Lake Vegetation Management Plan

☒ **Variance Requested by Cooperator**
☒ **Variance Approved (see Section VI)**

Section I: Lake Information

Name: North Browns DOW Number: 73-0147 County: Stearns
Fisheries Area: Montrose Surface Acres: 324 Littoral Acres: 130
Classification: Recreational Development

Cooperator(s): North Browns Lake Association, MnDNR Invasive Species, MnDNR Fisheries, and MnDNR Fisheries-Aquatic Plant Management

Section II: Water Quality and Plant Community

A. Water Quality

☒ Total Phosphorus: 20-530 ppb; 110 ppb mean, 38 obs. (data from MPCA and Sauk River Watershed District) Date: 6/17/99 to 9/21/2009

☒ Chlorophyll-a: 1-106 ppb; 28.8 ppb mean; 41 obs. (data from MPCA and Sauk River Watershed District) Date: 6/30/81 to 9/21/09

☒ Secchi Disc: 0.5-6.9 m; 2.4 m mean; 426 obs. (data from MPCA)
Date: 5/5/73 to 9/21/09

Narrative (describe water quality concerns, quantify TSI, NOTE if impaired or if TMDL exists):
North Browns Lake is in the North Central Hardwood Forests Ecoregion. Lakes in this region typically have total phosphorous levels from 23 to 50 ppb, chlorophyll-a levels from 5 to 22 ppb, and Secchi disk readings from 1.5 to 3.2 m. Average measurements of total phosphorus and chlorophyll-a from North Browns Lake exceeded these water quality interquartile ranges developed from reference lakes in the ecoregion. Trophic state indexes ranged from 48 to 72. Therefore, North Browns Lake is classified as hypereutrophic and is listed as impaired by the MPCA. A TMDL for the entire Sauk River Chain of Lakes has been completed and is awaiting EPA approval. Aquatic recreation is seasonal, due to abundant vegetation growth (primarily curly-leaf pondweed, Potamogeton crispus, (CLP) and algae blooms.

B. Plant Community:

Narrative (describe plant community, list plant surveys, include a table of percent frequency, and make sure to note rare species and species of concern):

Based on a survey on May 28 and June 2, 2009 (Ebinger et al. 2009; Appendix 1):
A total of six aquatic plants were recorded. Four species were native submerged plants, one species was an emergent plant, and one species was a non-native submerged plant (CLP). Plants were found in depths up to 12 feet.

The submerged plant community was dominated by CLP, which was found at 38% of the sample sites. It occurred in depths up to 12 feet.

Coontail (Ceratophyllum demersum) and chara (Chara sp.) were the most abundant native submerged plant species, occurring at 19% and 10% of the sample sites, respectively. The other two native submerged plant species sampled were claspingleaf pondweed (Potamogeton richardsonii; 4% of the sample sites) and northern watermilfoil (Myriophyllum sibiricum; 2% of the sample sites).

Cattail (Typha sp.) was the only emergent plant species found, occurring at 1% of the sample sites.

MnDNR Fisheries transect surveys have been completed in past years in the middle of the summer. These surveys may better illustrate the native plant community. Species sampled during these surveys is presented in Appendix 2.

Section III: Public Input Process (narrative):
A meeting with the North Browns Lake Association occurred on July 18, 2009. Staff from the Sauk River Watershed District were present to discuss water quality trends in the lake. Invasive species staff from the MnDNR presented information regarding CLP and the grant for the pilot project to conduct lake-wide control of CLP. Members agreed at this meeting to move forward with evaluating the feasibility of raising funds to pay for their portion of the cost to conduct lake-wide control of CLP, if they were successful in obtaining a grant from the MnDNR.

Section IV: Problems to be Addressed in this Plan (narrative):

1. Ecological problems: Surface mats or areas of CLP interfere with and reduce native plant species. Decomposing CLP may add to the concentration of phosphorus in the lake, resulting in algae blooms.
2. Recreation: Areas of dense CLP interfere with fishing, boating, and swimming. Algae blooms, which can be exacerbated by decomposing CLP, detract from the lake's aesthetics and possible use.

Section V: Goals for Management of Aquatic Plants (narrative, include a description of efforts to protect rare features):

1. Reduce interference with recreational use of North Browns Lake by reducing density and coverage of CLP.
2. Increase water clarity, presumably as an indirect effect of reducing concentrations of phosphorous in the water and the planktonic algae supported by this nutrient.
3. Increase distribution and abundance of native submerged aquatic plants.
4. Protect high quality communities of native aquatic plants.

   Lake-wide treatments of CLP will be early in the season when surface water temperatures are between 50-60 degrees F. This usually occurs in May. At this temperature range CLP growth is active but the plants are still small, and most native plants are not yet actively growing. It is hoped that by treating actively growing CLP before the plants can build up sufficient carbohydrate reserves the plants will not be able to reproduce. Thus, the turion bank will be depleted, and abundance and distribution of CLP will decrease. By treating early in the season,

before native plants are actively growing, chemicals used for treatment of CLP pondweed should be selective and not have much effect on native plant growth.

Section VI: Treatment Plan (map marked with areas where control of plants is anticipated):

A. Commons Area (>150' from shore)

☐ Mechanical Control: #### acres to be treated, #### % of littoral area

Narrative:
Click here to enter text.

☒ Herbicide Control: 98 acres to be treated, 75 % of littoral area

Product(s): Endothall as Aquathol K or Aquathol Super K
Rate of Application: anticipate 0.75 to 1 ppm
Timing of Application: Surface water temperature should be between 50-60 degrees F, usually in May, when there is active CLP growth, but before turions form and before most native plants are actively growing. Actual application will depend on weather, water temperature, growth of CLP and scheduling of applicators.

Narrative:
Lake-wide treatment of CLP that is associated with the MnDNR grant program will be within areas delineated during spring of the year of the planned treatment. No herbicide will be applied outside of the delineated and permitted treatment areas. CLP treatment acreage (offshore and near shore combined) is estimated to be, but not limited to, 98 acres. Estimates of acreage will be based upon results of the pre-treatment delineation by Ecological and Water Resources. Actual acreage of each area may vary from year to year based on success of previous year's treatments and overwinter growing conditions. Actual areas that will be treated will be based on annual pre-treatment plant surveys, conducted by MnDNR Invasive Species staff. If North Browns Lake Association does not receive a grant for lake-wide control of CLP, and chooses to continue with the lake-wide treatments, the responsibility of determining the treatment locations and acreages will fall on the North Browns Lake Association.

☐ Other: #### acres to be treated, #### % of littoral area

Narrative:
Click here to enter text.

B. Individual Permit Standards (new permits)

Chemical Treatment of Submerged Plants: 35 feet along shore 50 feet lakeward

Narrative:
Any permit applications received from riparian landowners for chemical treatment of native submersed vegetation at properties adjacent to North Browns Lake after the lake-wide treatment of CLP will be considered individually. Removal of native submersed vegetation will be limited to only that necessary

to allow reasonable use, with the maximum area being no more than 35 feet wide by 50 feet lakeward plus a 15 foot wide channel to open water may extend from the lakeward side of the 35 x 50 foot area. No removal of sparse native vegetation using chemicals will be permitted.

Treatment of Emergent Plants: 15 feet along shore to open water
Narrative:
If permit applications are received for removal of emergent or floating leaf vegetation, they will be limited to 15 foot wide channels through dense areas of emergent or floating leaf vegetation that prevent access to open water. In some cases where emergent vegetation extends beyond 40 feet to 50 feet lakeward, docking over the top of the vegetation with a permanent or floating dock will be the typical methods allowed to gain access. All applications will be considered individually.

Other Treatment - : ##### feet along shore ##### feet lakeward
Narrative:

Section VII: **Funding** [check all that apply]

- ☒ Lake Association
- ☒ DNR Grant
- ☐ Lake Improvement District (LID)
- ☐ Conservation District
- ☐ Other (please describe):

Section VIII: The commissioner may issue APM permits with a variance from one or more of the provisions of parts 6280.0250, subpart 4, and 6280.0350, except that no variance may be issued for part 6280.0250, subpart 4, items B and C. Variances may be issued to control invasive aquatic plants, protect or improve aquatic resources, provide riparian access, or enhance recreational use on public waters (6280.1000, subpart 1). Variance(s) and Justification(s) [check all that apply]

☒ **Application of pesticides to control submerged vegetation in more than 15 percent of the littoral area (M.R. 6280.0350, Subp. 4, A). (list justification below)**

☐ **Application of pesticides to control aquatic macrophytes in natural environment lakes established pursuant to part 6120.3000 (M.R. 6280.0250, Subp. 4, E.). (list justification below)**

☐ **Mechanical control of aquatic macrophytes in more than 50 percent of the littoral area (M.R. 6280.0350, Subp. 3, B). (list justification below)**

☒ **Other (please explain)**

Variance from the signature requirement of *Minnesota Rules* 6280.0450, subp. 1a. The rule requires annual signatures of approval from all landowners whose shorelines will be treated before permits may be issued. Specifically, this variance allows signatures of approval, obtained in 2011, from landowners whose property is located adjacent to areas proposed for lakewide management of curly-leaf pondweed with herbicides, to remain valid for a three year period.

Justifications (identify which variance and provide the rational for all items checked above):
Narrative:
Lake-wide treatments to control and reduce non-native CLP in order to provide recreational and ecological benefits by increasing abundance of native submerged aquatic plants and improving water quality. To maximize control area of CLP by treating as large a contiguous area as possible, including undeveloped shoreline (variance to M.R. 6280.0350, Subp. 4, A).

Signatures of property owners in which a treatment area will encroach within 150 feet of their shoreline must be obtained in 2011 and will be valid for a three year period (i.e., 2011, 2012, and 2013), unless the property is sold or transferred to another owner. This is a variance to M.R. 6280.0450, Subp. 1a. North Brown's Lake Association will be required to obtain new signatures of all property owners in 2014. This variance is meant to minimize the hardship that results from collecting property owner signatures each year.

☐ **Variance approved without condition(s)**

☒ **Variance approved with following conditions(s):**

☒ **Pre-treatment data collection**

Narrative:
Pretreatment data based on the May 28 and June 2, 2009 survey by Ebinger et al. (2009).
Ebinger, T., M. Swanson, and R. Ebinger. 2009. North Browns Lake 73-147 Aquatic plant survey emphasis (Potamogeton crispus). 15 pp.

☒ **Post treatment data collection**

Narrative:
Monitoring:
Monitoring of the lake to document effectiveness of treatments and to provide updated, accurate data for permit issuance is required. At a minimum, monitoring will include pre-treatment delineation of CLP, post-treatment point-intercept survey during mid-summer when native plants are at or near maximum abundance, bi-weekly observations of Secchi disk transparency, and monthly water quality samples for phosphorus and chlorophyll-a. This monitoring data will be evaluated to determine if the CLP treatments were effective and therefore warrant continued treatment. If the lake-wide treatment of CLP is in association with the MnDNR grant program, Invasive Species Program staff with Ecological and Water Resources will conduct the pre- and post-treatment point-intercept surveys and North Browns Lake Association will be responsible for bi-weekly observations of Secchi disk transparency and collection of monthly water quality samples for determination of total phosporous and chlorophyll-a

levels. If North Browns Lake Association does not receive a grant for lake-wide control of CLP, and chooses to continue with the lake-wide treatments, the responsibility of completing the required monitoring work in an acceptable manner will fall on the North Browns Lake Association. Monitoring protocols are outlined in Appendix 3. If a private consultant is contracted to do the point intercept survey, the same consultant (or someone affiliated with that consultant) cannot do the commercial herbicide application. Monitoring data shall be submitted to the MnDNR's Invasive Species Program staff at the MnDNR Office in Fergus Falls prior to the end of that treatment year. Results must be compiled and submitted in a manner that is readily reviewable by Invasive Species Program staff. These data must be received before a permit will be issued for the following year as APM staff will consult with Invasive Species Program staff before permit issuance. The results of the pre-treatment survey detailing proposed treatment areas for that season must either accompany the permit application sent to the Little Falls APM Office or follow the application, as long as it is received by the Little Falls office prior to permit issuance and treatment. The MnDNR will not issue a permit before the results of the pre-treatment delineation of CLP are received.

☒ **Evaluation**

Narrative:

Lake-wide teatment of CLP may not be permitted if results of monitoring indicate that the treatment is doing more harm than good. In the event that treatments are found to cause significant negative impacts to the native plant community, water quality, or both in North Browns Lake, the MnDNR will work with the North Browns Lake Association to develop an alternate treatment plan.

☐ **Other:**

Narrative:

Lake Vegetation Management Plan

Section IX: Signatures

This Lake Vegetation Management Plan is in effect for 5 years from date of Regional Fisheries approval. If the plan is not renewed, then permits will be issued according to the standards listed in MR6280.

DNR Approval

Submitted By: Nathan Olson

Title: Invasive Species Specialist-Fergus Falls

Date: April 4, 2011

Paul Pudrith — Area Fisheries Supervisor — 4-4-11 — Date

Bradford Parsons — Regional Fisheries Approval — 4-13-11 — Date

Liz Harper — Regional Ecological Resources Approval — 14 April 2011 — Date

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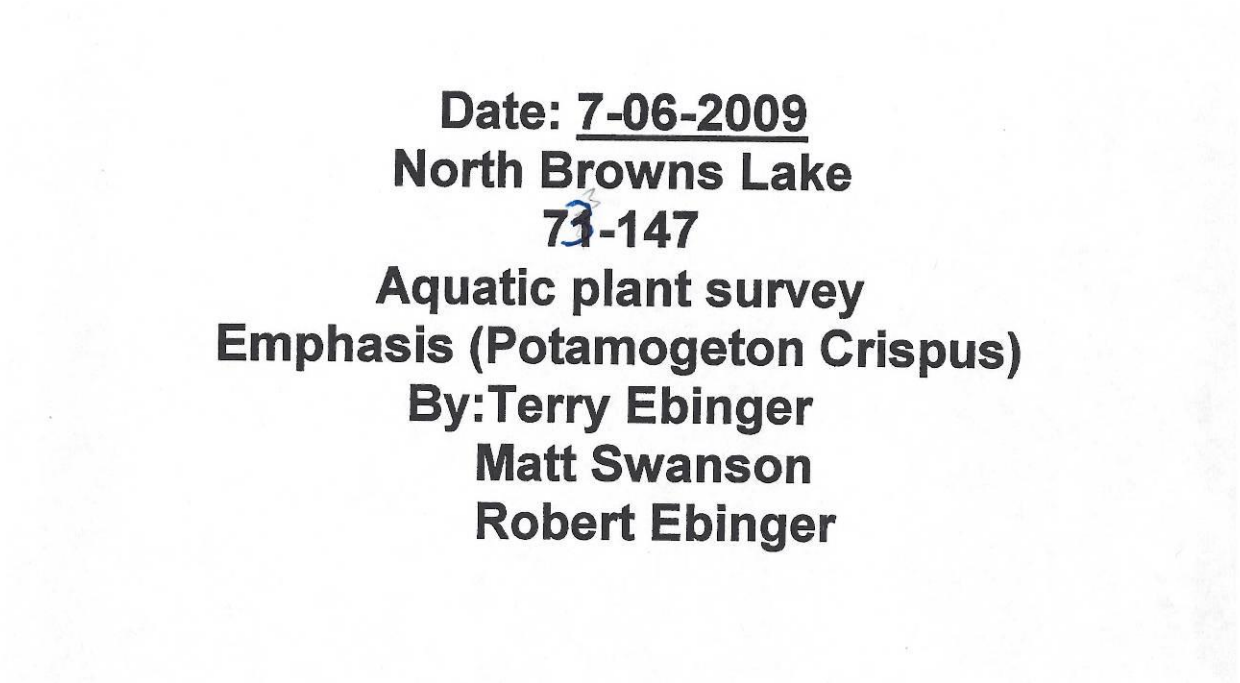
I affirm that I am an authorized representative of North Browns Lake Association and acknowledge participation in the development and implementation of this lake vegetation management plan.

PRESIDENT — Cooperator's Signature and Title — 4-11-11 — Date

Either party may terminate participation in this plan at any time, with or without cause, upon 30 days' written notice to the other party. If participation is terminated, permits will be issued according to standards listed MR6280.

Appendix 1. Point intercept survey of North Browns Lake, Stearns County, 73-0147, May 28 and June 2, 2009.



Date: 7-06-2009
North Browns Lake
73-147
Aquatic plant survey
Emphasis (Potamogeton Crispus)
By:Terry Ebinger
Matt Swanson
Robert Ebinger

Lake Vegetation Management Plan

DATE 5-28-2009
Summary of Curlyleaf Pondweed (Potamogeton Crispus) abundance on North Browns Lake (71-0147) Stearns County
Survey conducted by
Terry Ebinger
Matt Swanson
Robert Ebinger

INTRODUCTION

North Browns Lake (DOW 73-147) is located in South central Stearns County Minnesota, just North of the city of Eden Valley - North Browns Lake is the third in a series of lakes that exit to the Sauk River chain of lakes. The immediate watershed of North Browns Lake is 4000 acres and receives input from Eden and Mud lakes which has a watershed of about 24,000 acres. North Browns Lake has a surface area of 324 acres and a maximum depth of 41 feet. At least 40.13% (littoral area) of the lake is less than 15 feet in depth. The North Browns Lake group has committed $1900.00 for one survey (assessment) of submersed plants in North Browns Lake, with emphasis on Curlyleaf Pondweed (Potamogeton Crispus). This assessment was conducted on May 28, 2009 and June 2nd 2009 with the point intercept method utilized as described in the DNR document entitled "PROTOCOLS for aquatic plant surveys by the Minnesota Department of Natural Resources for the collection of pre-treatment data for the MN DNR grant program "Pilot projects to control Curly Leaf Pondweed or Eurasian Watermilfoil on a lakewide basis for ecological benefits" by Wendy Crowell, dated April 13, 2006.
The survey was conducted on May 28 and June 2nd , 2009 by Terry Ebinger and Matt Swanson. On May 28th the sky was clear, air temperature was at 68 degrees and the wind was light from the South West at about 1 MPH. On June 2nd the final day of survey the sky was clear, air temperature was 72 degrees and wind was light from the South West at about 3 MPH. Water temperature on May 28th was 62 degrees F and secchi disc reading was 6 feet. The maximum depth of aquatic plant growth was mostly limited to a maximum depth of 10 feet, however the greatest portion of plant growth is between 3 foot and 6 foot depths.

CLP was found in depths up to 12 ft.

Vegetation survey objectives

The purpose of this aquatic plant survey was to complete a point intercept survey of Curlyleaf Pondweed.
1. Estimate the maximum depth of rooted aquatic vegetation.
2. Record the coverage of Curlyleaf Pondweed
3. Record other aquatic plant species .
4. Develop maps of distribution of Curlyleaf Pondweed, other exotics and native aquatic species.

METHODS

A Geographic Information System (GIS) was used to generate sample points across the lake surface in a 100 meter by 100 meter grid, resulting in a total of 125 potential survey points. Of the 125 points projected for survey, All of them were actually sampled. There were no aquatic plant species found in samples, on a total of 77 points where water clarity prhibited any plant growth. Emphasis of the survey was mainly within the 0 to 15 foot contour, although sampling of the 125 individual points was conducted.

Survey points were generated in the GIS and uploaded into a Global Positioning System (GPS) unit which we used to navigate the boat to each sampling point. One particular point in the watercraft was designated as the sampling point and used throughout the survey. At each point, water depths were electronically sensed by a depth finder. All plant species found at each point were documented. Sampling was conducted with a double headed garden rake attached to a rope in those areas where no visible plants were at the surface. Frequency of occurrence was measured by a scale of 1 to 3 with the number 1 indicating low abundance, number 2 moderate and the number 3 very dense plant growth.

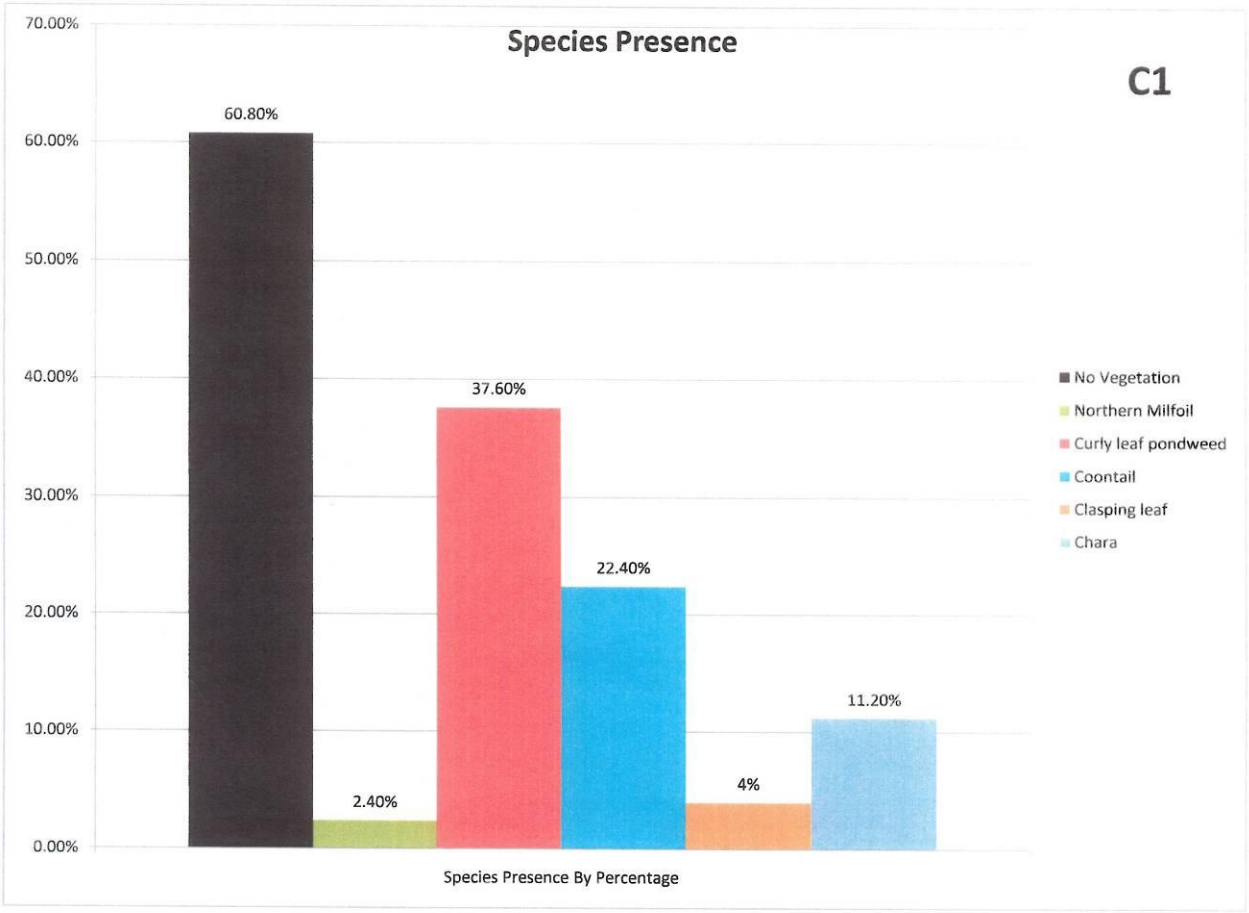
RESULTS

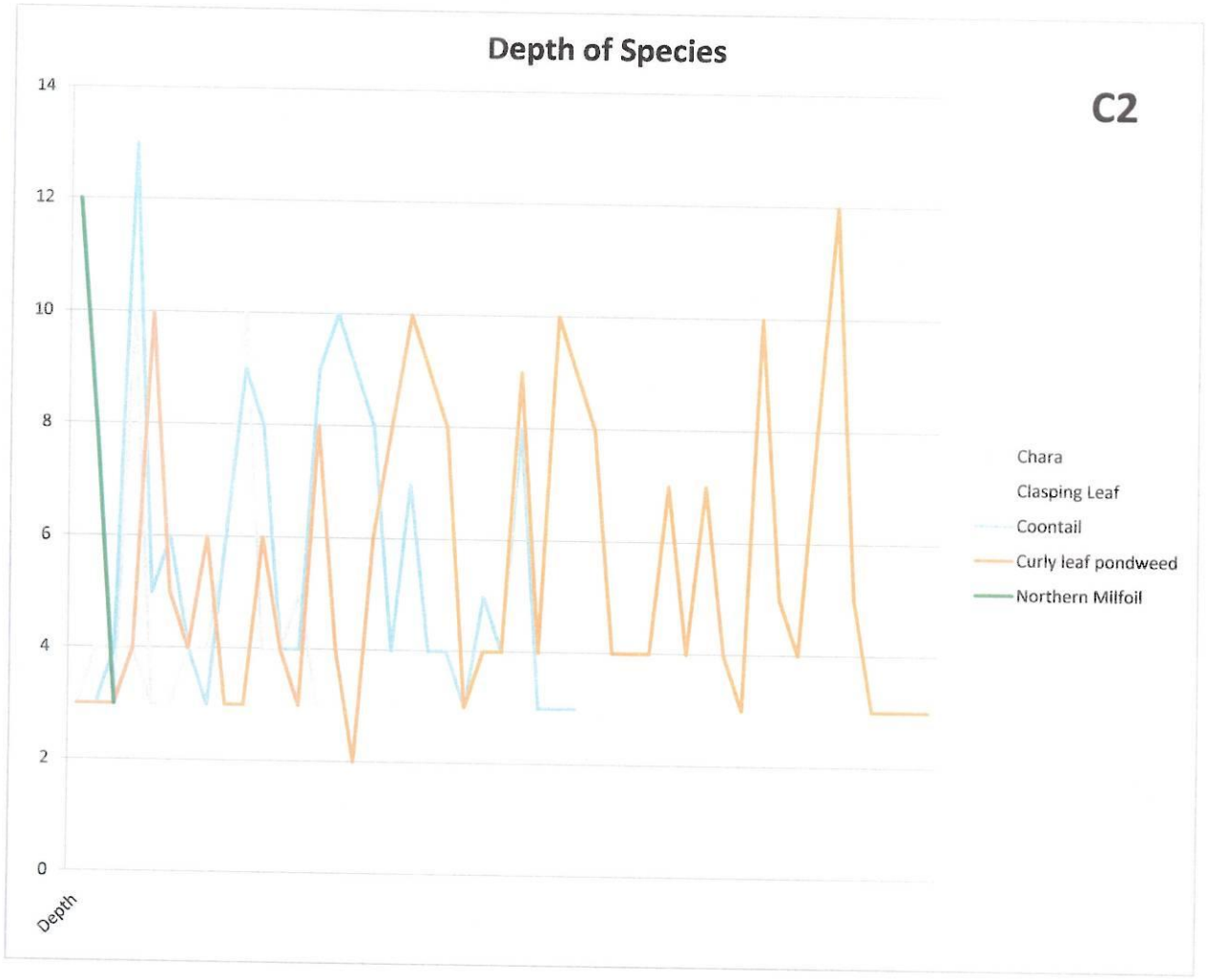
Distribution of vegetation by water depth

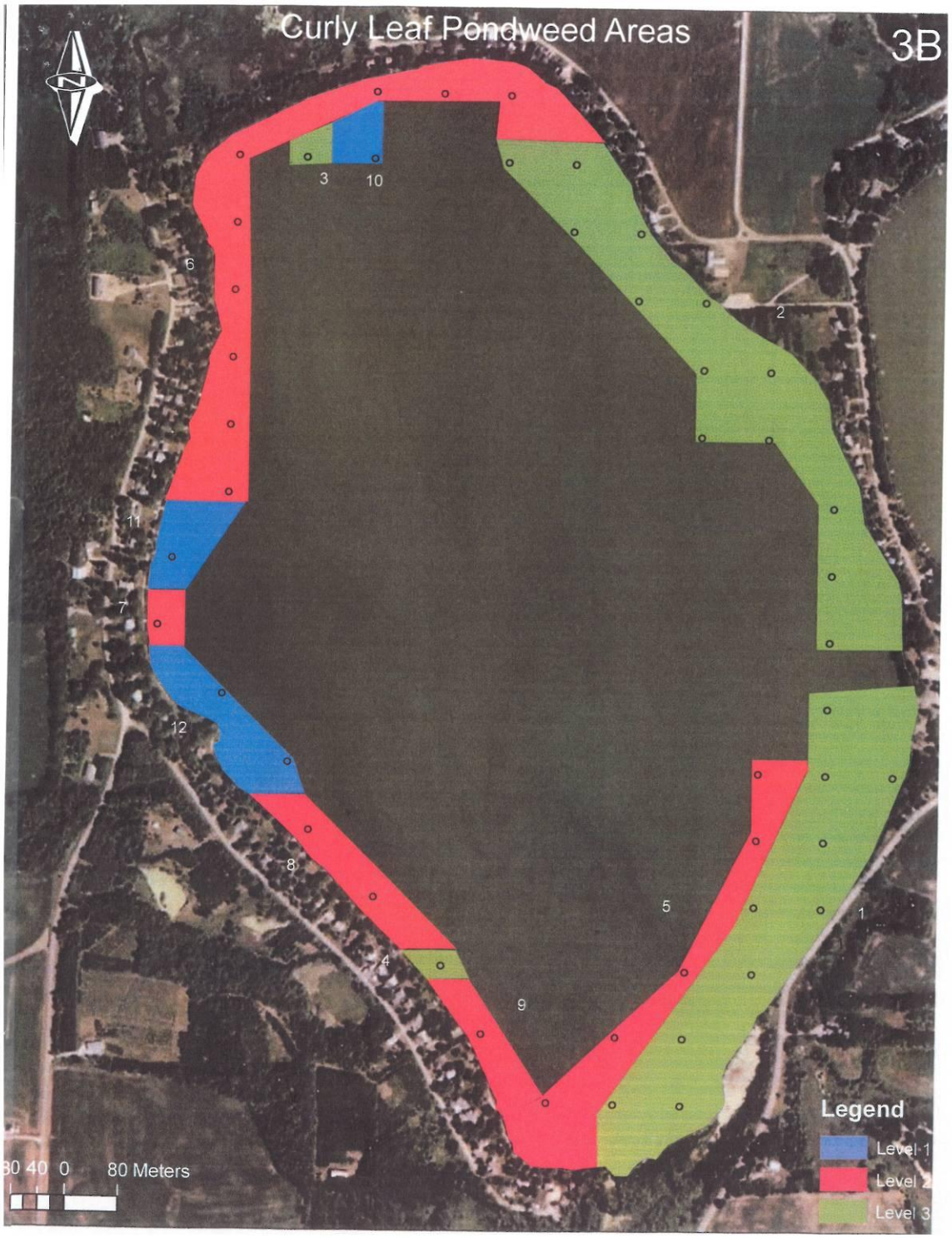
In North Browns Lake, aquatic plants were found in 38.4% of the sites sampled and Curlyleaf Pondweed was found in 38.4% of the sampled points to a depth of 12 feet . Plant abundance varied by water depth and vegetation was most abundant in depths from 4 to 8 feet (Figure C1 and C2). A total of 61.6% of the total number of points sampled were outside the major plant growth zone, (over 15 feet). Curlyleaf Pondweed extends along most of the shoreline in varying abundance and is present and matted on the surface on the North, South, and East shorelines where infestation is the most serious and these locations are noted on Figure 3B. Figures 1A thru 4A identifies the GPS sample points and documents the fact that the individual specie noted was found at that point. Figure 4B indicates Curlyleaf Pondweed coverage of each level expressed as an acreage, level 1 at 9.21 acres, level 2 at 36.8 acres and level 3 at 52.25 acres. Figure 5B indicates Curlyleaf Pondweed coverage of each level expressed as a percentage of coverage, level 1 at 2.94 %, level 2 at 11.78%, and level 3 at 31.47%. Figure 1A shows all points in the grid sampled for each aquatic plant species and table 1 shows the frequency of occurrence of each species based on the number of sample sites and expressed as a percentage of the total. Tables 1B and 2B provides GPS waypoints, latitude, longitude and acreage information for future work.

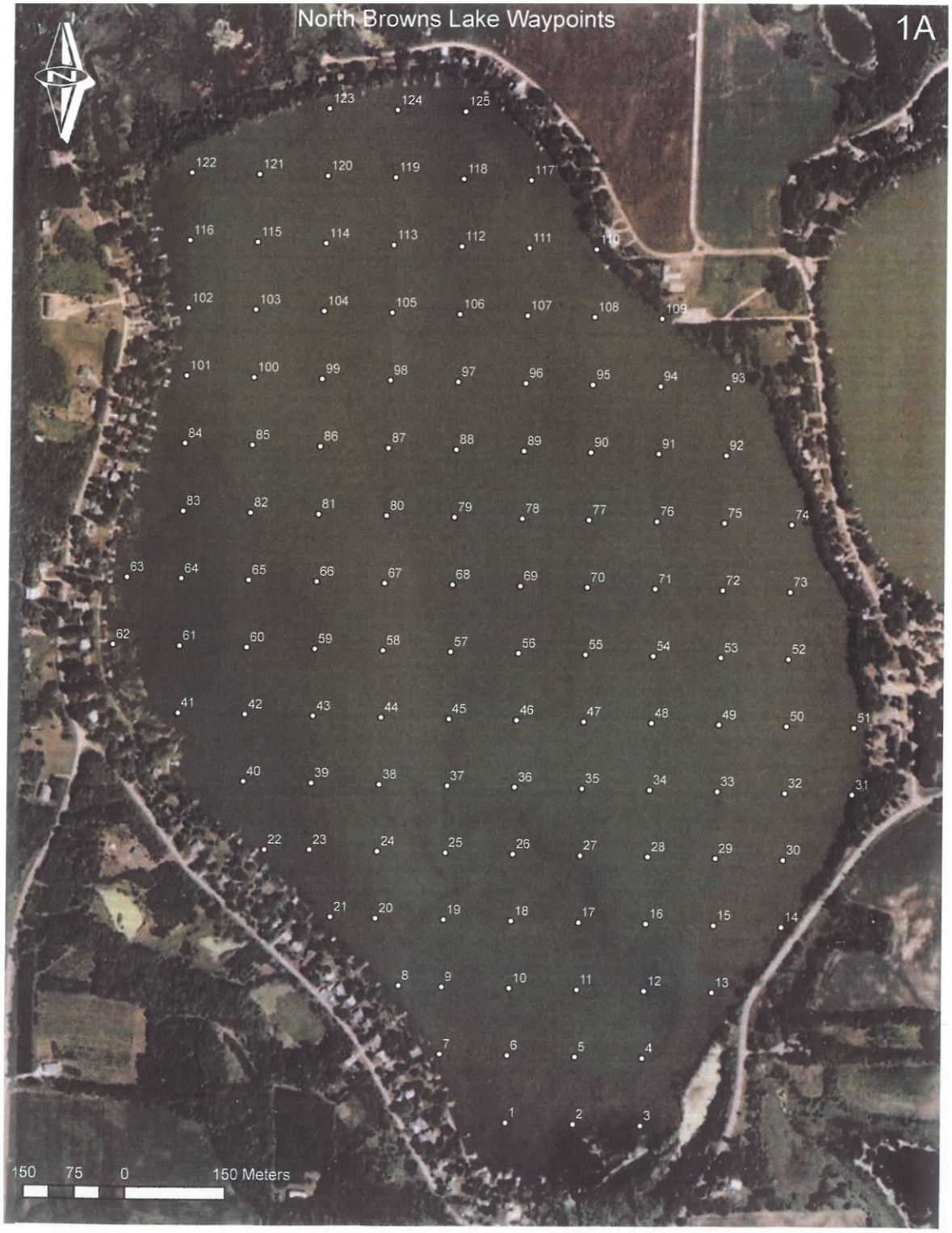
Types of aquatic plants found

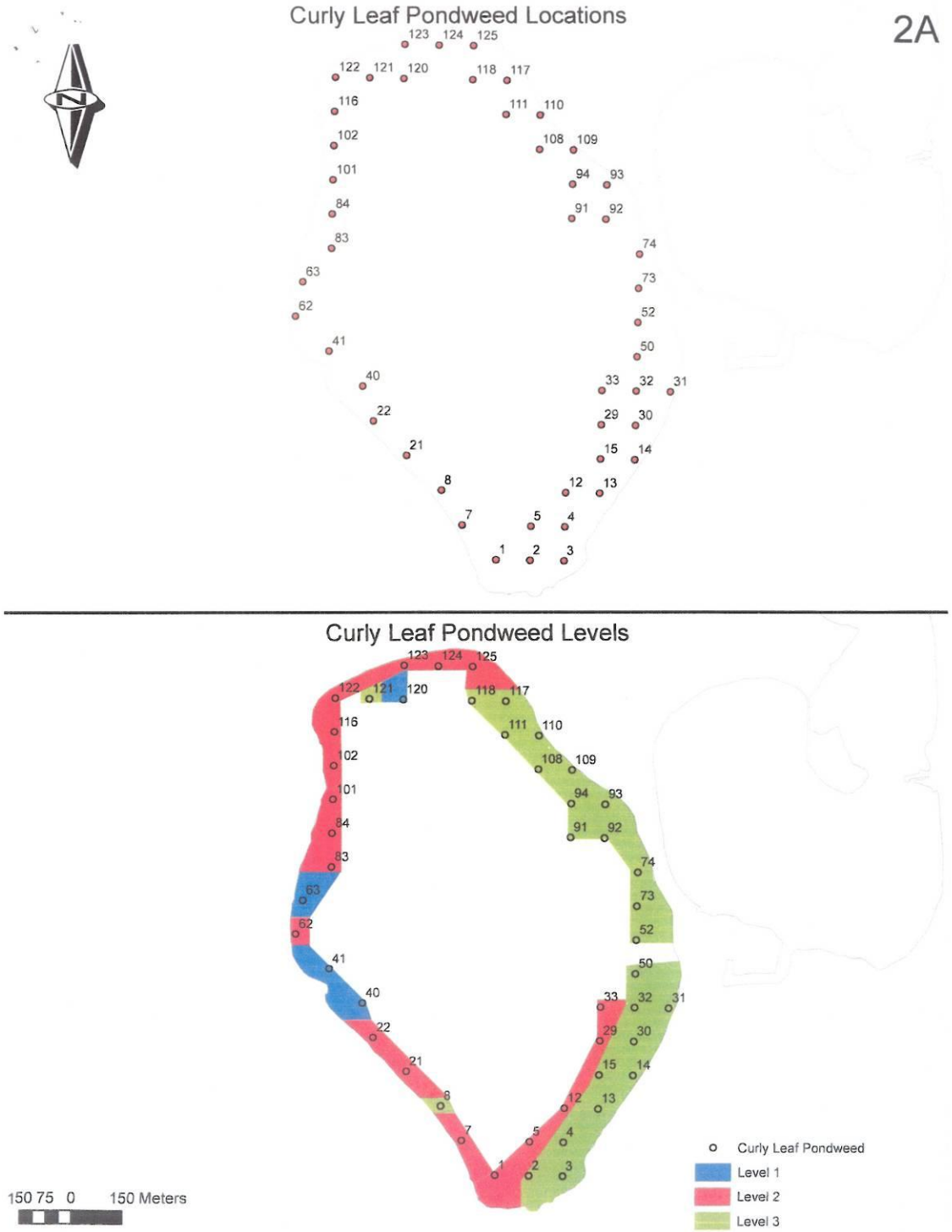
Five (5) species of native submergent aquatic plants were identified during the survey. Cattail was the only Emergent species noted and was limited to one small location at the North end of the lake and another small growth at the South shore. Floating leaf plants were not sighted along any of the shoreline during the survey. One exotic species, Curlyleaf Pondweed was identified and is the predominent aquatic plant present. Native aquatic plant growth is extremely limited in North Browns Lake, likely caused by early growth of Curly Leaf Pondweed and limited water clarity. Points locating the five most predominent species are sited on Figures 2A thru 4A.

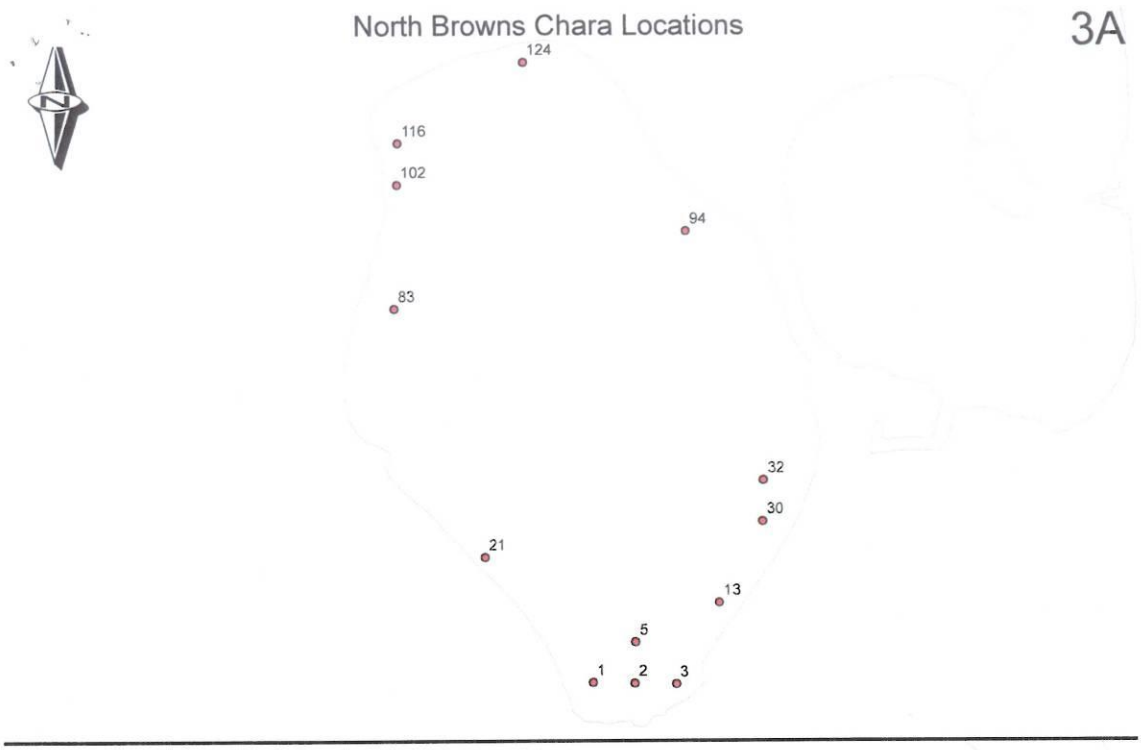

Species Presence
C1
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
60.80%
2.40%
37.60%
22.40%
4%
11.20%
No Vegetation
Northern Milfoil
Curly leaf pondweed
Coontail
Clasping leaf
Chara
Species Presence By Percentage

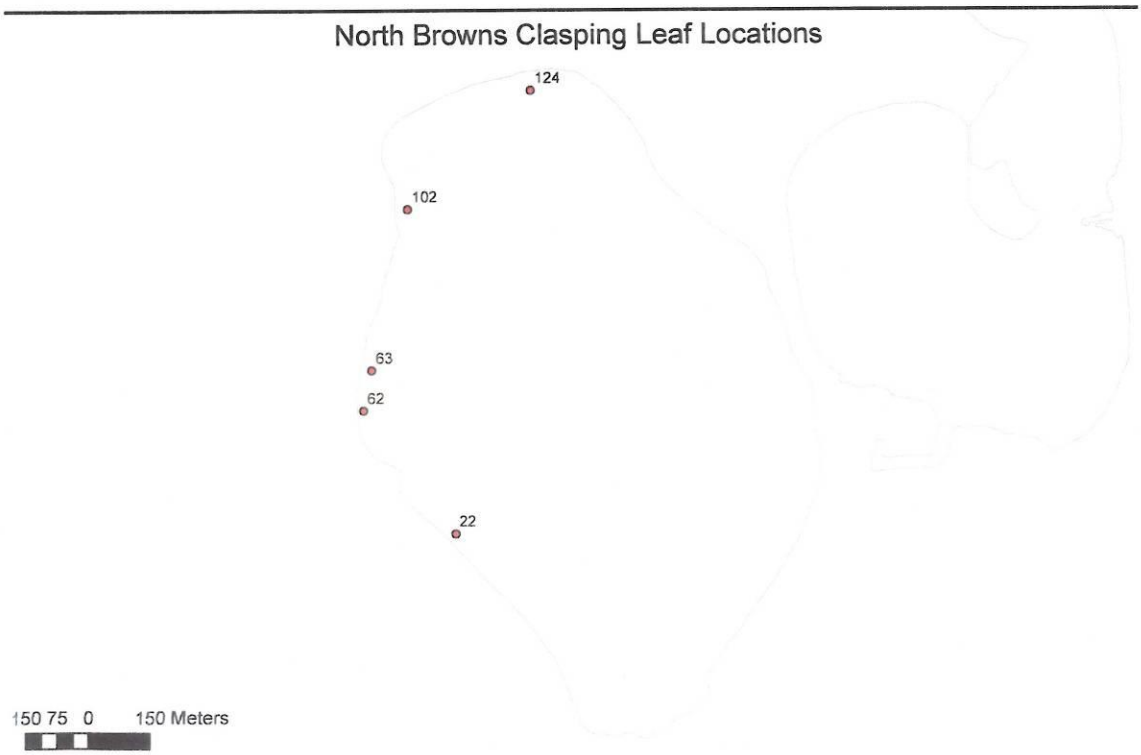

Depth of Species
C2
14
12
10
8
6
4
2
0
Depth
Chara
Clasping Leaf
Coontail
Curly leaf pondweed
Northern Milfoil

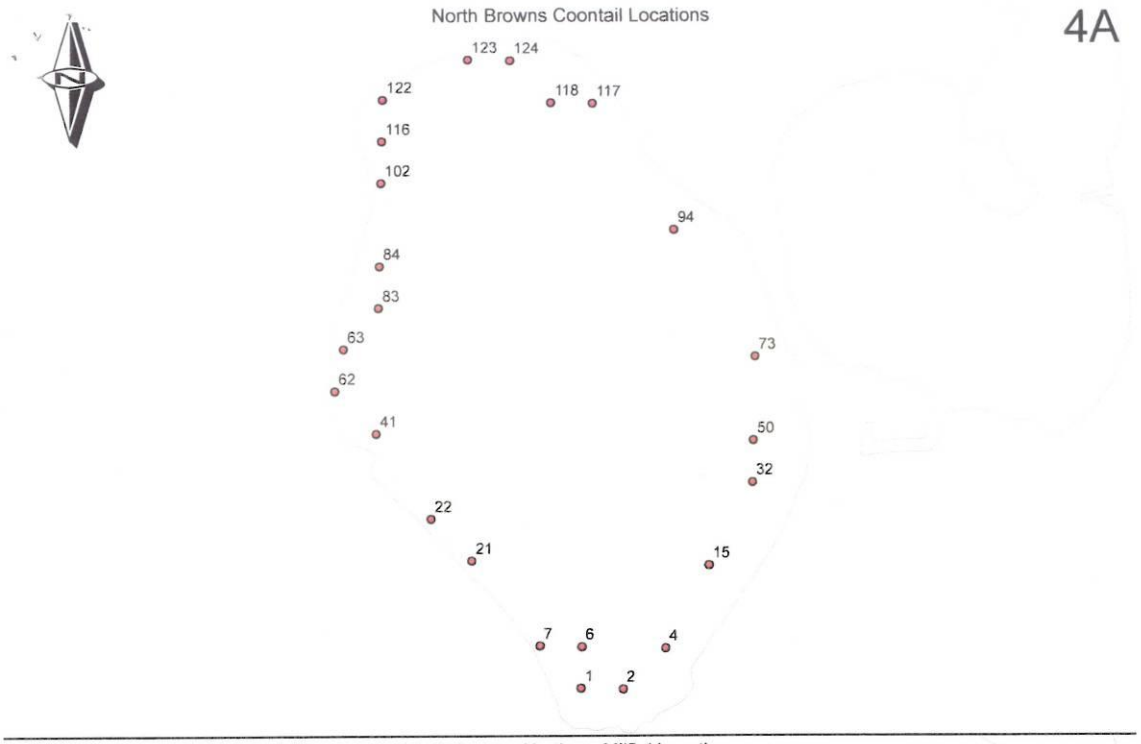

Curly Leaf Pondweed Areas
3B
N
3
10
6
2
11
7
12
8
5
1
4
9
Legend
Level 1
Level 2
Level 3
80 Meters

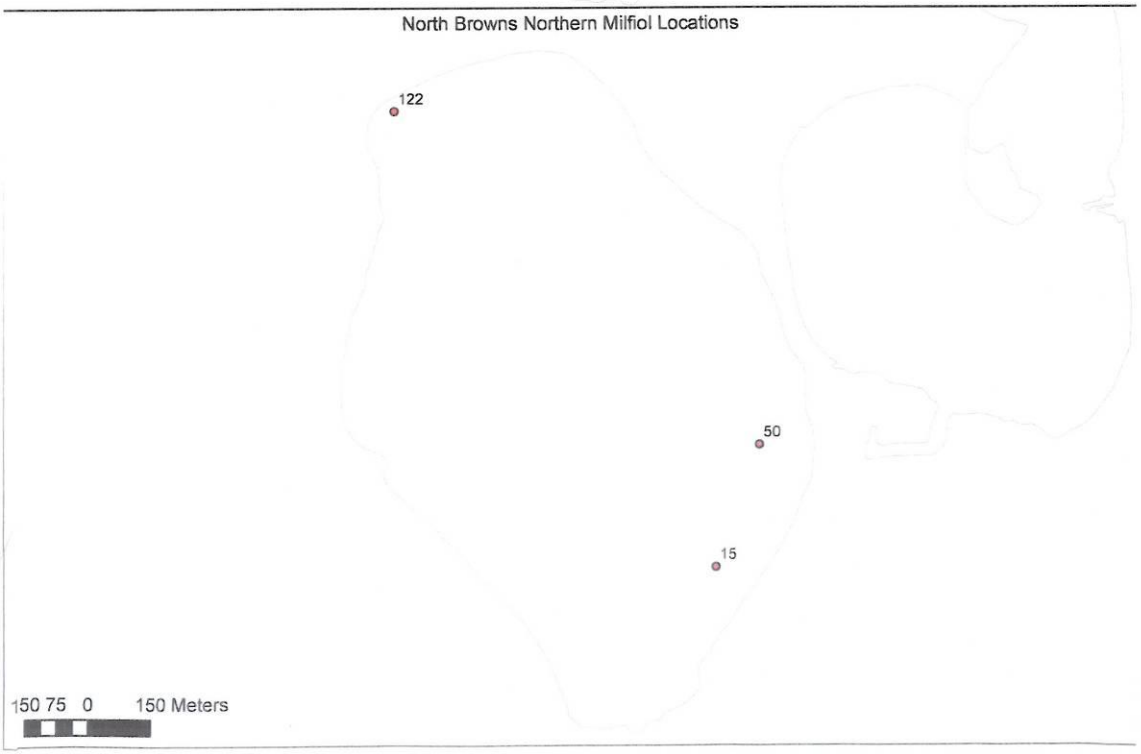

North Browns Lake Waypoints
1A
123 124 125
122 121 120 119 118 117
116 115 114 113 112 111 110
102 103 104 105 106 107 108 109
101 100 99 98 97 96 95 94 93
84 85 86 87 88 89 90 91 92
83 82 81 80 79 78 77 76 75 74
63 64 65 66 67 68 69 70 71 72 73
62 61 60 59 58 57 56 55 54 53 52
41 42 43 44 45 46 47 48 49 50 51
40 39 38 37 36 35 34 33 32 31
22 23 24 25 26 27 28 29 30
21 20 19 18 17 16 15 14
8 9 10 11 12 13
7 6 5 4
1 2 3
150 75 0 150 Meters


Curly Leaf Pondweed Locations
2A
123 124 125
122 121 120 118 117
116 111 110
102 108 109
101 94 93
84 91 92
83 74
63 73
62 52
41 50
40 33 32 31
22 29 30
21 15 14
8 12 13
7 5 4
1 2 3
Curly Leaf Pondweed Levels
Curly Leaf Pondweed
Level 1
Level 2
Level 3
150 75 0 150 Meters

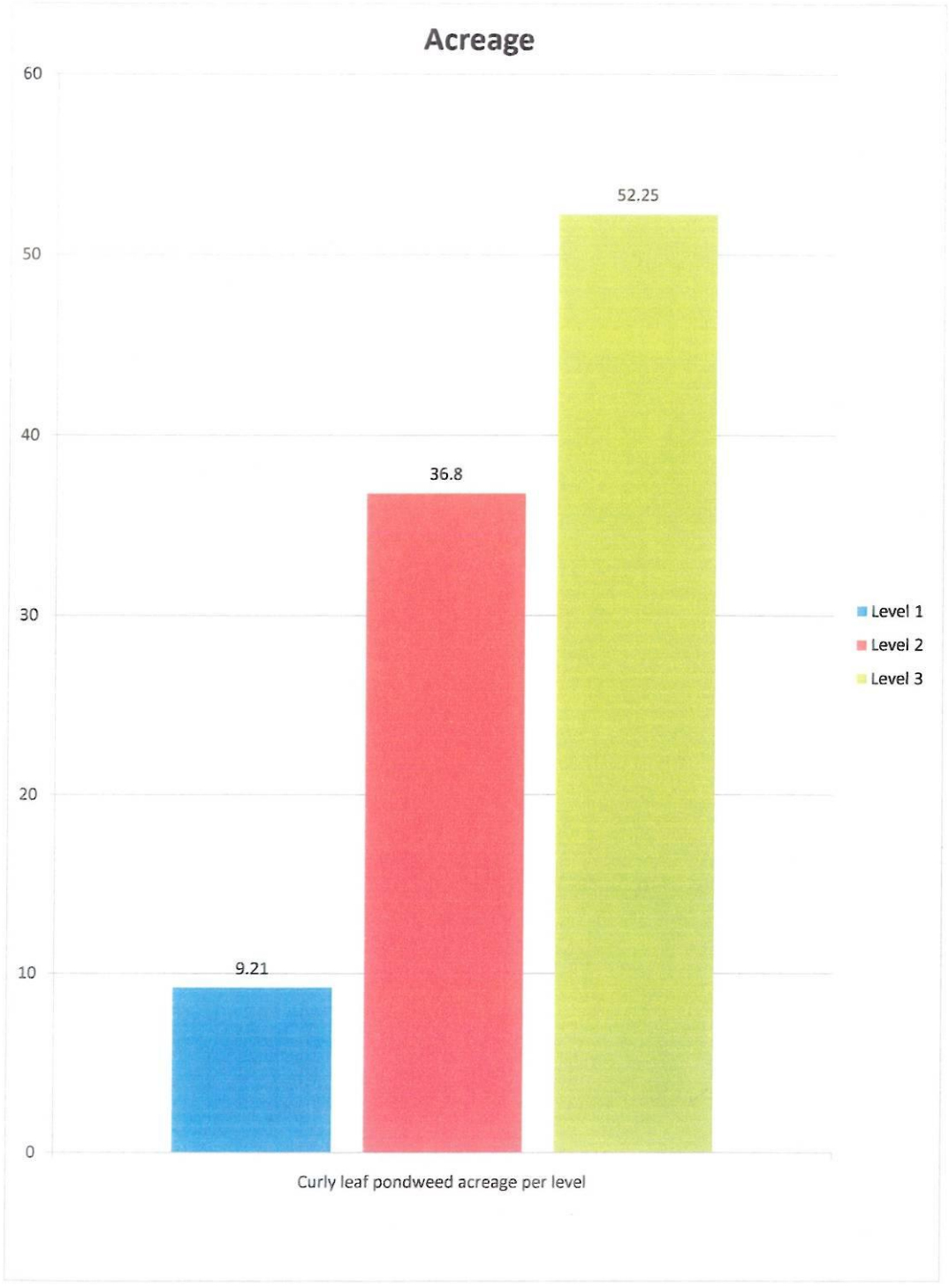

North Browns Chara Locations
3A
124
116
102
94
83
32
30
21
13
5
1
2
3


North Browns Clasping Leaf Locations
124
102
63
62
22
150 75 0 150 Meters


North Browns Coontail Locations
4A
123
124
122
118
117
116
102
94
84
83
63
73
62
41
50
32
22
21
15
7
6
4
1
2


North Browns Northern Milfiol Locations
122
50
15
150 75 0 150 Meters

4B


Acreage
60
50
40
30
20
10
0
52.25
36.8
9.21
Level 1
Level 2
Level 3
Curly leaf pondweed acreage per level

5B

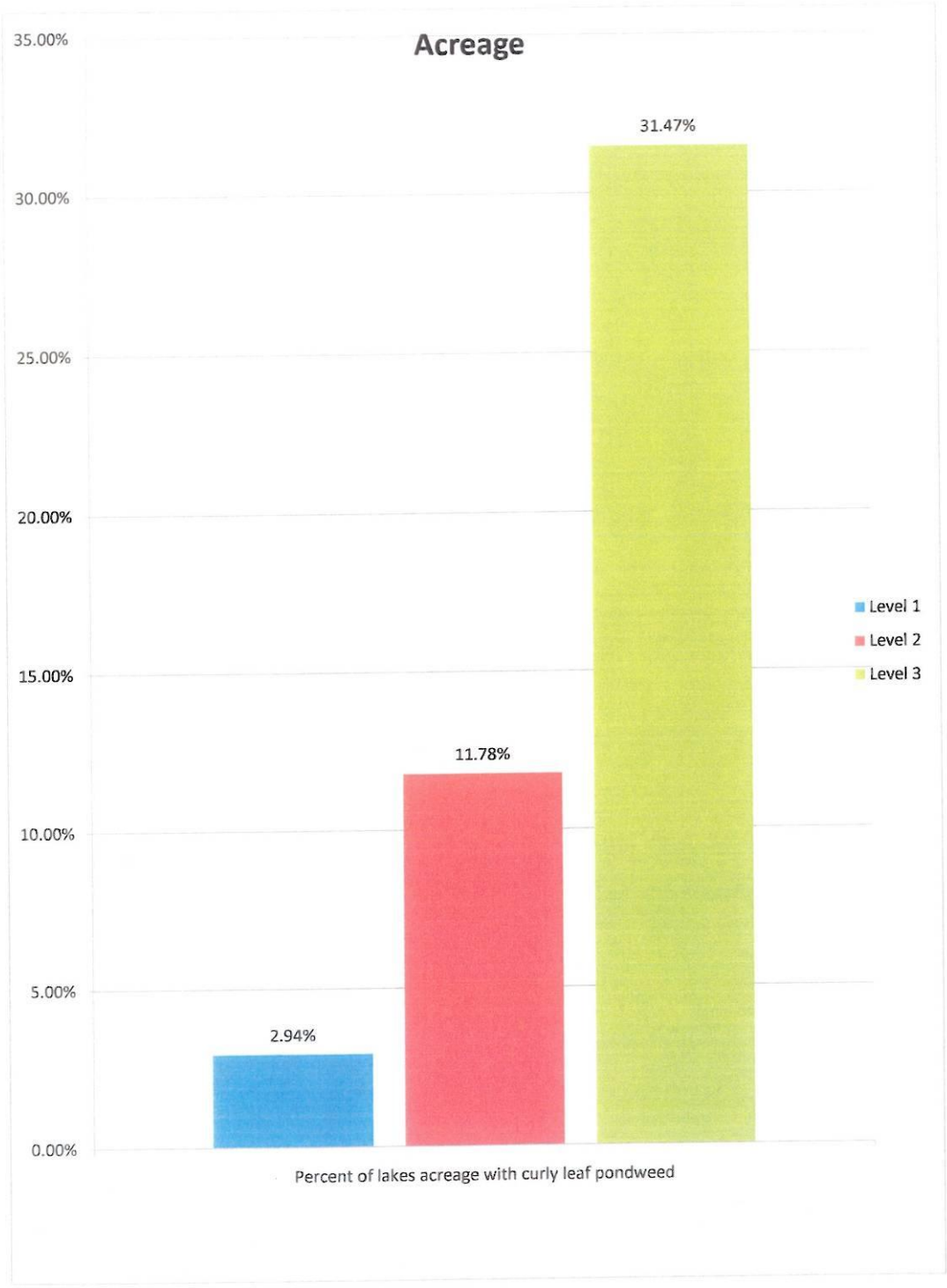

Acreage
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
31.47%
11.78%
2.94%
Level 1
Level 2
Level 3
Percent of lakes acreage with curly leaf pondweed

Table 1. Aquatic plants of North Browns Lake (DOW 71-147) based on a point intercept survey by Terry Ebinger and Matt Swanson on May 28 and June 2, 2009. The frequency of occurrence of different species of aquatic plants is the number of sample sites where the species was found, expressed as a percentage of the total of 125 sample sites in the full lake grid rather than the limited littoral zone, (shoreline to depth of 15 feet).

Life Form	Common Name	Scientific Name	Frequency of Occurrence
Submersed	Curlyleaf Pondweed	Potamogeton Crispus	38.4%
	Coontail		19.2%
	Northern Watermilfoil		2.4%
	Claspingleaf Pondweed		4.0%
	Chara		10.4%
Emergent	Cattail		1.0%

North Browns Curly Leaf Pondweed Data 1B

Level 1								
	Area	Acres	Waypoint	Long	Lat	X Projection	Y Projection	Depth
	10	1.49	120	-94.54105	45.3917	379372.24	5027619.889	12
	11	2.95	63	-94.54467	45.386347	379,077.59	5027030.593	4
	12	4.77	40	-94.54236	45.383633	379,252.32	5,026,725.67	10
			41	-94.54366	45.384541	379,152.97	5,026,828.45	9
Level 1 Acres		9.21					Average Depth	8.75
Level 2								
	5	10.36	1	-94.53725	45.3792	379,642.90	5,026,225.45	3
			5	-94.53596	45.38005	379,745.69	5,026,317.96	10
			12	-94.53459	45.380963	379,855.32	5,026,417.32	6
			29	-94.53337	45.382768	379,954.68	5,026,616.03	6
			33	-94.53339	45.383693	379,954.68	5,026,718.82	8
	6	17.28	83	-94.54356	45.387256	379,166.67	5,027,129.95	10
			84	-94.54358	45.388089	379,166.67	5,027,222.46	9
			101	-94.54365	45.389106	379,163.24	5,027,335.52	7
			102	-94.54367	45.389969	379,163.24	5,027,431.45	4
			116	-94.54361	45.390895	379,170.10	5,027,534.24	5
			122	-94.54363	45.391727	379,170.10	5,027,626.74	3
			123	-94.54108	45.392687	379,372.24	5,027,729.53	3
			124	-94.53972	45.392705	379,478.45	5,027,729.53	3
			125	-94.5385	45.392691	379,574.38	5,027,726.10	3
	7	1.51	62	-94.54495	45.38548	379,053.61	5,026,934.66	4
	8	4.69	21	-94.54065	45.381899	379,382.52	5,026,530.38	4
			22	-94.54203	45.382682	379,276.31	5,026,619.46	3
	9	2.96	7	-94.53855	45.380046	379,543.55	5,026,321.38	35
Level 2 Acres		36.8					Average Depth	5.3125
Level 3								
	1	25.83	2	-94.53603	45.379155	379,738.84	5,026,218.60	3
			3	-94.53476	45.37911	379,838.19	5,026,211.75	3
			4	-94.53474	45.380005	379,841.62	5,026,311.11	4
			13	-94.53345	45.380885	379,944.40	5,026,407.04	3
			14	-94.53216	45.381859	380,047.19	5,026,513.25	3
			15	-94.53343	45.381842	379,947.83	5,026,513.25	6
			30	-94.53219	45.382784	380,047.19	5,026,616.03	4
			31	-94.53081	45.383696	380,156.82	5,026,715.39	2
			32	-94.53204	45.383711	380,060.89	5,026,718.82	6

North Browns Curly Leaf Pondweed Data 2B

		Area	Acres	Waypoint	Long	Lat	X Projection	Y Pojection	
				50	-94.53206	45.384512	380,060.89	5,026,807.89	8
		2	24.9	52	-94.53217	45.385436	380,054.04	5,026,910.68	3
				73	-94.53215	45.386392	380,057.47	5,027,016.89	9
				74	-94.53213	45.387287	380,060.89	5,027,116.25	4
				91	-94.53461	45.388179	379,869.03	5,027,219.03	8
				92	-94.53334	45.388196	379,968.39	5,027,219.03	4
				93	-94.53332	45.389091	379,971.81	5,027,318.39	4
				94	-94.53472	45.389103	379,862.18	5,027,321.82	4
				108	-94.53593	45.390012	379,769.67	5,027,424.60	7
				109	-94.53466	45.389998	379,869.03	5,027,421.17	4
				110	-94.53591	45.390814	379,773.10	5,027,513.68	3
				111	-94.53731	45.390887	379,663.46	5,027,523.96	10
				117	-94.53729	45.39172	379,666.89	5,027,616.46	4
				118	-94.53842	45.391705	379,577.81	5,027,616.46	8
		3	0.75	121	-94.54232	45.391745	379,272.88	5,027,626.74	5
		4	0.77	8	-94.53936	45.380898	379,481.87	5,026,417.32	4
Level 3 Acres			52.25						
Total Acres			98.26					Average Depth	5.04

Appendix 2. Documented history of aquatic vegetation species composition in North Browns Lake, Stearns County. Data collected by the Minnesota Department of Natural Resources, Section of Fisheries.

Common Name	Scientific Name[1]	1949	1972	1980	1990	7-17-2003
Coontail	Ceratophyllum demersum	X		X	X	X
Muskgrass group	Chara sp.				X	
Canada waterweed	Elodea canadensis					X
Slender waterweed	Elodea nuttallii			X		
Lesser duckweed	Lemna minor				X	X
Sedge	Salix sp.					X
Northern watermilfoil	Myriophyllum sibiricum	X				X
Bushy pondweed	Najas flexilis	X				X
Yellow water lily	Nuphar luteum variegatum	X				
Submerged pondweeds	Potamogeton sp.		X			
Curlyleaf pondweed (I)	Potamogeton crispus			X	X	X
Sago pondweed	Potamogeton pectinatus	X			X	X
White-stem pondweed	Potamogeton praelongus					X
Small pondweed	Potamogeton pusillus	X				
Claspingleaf pondweed	Potamogeton richardsonii	X		X	X	X
Narrowleaf pondweed group	Potamogeton sp.					X
Flatstem pondweed	Potamogeton zosterformis			X		
White water buttercup group	Ranunculus sp.	X				
Bulrush group	Schoenoplectus sp.	X	X	X	X	X
River bulrush	Schoenoplectus fluviatilis				X	X
Knotted rush	Juncus nodosus					X
Cattail group	Typha sp.	X		X	X	X
Reed canary grass	Phalaris arundinaceae			X	X	X
Smartweed	Persicaria amphibia				X	X
Giant Burreed	Sparganium eurycarpum					X
Wild celery	Valisneria americana	X			X	X
Wild rice	Zizania aquatic	X				
Water moss	Drepanocladus sp.			X		

[1] Crow, G.E. and C.B. Hellquist. 2000. Aquatic and wetland plants of Northeastern North America. Vol. 1-2. The University of Wisconsin Press, Madison.

I = invasive species; P = protected wildflower; SC = special concern ; T = threatened

Appendix 3. Monitoring protocols for North Browns Lake, Stearns County, 73-0147.

1. Frequency and timing of point intercept surveys

Two point intercept surveys following methods described by Madsen (1999) shall be done. The first needs to occur prior to the treatment of curly-leaf pondweed (CLP) to determine treatment areas. The second should occur during the last week of July or first week in August, in order to sample actively growing native aquatic vegetation.

2. Point intercept sampling method

This method requires that a regular grid of sample points be created over an orthorectified map or aerial photo of the lake (Madsen 1999). The MnDNR has created a sampling grid for Latimer Lake for the survey and will provide it as an electronic file to the surveyor (the coordinates are also listed in Appendix 3). These established sample points are to be used for each survey conducted. Once the surveyor loads the established points into a GPS unit, they will use this to navigate their boat to each point on the lake. All sampling should be done when wind velocity is at or less than 10 mph in the area being sampled.

At each of the points, the surveyors should measure the water depth (using an electronic depth finder for depths greater than 8 feet, or a depth stick for depths less than 8 feet) and throw the rake (made of two weighted metal garden rake heads tied together on the end of a rope that is at least 25' in length, Figure 1)) about 10 feet from the boat. One side of the boat should be designated as the sample area. The rake is then allowed to sink to the bottom and allowed to cover a 1 square meter sample area before it is retrieved. If possible, the 1 meter square sample site also should be visually observed for plants not present on the rake. All plant species on the rake or visually observed should be recorded. All plants should be identified to species if possible, and to genus if not.

Figure 1. Picture of the double-headed rake used for point intercept aquatic plant surveys.

At each sample point record: the sample point number, the sample point depth, the plant species observed, and the estimated abundance of the plant species observed. Estimate the abundance of plant species observed using the following ranking system: 1 = 1 – 2 plants on the rake, 2 = rake ½ covered, 3 = rake ¾ covered, 4 = rake completely covered and over the top of the rake. For locations where CLP is found, note if it is matted or not matted at the water surface. Take digital photos if possible.

Surveyors do not have to sample in depths that are more than one inter-point distance deeper that the deepest recorded vegetation, but they must do at least one interval deeper than where vegetation was found. One voucher specimen of each species found should be collected. Press and mount specimens

and label pressed samples with a standard herbarium label. Instruction on how to press an aquatic plant or assistance with plant identification is available from the MnDNR contact.

The report should outline all of the species found, the maximum depth of vegetation growth, locations of actively growing CLP and abundant native vegetation, the frequency of occurrence of each species of aquatic plant found in the survey, the percentage of sites sampled that had native vegetation, and the average number of native plants found per sample site. Frequency of occurrence can be calculated for each species (or combined taxa) as the number of sites in which a species occurred divided by the total number of sample sites. Do not include sample points that were deeper than the maximum depth where plants were found. For example, from the point intercept survey conducted on June 24, 2009 on Latimer Lake, the maximum depth at which plants were found growing was 10 feet (Loso and Perleberg 2009). A total of 69 points were sampled in this area (from shore to a depth of 10 feet). CLP was present at 43 of the 69 points, resulting in a frequency of occurrence of 62% (i.e., 43/69*100=62). Sampling points should also be grouped by water depth and separated into five depth zones for analysis: 0 to 5 feet, 6 to 10 feet, and 11 to 15 feet. A graph can then be made showing how many sample points had vegetation present for each depth zone. An example of these calculations can be found in Loso and Perlieberg (2009).

When choosing someone to do these types of surveys, consider these key skills needed by anyone who does this work. 1. Ability to identify common and rare aquatic plants to species. 2. Knowledge of design of sampling schemes and statistical analysis. 3. Ability to enter or load the sampling coordinates into a GPS unit for later sampling. 4. Ability to use a boat and GPS to navigate to sampling locations. 5. Ability to record data accurately, both on the lake, and in the lab. 6. Ability to report results in a clear and accurate manner, including summaries of data and raw data.

Key equipment needed by anyone who does this work 1. Boat. 2. Aquatic plant grapple (two weighted rake heads tied together on the end of a rope). 3. Depth finder. 4. GPS unit that has options for the same coordinate and datum system that the DNR utilizes (UTM, NAD 83, Zone 15). 5. Secchi disk. 6. Field data sheets. 7. Computer, word processing and spreadsheet software to summarize and tabulate data with the ability to e-mail to the appropriate DNR contact. 8. Plant press (if necessary). 9. Depth pole (e.g. stadia rod).

3. Water quality sampling

Secchi disk transparency should be collected in the deepest part of the lake each day survey work is done and bi-weekly from April to November. The Latimer Lake Association is encouraged (if they are not already) to partner with the Minnesota Pollution Control Agency (MPCA) and join the Citizen Lake Monitoring Program (CLMP). As a member of this program, the MPCA offers knowledge, data sheets, and Secchi disks to cooperating members. The manual for this program (MPCA 2008) outlines the methods that should be followed for collection of Secchi disk data.

Water samples need to be collected at least monthly for determination of total phosphorous and chlorophyll-a levels. These water samples need to be collected in coordination with a certified laboratory and shipped for processing and data reporting. Methods for collection of the water samples will vary depending on the laboratory utilized.

Electronic Data

For the aquatic plant point intercept surveys, provide electronic copies of all original raw data including those at which no plants were found. This can be in a database or spreadsheet format. Raw data must include, in addition to the observed result: the date of observation, name of observer, designated sample point number, GPS coordinates of observation, depth of location, and any other comments. All data must include units of measure. For example, was depth measured in feet or in meters? The water quality sampling results should also be included in a spreadsheet format with columns that indicate date of sample, sample observer or collector, result of the sample, sample units, and any notes regarding observations made during the sampling. This data should be supplied to the Invasive Species Specialist assigned to your region by December 31 of the current year.

Literature Cited:

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