery. The appropriate action depends primarily on the size of the new EWM growth, and time of year the discovery is made.

Objective: Have a plan in place to contact the appropriate people and implement controls based on the size and location of the EWM discovery.

A plan for dealing with new EWM discoveries should include whom to contact, a designated person to coordinate EWM eradication efforts, a list of people who can assist with eradication efforts, and list of state and local resource agencies to contact for assistance.

Target – Set up a procedure for whom to notify when new EWM populations are discovered.

Target – The Aquatic invasive species committee should develop a procedure to respond to new EWM discoveries based on the number of plants and location.

Objective: Preserve a strong native plant community in Big and Little Newton Lakes.

It is much more difficult for an invasive species to establish a foothold in areas with a healthy native plant community. EWM and many other invasive species are very good at exploiting disturbed areas and rapidly filling in where native plants have been removed.

Target – Limit disturbance to the native plant community.

Target – Chose management techniques that selectively control EWM while preserving native plants.

Objective: Educate lake residents and visitors to assist in EWM eradication efforts.

Implementing an aggressive EWM eradication effort that will be sustainable for several years will require effective communication. The Association should use very avenue at its disposal to communicate information, goals and outcomes to its members. The EWM eradication plan should also include a strong educational component to provide information to lake residents and visitors.

Target – Provide aquatic invasive species educational materials to members.

Target – Provide aquatic invasive species educational materials to visitors to the Newton Lakes.

Target – Educate lake residents and visitors so they can identify EWM and let them know what they should do if they find any.

Goal: Prevent the spread of EWM and other invasive species into Big and Little Newton Lakes.

Due to its proximity to Little Newton Lake, and since both lakes are connected during periods of high water, Big Newton Lake is at great risk of EWM invasion. Unfortunately, even if EWM is successfully eradicated from Little Newton Lake both lakes remain vulnerable to invasion by numerous aquatic invasive species.

Protecting the lakes from new aquatic invasive species and successfully responding to new invaders will require the Association to educate the public and lake residents, be on the lookout for invasive species, and have a plan in place to deal with new invasions.

Objective: Develop a plan to prevent new aquatic invasions, monitor for the presence of aquatic invasive species, and respond to new invasions should they occur.

Any plan for the prevention of aquatic invasive species will require an educational component, a plan to monitor the lakes on a routine basis, and a plan to respond quickly when new invasive species are discovered.

> ***Target – Develop an information and education program to target residents and visitors who bring watercraft to the Newton Lakes from other water bodies.***
>
> ***Target – Develop a plan to have volunteers survey the lake for aquatic invasive species on a routine basis.***
>
> ***Target – Work with local resource agencies to develop a plan for responding to new AIS invasions.***

Aquatic Invasive Species Management Alternatives

A successful aquatic invasive species management strategy must be tailored to the lake and species in question and will typically utilize multiple control methods as appropriate. A comprehensive review of AIS management alternatives follows. While each of the alternatives may be beneficial in certain situations, not all are currently applicable to managing EWM in Little Newton Lake.

Do Nothing

Doing nothing is inexpensive, easy to do, and relatively uncontroversial. However, it is rarely effective. Lakes are complicated ecosystems and aquatic plant populations fluctuate within them due to a variety of factors. Large-scale climactic conditions and local weather cycles can impact water levels, temperature, and clarity, all of which effect aquatic plant growth. Plant populations also vary because of disease, species introduction, competition and other internal processes. Left to its own devices the plant community in Big and Little Newton Lakes will continue to change over time.

In the case of Eurasian watermilfoil, doing nothing typically leads to EWM domination of the aquatic plant community. While the EWM dominance is often thought to be permanent, the history of EWM in Wisconsin shows this is not always the case. Carpenter (1980) reported that the duration of peak abundance in some lakes is approximately 10 years after which EWM may experience a significant decline. While the reason for these "natural" EWM declines is poorly understood some attribute it to a native milfoil weevil (*Euhrychiopsis lecontei*). Unfortunately this natural decline has not been seen everywhere and is not typically permanent. In some lakes EWM populations experience quite a bit of natural variability with periodic declines and subsequent increases without any active management. In Little Newton Lake, doing nothing will surely lead to a drastic increase in EWM abundance to the point where it becomes a serious nuisance.

Chemical Control

When properly planned and executed, chemical control of aquatic plants can be effective. However, if care is not taken in the selection timing, and application of aquatic herbicides the results can be less than desirable, or worse, have unintended consequences.

There are several herbicides approved for aquatic use in Wisconsin and each differs in its mode of action and in the species it controls. Contact herbicides kill exposed plant material but can leave the root system intact, allowing for rapid recovery and plant growth. Systemic herbicides are transported to the roots and kill the entire plant. Systemic herbicides provide longer-term control but may act slower than contact herbicides.

Herbicides can also be grouped into two general groups, "broad-spectrum" and "selective". Broad-spectrum herbicides control a relatively broad range of plants. Selective herbicides, as the name implies, are more-or-less selective and control fewer species while leaving many others unharmed. Often selectivity is a function of timing of the application or herbicide concentration.

Eurasian watermilfoil (EWM) is very susceptible to several common aquatic herbicides. The plant is especially susceptible to formulations of 2,4-D, a systemic herbicide. Since most pondweeds and many other native aquatic plants are resistant or only slightly susceptible to 2,4-D the chemical can be used to selectively control milfoil while protecting many native species (Parsons, 2001). Chemical control of EWM is a popular and effective control measure where the goal is to shift the plant community to a more natural mix of native species. Recommended treatment rates vary by depth and size of the treatment area. In Little Newton Lake most of the EWM was found in water between 10 and 15 feet deep. In early May of 2009 an application of Navigate 2,4-D at 200 lbs/ac was very successful at controlling the EWM with little or no impact on the dominant native plants in the treatment area.

When used in a selective manner it is possible to get multi-year control from herbicides. This is most likely to be achieved when the native community is relatively vigorous and can resist EWM reestablishment. Eventually EWM will return so even selective management will have to be repeated on a regular basis.

Some lakes have seen very good results using low dose Fluridone to treat EWM. Fluridone is a newer systemic herbicide that acts slowly to kill target plants. Fluridone is only appropriate for whole lake treatments because the chemical concentration must be maintained for 60 to 90 days. This requires routine monitoring of herbicide levels and can require follow-up applications. While many native species are not susceptible to low doses of Fluridone studies in Wisconsin lakes found that common waterweed and bushy pondweed are both susceptible at concentrations required to treat EWM (Wagner, 2007). Since common waterweed and bushy pondweed are both dominant species in Little Newton Lake Fluridone may not be the best chemical to use.

Improper or excessive use of aquatic herbicides can have unintended consequences. Widespread use of broad-spectrum herbicides can leave large areas of suitable habitat exposed to colonization by nuisance species. Many of the more common nuisance plants, such as EWM, are aggressive pioneer species that can quickly invade disturbed areas. The decomposition of tons of aquatic plants also releases large amounts of nutrients to the water column. These nutrients can trigger algae blooms and fuel additional aquatic plant growth

Chemical treatment cost depends primarily on the chemical formulation and application rate, the distance a certified applicator has to travel, and the time and equipment involved. In 2010 EWM treatment with Navigate granular 2,4-D could be expected to cost between $500.00 and $900.00 per acre depending on the application rate and size of the treatment area. Fluridone is rather expensive, costing up to $2,000.00 per acre if sequential treatments are required. In some instances the State of Wisconsin can provide funding for chemical treatment of Eurasian watermilfoil or other lake restoration activities recommended in a lake management plan approved by the DNR.

Chemical treatment of aquatic plants in Wisconsin always requires a permit from the Wisconsin DNR. This is to ensure that the proposed chemical treatment will use appropriate chemical(s), at the correct concentration and at the proper time of the year. In almost all situations the chemical applicator must have Wisconsin Department of Agriculture Trade and Consumer Protection certification.

Benthic Barriers

Benthic, or sediment barriers cover the sediment and prevent the growth of aquatic plants. The barriers work by physically disrupting plant growth or eliminating light at the sediment surface. When installed properly benthic barriers are very effective at eliminating all plant growth. However the difficulty of installing and maintaining these barriers prevent their widespread use.

Benthic barriers can be made of naturally occurring materials (sand and gravel) or artificial (synthetic plastic sheeting). Sand or pea gravel is commonly used to create weed free swim areas. However, there are several common problems with sand and gravel benthic barriers. If deposited on soft sediment it can sink in and mix with the native sediment. Also, over time new sediment is deposited on top of the barrier. All of these factors will lead to failure of the barrier.

Artificial barriers typically consist of sheets of polypropylene, polyethylene, fiberglass or nylon (Wagner 2004). All must be weighted to hold them in place against water currents, waves, and boat wake. If constructed of non-porous material benthic barriers will be subject to billowing and may float free of the sediment as gasses from decomposition build up beneath them. Porous barriers are less subject to billowing but plant fragments that settle on top are better able to root through them. Both types of barriers require annual maintenance since sediment accumulation on top of the barriers will build up and support new aquatic plant growth.

Artificial benthic barriers are also relatively expensive and difficult to install and maintain. Maintenance consists primarily of annually removing accumulated sediment, which typically requires removal and replacement of the barrier. The use of any type of benthic barrier requires a DNR permit.

Dyes and Floating Covers

Dyes are liquid chemicals that are applied to change the color of the water. Covers physically cover the water surface. Both control aquatic plants by reducing the amount of light reaching the sediment.

Dyes typically color the water a deep blue or even black. For small ponds they are relatively inexpensive, long lasting, and effective. Effectiveness is limited in shallow water (2 feet or less) where the light reduction is seldom enough to prevent plant growth. Dyes must stay in the water throughout much of the growing season. Because of their dark color, dyes increase light absorption and can result in higher water temperatures. The increase water temperature can in-turn result in stronger stratification, lower dissolved oxygen and widespread changes in the aquatic community (Wagner 2004). Dyes are not an option in larger lakes and those with significant outflow.

Floating covers also disrupt plant growth by reducing light levels at the sediment surface. However, unlike dyes the floating covers prevent virtually all water use while they are in place. Floating covers can be difficult to install and effectively anchor.

Both dyes and floating covers require DNR permits. The main permitting issue with floating covers is the disruption of public water rights (fishing and navigation) that they cause while installed.

Manual Plant Removal

Manually removing EWM entails locating individual plants or small colonies of EWM and utilizing divers or snorkelers to manually remove the plants from the lakebed. Manual removal is typically only feasible as a "mop-up" operation where EWM growth is widely scattered and/or very limited in density.

Manual removal is best accomplished by marking visible EWM plants with buoys from the surface while a team of divers removes the offending plants. For hand pulling a good technique is for the diver to wrap larger plants around his or her forearm then reaching into the sediment to pull as many roots as possible. Plants and roots can be placed in a bag made of fine mesh. A laundry bag works well. Adding a stiff wire to the rim so the bags stay open underwater helps considerably.

Manual removal can also be accomplished using a small suction dredge. Several lake groups have built their own suction dredge using a trash pump on a pontoon boat with several tanks for filtering out the plants, fragments and muck before returning the water to the lake. The suction hose is controlled by a diver who uses it like a shop-vac hose to suck up EWM and the root system while preserving surrounding plants. Using this method a diver can "harvest" far more plants than by hand pulling alone.

Manual EWM removal works best where water clarity is good so plants can be seen and marked from the surface and where the EWM can be easily distinguished from other plants in the lake. In these respects Little Newton Lake is an ideal lake for manual EWM removal. The water clarity in Little Newton Lake is typically excellent and the dominant native plants are typically low growing and form a mat on the lakebed. EWM in Little Newton tends to stand out and be readily identifiable.

A permit is not required for hand pulling of EWM. Use of a suction dredge to remove plants would require a DNR permit.

Mechanical Harvesting
Aquatic plant harvesting is a widely accepted aquatic plant management alternative that can be effective on a large or small scale. Individual landowners often manually clear small areas around their dock or swim area. Typically this is accomplished by using one of several specially designed aquatic plant rakes and/or hand-held cutting implements. Under current Wisconsin Law landowners can manually harvest plants without a permit if the plant removal is not in a DNR designated sensitive area and is limited to a 30-foot wide area (measured parallel to shore). There is no limit on how far out into the lake a landowner can harvest by hand if they stay within the 30-foot wide corridor. The control area must be around existing piers, boat lifts, and swim rafts and the cut plants must be removed from the water.

Large scale harvesting is typically accomplished using specially designed aquatic plant harvesters that cut and collect aquatic plants in one operation. The size and capacity of these harvesters varies greatly but the largest can cut a 10-foot wide swath up to 6 feet deep and holds more than 16,000 lbs of cut plants.

Like most aquatic plant management alternatives harvesting seldom eliminates plants. Much like cutting your lawn, harvesting leaves the root system intact and plants will re-grow. In some cases repeated harvesting close to the sediment surface can stress plants enough to cause mortality. Species that depend on seed production for their spread may be partially controlled by harvesting if seeds are repeatedly removed.

Plants that spread by fragmentation such as EWM and coontail can actually be spread through harvesting when cut fragments escape the harvester and drift to other areas of the lake. For this reason, harvesting should only be used as a tool for managing EWM if the plant has already taken over a lake. With early infestations harvesting will speed the spread of EWM within the lake since it causes increased fragmentation. .

Any mechanical harvesting requires a permit from the Wisconsin DNR. An approved aquatic plant management plan is also required.

Biological Plant Control
Biological control (biocontrol) typically utilizes bacteria, fungi, or insects to control an unwanted plant. Biocontrol of exotic species often involves finding the natural control mechanism in the exotic plants country of origin and importing it to the US. Since there is always a risk that introducing a new organism may lead to unintended impacts to non-target species a lot of study is required to approve the use of new biocontrol agents.

In a rather unusual twist, one of the most promising biocontrol agents for Eurasian watermilfoil is a native insect. The milfoil weevil (*Euhrychiopsis lecontei*) is a native species that normally feeds on northern water milfoil. The adult weevil lays its eggs on the growing tips of milfoil where the larvae feed and weaken the plant. Older larvae also burrow into the stems, often causing enough damage to cause the plants to loose buoyancy and sink. The stout stems and shoots of northern water milfoil typically show little damage from this feeding activity. Eurasian water milfoil however has relatively weak stems that are readily damaged by the insects. Studies have shown that milfoil weevils actually prefer EWM and increase in population when EWM is the dominant food source (Lillie, 1997). It's believed that the natural decline in EWM infestations in some lakes may be due to the native milfoil weevil that has been found to be widespread in Wisconsin lakes (Jester, 1998).

Since its discovery as a control agent "stocking" milfoil weevils to control Eurasian watermilfoil has been used with mixed results. In Wisconsin it was found that in twelve lakes where weevils were stocked a few experienced milfoil declines while others saw little or no change (Jester 1999). Several factors seem to affect the success of EWM biocontrol. Jester found better results when EWM had already reached its maximum distribution. The study also found that weevil density was positively correlated with increasing water temperature, distance of plant beds from shore (closer was better), and the percent of natural shoreline. The amount of natural shoreline is important because the adult weevils over winter in leaf litter on the forest floor within several yards of the water. Other studies have found that sunfish species (bluegill, pumpkinseed etc.) are very efficient predators of milfoil weevils and play a major role in reducing their effectiveness (Newman 2004, Ward 2006). Environmental factors such as winter severity, disease, etc. can also affect weevil abundance and may play a role in variable biocontrol results.

Where successful, biocontrol can reduce the abundance of EWM and allow the native species to better compete. However, the expense ($1.00 per weevil) and highly variable results make it hard to recommend weevil stocking as a control measure. Also, even in lakes were biocontrol has been effective the declines in EWM biomass have often been temporary. This may be due to natural cycles in weevil abundance or other natural environmental factors.

Exotic Species Monitoring and Prevention

As is often the case, an ounce of prevention is worth a pound of cure. With exotic species this is doubly true. In most lakes, and for most exotic species the primary mode of introduction is by boat, boat trailer, or bait bucket. While public access points are particularly susceptible, many exotic have been introduced on lakes without any public access.

Once established in a water body it is extremely difficult to eradicate an exotic species. In the few cases where eradication has been successful the introduction was detected early. For this reason routine monitoring to detect new invasive species is an important step in any aquatic plant management effort. The Wisconsin DNR and University of Wisconsin Extension have many good publications and websites to help the layperson identify exotic species. Periodically these agencies also offer exotic species identification and control training to landowners.

AIS Management & Eradication Recommendations

Since the EWM invasion of Little Newton Lake is still in an early stage and the native plant community is still in relatively good condition it makes sense to aggressively attack the EWM with the goal of eradication. At the same time, the Association needs to prevent the spread of EWM into Big Newton Lake and explore all available options for the long-term control of EWM should eradication efforts fail.

Recommendation #1 – Form an invasive plant committee to coordinate EWM eradication efforts. The association should have a formal committee to oversee efforts to find and eradicate EWM from Little Newton Lake and to coordinate information and education efforts. The committee should develop a procedure for promptly responding to new EWM discoveries and communicating with association members.

Recommendation #2 – Conduct monthly EWM reconnaissance on Little Newton Lake. Previous efforts at controlling EWM in Little Newton Lake with early season herbicide applications were very successful. However, EWM has not been eradicated from the lake and it will likely persist for many years.

The Association should look for EWM monthly during the summer months (June through September). Individual plants and small clumps should be marked with a buoy. The location of any large stands of EWM should also be marked using a handheld GPS.

Recommendation #3 – Hand pull isolated EWM plants and colonies as soon as possible after discovery. The best method for eliminating isolated EWM plants and small groups of plants is to pull the plants and roots. For best results remove the plants, roots, and any fragments.

Manual removal can be accomplished by snorkeling or SCUBA diving. A fine mesh bag can be used to hold the plants while underwater. Where possible, avoid disturbing the surrounding native vegetation.

If hand pulling is found to be unsuccessful due to the inability to pull roots and collect fragments the Association should consider a using a suction dredge system for manual EWM removal as described in the management alternatives. A suction dredge system would do a better job of collecting the root system and result in less fragmentation.

Recommendation #4 – Mark larger EWM colonies for early season 2,4-D treatment. EWM colonies covering more than 100 square feet (10 ft x 10 ft) are probably too large for manual control. These should be marked and their locations accurately recorded so they can be chemically treated. Past experience shows that EWM in water more than 10 feet deep can be successfully treated in early May with 200 lbs of Navigate 2,4-D per acre. The Association should consult with the Marinette County LWCD for assistance with mapping larger EWM colonies.

Recommendation #5 – If needed, utilize Aquatic Invasive Species Implementation Grants for EWM control efforts. If hand pulling fails to eliminate EWM from the lake within two or three years, or if larger colonies are found, the Association should consider applying for an aquatic invasive species control grant. These grants pay 70% of the cost of EWM control efforts including herbicide treatments, suction dredging, and required plant monitoring.

Recommendation #6 – Consider whole lake treatment if current eradication efforts are unsuccessful. Whole lake chemical treatments using 2,4-D have been effective at controlling EWM. As a last resort, a whole lake treatment with Fluridone could also be considered. While it has proven successful at managing EWM, its impact on common waterweed and bushy pondweed, two dominant plants in Little Newton Lake, make it a less desirable option.

Information & Education Plan

A strong information and education program will help considerably in the EWM eradication effort and is the most important part of any AIS prevention program. The information and education plan should target lake residents and visitors alike.

Recommendation #1 – Publish a regular newsletter, provide educational materials, and update lake residents about AIS management efforts. The Association should publish a regular newsletter as a way of distributing educational materials and keeping members abreast of the EWM eradication project and other lake management issues. E-newsletters can be a cost effective alternative or supplement. The Association should also sign members up to receive the Lake Tides Newsletter, a free quarterly publication by the Wisconsin Lakes Partnership.

Recommendation #2 – Maintain signage at the boat landings and provide educational materials to visitors to Newton Lakes. Maintain educational signage at the boat landings to inform visitors to Newton Lakes about the EWM eradication efforts and efforts to prevent its spread. Handouts should be provided through the "Clean Boats, Clean Waters" program during busy periods. Signage and educational materials can be obtained from the Peshtigo DNR office or on line at Wisconsin Lakes Partnership or UW Extension Lakes Program websites.

Recommendation #3 – Continue as a member of the Wisconsin Association of Lakes and take advantage of their resources. The Wisconsin Association of Lakes (WAL) is a statewide lake organization that promotes sound lake policy and provides training opportunities for lake groups throughout the state. The Association should send a few members each year to the annul lakes convention, a three day event featuring numerous speakers, workshops and presentations concerning lake management, operating effective lake organizations, and other current issues affecting Wisconsin Lakes

Aquatic Invasive Species Prevention, Monitoring & Rapid Response Plan

Unfortunately, Eurasian watermilfoil is not the only aquatic invasive species threatening out lakes. South of Marinette County curly-leaf pondweed (*Potamogeton crispus*) is an emerging problem. Other species including Hydrilla (*Hydrilla verticillata*), Brazilian waterweed (*Egaria densa*) and yellow floating heart (*Nymphoides peltata*) have been spreading north and may threaten our lakes in the future. Beyond the plant world we have Zebras mussels (*Drissena polymorpha*), Quagga mussels (*Drissena rostriformis)*, Rusty crayfish (*Orconenctes rusticus*), exotic zooplankton, and fish diseases such as VHS to worry about. The best way to deal with these invaders is to be proactive and prevent their introduction. The Newton Lakes Association should also adopt an exotic species prevention plan to reduce the likelihood of new invasions, a monitoring plan to detect early invasions, and a rapid response plan to deal with new invasive species if they are found.

Prevention

An effective AIS prevention plan should focus on the most common routes of AIS invasion, boats, and water gardens. Boats traveling between lakes can carry plant fragments or zebras mussels attached to the boat or trailer. Water in the boat or bait buckets can carry plants, mussels, zooplankton, algae, and disease causing organisms. While the information & education program can provide valuable information regarding the spread of AIS a more effective case can be made when delivering the message face-to-face.

Recommendation #1 – The Association should continue with the "Clean Boats, Clean Waters" watercraft inspection and information campaign. Additional volunteers should be trained to conduct watercraft inspections and talk to boaters about the danger of spreading invasive species. This is a good project in which to get youth involved. The Wisconsin Lakes Partnership sponsors the CBCW program.

Recommendation #2 – Education efforts should focus on the dangers of water gardening and the unintentional releases associated with the hobby. Mail order water garden plants are believed to be the likely source of hydrilla, an invasive exotic that was recently found growing in a Marinette County pond. It had been believed hydrilla could not survive this far north but it was well established and expanding in the pond when discovered. On a positive note, the hydrilla was aggressively attacked and it appears to have been eliminated. Yellow floating heart has also been found growing in outdoor garden ponds in the county. A recent investigation of the water garden industry found that plants known to be invasive are available and routinely shipped around the country. Contamination of orders with other species, including invasive species, is also rampant (Maki, 2004).

Monitoring

Effective management of AIS is much easier when the invader is detected early. In some cases it may even be possible to eradicate an invasive species if it is discovered early enough.

Recommendation #1 – The Association should join the Citizen Lake Monitoring Network and train several members in AIS monitoring procedures. While the information & education program should equip all Association members with a basic knowledge of invasive species, several should be trained specifically for AIS monitoring. The Citizen Lake Monitoring Network holds training workshops to train volunteers in AIS monitoring protocol. They also provide a monitoring manual and laminated AIS identification sheets along with reconnaissance and reporting forms. The County LWCD can assist in AIS training, identification and monitoring.

Recommendation #2 – Volunteer AIS monitors should conduct annual AIS surveys of the lakes. Aquatic plant surveys, although very beneficial, are not designed to find many types of aquatic invaders and may even miss pioneer plant invasions. A better method is to look specifically for different invasive species at the optimal time and in the most likely habitats. The ideal monitoring time varies by species but can typically be covered with one early and one late summer survey.

Trained volunteers should conduct annual invasive species surveys. Findings should be reported to the Association and the Citizen Lake Monitoring Network.

Recommendation #3 – Report any suspected aquatic invasive species to local resource professionals and collect a sample for identification. If any suspected exotic species are found report it immediately to the Peshtigo DNR office or the County LWCD. Collect a sample of any suspected exotic species and keep it refrigerated in a zip-lock bag until it can be positively identified.

Rapid Response

When a new invasive species is positively identified the District needs to act quickly. Depending on the species found, length of time since invasion, and where the pioneer colony is found, there may be a possibility for eradication. The following steps should be followed:

Step #1 – Notify Association Board and local resource agencies and explore grant funding opportunities. The Association Board should immediately notify the Wisconsin DNR, arrange a meeting to explore control measures, and determine if an AIS Rapid Response grant is advisable. These grants are designed to deal with pioneer AIS infestations. The typical grant application process is bypassed so grant funds can be made available for quick action in hopes of eradication.

Step #2 – Notify membership of the discovery and what the Board plans to do about it. Notify Lake Association members of the discovery and measures they can take to prevent its further spread within the lake or to other waters. Let them know how the Board plans on dealing with the invasion.

Step #3 – Conduct a thorough survey of the lake to determine the extent of the AIS infestation. Working with County or DNR staff, conduct a thorough survey of the lake. For invasive plants, map its location and record the density as well as any other physical data that may be important such as water depth, sediment type etc.

Step #4 – Determine if eradication is a possibility or if management is the only option. Work with local resource agencies and outside experts where necessary to determine if eradication is possible. Where eradication is not feasible begin revising the Newton Lakes Aquatic Invasive Species Management Plan to deal with the new species.

Step #5 - Develop an action plan based on species and extent of invasion. Work closely with the experts to develop a customized plan aimed at eradication or control.

If outside consultants are needed for things like herbicide treatment or scuba diving bring them into the process early. Many consultants can also help with things like mapping and planning.

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Aquatic Invasive Species Management Plan
For
Big & Little Newton Lakes

APPENDIX A

Aquatic Plant Survey Data

STATS

Lake Name	Little Newton Lake
County	Marinette
WBIC	502300
Survey Date	08/13/09

INDIVIDUAL SPECIES STATS:

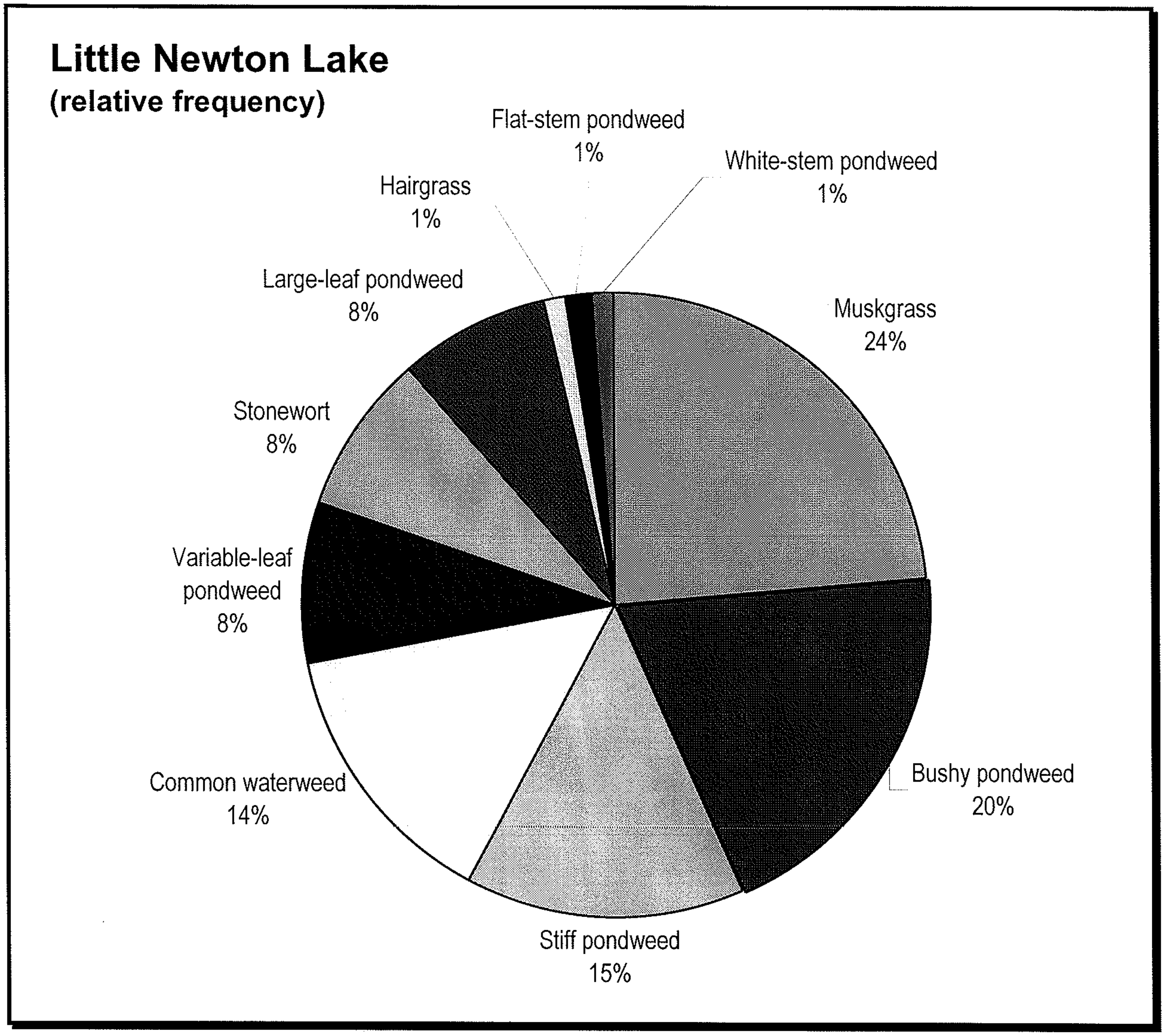
	Total vegetation	Myriophyllum spicatum	Potamogeton crispus	Chara	Potamogeton gramineus	Najas flexilis	Elodea canadensis	Potamogeton strictifolius	Nitella sp.	Eleocharis acicularis	Potamogeton zosteriformus	Potamogeton amplifolius	Potamogeton praelon	X
Frequency of occurrence within vegetated areas (%)				43.80	15.33	36.50	26.28	27.01	15.33	2.19	2.19	14.60	2.19	
Frequency of occurrence at sites shallower than maximum depth of plants				38.22	13.38	31.85	22.93	23.57	13.38	1.91	1.91	12.74	1.91	
Relative Frequency (%)				23.6	8.3	19.7	14.2	14.6	8.3	1.2	1.2	7.9	1.2	
Relative Frequency (squared)	0.16			0.06	0.01	0.04	0.02	0.02	0.01	0.00	0.00	0.01	0.00	
Number of sites where species found				60	21	50	36	37	21	3	3	20	3	
Average Rake Fullness	1.89			1.37	1.29	1.94	1.36	1.62	1.33	2.67	1.00	1.20	1.00	
#visual sightings														
present (visual or collected)				present	present	present	present	present	present	present	present	present	present	

EXOTICS SPECIES STATS:

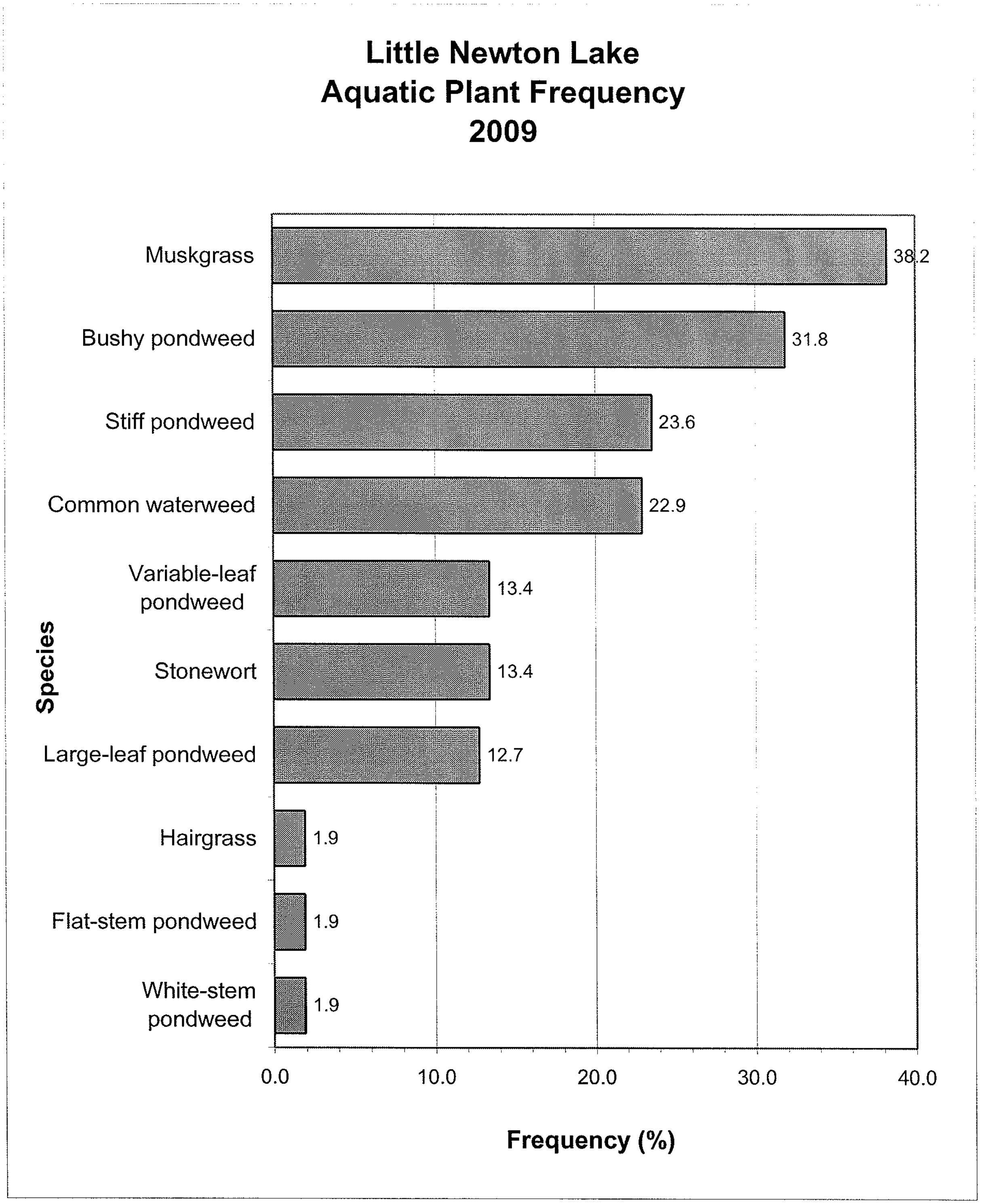
	Myriophyllum spicatum	Potamogeton crispus
# at surface		
# within 1 ft of surface		
# > 1 ft from surface		
# sparse		
# dense		
# unknown		

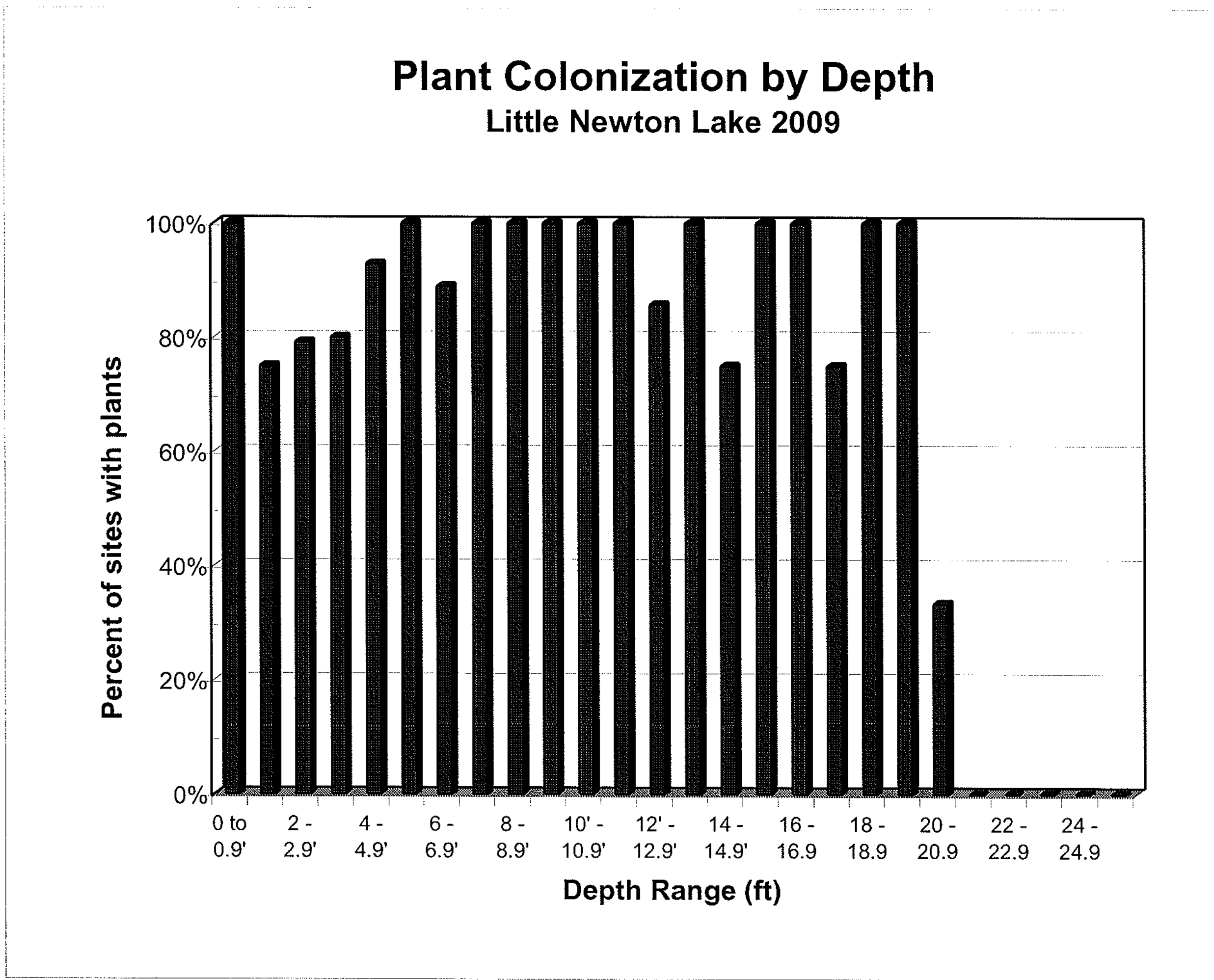
SUMMARY STATS:

Total number of points sampled	240
Total number of sites with vegetation	137
Total number of sites shallower than maximum depth of plants	157
Frequency of occurrence at sites shallower than maximum depth of plants	87.26
Simpson Diversity Index	0.84
Maximum depth of plants (ft)	20.00
Number of sites sampled using rake on Rope (R)	0
Number of sites sampled using rake on Pole (P)	0
Average number of all species per site (shallower than max depth)	1.61
Average number of all species per site (veg. sites only)	1.85
Average number of native species per site (shallower than max depth)	1.61
Average number of native species per site (veg. sites only)	1.85
Species Richness	10
Species Richness (including visuals)	10

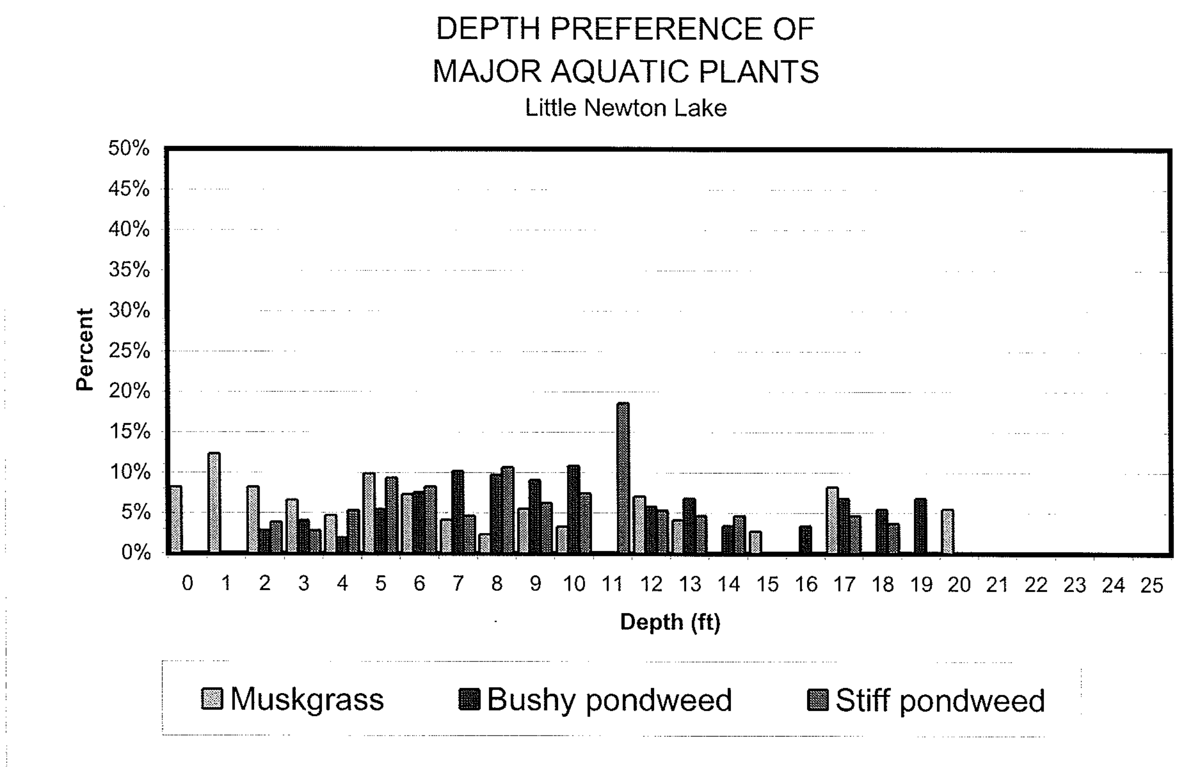


Little Newton Lake
(relative frequency)
Flat-stem pondweed
1%
White-stem pondweed
1%
Hairgrass
1%
Large-leaf pondweed
8%
Muskgrass
24%
Stonewort
8%
Variable-leaf
pondweed
8%
Bushy pondweed
20%
Common waterweed
14%
Stiff pondweed
15%

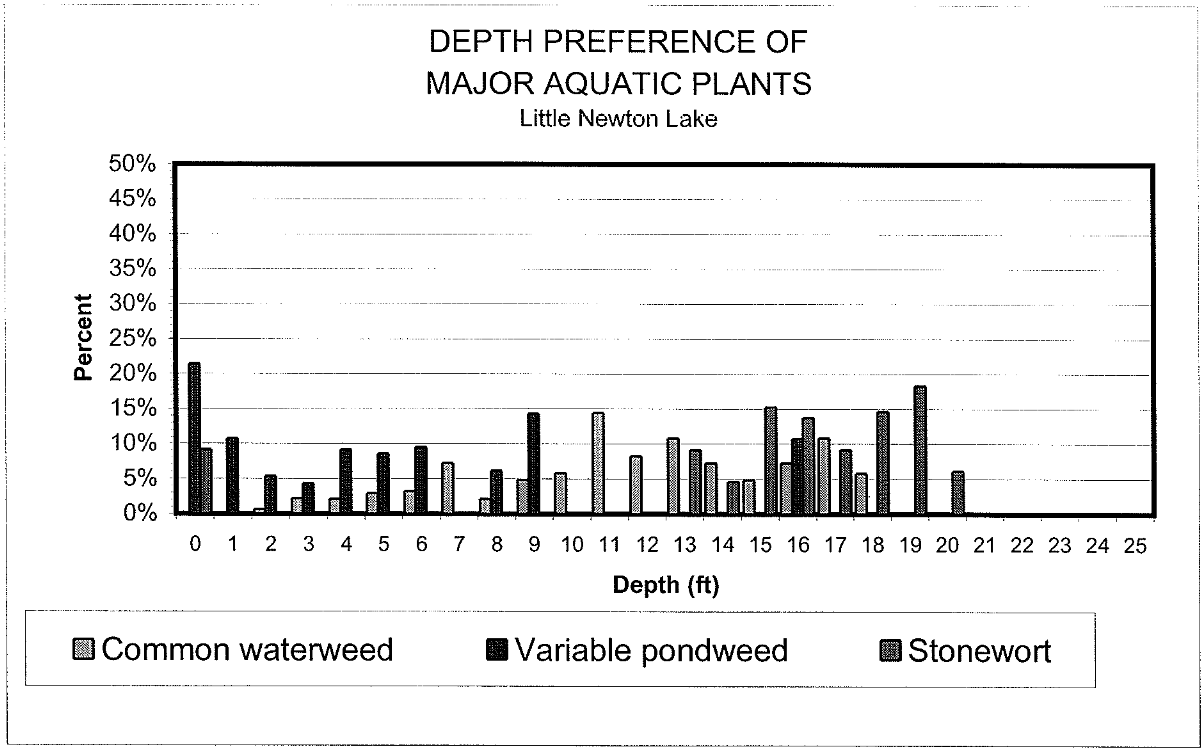

Little Newton Lake
Aquatic Plant Frequency
2009
Muskgrass
Bushy pondweed
Stiff pondweed
Common waterweed
Variable-leaf pondweed
Stonewort
Large-leaf pondweed
Hairgrass
Flat-stem pondweed
White-stem pondweed
38.2
31.8
23.6
22.9
13.4
13.4
12.7
1.9
1.9
1.9
Species
0.0
10.0
20.0
30.0
40.0
Frequency (%)



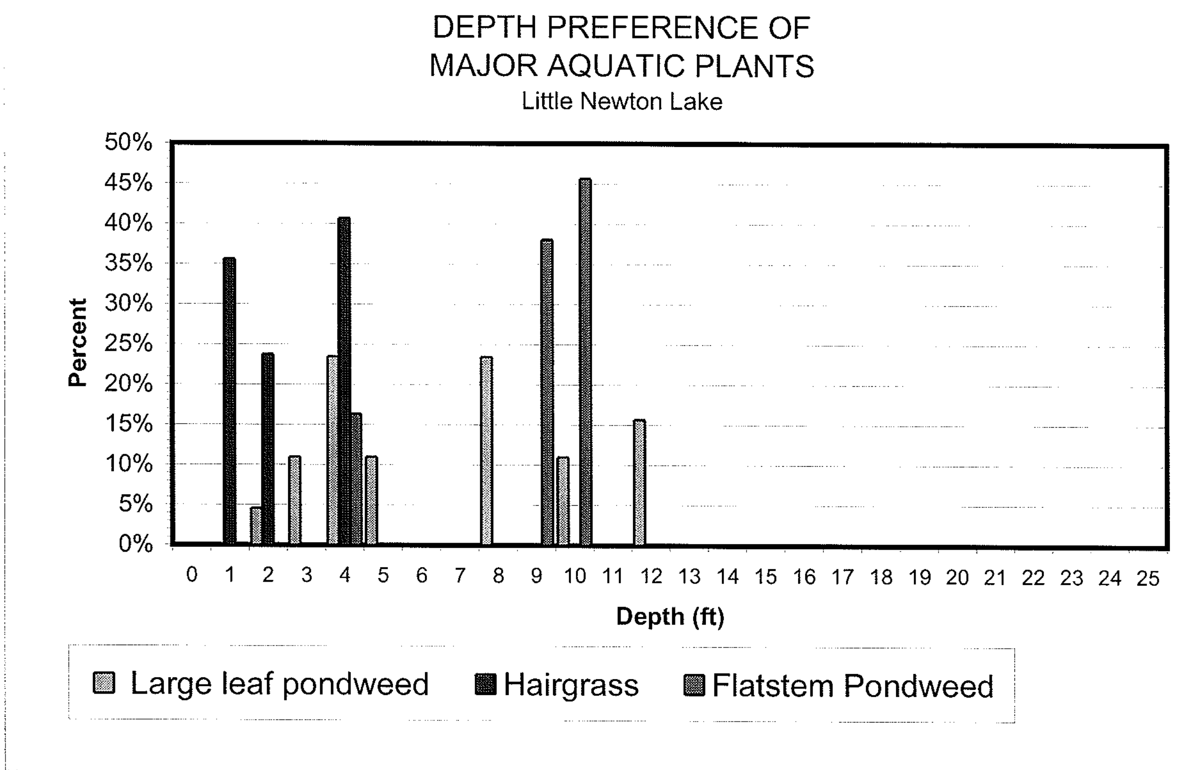
Plant Colonization by Depth
Little Newton Lake 2009
100%
80%
60%
40%
20%
0%
Percent of sites with plants
0 to 0.9'
2 - 2.9'
4 - 4.9'
6 - 6.9'
8 - 8.9'
10' - 10.9'
12' - 12.9'
14 - 14.9'
16 - 16.9
18 - 18.9
20 - 20.9
22 - 22.9
24 - 24.9
Depth Range (ft)

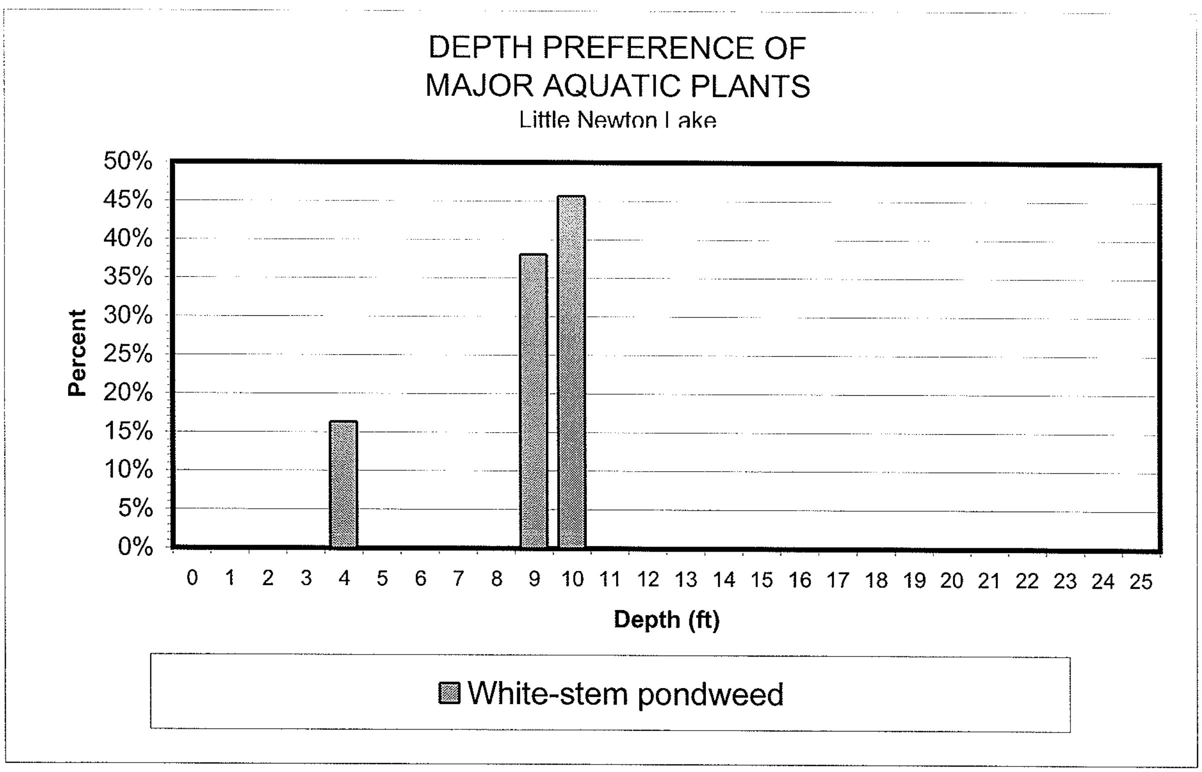


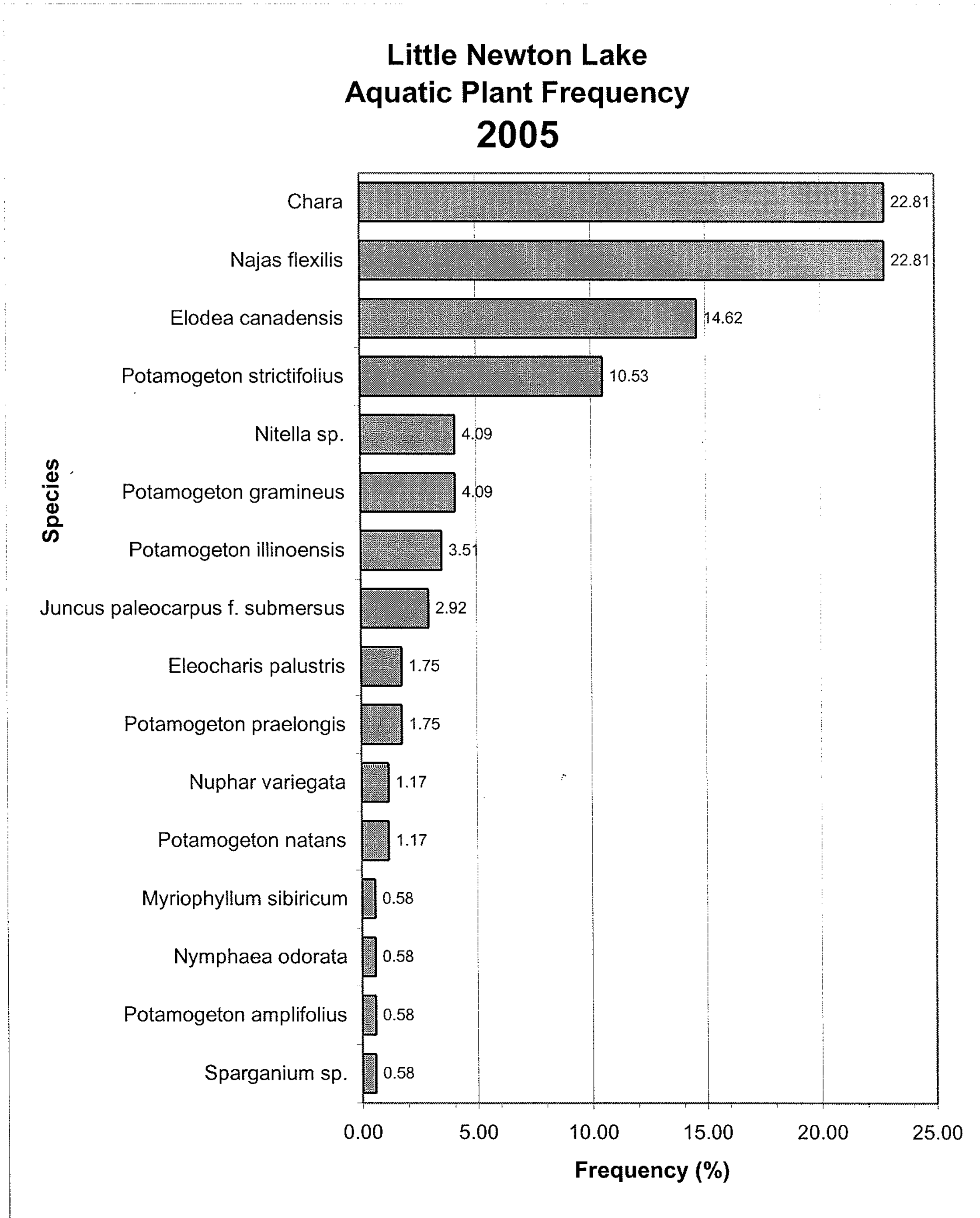
DEPTH PREFERENCE OF
MAJOR AQUATIC PLANTS
Little Newton Lake
Percent
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Depth (ft)
Muskgrass
Bushy pondweed
Stiff pondweed

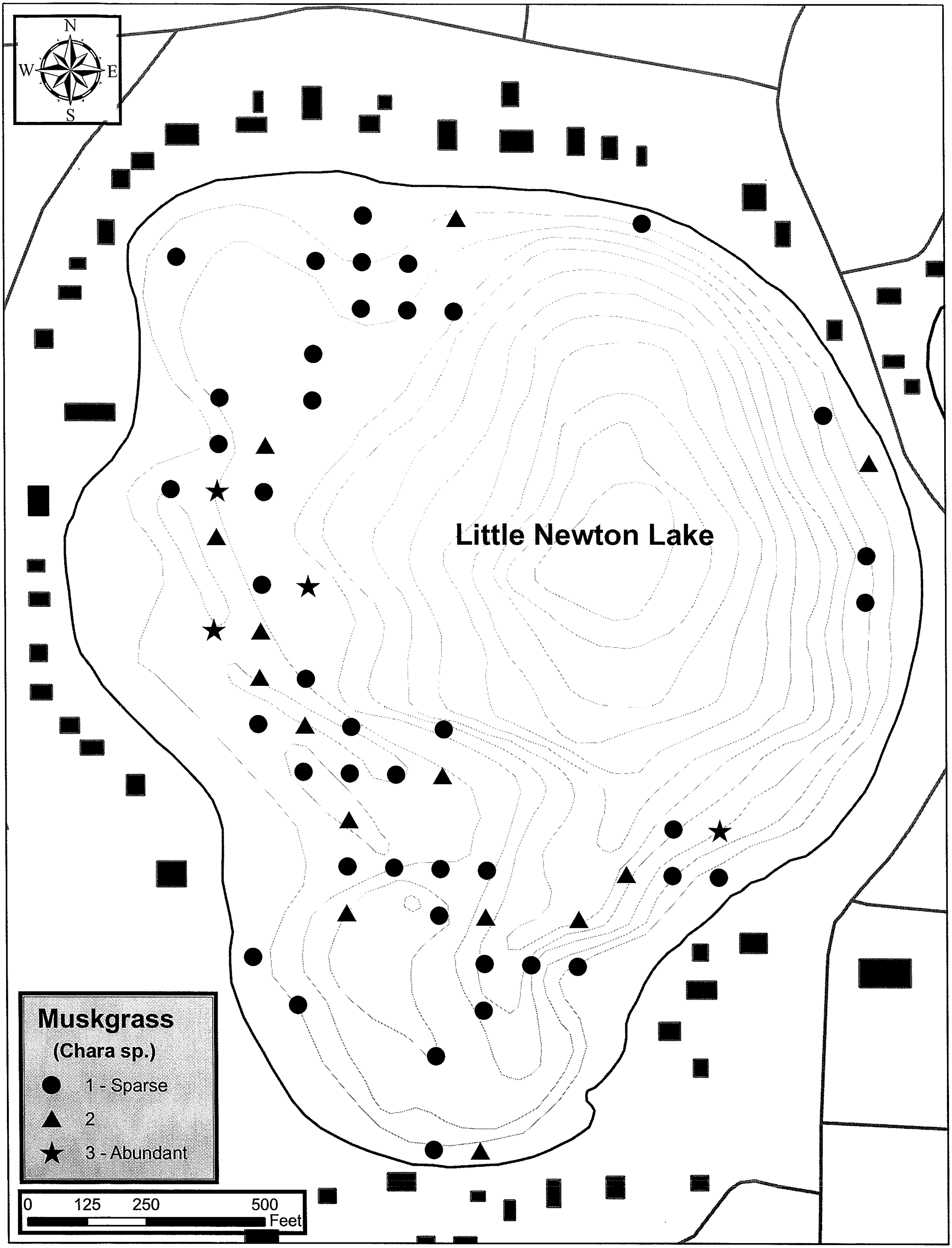


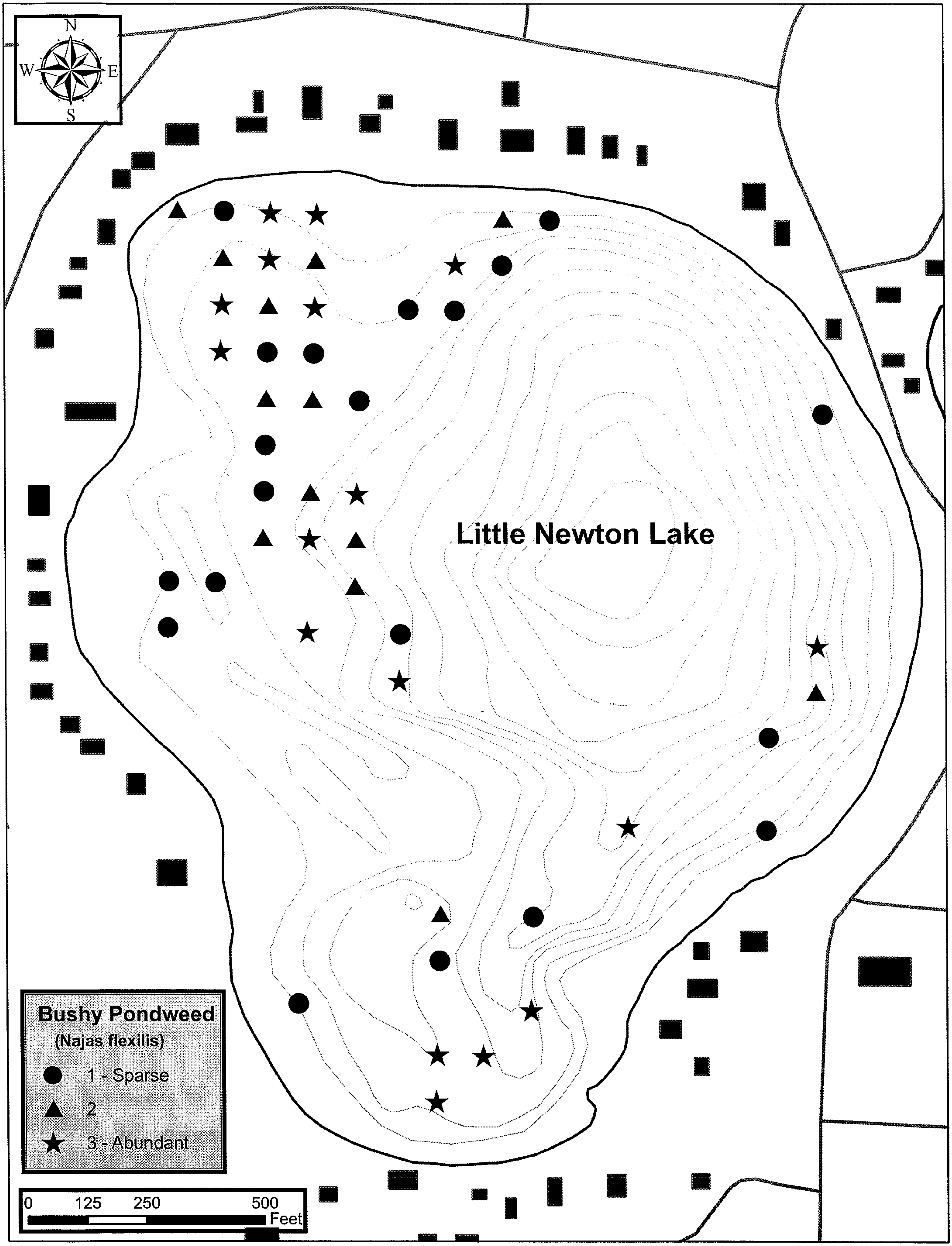
DEPTH PREFERENCE OF
MAJOR AQUATIC PLANTS
Little Newton Lake
Percent
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Depth (ft)
Common waterweed
Variable pondweed
Stonewort


DEPTH PREFERENCE OF
MAJOR AQUATIC PLANTS
Little Newton Lake
Percent
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Depth (ft)
Large leaf pondweed
Hairgrass
Flatstem Pondweed

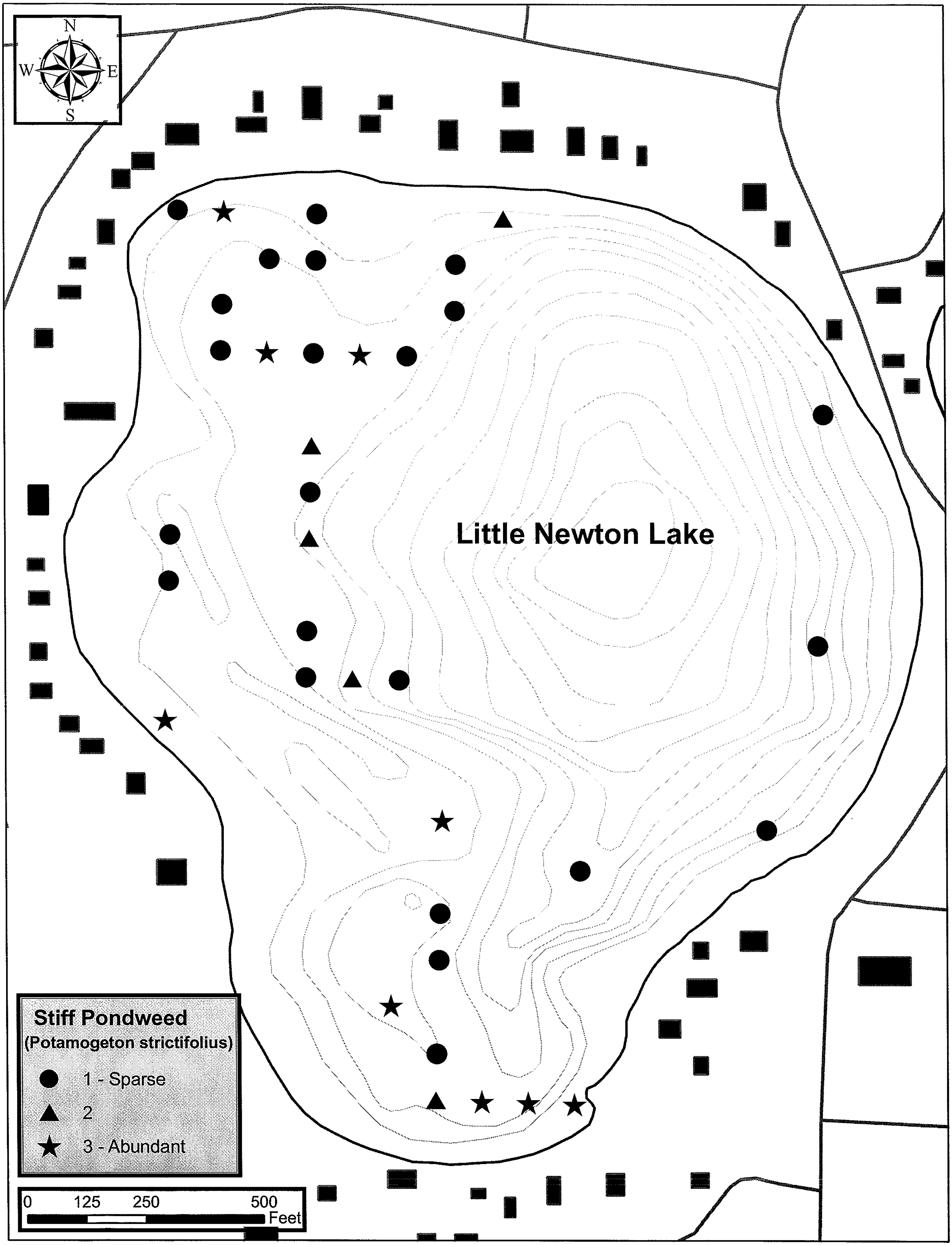

DEPTH PREFERENCE OF
MAJOR AQUATIC PLANTS
Little Newton Lake
Percent
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Depth (ft)
White-stem pondweed

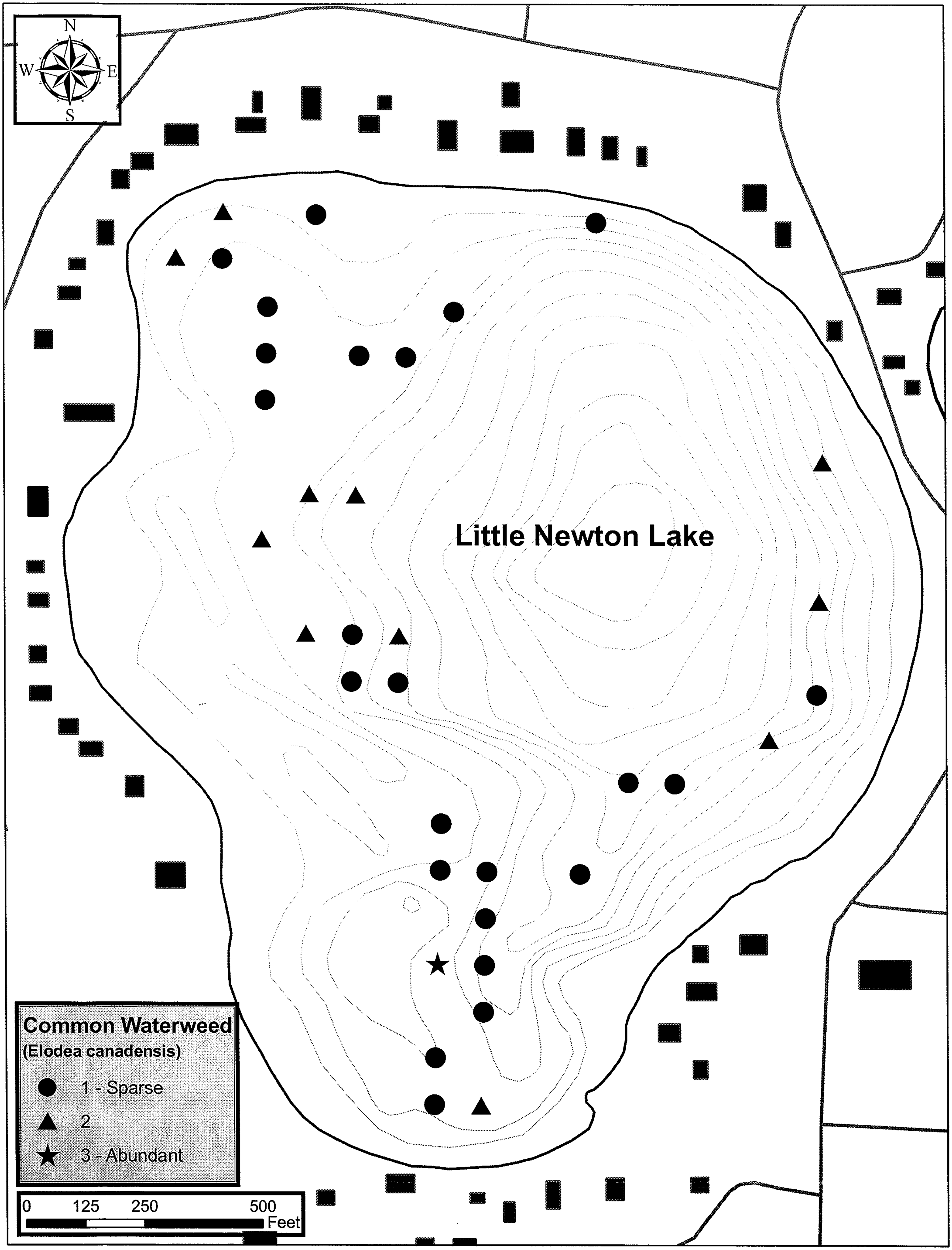

Little Newton Lake
Aquatic Plant Frequency
2005
Species
Chara
Najas flexilis
Elodea canadensis
Potamogeton strictifolius
Nitella sp.
Potamogeton gramineus
Potamogeton illinoensis
Juncus paleocarpus f. submersus
Eleocharis palustris
Potamogeton praelongis
Nuphar variegata
Potamogeton natans
Myriophyllum sibiricum
Nymphaea odorata
Potamogeton amplifolius
Sparganium sp.
22.81
22.81
14.62
10.53
4.09
4.09
3.51
2.92
1.75
1.75
1.17
1.17
0.58
0.58
0.58
0.58
0.00
5.00
10.00
15.00
20.00
25.00
Frequency (%)

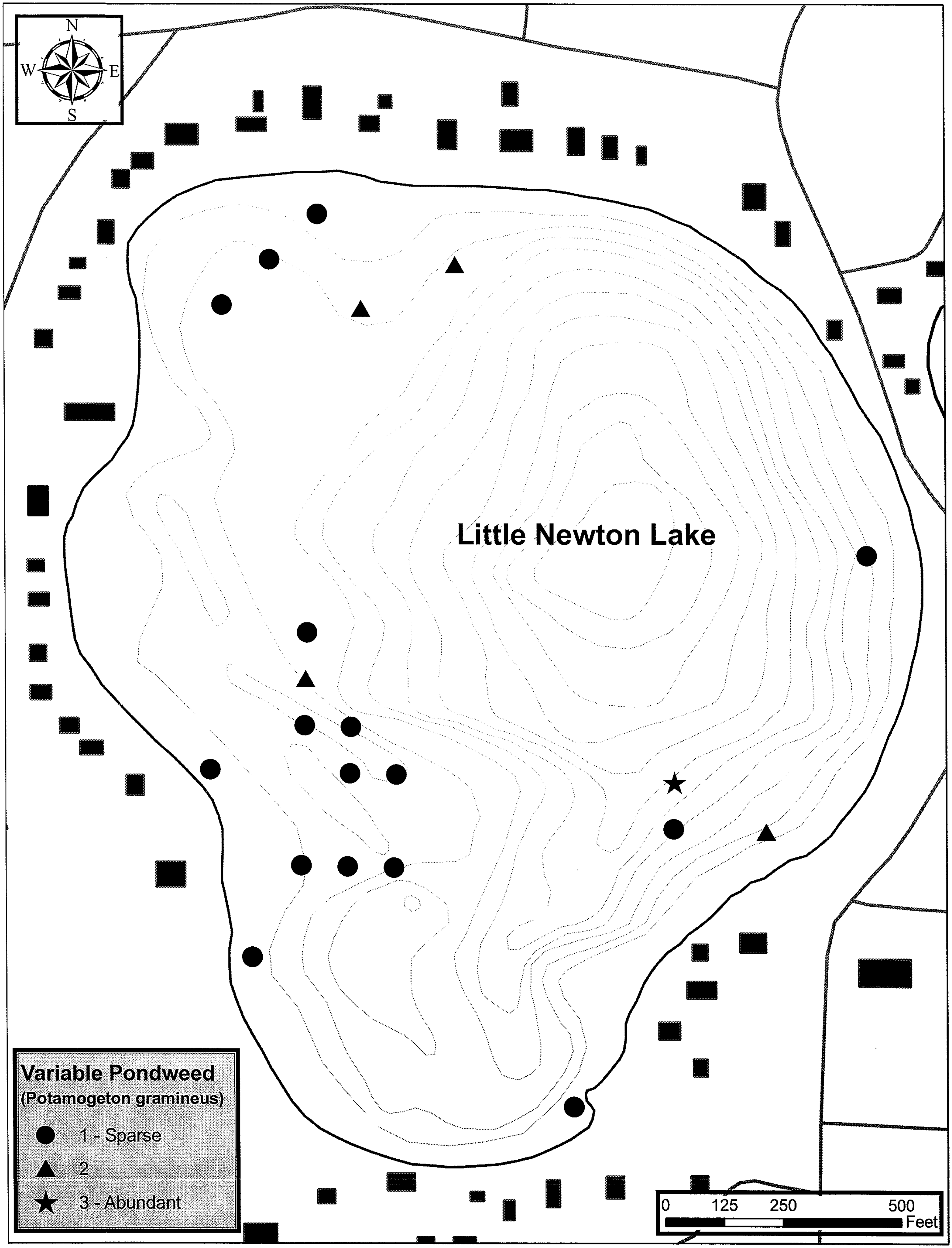

N
S
E
W
Little Newton Lake
Muskgrass
(Chara sp.)
1 - Sparse
2
3 - Abundant
0
125
250
500
Feet

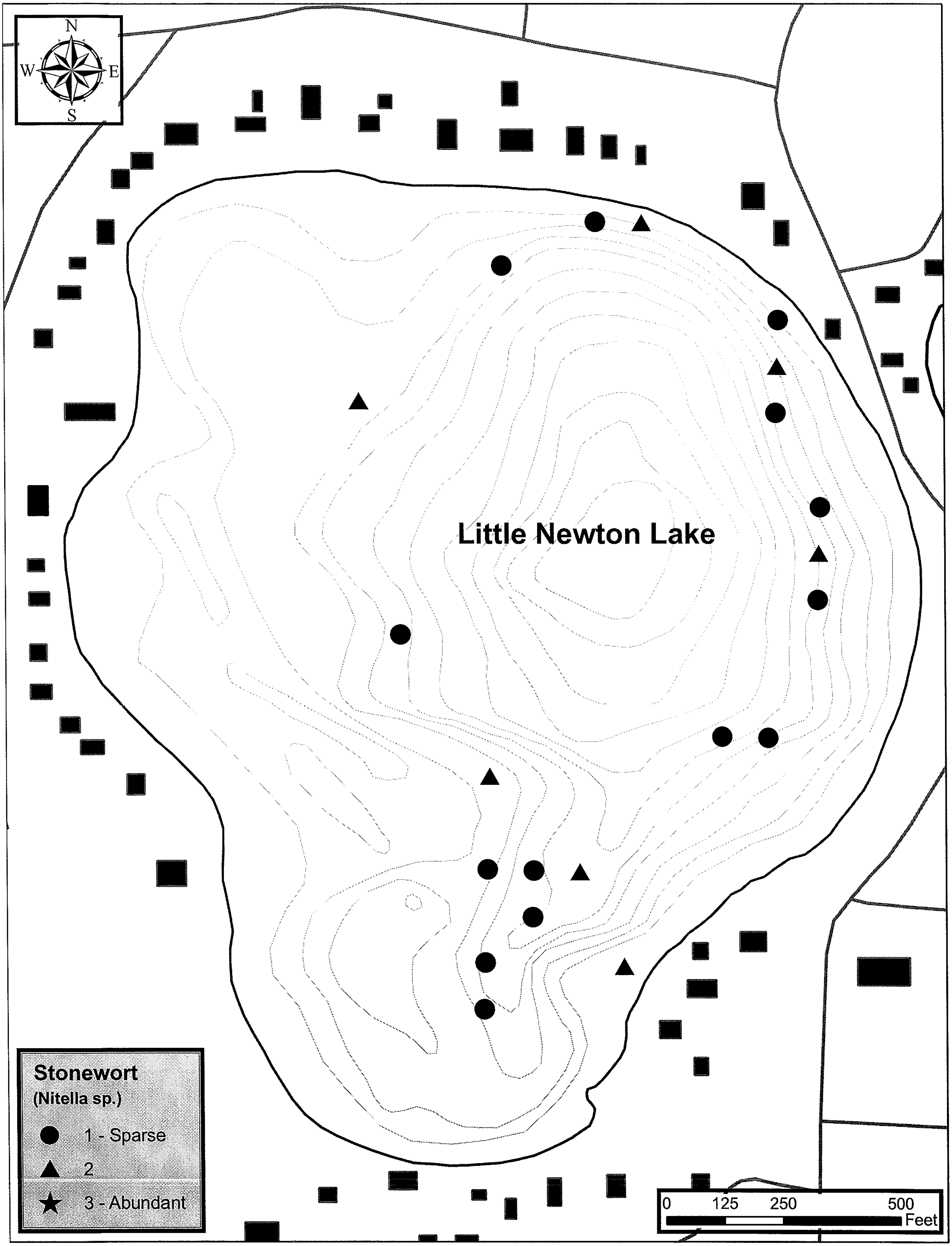


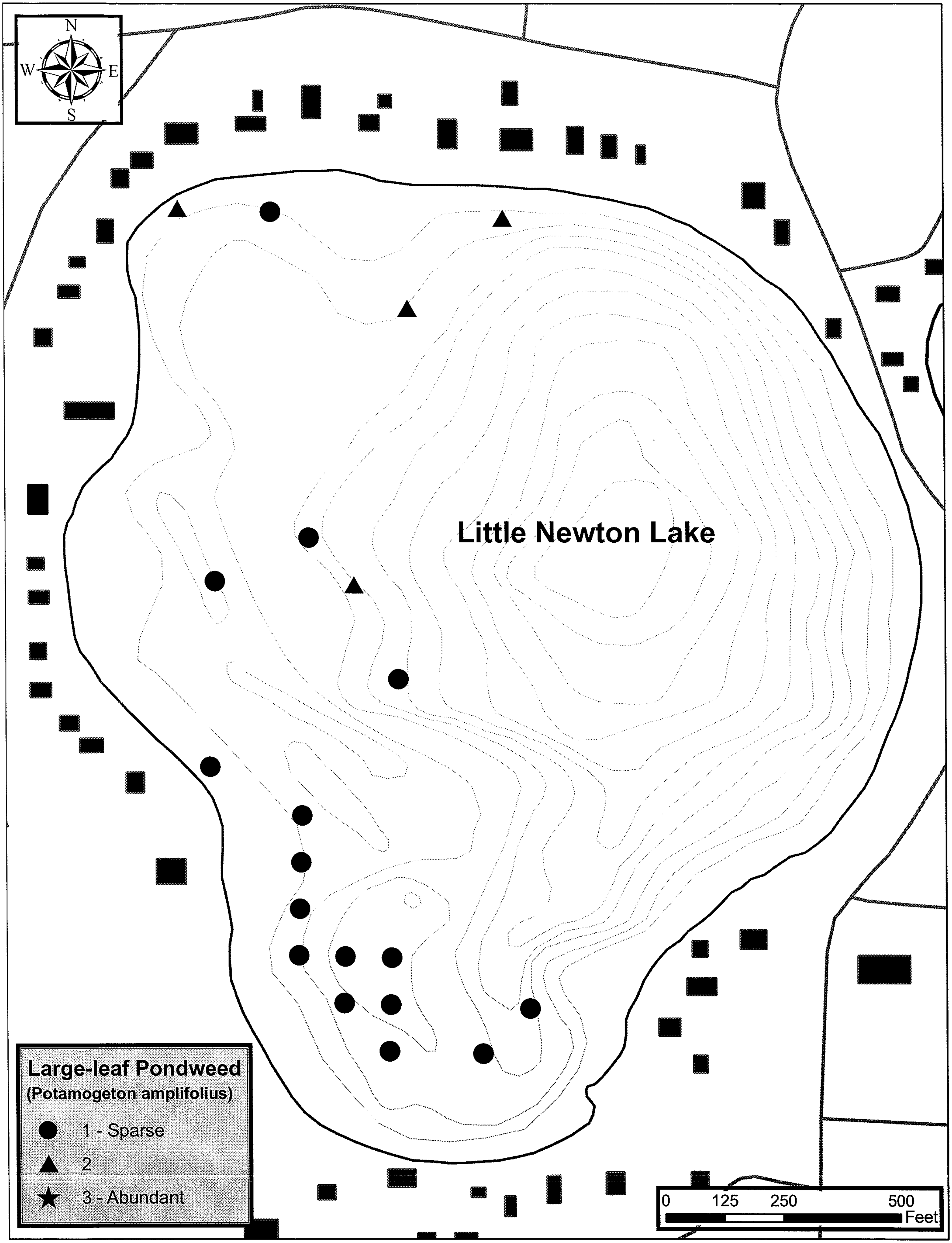
N
W
E
S
Little Newton Lake
Bushy Pondweed
(Najas flexilis)
1 - Sparse
2
3 - Abundant
0
125
250
500
Feet

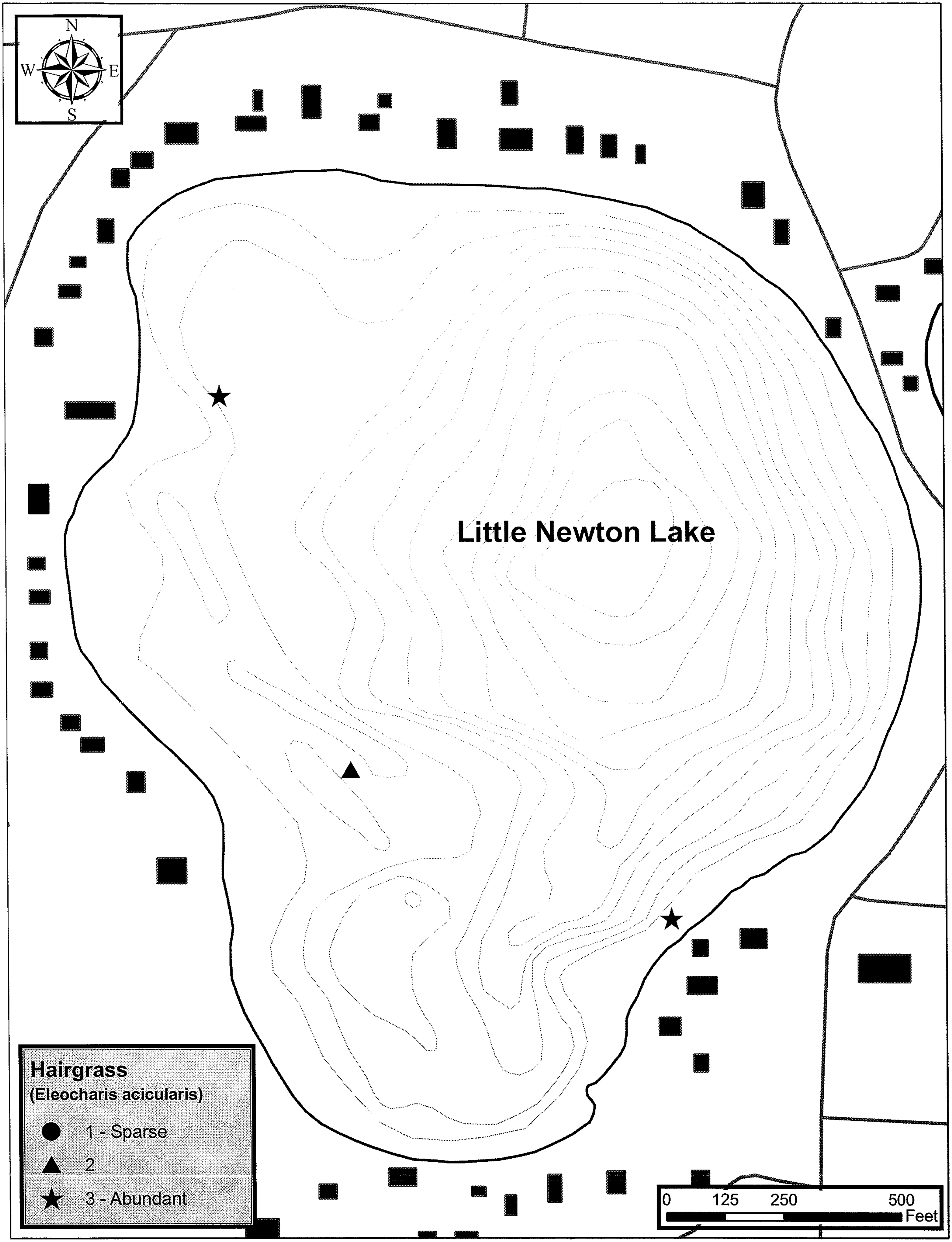

N
S
W
E
Little Newton Lake
Stiff Pondweed
(Potamogeton strictifolius)
1 - Sparse
2
3 - Abundant
0
125
250
500
Feet

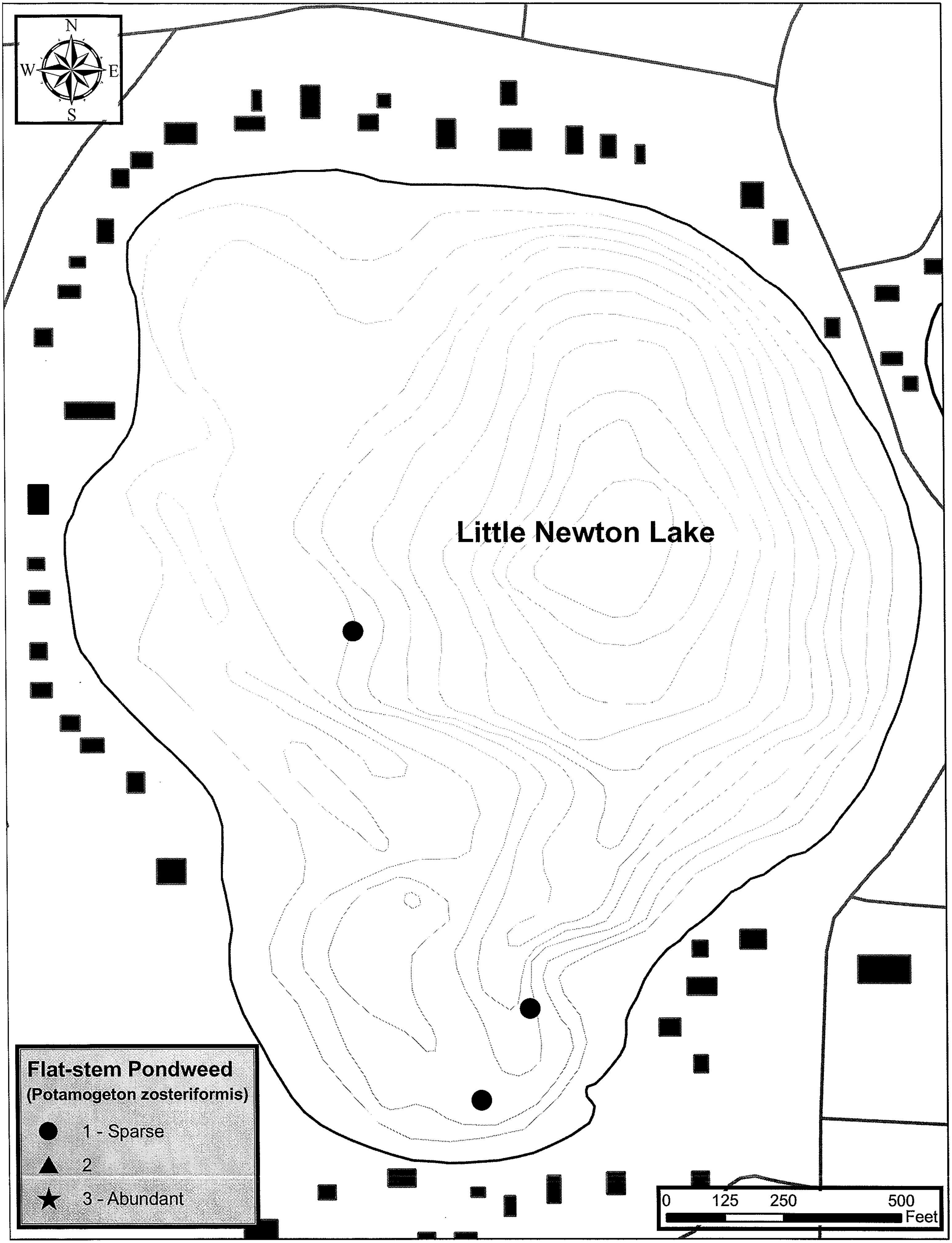

N
W
E
S
Little Newton Lake
Common Waterweed
(Elodea canadensis)
1 - Sparse
2
3 - Abundant
0
125
250
500
Feet

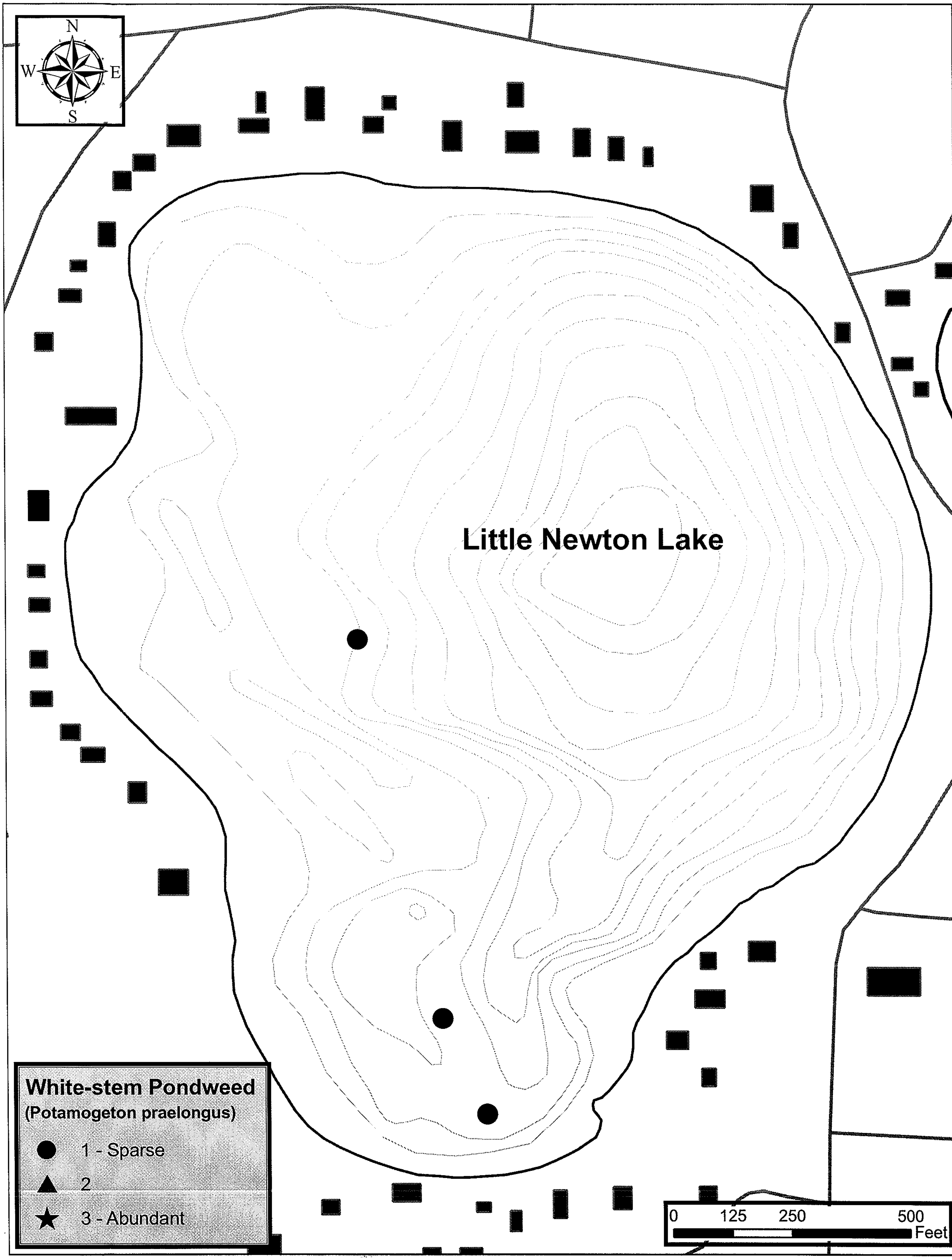

N
S
W
E
Little Newton Lake
Variable Pondweed
(Potamogeton gramineus)
1 - Sparse
2
3 - Abundant
0
125
250
500
Feet


N
W
E
S
Little Newton Lake
Stonewort
(Nitella sp.)
1 - Sparse
2
3 - Abundant
0
125
250
500
Feet

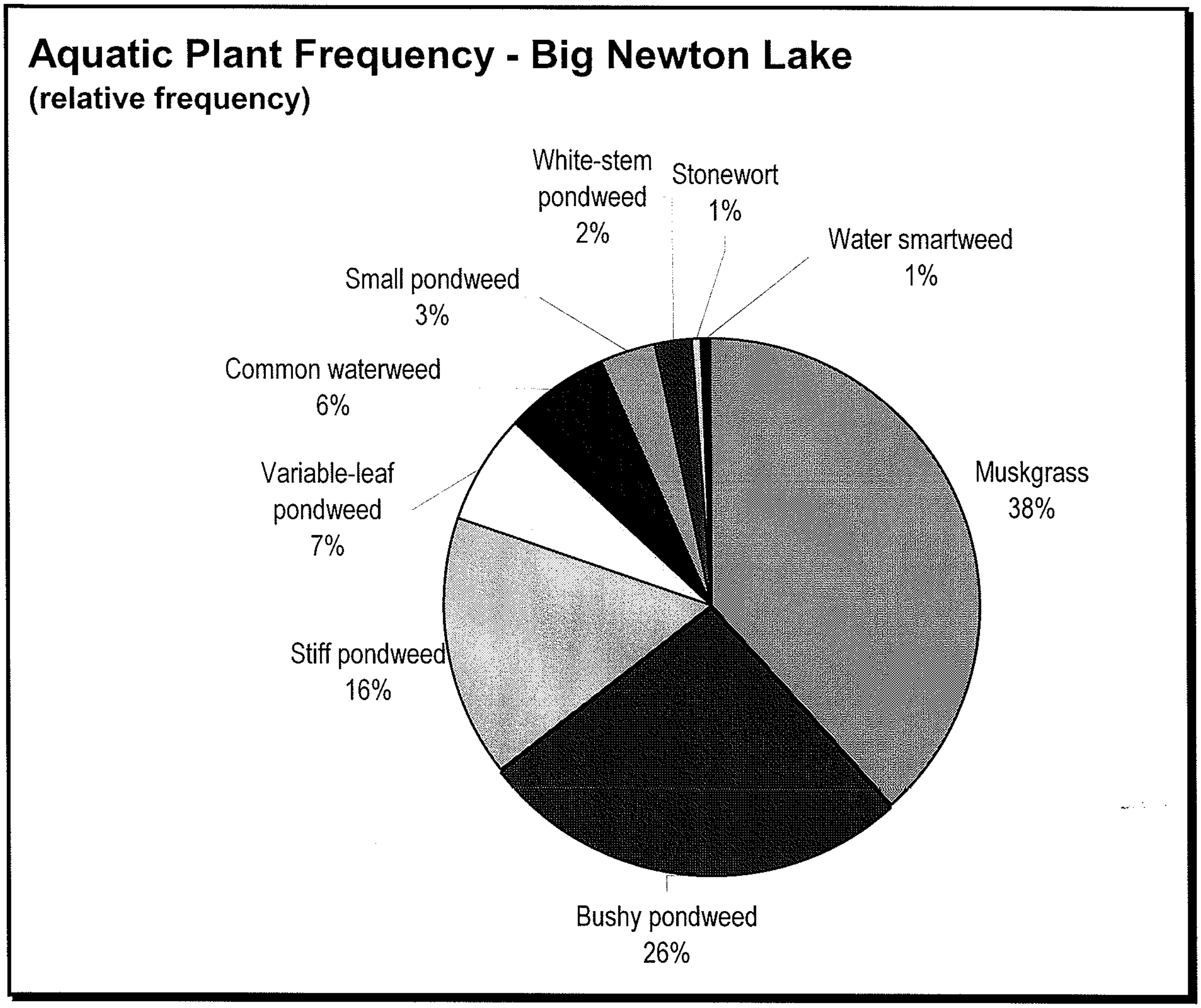

N
S
W
E
Little Newton Lake
Large-leaf Pondweed
(Potamogeton amplifolius)
1 - Sparse
2
3 - Abundant
0
125
250
500
Feet


N
W
E
S
Little Newton Lake
Hairgrass
(Eleocharis acicularis)
1 - Sparse
2
3 - Abundant
0
125
250
500
Feet

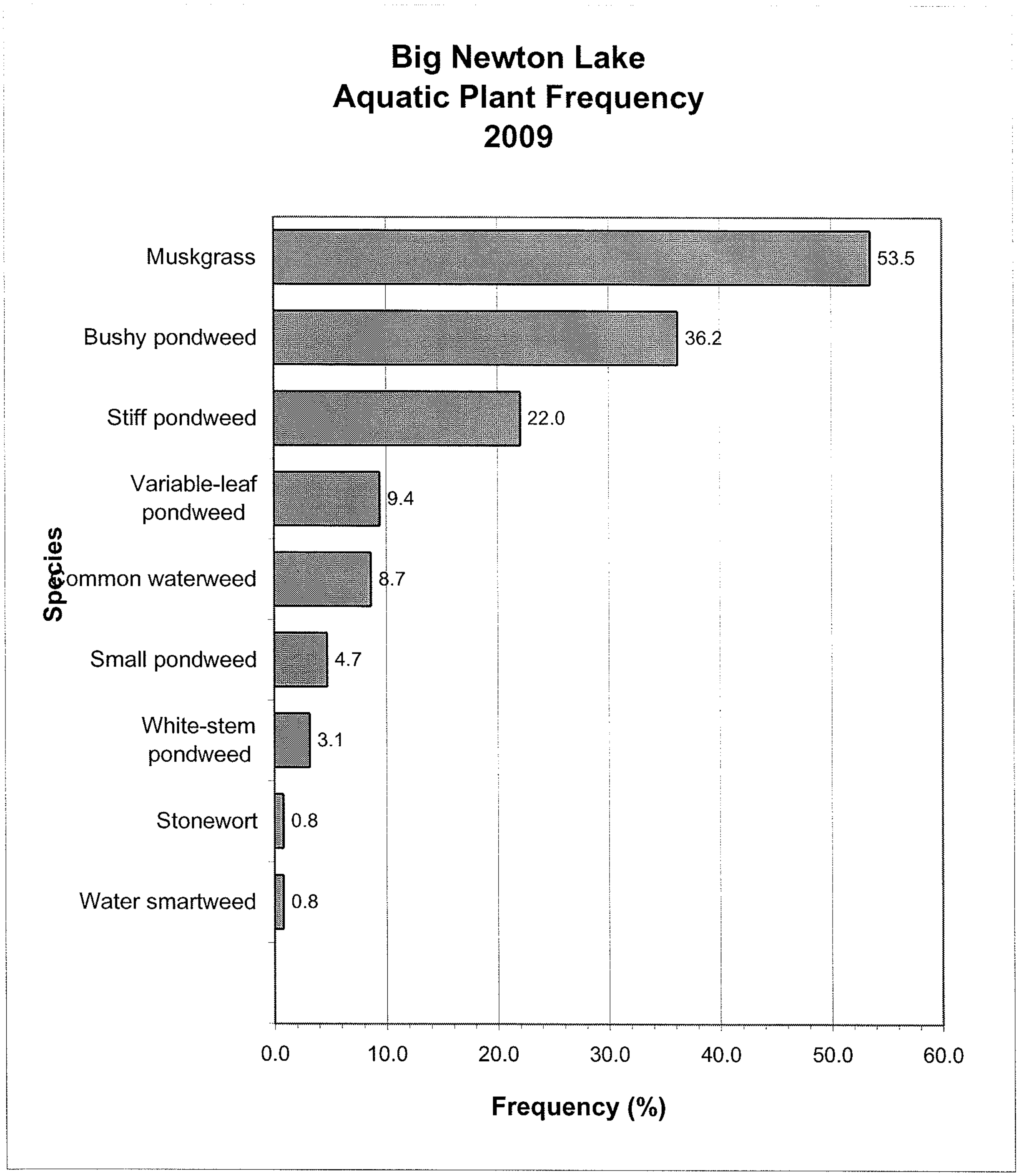

N
W
E
S
Little Newton Lake
Flat-stem Pondweed
(Potamogeton zosteriformis)
1 - Sparse
2
3 - Abundant
0
125
250
500
Feet

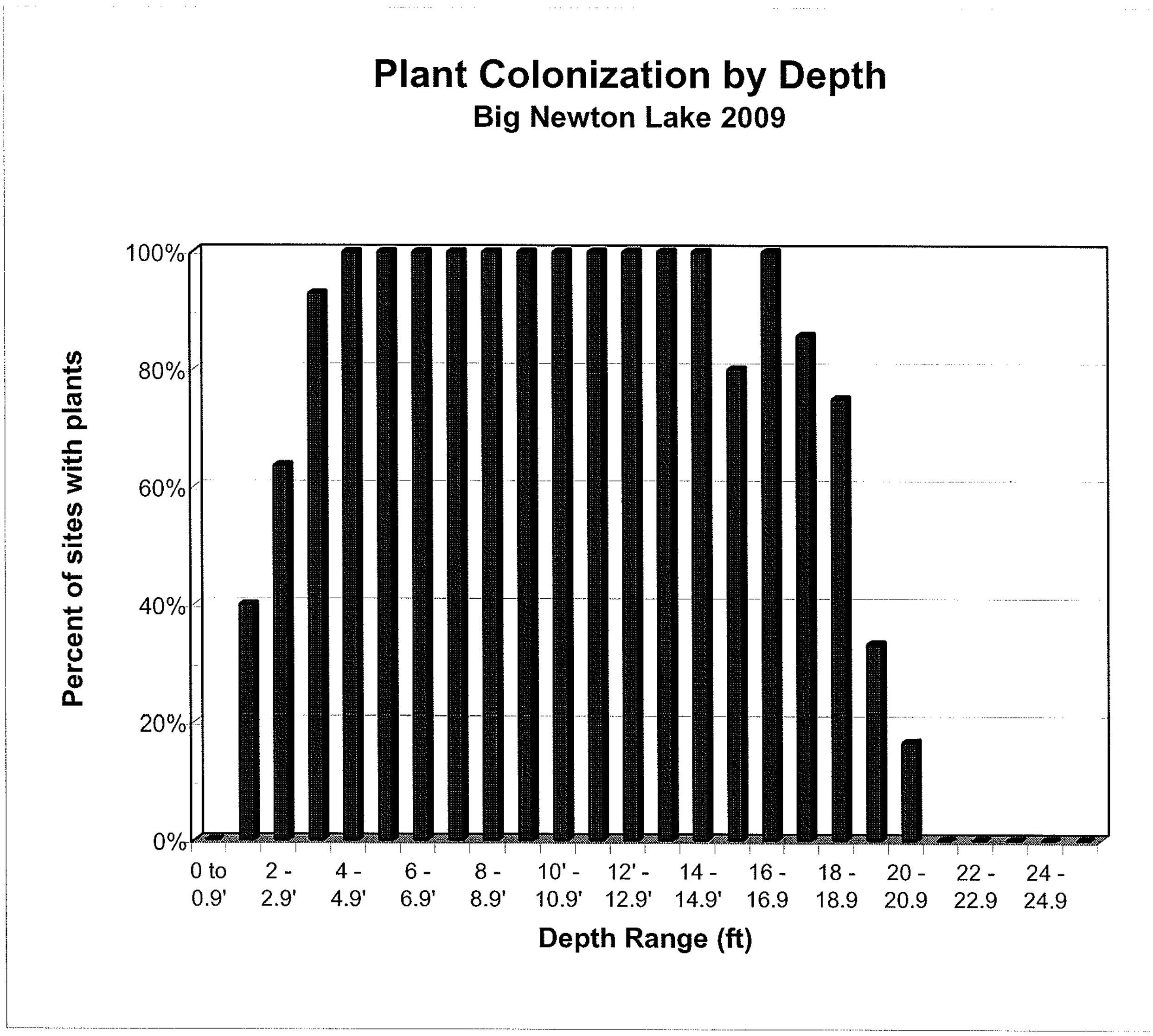

N
S
W
E
Little Newton Lake
White-stem Pondweed
(Potamogeton praelongus)
1 - Sparse
2
3 - Abundant
0
125
250
500
Feet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1		**STATS**	Total vegetation	Myriophyllum spicatum	Potamogeton crispus	Chara	Potamogeton gramineus	Najas flexilis	Elodea canadensis	Potamogeton strictifolius	Nitella sp.	Eleocharis acicularis	Potamogeton praelongus	Polygonum amphibium	Moss	Potamogeton pusillus	X	X
2	Lake Name	Big Newton Lake																
3	County	Marinette																
4	WBIC	498800																
5	Survey Date	08/13/09																
6		**INDIVIDUAL SPECIES STATS:**																
7		Frequency of occurrence within vegetated areas (%)				66.67	11.76	45.10	10.78	27.45	0.98		3.92	0.98	0.98	5.88		
8		Frequency of occurrence at sites shallower than maximum depth of plants				53.54	9.45	36.22	8.66	22.05	0.79		3.15	0.79	0.79	4.72		
9		Relative Frequency (%)				38.2	6.7	25.8	6.2	15.7	0.6		2.2	0.6	0.6	3.4		
10		Relative Frequency (squared)	0.25			0.15	0.00	0.07	0.00	0.02	0.00		0.00	0.00	0.00	0.00		
11		Number of sites where species found				68	12	46	11	28	1		4	1	1	6		
12		Average Rake Fullness	1.94			1.81	1.08	1.24	1.45	1.64	1.00		1.00	1.00	1.00	1.33		
13		#visual sightings				1												
14		present (visual or collected)				present	present	present	present	present	present		present	present	present	present		
15																		
16		**EXOTICS SPECIES STATS:**																
17		# at surface																
18		# within 1 ft of surface																
19		# > 1 ft from surface																
20		# sparse																
21		# dense																
22		# unknown																
23																		
24		**SUMMARY STATS:**																
25		Total number of points sampled	213															
26		Total number of sites with vegetation	102															
27		Total number of sites shallower than maximum depth of plants	127															
28		Frequency of occurrence at sites shallower than maximum depth of plants	80.31															
29		Simpson Diversity Index	0.75															
30		Maximum depth of plants (ft)	20.00															
31		Number of sites sampled using rake on Rope (R)	0															
32		Number of sites sampled using rake on Pole (P)	0															
33		Average number of all species per site (shallower than max depth)	1.40															
34		Average number of all species per site (veg. sites only)	1.75															
35		Average number of native species per site (shallower than max depth)	1.40															
36		Average number of native species per site (veg. sites only)	1.75															
37		Species Richness	10															
38		Species Richness (including visuals)	10															
39																		

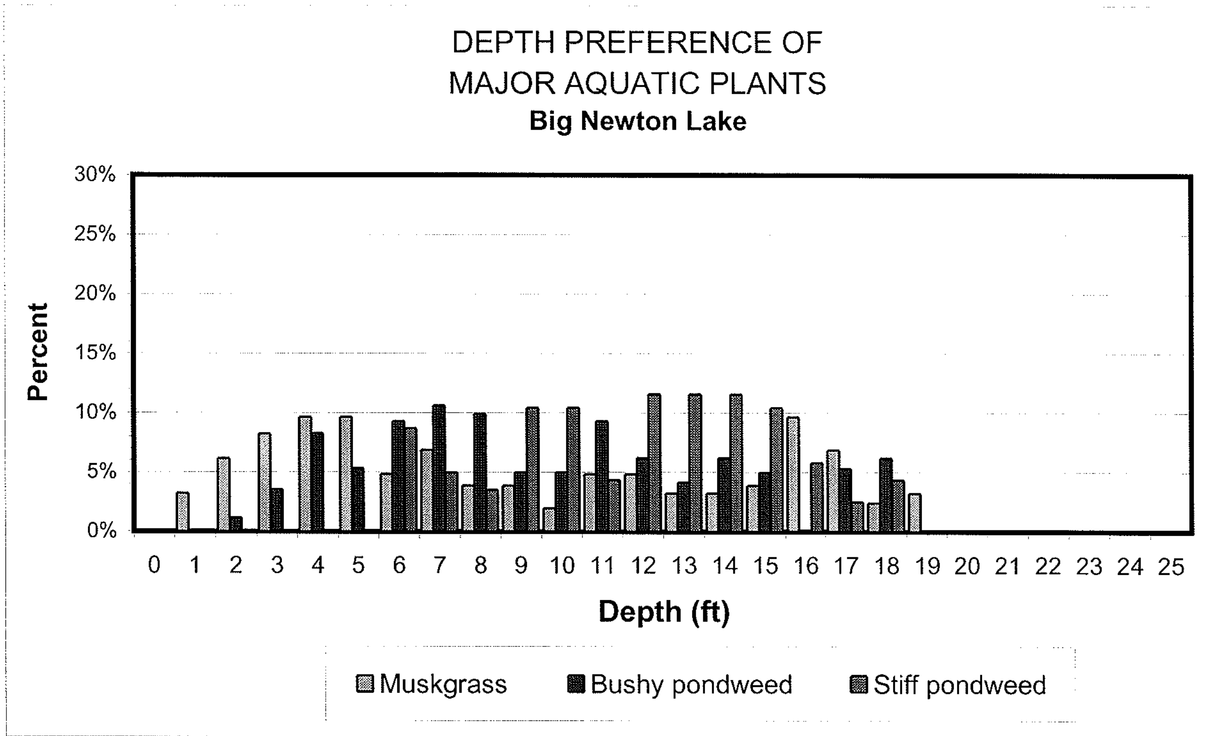


Aquatic Plant Frequency - Big Newton Lake
(relative frequency)
White-stem pondweed 2%
Stonewort 1%
Water smartweed 1%
Small pondweed 3%
Common waterweed 6%
Variable-leaf pondweed 7%
Stiff pondweed 16%
Muskgrass 38%
Bushy pondweed 26%

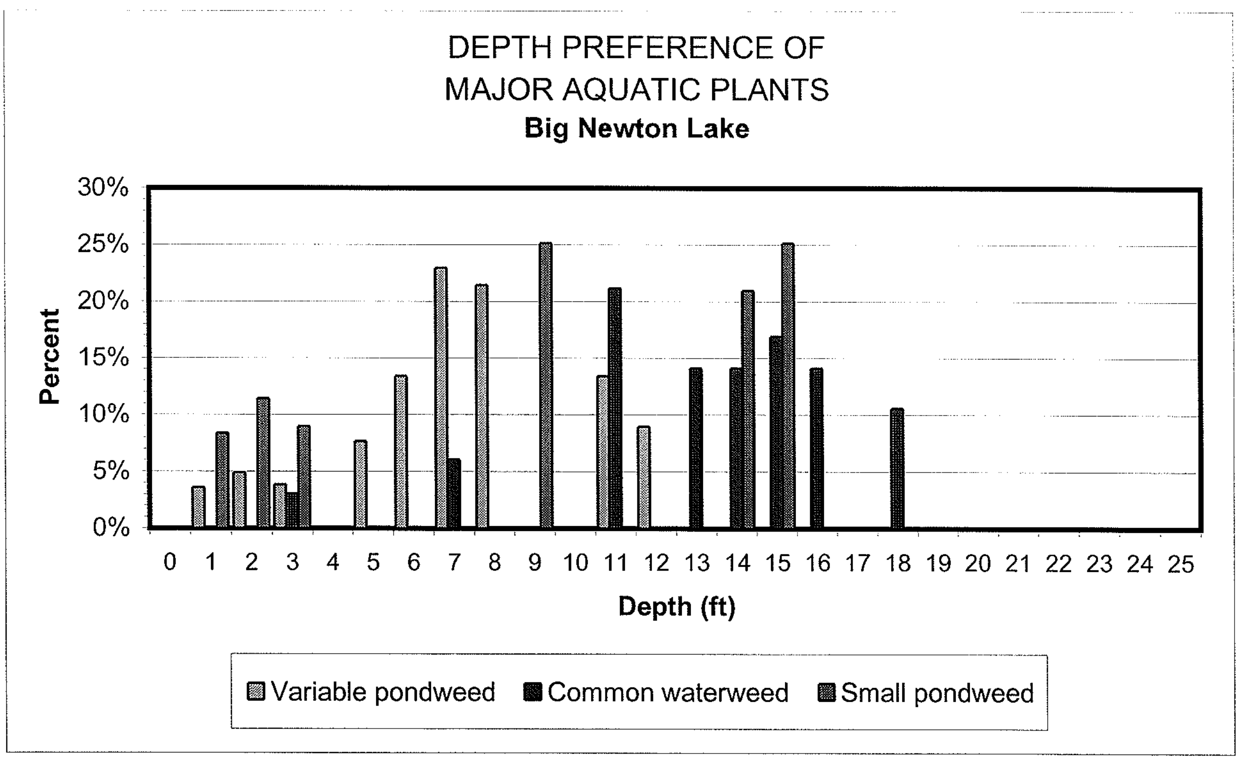

Big Newton Lake
Aquatic Plant Frequency
2009
Muskgrass
Bushy pondweed
Stiff pondweed
Variable-leaf pondweed
Common waterweed
Small pondweed
White-stem pondweed
Stonewort
Water smartweed
53.5
36.2
22.0
9.4
8.7
4.7
3.1
0.8
0.8
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Species
Frequency (%)



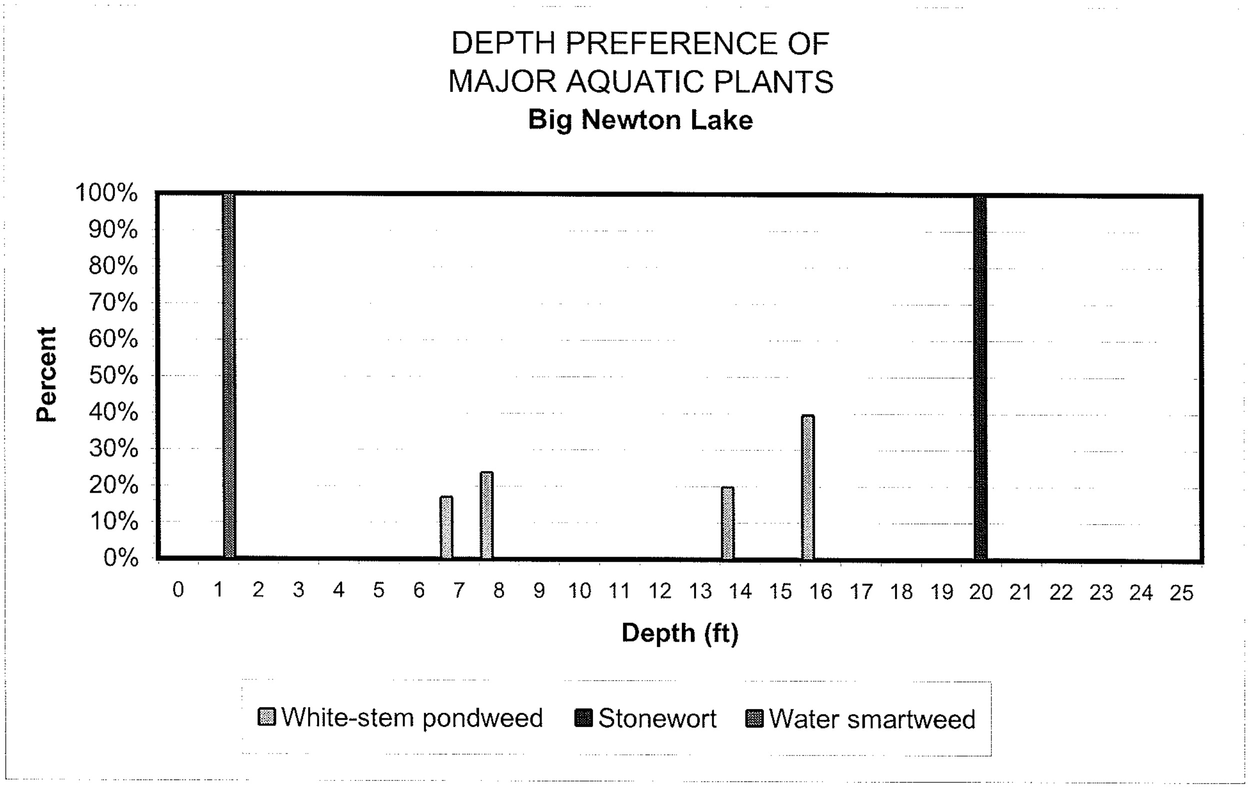
Plant Colonization by Depth
Big Newton Lake 2009
Percent of sites with plants
100%
80%
60%
40%
20%
0%
0 to 0.9'
2 - 2.9'
4 - 4.9'
6 - 6.9'
8 - 8.9'
10' - 10.9'
12' - 12.9'
14 - 14.9'
16 - 16.9
18 - 18.9
20 - 20.9
22 - 22.9
24 - 24.9
Depth Range (ft)

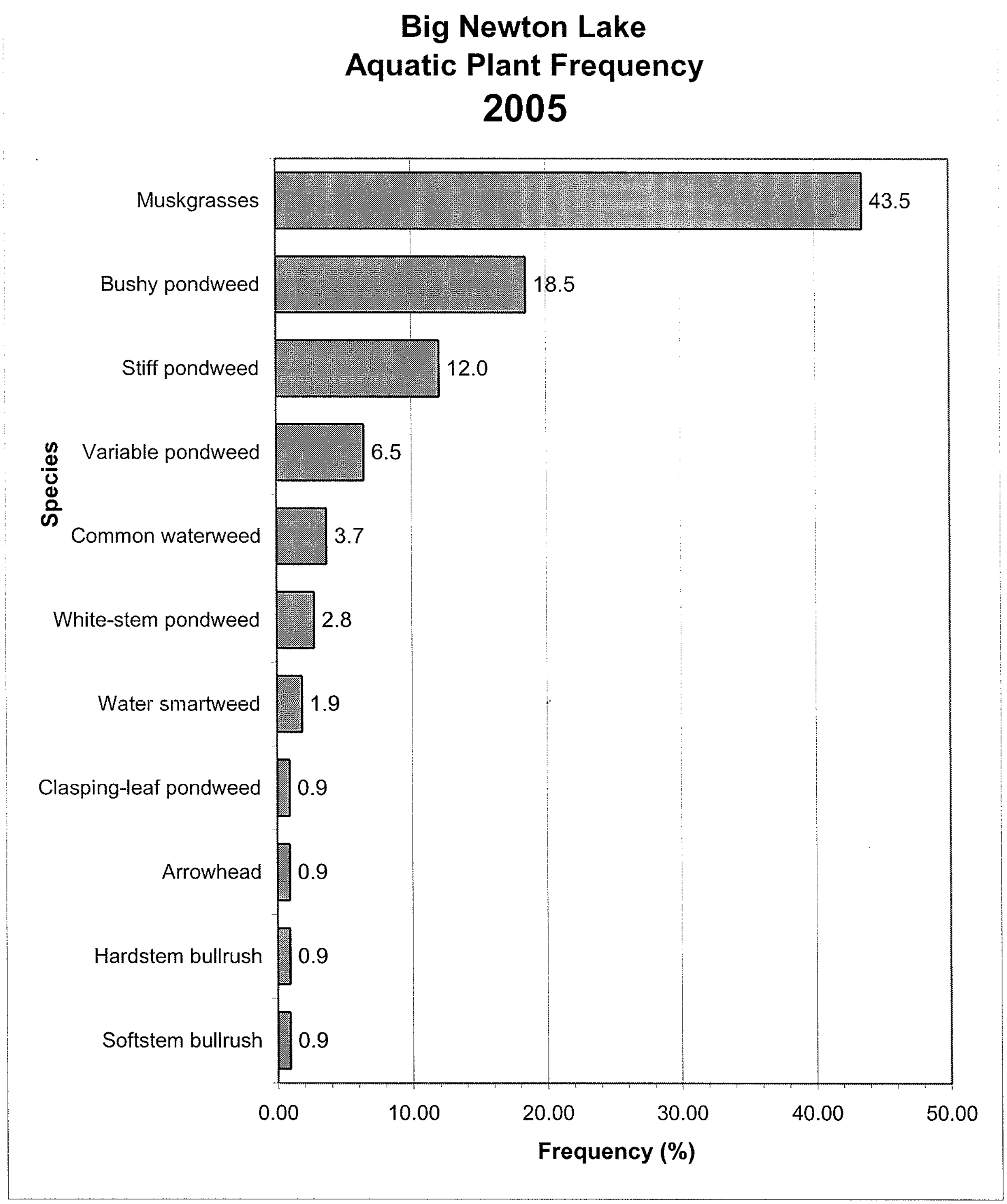


DEPTH PREFERENCE OF
MAJOR AQUATIC PLANTS
Big Newton Lake
Percent
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Depth (ft)
Muskgrass
Bushy pondweed
Stiff pondweed

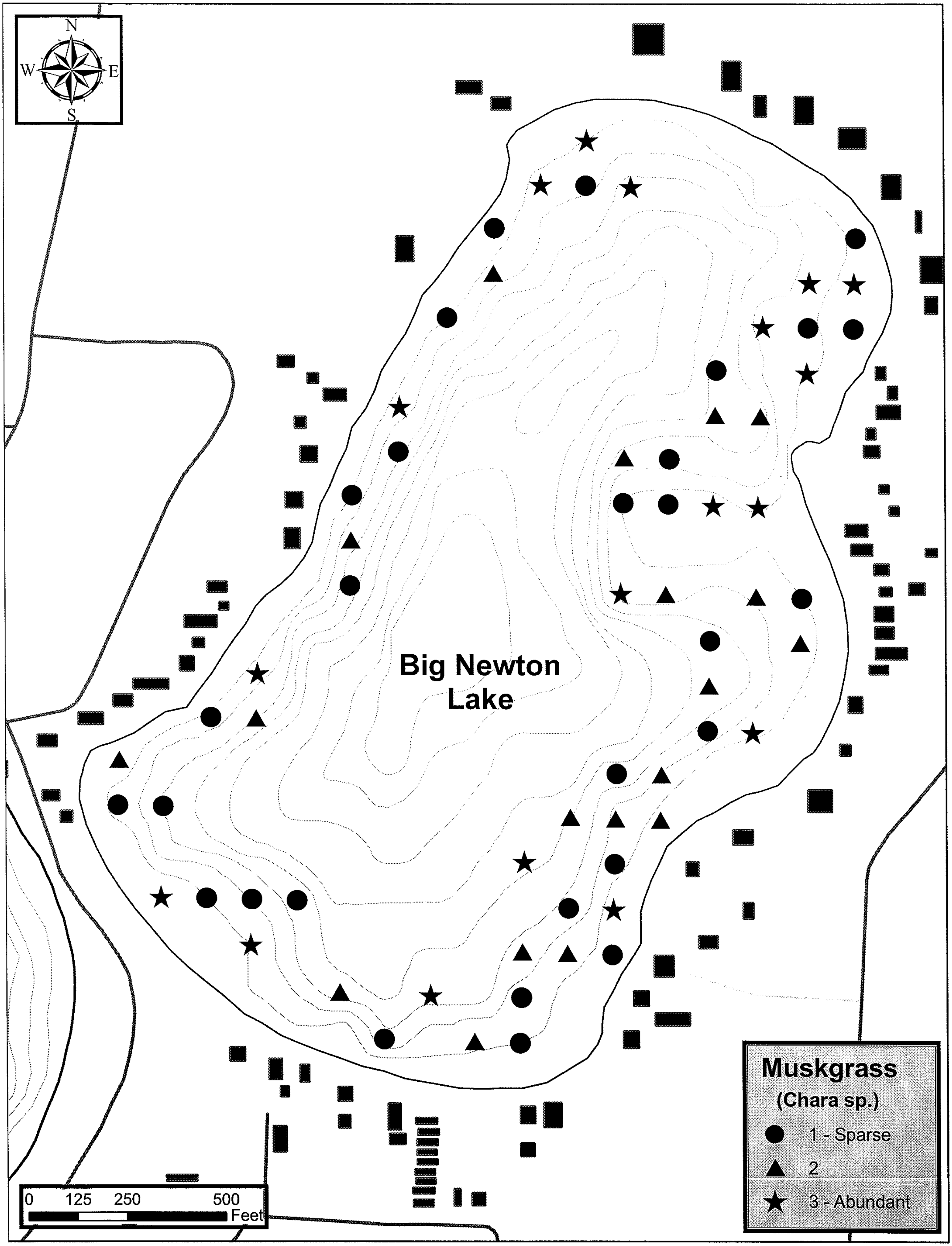


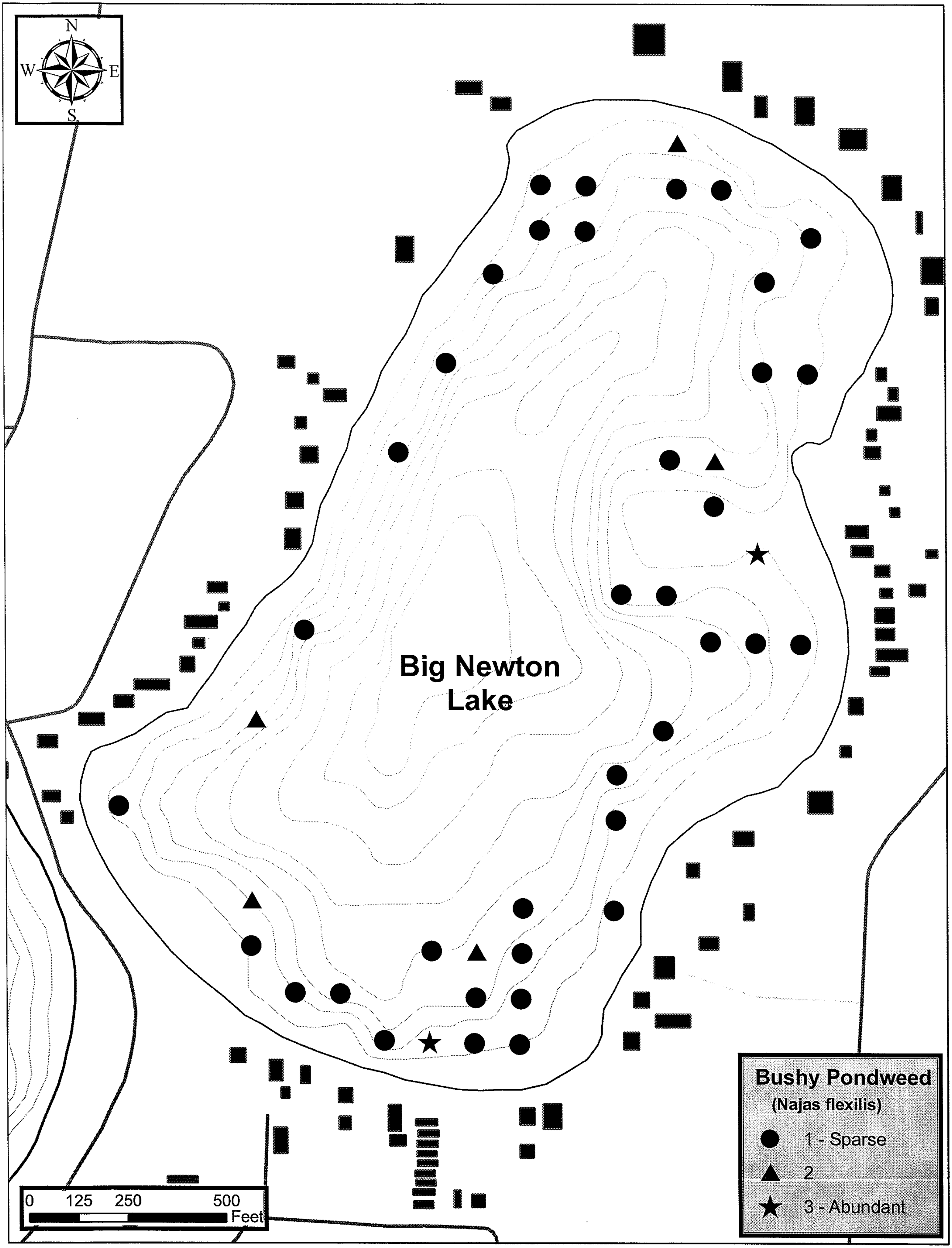
DEPTH PREFERENCE OF
MAJOR AQUATIC PLANTS
Big Newton Lake
Percent
30%
25%
20%
15%
10%
5%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Depth (ft)
Variable pondweed
Common waterweed
Small pondweed

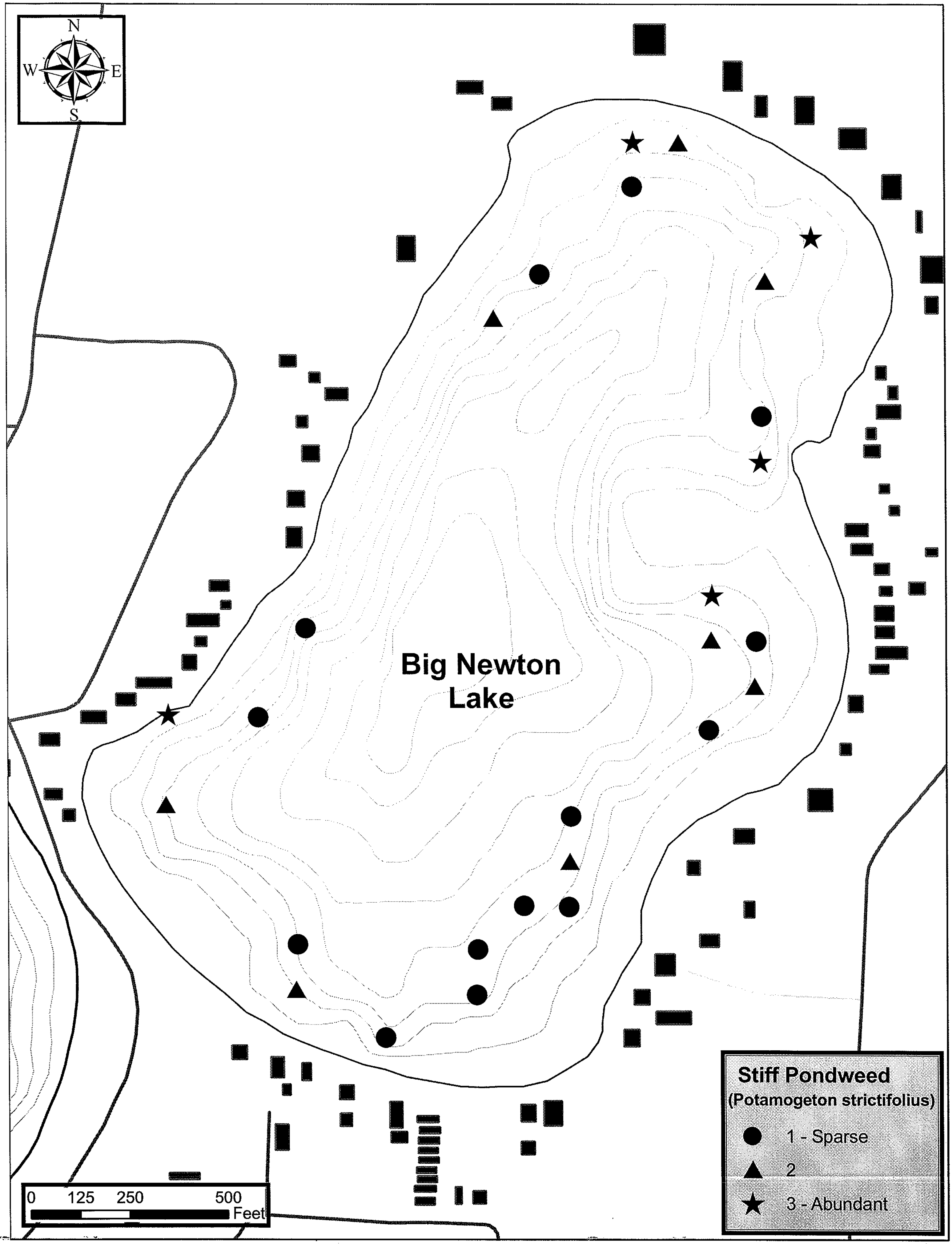

DEPTH PREFERENCE OF
MAJOR AQUATIC PLANTS
Big Newton Lake
Percent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Depth (ft)
White-stem pondweed
Stonewort
Water smartweed



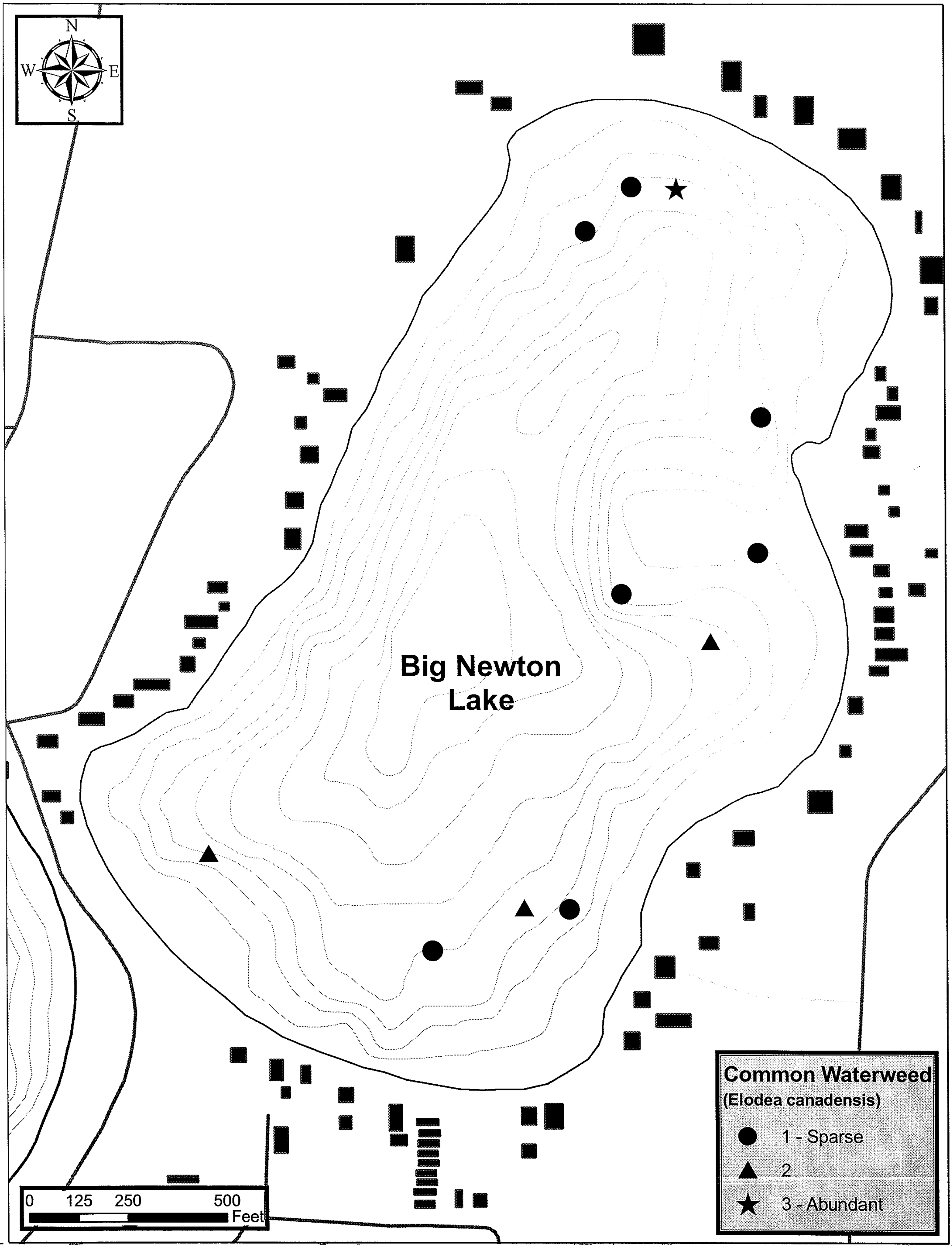
Big Newton Lake
Aquatic Plant Frequency
2005
Muskgrasses
Bushy pondweed
Stiff pondweed
Variable pondweed
Common waterweed
White-stem pondweed
Water smartweed
Clasping-leaf pondweed
Arrowhead
Hardstem bullrush
Softstem bullrush
Species
43.5
18.5
12.0
6.5
3.7
2.8
1.9
0.9
0.9
0.9
0.9
0.00
10.00
20.00
30.00
40.00
50.00
Frequency (%)

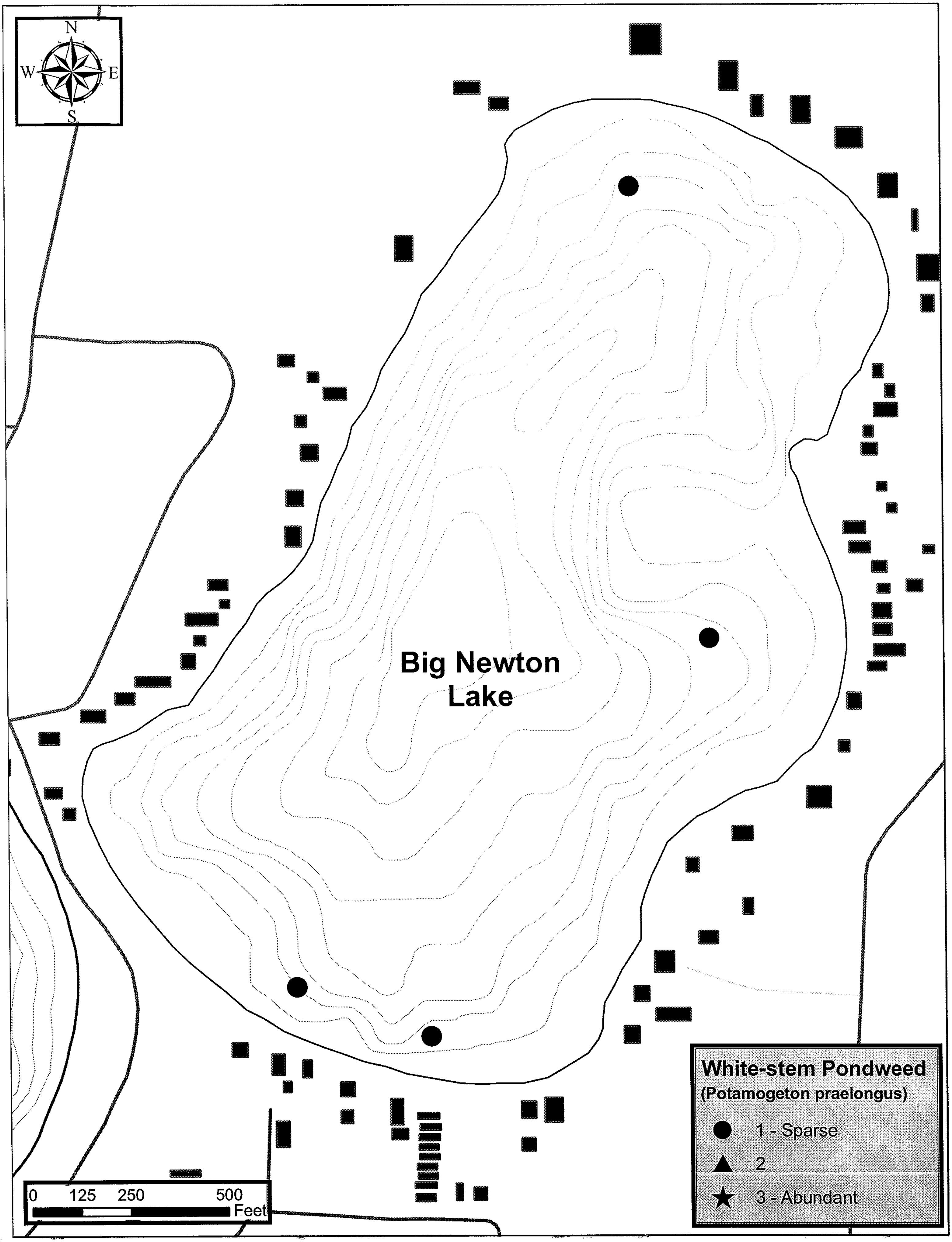

N
W
E
S
Big Newton Lake
Muskgrass
(Chara sp.)
1 - Sparse
2
3 - Abundant
0 125 250 500
Feet

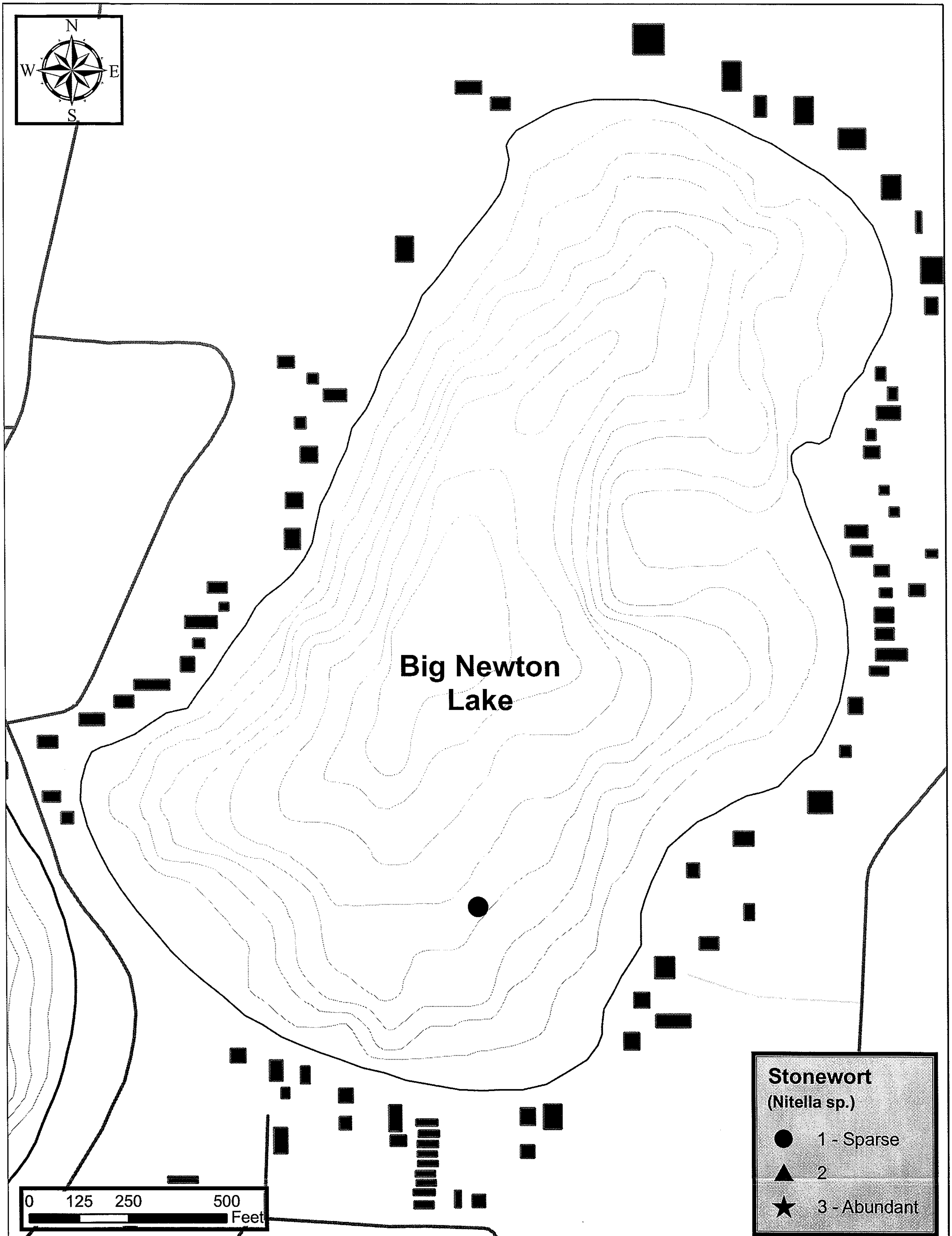

N
W
E
S
Big Newton Lake
Bushy Pondweed
(Najas flexilis)
1 - Sparse
2
3 - Abundant
0
125
250
500
Feet

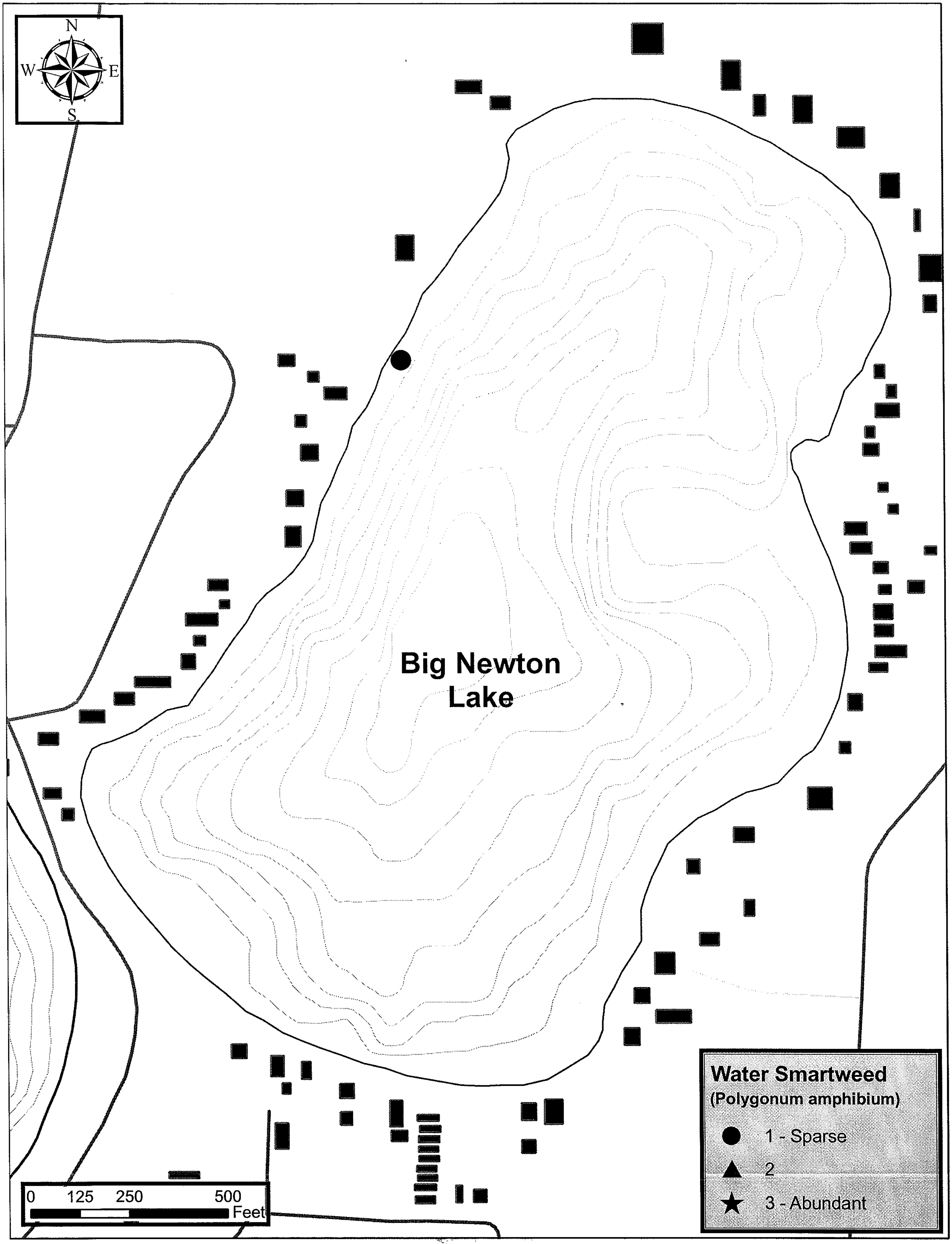


N
W
E
S
Big Newton Lake
Stiff Pondweed
(Potamogeton strictifolius)
1 - Sparse
2
3 - Abundant
0 125 250 500
Feet


N
W
E
S
Big Newton Lake
Common Waterweed
(Elodea canadensis)
1 - Sparse
2
3 - Abundant
0 125 250 500
Feet


N
W
E
S
Big Newton Lake
White-stem Pondweed
(Potamogeton praelongus)
1 - Sparse
2
3 - Abundant
0
125
250
500
Feet


N
W
E
S
Big Newton Lake
0 125 250 500
Feet
Stonewort
(Nitella sp.)
1 - Sparse
2
3 - Abundant


N
S
W
E
Big Newton
Lake
0 125 250 500
Feet
Water Smartweed
(Polygonum amphibium)
1 - Sparse
2
3 - Abundant