Turtle Lake Aquatic Macrophyte Survey

Prepared for
Turtle Lake Homeowners Association

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BARR

4700 West 77th Street
Minneapolis, MN 55435
Phone: (612) 832-2600
Fax: (612) 832-2601

Introduction

A macrophyte survey was completed in Turtle Lake during July 26 and 27 of 1999 (A previous macrophyte survey was completed on June 30, 1994). The survey evaluated plant coverage, density, and species composition. Plant diversity in the lake was average when compared with other Minnesota lakes. A total of 18 species were found in Turtle Lake during the 1999 survey (14 species found in 1994). Approximately 6 species were found in each sample transect during 1999 and approximately 5 species were found in each sample transect during the 1994 macrophyte survey. Individual species generally occurred in a relatively low density and concurrent growth of many species at each sample location resulted in an overall plant growth of low to moderate density.

Macrophytes in Turtle Lake consisted almost entirely of native species. Only two exotic species (i.e., not native to this region), Potamogeton crispus (curly-leaf pondweed) and Lythrum salicaria (purple loosestrife) were found.

Potamogeton crispus is an early bloomer so we can surmise that it probably existed in higher densities and over a greater range then that recorded during the survey. Only one plant colony of Lythrum salicaris was found during the survey. Exotic or non-native species are undesirable because their natural control mechanisms are not introduced with the species. Consequently, exotic species frequently exhibit rapid unchecked growth patterns, which eliminate native species.

The survey results can be used to develop a macrophyte management plan with the following aquatic plant management goals:

- Improve navigation within the lakes through areas containing dense plant beds
- Improve recreational attributes of the lakes
- Remove or limit current exotic plants (i.e., curly-leaf pondweed)
- Preserve native species and prevent introduction of additional exotic species
- Preserve and/or improve fish and wildlife habitat
- Protect and/or improve quality of the resources for all to enjoy (i.e., people, fish, wildlife)
- Minimize disturbance of sensitive areas (i.e., fish and wildlife)

Methods

An aquatic plant (macrophyte) survey of Turtle Lake was completed during July 26 and July 27, 1999. The survey was conduted by Barr Engineering Co. with assistance from volunteer Carl Johnson.

Transects were positioned in locations similar to those of the macrophyte survey which took place on June 30, 1994. The actual locations of the 20 transects selected for the study of Turtle Lake are shown on Figure 1. Transects extended from shore to the maximum depth of plant growth.

- Transects were broken down into the following depth categories:
  0 to 2 feet
  2 to 5.0 feet
  5 to 10 feet (or to the maximum rooting depth)

- Collection of samples, identification of species, and determination of density ratings for each species occurred at all sampling points. The same grid sampling method followed in the previous survey was used this year, *An Evaluation of Survey Techniques for Submerged Aquatic Plants* (Jessen and Lound, 1962). This coverage technique was utilized to assign density ratings in accordance with the following criteria:

Rake Recovery of Species	Density Rating
Rake teeth full during all four casts	5
Rake teeth partly full during all four casts	4
Found on rake teeth 3 of 4 casts	3
Found on rake teeth 2 of 4 casts	2
Found on rake teeth 1 of 4 casts	1

- A Global Positioning System (GPS) unit was used in the field to note latitude and longitude readings of each sampling point for future reference.

- Sediment type was determined and recorded for each sampling point.

- Maximum rooting depths were observed at all transects.

Tables 1 presents a summary of the results of the macrophyte survey completed on Turtle Lake in 1999 as well as a comparison to the 1994 survey results. The frequency of occurrences, as shown in the table, is a measure of how often a particular weed species was found after a sampling event. For example, there were 65 sampling points for this survey, and 20 times a particular weed species was found. Therefore, the plant species would then have a frequency of occurrence of 31 percent. The density rating is a measure of how "dense" a particular weed species grows in a particular area. A density rating of 5 indicates an extremely dense growth and a density ratio of 1 indicates a relatively small amount of growth.

Macrophyte Survey Results and Discussion

Various macrophytes have different plant fuctions. Table 3 provides a summary of the functions for most of the commonly found macrophytes.

- Submersed plants were found in all sample transects during the survey of Turtle Lake.

- Floating-leaf plants were found in only a few of the sample transects during the survey.

- Emergent plants were found in only a few of the sample transects during the survey.

- The alga *Chara* was sited in 65 percent transects during the survey.

The average number of species noted in Turtle Lake during 1999 is indicative of a stable and healthy macrophyte community. Further evidence of a diverse plant community was indicated by the moderate to high number of species found in each transect. The average number of species occurring in each transect was 6.

Although it is difficult to determine any macrophyte trends based on two surveys (1994 and 1999), The 1999 survey does indicate an apparent increase in macrophyte diversity, while the abundance of plant growth seems relatively stable. A diverse macrophte community that is not in overabundance can increase the water quality and maintain a healthy fish and wildlife habitat.

Table 1

Turtle Lake Macrophyte Survey
Comparison of July 26 and 27, 1999 to June 30, 1994 data ( )

Plant Species Scientific Name	Plant Species Common Name	Frequency of Occurrence* (%)	Species Mean Density Rating** (1-5)
Ceratophyllum demersum	Coontail	9 (8)	1.7 (1.2)
Chara spp.	Chara	65 (34)	2.8 (3.7)
Eleocharis spp.	Spikerush	8 (NF)	1.2 (NF)
Elodea canadensis	Elodea	3 (9)	1.5 (2.2)
Myriophyllum sibericum	Northern water milfoil	12 (18)	1.5 (2.2)
Najas flexilis	Naiads	75 (23)	2.6 (2.0)
Potamogeton crispus	Curley leaf pondweed	3 (2)	1.0 (1.0)
Potamogeton illinoensis	Illinois pondweed	31 (8)	1.6 (1.6)
Potamogeton pectinatus	Sago pondweed	2 (8)	2.0 (1.0)
Potamogeton spp.	Narrow-leaved pondweeds	8 (NF)	1.0 (NF)
Potamogeton richardsonii	Clasping leaf pondweed	22 (20)	1.5 (2.2)
Potamogeton robbinsii	Fern pondweed	3 (NF)	1.0 (NF)
Potamogeton zosteriformis	Flat stem pondweed	14 (9)	1.7 (1.3)
Ranunculus spp.	Buttercup	5 (2)	1.0 (4.0)
Sagittaria gramninea	Slender arrowhead	8 (NF)	1.0 (NF)
Sagittaria spp.	Arrowhead	5 (NF)	1.5 (NF)
Vallisneria americana	Water celery	5 (2)	2.3 (1.0)
Zosterella dubia	Water star grass	15 (9)	1.4 (2.5)

* The percentage of all sample points where a species has occurred.

** An average of the density ratings from the sample points where each species was found.

(NF) Not found in the 1994 survey

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Table 2

Long-Term Trend Lake Macrophyte Data
Sample Point Data

Lake Name: Turtle Lake **County Name:** Ramsey

Date: 7/26/99

Note Taker: CAJ **Field Crew:** MEW, Carl Johnson

Transect	Depth Code	Depth (ft.)	Substrate	Species/Density Rating
1	A	8.5	Silt/Sand	*Chara sp. /4* *Najas Flexilis /4* *Potamogeton Crispus /1* *Potamogeton Richardsonii /1* *Potamogeton Illinoensis /1* *Ceratophyllum Demersum /1* *Myriophyllum Sibiricum /1*
	B	3.0	Sand	*Sagittaria sp. /2* *Najas Flexilis /3* *Chara sp. /1* *Potamogeton Illinoensis /2*
	C	2.0	Sand	NO MACROPHYTES FOUND IN DEPTH CODE
2	A	8.5	Sand	*Najas Flexilis /4* *Chara sp. /3* *Potamogeton Richardsonii /1* *Ceratophyllum Demersum /1*
	B	4.0	Sand	*Najas Flexilis /4* *Chara sp. /3* *Sagittaria sp. /1*
	C	2.0	Sand	*Najas Flexilis /1*
3	A	8.5	Sand	*Chara sp. /4* *Najas Flexilis /4* *Potamogeton Illinoensis /1*
	B	3.0	Sand	NO MACROPHYTE FOUND IN DEPTH CODE
	C	2.0	Sand	NO MACROPHYTE FOUND IN DEPTH CODE
4	A	9.0	Sand	*Najas Flexilis /3* *Chara sp. /2* *Potamogeton sp. /1*
	B	4.5	Sand	NO MACROPHYTE FOUND IN DEPTH CODE
	C	2.0	Sand	NO MACROPHYTE FOUND IN DEPTH CODE
5	A	8.5	Sand	*Potamogeton Richardsonii /3* *Myriophyllum Sibiricum /3* *Najas Flexilis /4* *Zosterella Dubia /4* *Chara sp. /2* *Potamogeton Illinoensis /1*
	B	5.0	Sand	*Chara sp. /4* *Najas Flexilis /3* *Potamogeton Robinsii /1* *Potamogeton Illinoensis /3* *Sagittaria Graminea /1*

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Table 2 (continued)

Long-term Trend Lake Macrophyte Data
Sample Point Data

Lake Name: Turtle Lake

County Name: Ramsey

Date: 7/26/99

Note Taker: CAJ

Field Crew: MEW, Carl Johnson

Transect	Depth Code	Depth (ft.)	Substrate	Species/Density Rating
5 (cont.)	C	2.0	Sand	*Najas Flexilis /1* *Chara sp. /2* *Potamogeton Illinoensis /1*
6	A	10.0	Sand	*Najas Flexilis /1* *Chara sp. /1* *Potamogeton sp. /1* *Myriophyllum Sibiricum /1*
	B	4.5	Sand	*Potamogeton Illinoensis /2* *Chara sp. /4* *Najas Flexilis /4* *Eleocharis sp. /2* *Myriophyllum Sibiricum /1*
	C	1.5	Sand	*Najas Flexilis /1*
7	A	11.0	Sand	*Potamogeton Zosteriformis /1* *Potamogeton Illinoensis /1* *Potamogeton Richardsonii /2* *Najas Flexilis /2*
	B	3.5	Sand	NO MACROPHYTE FOUND IN DEPTH CODE
	C	1.5	Sand	NO MACROPHYTE FOUND IN DEPTH CODE
8	A	7.0	Sand	*Najas Flexilis /1*
	AA	90	Silt	*Najas Flexilis /4* *Potamogeton Zosteriformis /1* *Myriophyllum Sibiricum /1* *Zosterella Dubia /1* *Chara sp. /3* *Ceratophyllum Demersum /2* *Potamogeton Richardsonii /1*
	B	3.5	Sand	*Najas Flexilis /2* *Sagittaria Graminea /1*
	C	1.5	Sand	NO MACROPHYTE FOUND IN DEPTH CODE
9	A	7.5	Sand	*Potamogeton Richardsonii /1*
	B	3.0	Sandt	NO MACROPHYTE FOUND IN DEPTH CODE
	C	2.0	Sandt	NO MACROPHYTE FOUND IN DEPTH CODE

Table 2 (continued)

Long-term Trend Lake Macrophyte Data
Sample Point Data

Lake Name: Turtle Lake

County Name: Ramsey

Date: 7/26/99

Note Taker: CAJ

Field Crew: MEW, Carl Johnson

Transect	Depth Code	Depth (ft.)	Substrate	Species/Density Rating
10	A	7.5	Sand	NO MACROPHYTE FOUND IN DEPTH CODE
	B	4.0	Silt	*Chara sp. /4* *Najas Flexilis /3* *Potamogeton Richardsonii /1* *Potamogeton Illinoensis /4* *Ranunculus sp. /1*
	C	2.0	Sand	*Najas Flexilis /4* *Chara sp. /3*
11	1	10.5	Sand	*Najas Flexilis /4* *Chara sp. /1*
	AA	7.5	Sand	*Chara sp. /4* *Najas Flexilis /3*
	B	3.5	Sand	*Najas Flexilis /1*
	C	2.0	Sand	*Sagittaria Graminea /1* *Najas Flexilis /2* *Zosterella Dubia /1* *Chara sp. /1* *Potamogeton Illinoensis /1* *Eleochans sp. /1*
12	A	9.0	Silt	*Chara sp. /4* *Potamogeton Zosteriformis /1* *Najas Flexilis /4* *Ceratophyllum Demersum /2* *Zosterella Dubia /2* *Potamogeton Crispus /1*
	B	3.5	Sand	*Chara sp. /3* *Eleocharis sp. /1* *Najas Flexilis /2* *Potamogeton Illinoensis /1*
	C	2.0	Sand	NO MACROPHYTE FOUND IN DEPTH CODE
13	A	8.0	Silt	*Chara sp. /4* *Potamogeton Illinoensis /1* *Najas Flexilis /1*
	B	4.5	Silt	*Chara sp. /4* *Potamogeton Illinoensis /2* *Najas Flexilis /4* *Potamogeton Richardsonii /1*
	C	2.0	Sand	*Potamogeton Illinoensis /1* *Chara sp. /3* *Potamogeton Richardsonii /1*

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Table 2 (continued)

Long-term Trend Lake Macrophyte Data
Sample Point Data

Lake Name: Turtle Lake **County Name:** Ramsey

Date: 7/26/99

Note Taker: CAJ **Field Crew:** MEW, Carl Johnson

Transect	Depth Code	Depth (ft.)	Substrate	Species/Density Rating
14	A	8.0	Silt	*Najas Flexilis /4* *Potamogeton Illinoensis /3* *Potamogeton Richardsonii /3* *Chara sp. /2* *Potamogeton Robinsii /1*
	AA	7.0	Silt	*Chara sp. /3* *Potamogeton Richardsonii /1* *Najas Flexilis /2* *Potamogeton Zosteriformis /1*
	B	3.0	Silt	*Chara sp. /4* *Najas Flexilis /4*
	C	2.0	Sand	*Chara sp. /4* *Najas Flexilis /3*
15	A	9.0	Sand	*Chara sp. /3* *Najas Flexilis /1*
	B	3.5	Sand	NO MACROPHYTE FOUND IN DEPTH CODE
	C	2.0	Sand	NO MACROPHYTE FOUND IN DEPTH CODE
16	A	9.0	Silt	*Najas Flexilis /4* *Chara sp. /2*
	B	4.0	Sand	*Najas Flexilis /1* *Chara sp. /1*
	C	2.0	Sand	*Ceratophyllum Demersum /1* *Chara sp. /1* *Najas Flexilis /2* *Elodea Canadensis /1*
17	A	7.0	Silt	*Najas Flexilis /4* *Potamogeton Richardsonii /1* *Potamogeton Zosteriformis /2* *Chara sp. /3* *Vallisneria Americana /1* *Potamogeton Illinoensis /1* *Zosterella Dubia /1*
	B	4.5	Silt	*Chara sp. /4* *Najas Flexilis /4* *Potamogeton Illinoensis /2*
	C	2.0	Sand	*Najas Flexilis /1*

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Table 2 (continued)

Long-term Trend Lake Macrophyte Data
Sample Point Data

Lake Name: Turtle Lake **County Name:** Ramsey

Date: 7/26/99

Note Taker: CAJ **Field Crew:** MEW, Carl Johnson

Transect	Depth Code	Depth (ft.)	Substrate	Species/Density Rating
18	A	7.5	Sand	*Potamogeton Illinoensis /2* *Chara sp. /4* *Najas Flexilis /2* *Potamogeton Zosteriformis /1* *Zosterella Dubia /1*
	AA	12.0	Sand	*Zosterella Dubia /1* *Chara sp. /1* *Najas Flexilis /2*
	B	4.5	Silt	*Chara sp. /4* *Potamogeton Illinoensis /1* *Najas Flexilis /2* *Eleocharis sp. /1*
	C	2.0	Sand	*Zosterella Dubia /1* *Chara sp. /4* *Sagittaria Graminea /1* *Najas Flexilis /2* *Elodea Canadensis /2* *Mynophyllum Sibiricum /2* *Potamogeton Zosteriformis /1*
19	A	11.0	Silt	*Chara sp. /2* *Mynophyllum Sibiricum /3* *Najas Flexilis /4* *Potamogeton Zosteriformis /2* *Ceratophyllum Demersum /4*
	B	4.0	Sandy Muck	*Potamogeton Pectinatus /2* *Zosterella Dubia /3* *Vallisneria Americana /4* *Chara sp. /4* *Ranunculus sp. /1* *Najas Flexilis /2* *Potamogeton sp. /1*
	C	2.0	Sand	*Chara sp. /3* *Najas Flexilis /1*
20	A	6.5	Sand	*Najas Flexilis /2* *Chara sp. /1*
	B	4.0	Sand	NO MACROPHYTE FOUND IN DEPTH CODE

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Table 2 (continued)

Long-term Trend Lake Macrophyte Data
Sample Point Data

Lake Name: Turtle Lake

County Name: Ramsey

Date: 7/26/99

Note Taker: CAJ

Field Crew: MEW, Carl Johnson

Transect	Depth Code	Depth (ft.)	Substrate	Species/Density Rating
20 (cont.)	BB	4.5	Sand	*Ceratophyllum Demersum /1* *Vallisneria Americana /2* *Potamogeton Richardsonii /2* *Chara sp. /4* *Potamogeton Zosteriformis /2* *Myriophyllum Sibiricum /1* *Ranunculus sp. /1* *Najas Flexilis /3* *Potamogeton Illinoensis /1* *Zosterella Dubia /2*
	C	2.0	Sand	*Najas Flexilis /2* *Chara sp. /3* *Eleocharis sp. /1* *Potamogeton Richardsonii /1* *Sagittaria Graminea /1*

Table 3

Functions of Aquatic Plant Species

Scientific Name (Common Name)	Plant Type	Plant Functions
Ceratophyllum demersum (Coontail)	Submersed	Many waterfowl species eat the shoots; it provides cover for young bluegills, perch, largemouth bass, and northern pike; supports insects that fish and ducklings eat.
Chara spp. (Muskgrass)	Submersed	Muskgrass is a favorite waterfowl food. Algae and invertebrates found on muskgrass provide additional grazing. It is also considered valuable fish habitat. Beds of muskgrass offer cover and are excellent producers of food, especially for largemouth bass and smallmouth bass.
Elodea canadensis (Canada Waterweed)	Submersed	Provides habitat for many small aquatic animals, which fish and wildlife eat.
Lemna trisulca (Star Duckweed)	Floating-leaf	Star duckweed is a good food source for waterfowl. Tangled masses of fronds also provide cover for fish and invertebrates.
Lemna sp. (Duckweed)	Floating-leaf	Small duckweed is a nutritious food source that can provide up to 90% of the dietary needs for a variety of ducks and geese. It is also consumed by muskrat, beaver and fish. Rafts of duckweed offer shade and cover for fish and invertebrates. Extensive mats of duckweed can also inhibit mosquito breeding.
Myriophyllum sibericum (formerly exalbescens) (Northern Milfoil)	Submersed	Provides cover for fish and invertebrates; supports insects and other small animals eaten by fish; waterfowl occasionally eat the fruit and foliage.
Najas flexilis (Spiny Naiad, Bushy Pondweed)	Submerged	Bushy pondweed is one of the most important plants for waterfowl. Stems, leaves and seeds are all consumed by a wide variety of ducks including black duck, bufflehead, canvasback, gadwall, mallard, pintail, redhead, ringnecked duck, scaup, shoveler, blue-winged teal, green-winged teal, wigeon and wood duck. It is also important to a variety of marsh birds as well as muskrats. Slender naiad is a good producer of food and shelter for fish.
Potamogeton amplifolius (Large-leaf Pondweed, Bass Weed, Musky Weed)	Submersed	The broad leaves of *Potamogeton amplifolius* offer shade, shelter and foraging opportunities for fish. Abundant production of large nutlets makes this a valuable waterfowl food.
Potamogeton crispus (Curly-leaf Pondweed)	Submersed	Provides some cover for fish, several waterfowl species feed on the seeds; diving ducks often eat the winter buds.

Table 3 (cont.)

Functions of Aquatic Plant Species

Scientific Name (Common Name)	Plant Type	Plant Functions
Potamogeton Richardsonii (Clasping-leaf Pondweed)	Submerged	Broad-leaf pondweeds provide excellent habitat for panfish, largemouth bass, muskellunge, and northern pike; bluegills nest near these plants and eat insects and other small animals found on the leaves; walleyes use these pondweeds for cover.
Potamogeton zosteriformis (Flat-stem Pondweed), *Potamogeton pusillus* (Narrow-leaf Pondweed)	Submersed	Provides some cover for bluegills, perch, northern pike, and muskellunge, though these fish prefer broadleaf pondweeds; good cover for walleye; provide food for waterfowl; support aquatic insects and many small animals that fish and ducklings eat.
Ranunculus spp. (Water Crowfoot or Buttercup)	Submersed	As flowers give way to fruit, the water crowfoot bed becomes a choice spot for dabbling ducks. Both fruit and foliage of water crowfoot are consumed by a variety of waterfowl. When it is growing in shallow zones, it is sometimes consumed by upland game birds including ruffed grouse. Stems and leaves of water crowfoot provide valuable invertebrate habitat.
Sagittaria spp. (Arrowhead)	Emergent	Tubers, nutlets and other parts are eaten by waterfowl. Stems, roots and tubers are eaten by muskrats, porcupine and beaver. It also provides shade and shelter for young fish.
Vallisneria americana (Wild Celery)	Submersed	Provides shade and shelter for bluegills, young perch, and largemouth bass; choice food of waterfowl, particularly diving ducks; attracts muskrats, marsh birds, and shore birds.
Zosterella dubia (Water Star Grass)	Submersed	Water star grass can be a locally important source of food for geese and ducks including northern pintail, blue-winged teal and wood duck. It also offers good cover and foraging opportunities for fish.

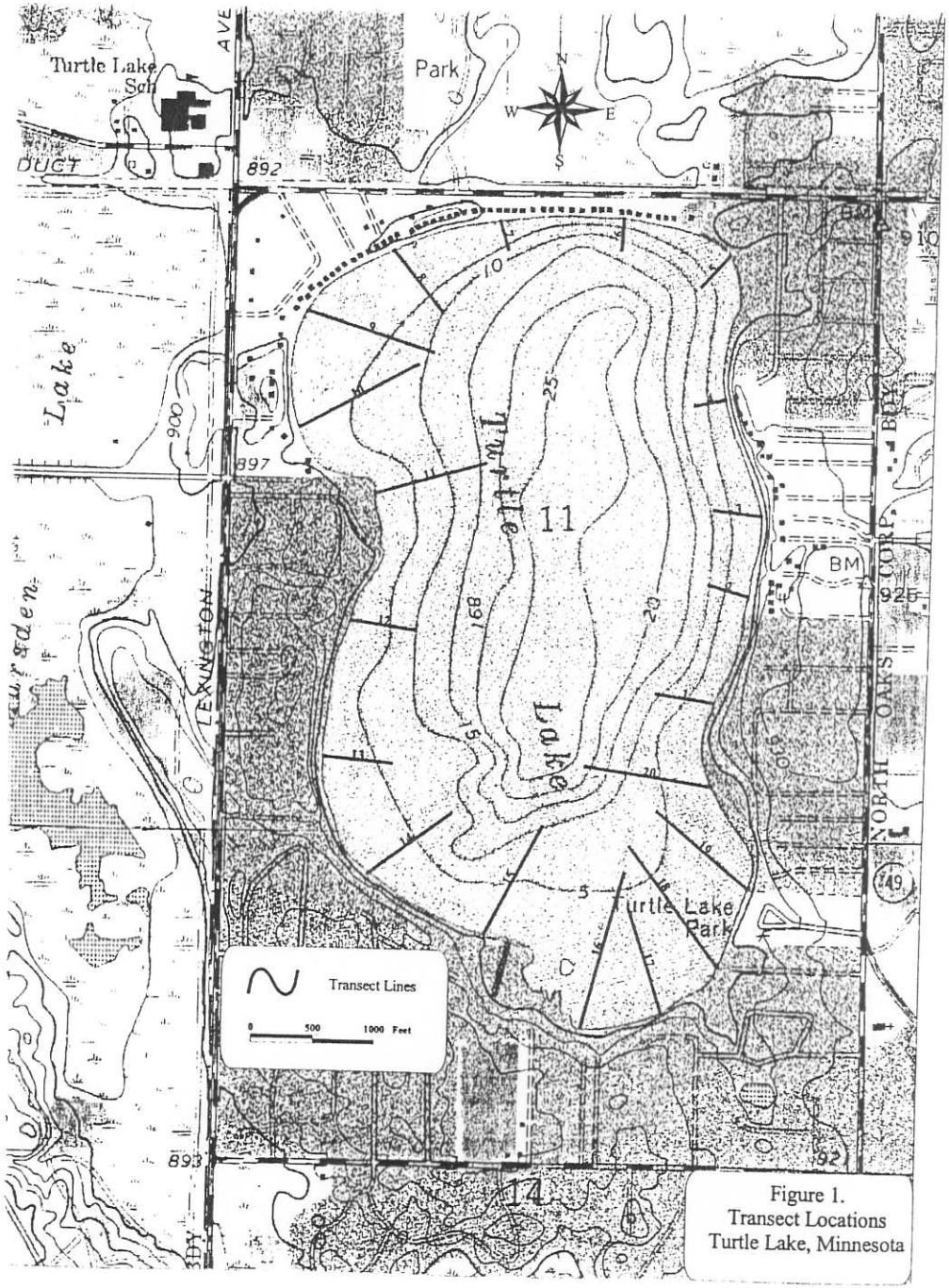

Figure 1.
Transect Locations
Turtle Lake, Minnesota