(Draft) Lake Management Plan
for
Portage Lake

Hubbard County, Minnesota

Revised: September 26, 2006

Healthy Lakes & Rivers Partnership Committee
Portage Lake Association

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Management Plan for Portage Lake

Introduction

In June 2005 the Portage Lake Association was invited to participate in the Northwest Minnesota Foundation's Healthy Lakes and Rivers Partnership program along with seven other lake and river Associations in Hubbard County. Under the coordination of William Alden and Alicia Laturnus (Hubbard Soil and Water Conservation District) and Ken Grob (Hubbard County Lakes and Rivers Association), representatives of each group attended two days of training on strategic planning, communication, and nonprofit group leadership.

Representatives of many state and local agencies, as well as nonprofit organizations also attended the training sessions in order to offer their assistance to each group in developing a strategic Lake Management Plan. The Portage Lake Association was represented at the Healthy Lakes & Rivers training sessions by: *Julie Fleisher, Larry Fleisher, Ken Keller, Sue Keller, Jerry Knoblich, Marilyn Peterson, Charlie Pieper, Dale Rogers*

Following the training sessions, each Lake Association held an inclusive community planning/visioning session designed to identify key community concerns, assets, opportunities, and priorities. The Portage Lake Association held this planning session on *August 27,2005* facilitated by *Will Yliniemi.* Details of the public input received at this session are provided within this plan.

This document is intended to create a record of historic and existing conditions and influences on Portage Lake, and to identify the goals of the Portage Lake community. Ultimately it is meant to also help prioritize goals, and guide citizen action and engagement in the priority action areas. Clearly state agencies and local units of government also have a vital role and responsibility in managing our surface waters and other natural resources, but above all else this Lake Management Plan is intended to be an assessment of what we as citizens can influence, what our desired outcomes are, and how we will participate in shaping our own destiny.

This Lake Management Plan is also intended to be a "living document;" as new or better information becomes available, as we accomplish our goals or discovered that alternative strategies are needed it is our intent to update this plan so that it continues to serve as a useful guide to future leaders.

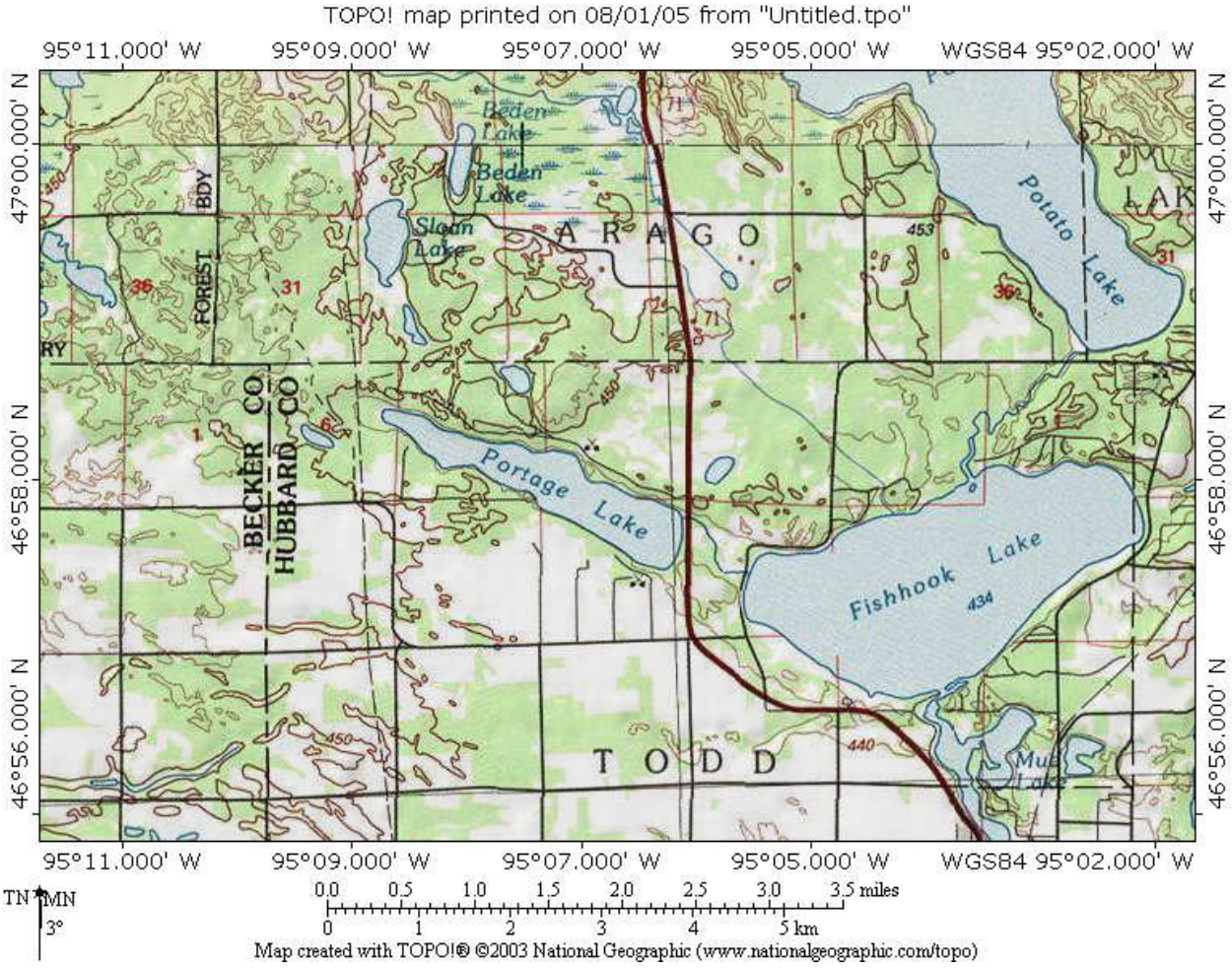
In discussing lake management issues, it is impossible to avoid all scientific or technical terms. We have tried to express our goals, measures of success, and other themes as simply and clearly as possible, but have included a glossary of common limnological terms at the end of the plan to assist the reader. Limnology is the study of lake conditions and behavior.

Finally, we would like to thank the funders of the Healthy Lakes & Rivers Partnership program including the Northwest Minnesota Foundation, The McKnight Foundation, and the Central Region Partnership of the University of Minnesota. Additional support has been provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative Commission on Natural Resources (LCMR).

Physical Characteristics and location of Portage Lake
Portage Lake (DNR ID#29-0250) is located 4.5 miles north of the City of Park Rapids in Hubbard County. The lake has a surface area of 412 acres, of which 410 acres (99.9 percent) is in the littoral zone, meaning that it has a depth of 15 feet or less. Portage Lake's maximum depth is 17 feet.

A county-owned public access is located on the south shore of the lake. Heavy algae blooms can occur on Portage Lake during the summer months. Due to the shallow depth, Portage Lake is subject to periodic "winter kill" events. Winter kill usually happens during winters when heavy snowfall accumulates on the ice and blocks sunlight from penetrating to the water, which in turn limits oxygen production through photosynthesis. At the same time, decaying aquatic vegetation on the lake bottom uses oxygen, causing oxygen levels in the lake to drop. Shallow lakes with heavy aquatic vegetation growth are more likely to winter kill than are deep water lakes.

The Minnesota Department of Natural Resources (DNR) has classified Minnesota's lakes into 43 different types based on physical and chemical characteristics. Portage Lake is in lake class 39. Other area lakes in this same classification include First and Fourth Crow Wing Lakes, Paine Lake, and Peysenski.



Precipitation

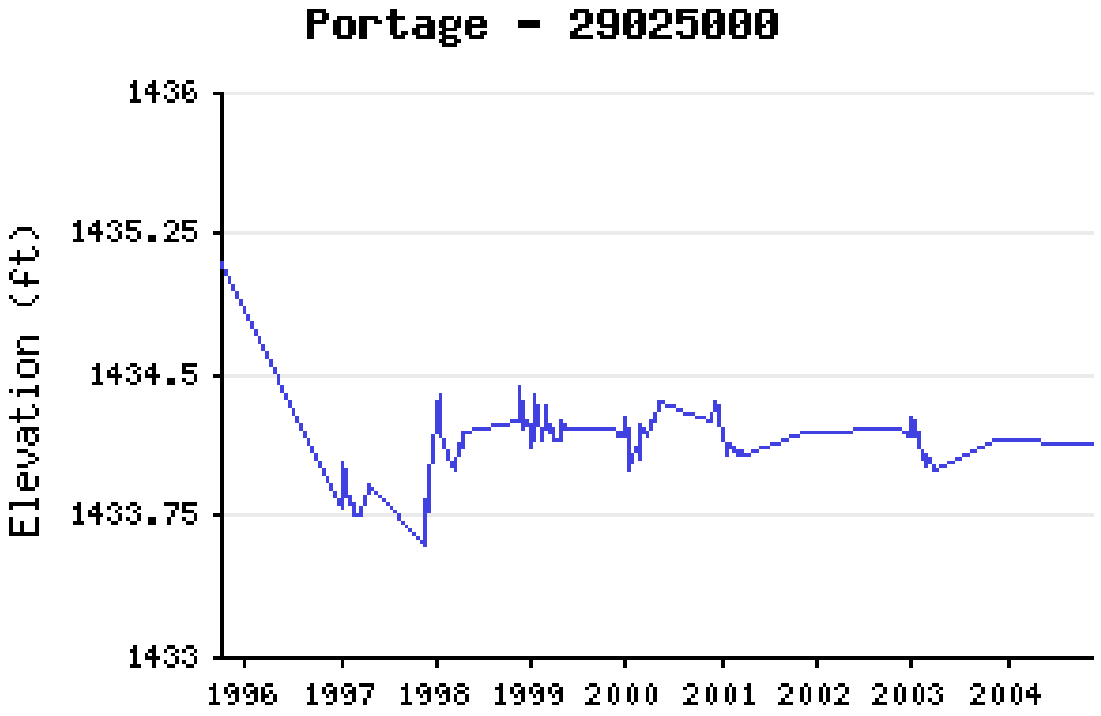
The Minnesota Pollution Control Agency (MPCA) completed a Lake Assessment Program (LAP) evaluation of nearby Kabekona Lake in 1994. The following characterization of precipitation was adapted from the Kabekona Lake report as an adequate representation of regional conditions:

> "…normal precipitation for (a water year, October through September) is on the order of 28 inches for this part of the state. Evaporation typically exceeds precipitation in this region of the state and averages about 31 inches per year. Runoff averages about 5 inches with 1 in10 year low and high values of 1.2 inches and 7.9 inches respectively."

Water Level

The DNR Division of Waters has historic water level data for Portage Lake from 1958 to present. During the period of record the lake level has varied 2.03 feet based on 155 readings (through May 2005).

Highest Recorded (feet/date)	Lowest Recorded (feet/date)	Average Level (feet)	Ordinary High Water (feet)
1,435.1 (March 14, 1996)	1,433.07 ft (Dec. 6, 1958)	1,434.11 ft	



Portage Lake water level can rise rapidly in just a few days due to beavers building a dam in the culvert under Hwy. 71 at the east end of the lake or by building their own dam of sticks and logs on top of the concrete dam on the east side of Hwy. 71.

Several times over the years, water level has dropped rapidly when wooden stop logs in the dam have been removed by vandals or removed by a resident living in the house near the dam who wanted to take his rowboat through the culvert to the lake. Lake residents would complain to the DNR in order to get him to put the boards back in order to keep the lake's water level up.

Kirk English, of the Division of Waters in Bemidji said that there is no record of replacement of the wooden stop logs by metal ones welded together, and a dam inspection has not been done since 1996.

Portage Lake History

Around 1895-1900, the Northern Pacific Railway owned most of the land surrounding Portage Lake. During the early "teens," various land & lumber companies owned and logged the land. Logs were skidded onto the ice during the winter so Portage was used as a holding pond for the logs till spring. When the ice went out, the logs were sent down the Portage River to Fish Hook Lake and into the Fish Hook River to the sawmill on the east side of the river. At this time, Portage Lake was shallower and the river wider and deeper. When the dam was built in 1937, after the logging boom, the lake's water level was raised. People do remember having to ford the river on their way to Park Rapids before the dam and highway were built. One gentleman remembered washing his car at the Portage River sometime in the 30's. Others recalled that during the drought of the 1930's, Portage shoreline grasses being cut for hay.

Three resorts were once on the lake, although there are no resorts now in 2005. Seaquist Resort, later known as Silver Birches, was located on the east end. With a lodge and two cabins, the resort also had the nicest beach. Jensen's Resort with a couple of cabins was on the northeast corner of the lake. These two resorts were still in operation when I came here in 1971.

The third resort was Karlson's Portage Retreat on the north about a third of a mile from Hwy. 71. The former log lodge is the Fred Atton cabin today. Electricity arrived via REA in 1947 and also telephone service, using the same poles. Karlson's resort closed in 1954, sold in 1955, after Hwy. 71 was detoured in 1954-56 to allow for construction and major resurfacing. The new owner had the property surveyed and platted into individual lots, selling them before he defaulted on bank loans. The resort cabins were where the cabins of Ken Smith, Erv Meyer, and Williams exist today.

By 1956 there was still little construction on the North shore other than this, and the South shore had no visible structures from the lake anyway. However, Mel Gulsvig, who started coming here in 1947 at the age of 10, does remember Fosters on the southwest, Schackmans on the north and the Seaquists on the east.

People do remember fish kills. Karlson remembers a bad one occurring about 1949 or 1950, creating a smelly scene, resulting in Portage being added to the restocking program. Mel Gulsvig remembers the 1965 fish kill as being the worst. The fish kill of 1985 was memorable because the gulls and crows cried into the night over so much available food (all the dead fish) when the ice broke up. Residents buried wheelbarrows full of fish that had washed up along the south shore. Bass, sunfish, crappies, perch, and walleyes all were casualties.

Mel Gulsvig and his dad dredged the lagoon or channel running from the SE corner of Portage Lake southward along Hwy.71 in 1965. Two ponds, one near the lake and one near the Gulsvig

farmstead were connected by a wetland, sometimes producing meadow hay. Dredging created continuous, deeper water in a narrow channel along Hwy. 71 stretching from the lake winding to the Southeast.. The dredging was DNR approved at the time because the intent was to create a place for walleyes to spawn, but instead the crappies and bass came to spawn. Huge sunfish and crappies used to be caught in the lagoon, with people parking along the highway to come down to fish. Mel recalls terrific northern fishing during the 1950's and a great supply of perch that almost disappeared after the 1985 fish kill.

There are some springs in the lagoon as well as springs along the southwest and northwest shores. Portage has no inlet, being spring fed. The culvert on the east end under Hwy.71 is the outlet to the Portage River that flows into Fish Hook Lake.

Our visioning session was held at the edge of tree plantation of 40,000 Norway pines planted by the Gulsvigs in 1981. The original farmstead is east of the channel, and the lake association held the annual picnic meetings for many years at the site where the green boathouse is now on the channel's east shore.

Portage Lake Improvement Association History

The association was begun in 1971 with membership dues of a couple dollars, and a checking account was opened at Citizens National Bank in Park Rapids. The association's annual meeting has always been a potluck picnic, a social occasion for residents to get together at homes of various residents. Various items of lake importance have been discussed over the years: excessive weeds, beavers cutting down too many trees, beavers building dams in the culvert on the east end, beavers building dams on top of the concrete dam, fish kills, too many bullheads, excessive amount of small northern pike, tarring the roads north and south of the lake, the new road names, and curly leaf pondweed. The association has invited various speakers from the DNR fisheries to explain changes in Fisheries policies. We also brought in experts in weed treatment from Professional Lake Management, the DNR, and UMN extension to help us with our curly leaf workshop. The purpose of the workshop was to educate not only Portage residents but members of other lake associations about curly leaf.

Another topic of conversation during the 70's and 80's concerned a resident who lived in the house near the dam who would remove boards from the dam lowering the water in the culvert enough so he could get his boat through the culvert to the lake. Because this would cause the lake level to go down rapidly, residents complained to the DNR to get him to put the boards back. Sometimes vandals caused the same problem by removing boards from the dam, and the dam also has sprung leaks between boards so boards needed replacing.

About 1997 the lake association joined COLA and started water monitoring for phosphorus and chlorophyll a at the persuasion of Jerry Knoblich who was and still is the Portage COLA representative. In order to pay for this water monitoring and COLA dues, association membership dues were increased from $5 to $10 a year/family or co-owners and $5 for individuals. President Carol Allison started the Portage Newsletter. President Marilyn Peterson has continued writing the association newsletter and started publishing a Portage Lake Annual Directory. The directory includes: a map showing each resident's location, phone numbers, addresses, and e-mails which is distributed to Portage Lake Association members. When a new resident comes to Portage Lake, samples of the newsletter along with a membership application to the association are either sent to them or presented to them in person.

In August 2004, the Portage Lake Improvement Association website built and maintained by resident Paul Peterson became operational. To find the website go to:
http://webpages.charter.net/paul-peterson/portage

Since 1998 when the association consisted of 28 (households) members, the membership has increased to 83 households out of approximately 107 parcels. 49 memberships are year round residents; 34 are seasonal residents. Total membership is about 78% (77.5%)of the number possible. Earlier in 2005, there were 85 members, but a few have moved or plan to sell. In the last few years, co-ownership of property has increased. For example, parents and children or several siblings are buying property together or sharing the responsibility of maintaining inherited property. Currently Portage has 4 of these co-ownerships. All members receive 2 newsletters a year (one winter, one summer) and the Portage Lake Annual Directory. The association hosts an annual potluck picnic meeting in June, a couple of women's luncheons during the summer, and sometimes a "dinner out" night. Members have the right to vote on lake issues brought up at the annual meeting or in any other special meeting.

The association was incorporated during the summer of 2001 as a non-profit corporation with the MN Secretary of State, suggested by COLA, in order to protect assets of officers and members. At the present time the association does not have 501 c 3 status.

In the spring of 2002, curly leaf pondweed became a major lake concern as it impeded many lake activities when huge mats of vegetation formed on the water surface, particularly in the east end and along the southern shore. After holding a special meeting to discuss the curly leaf problem, we voted to try the chemical treatment approach. The total estimated cost was divided by 70 willing contributors to arrive at a "fair share" contribution per willing resident in order to support the program. We raised the money needed and in May 2003 chemical treatment of curly leaf pondweed began. Chemical treatment has been successful for 3 years because no more big mats of vegetation have formed on the water surface and navigation is much improved. Blown in rolls of long curly leaf plants have been halted and turion production has vastly decreased, though there are still some turions floating around. This program still continues today and will continue in the future, since this exotic weed can never be eradicated, just controlled.

In the spring of 2005, the Portage Lake Association sent in an application to participate in the Healthy Lakes and Rivers Partnership program to obtain a grant to improve the quality of our lake. Several Portage residents are currently working within this program on three focus areas, water quality, land use and zoning, and invasive/exotic species.

***Mission:** The Portage Lake Improvement Association continues to be a social organization where neighbors can get together to talk over lake concerns for the maintenance and health of the lake. We quickly dealt with a major problem, curly leaf pondweed, by working together and providing financial support for chemical treatment. Our quick action instead of waiting a year or two is one reason for our successful treatment. Residents realize that we are in it for the long haul and need to maintain control of curly leaf and not let the situation backslide.*
We look to the future by contributing $50/yr. to the DNR walleye rearing pond fund through COLA and $50/yr to the Children's Water Festival held each spring by COLA. Also, by working through the HLRP we hope to obtain a grant to improve the quality and health of Portage Lake.

***Accomplishments:** We have 4-way communication possible with residents by phone, e-mail, mail, and website as we've built an excellent information database. All property owners are listed in*

our annual directory with their most recent addresses, phone numbers, and e-mails. Our directory is updated yearly with new residents and changes and also contains a map showing each resident's location.
Two newsletters are published each year—one summer, one winter. We have a quality newsletter with interesting articles about the lake, residents, plant and wildlife as well as color photos of interest contributed by residents. We could not afford this nice a newsletter without donated printing by resident Linda Harless at a minimum cost.
The Portage Lake Improvement Association has its own website since August 2004. To find the website, go to: http://webpages.charter.net/paul-peterson/portage
On the website one can click on several topics: announcements, ice dates, curly leaf information, Eurasian watermilfoil information, our current newsletter, membership, precipitation, lake monitoring data, our draft lake management plan, our HLRP program, and photos of residents attending our annual picnic meeting.
Portage Lake has participated in the Lake Monitoring Program for 9 years, gathering phosphorus, chlorophyll a, and Secchi disk data. Marilyn Peterson has taken Secchi disk readings at least once a week for 20 years for the MPCA Citizen Lake Monitoring Program.
The association has increased its membership rapidly in the last few years from 28 households to between 80-85 households, particularly after publishing newsletters and a directory as well as participating in the water monitoring program.

One of the best things we ever did was hosting a curly leaf workshop at the lake in May 2003. COLA and the Hubbard County Extension teamed up with the Portage Lake Association to host this workshop by bringing in DNR curly leaf experts Wendy Crowell and Dan Swanson, Doug Kingsley of DNR Fisheries and Will Yliniemi of the MN Extension Service to share their knowledge and expertise with residents. Neighboring lake associations from Hubbard, Wadena and Becker counties were invited to send members to attend this workshop because most people had never seen curly leaf. People not only saw slides and heard speakers, but got to see and touch curly leaf plants. Portage residents volunteered their pontoon boats to transport people to the curly leaf beds so they could see in person what curly leaf looked like growing in a lake, not just in pictures. Aqua-vu cameras were also on board so people could see what curly leaf looked like below the water surface and see how thick it grew. This workshop was very successful because people still comment about it. The "hands on" experience really worked!

Our biggest accomplishment has been successfully raising the money needed for curly leaf chemical treatment for three years in a row and seeing favorable treatment results. Many residents have contributed above and beyond the "suggested fair share" amount every year.

We hosted our HLRP visioning session in August 2005 at the lake in order to learn what lake concerns the residents had. Residents who did attend were very interested, concerned, and contributed so we feel it was successful.

1. Water Quality

Citizen volunteers from the Portage Lake Association have participated in the Minnesota Pollution Control Agency's (MPCA) Citizen Lake Monitoring Program (CLMP) since 1986. In recent years, Marilyn Peterson has been the volunteer participant in this program, recording secchi disc transparency – a measure of water clarity for Portage Lake.

On the MPCA's web-site link, "Lake Water Quality Database," secchi data are reported. The MPCA web site also provides a summary of average concentrations of total phosphorous (the primary nutrient found in lakes in this region) and chlorophyll *a* (the pigment in plants that photosynthesizes, and thus a good measure of plant concentration or "productivity").

One application of secchi disc transparency data is to convert the clarity measurements into a Carlson Trophic Status Index (TSI) score. The Carlson Trophic Status Index (TSI) is a tool used to summarize several measurements of water quality into one index value, which can be used to compare a lake to other lakes, or to historic/future data as a measure of degradation or improvement. In many ways, the index can be viewed as a measure of the potential for algal productivity. Since most people value lakes with low algae productivity, the lower the TSI value the healthier the lake. Specifically:

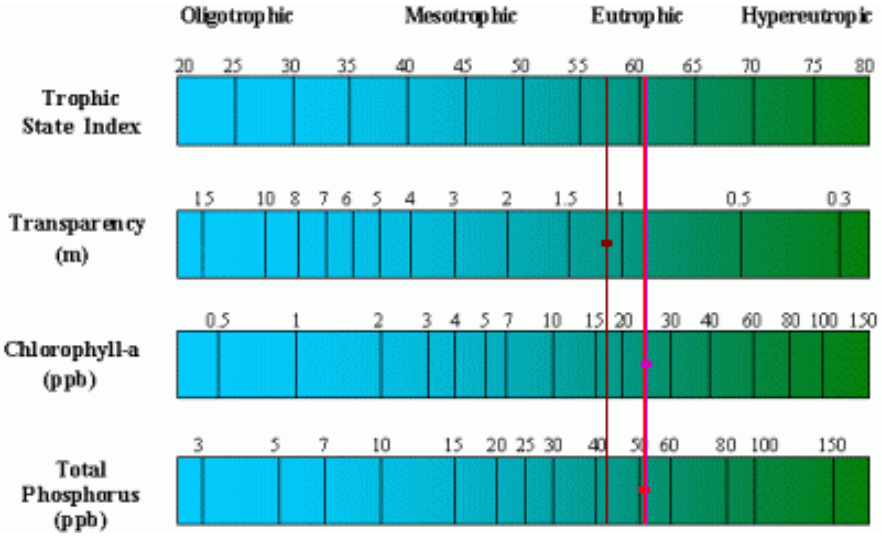
TSI Range	**Trophic Status**	**Characteristics**
0-40	Oligotrophic	Clean Lake
41-50	Mesotrophic	Temporary algae & aquatic plant problems
50-70	Eutrophic	Persistent algae & aquatic plant problems
Greater than 70	Hypereutrophic	Extreme algae & aquatic plant problems

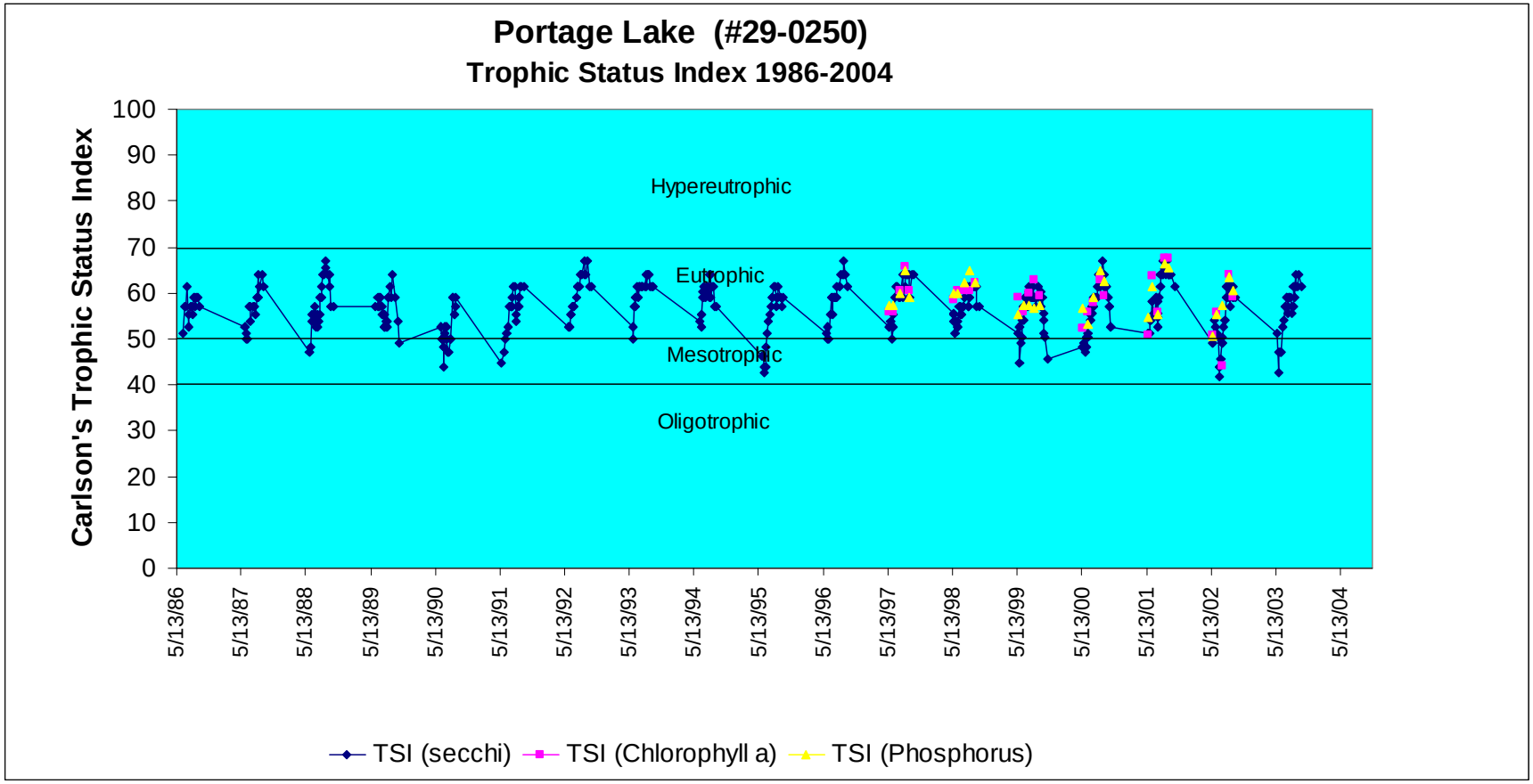
Based on the data provided on the MPCA website, an average concentration (or depth) for the key TSI parameters can be determined, and the associated TSI score calculated.

Year	Chlorophyll *a* (µg/L)	Total Phosphorus (µg/L)	Secchi Depth (feet)	Average TSI
1986	---	---	4.1	57.0
1987	---	---	4.3	51.0
1988	---	---	4.2	58.8
1989	---	---	4.1	57.4
1990	---	---	6.0	56.9
1991	---	---	4.3	54.3
1992	---	---	3.4	58.3
1993	---	---	3.3	60.2
1994	---	---	3.6	59.1
1995	---	---	5.4	54.4
1996	---	---	3.6	58.9
1997	20.8	48.2	3.4	59.8
1998	20.4	53.2	3.7	58.3
1999	19.4	38.6	3.9	56.6
2000	15.8	46.6	3.9	57.1
2001	26.6	53.6	3.2	60.3
2002	14.2	40.2	5.3	54.4
2003	18.0	44.6	4.4	55.2
2004	22.8	68.6	3.0	61.0
2005	31.4	62.2	3.1	

These data suggest that water quality in Portage Lake routinely exhibits eutrophic conditions (an average index between 50 and 70). The same conclusion is expressed in the graphic presented below which is copied from the MPCA's website summarizing water quality conditions on Portage Lake:

http://www.pca.state.mn.us/water/clmp/lkwqReadFull.cfm?lakeid=29-0250



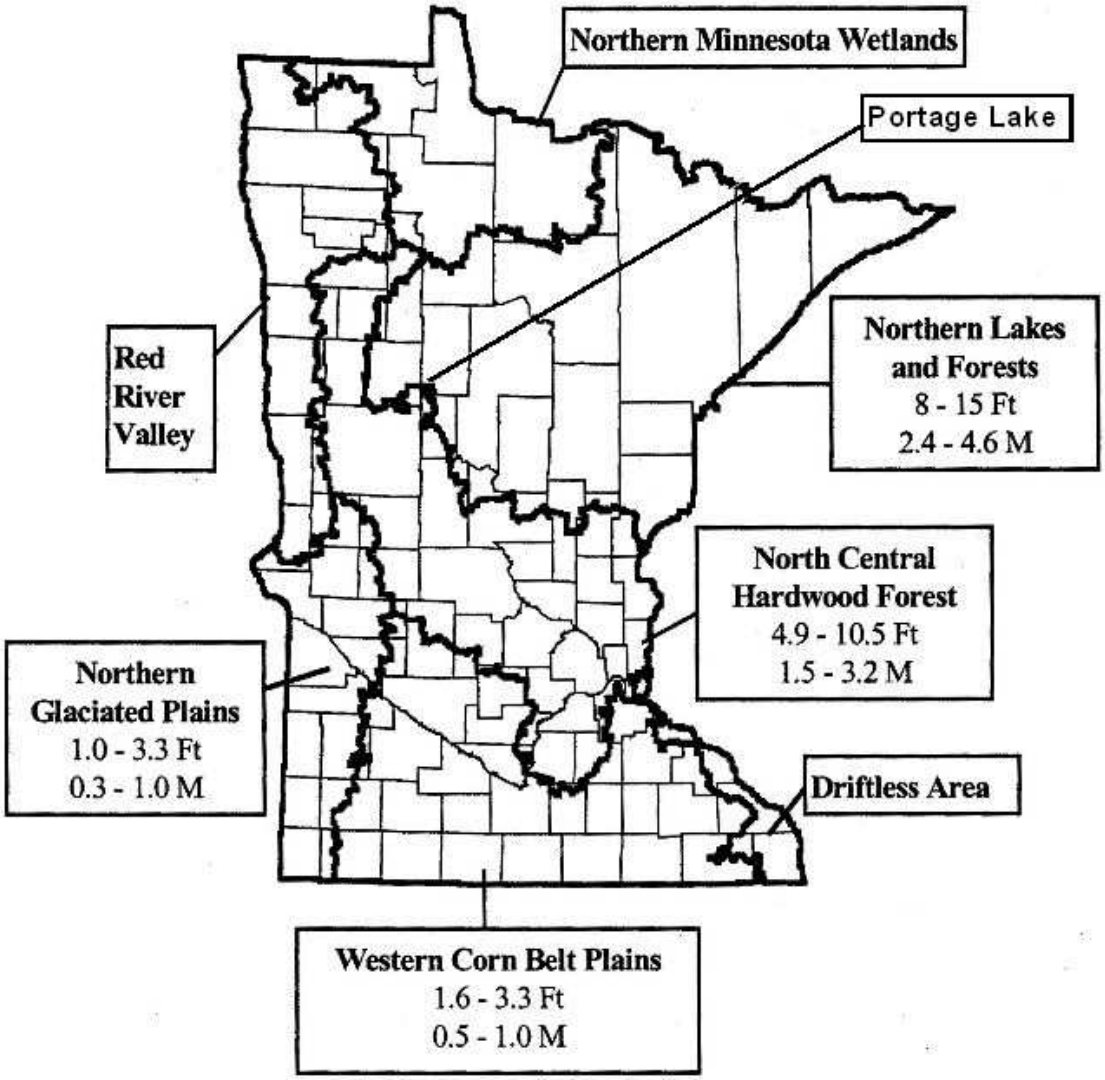


The chart above shows the long-term trends in Trophic Status Index values the years for which data are available. The variation observed within a single year reflects naturally occurring impacts of temperature, precipitation and water level; the important 'take home message" of this graph is that the data suggests a fairly stable range within the lower to mid-eutrophic conditions since data were first collected in 1986.

A second method of assessing water quality and determining whether your water body is the "best that it can be" is to compare it to other lakes of similar morphology, geology, and land uses. Listed below are ranges of common measures of water quality based on many years and locations of water quality. The tables below are adapted from the MN Pollution Control Agency "Environmental Data Access" database, and compare observed results in Portage to common water quality ranges for lakes within the Northern Lakes and Forests Eco-region.

Because Portage Lake lies in close vicinity to the North Central Hardwood Forest eco-region, its outward flow dammed up since 1937, being a shallow lake (most of the lake less than 15 feet in depth), and having slightly over 700 acres of land in agricultural use (including tree farming) within 1000 feet of the lake, many of its characteristics are that of the North Central Hardwood Forest eco-region. Eco-region boundaries do overlap in many cases.

Typical Summer-Mean Secchi Transparency.
Based on Interquartile Ranges for Reference Lakes



Average Summer Water Quality and Trophic Status Indicators

Parameter	Typical Range: Northern Lakes & Forests Eco-region (25th-75th Percentile)	Typical Range: North Central Hardwood Forests Eco-region (25th-75th Percentile)	Portage Lake Average ± Standard Deviation actual figure	Portage Lake 2005 Data
Total Phosphorus (µg/L)	14-27	23-50	47.5± 13.2 50.6 mean	32-105 range 62.2 mean
Chlorophyll *a* (µg/L) mean	4-10	5-22	20 ±9.5 21	31.4
Chlorophyll *a* (µg/L) maximum	< 15	7-37	57	57
Secchi disc (feet)	8-15	4.9-10.5	4.2 ± 1.7	3.12 ft.*
Total Kjeldahl Nitrogen (mg/L)	0.4 - 0.75	<0.60-1.2	ND	1.1**?
Nitrite + Nitrate Nitrogen (mg/L)	<0.01	<0.01	ND	?
Alkalinity (mg/L)	40 - 140	75-150	ND	ND
Color (Pt-Color units)	10 - 35	10-20	ND	ND
pH	7.2 - 8.3	8.6-8.8	ND	ND
Chloride (mg/L)	0.6 – 1.2	4-10	ND	ND
Total Suspended Solids (mg/L)	< 1 – 2	2-6	ND	ND
Total Suspended Inorganic Solids (mg/L)	< 1 – 2	1-2	ND	ND
Conductivity (µmhos/cm)	50 - 250	300-400	ND	ND
Total Nitrogen/Total Phosphorus ratio	25:1-35:1	25:1-35:1	ND	10.5:1**?

ND = No data

~NEW TABLE~ Portage secchi data includes 20 years of readings (1986-2005) in the MPCA Citizen Lake Monitoring Program (CLMP). Phosphorus and chlorophyll a data have been gathered over 9 years (1997-2005) in the water monitoring program through COLA.

The North Central Hardwood Forests eco-region has been added to the table above because Portage Lake has more characteristics of this region, even though its physical location is in the Northern Lakes and Forests Eco-region. Portage lies very close to the boundary of the two regions. (Refer to map of eco-regions above.) There is agricultural land use (698-706 acres) within 1000 ft. of the lake, and the lake has been dammed since 1937which may account for the difference in characteristics.

*3.12 ft. is the average secchi reading in the MPCA Citizen Lake Monitoring Program for the months, June-Sept. 2005, including 25 readings, several observations taken each month. If just the 5 water samples taken once a month, May-Sept. for water quality analysis by RMB Environmental Laboratories, Detroit Lakes, MN are used, the secchi average would be 4.45 ft. for 2005. Both secchi readings and monitoring for phosphorus and chlorophyll a will be continued.

**Only one water sample taken (9/18/2005) at our usual monitoring Site 201 has been analyzed for Nitrogen so the nitrogen data does not indicate a mean. It is just one reading taken when

water conditions were at their worst in Sept. 2005. A nitrogen phosphorus ratio of less than 12:1 could indicate nitrogen is a limiting factor for excessive plant and algae growth, rather than phosphorus.
More sampling and testing needs to be done to make a decision on which is a limiting factor.

A third application of these data is to compare phosphorus concentrations to the Minnesota Pollution Control Agency water quality criterion for swimming and other recreational contact. The Northern Lakes and Forests Ecoregion phosphorus criteria level of 30 micrograms per liter (µg/L) serves as the upper threshold for full-support for swimmable use. This concentration corresponds to Carlson's TSI values of 54 or lower.

For the Northern Lakes and Forests ecoregion, summer-mean total phosphorus concentrations above 35 µg/L were associated with nonsupport of aquatic recreational use. At concentrations above about 35 µg/L mild blooms occur over 50 percent of the summer, nuisance blooms (> 20 µg/L of chlorophyll *a*) about 15 percent of the summer.

Phosphorus concentrations above criteria levels would result in greater frequencies of nuisance algal blooms and increased frequencies of "impaired swimming."

Lake name	Mean Total Phosphorus mg/L	TSI (Secchi)	MPCA Swimming Criterion
Portage	50	61	Non Support

2. Fisheries:

Status of the Fishery (as of August 19, 2002) according to the MN Dept. of Natural Resources fisheries summary:

Portage Lake is located three miles north of Park Rapids in Hubbard County. Portage Lake is a shallow, 412 acre lake with a maximum depth of 17 feet. A county-owned public access is located on the south shore of the lake. Heavy algae blooms can occur on Portage Lake during the summer months. Due to the shallow depth, Portage Lake is subject to periodic "winter kill" events. Winter kill usually happens during winters when heavy snowfall accumulates on the ice and blocks sunlight from penetrating to the water, which in turn limits oxygen production through photosynthesis. At the same time, decaying aquatic vegetation on the lake bottom uses oxygen, causing oxygen levels in the lake to drop. Shallow lakes with heavy aquatic vegetation growth are more likely to winter kill than are deep water lakes. Gamefish such as largemouth bass and bluegill are less tolerant of low oxygen levels than are northern pike and bullheads. Portage Lake has suffered only partial winter kills (last winter kill during the winter of 1995-96), but a gamefish population has always remained. Walleye, northern pike, and panfish are the most common species anglers target when fishing Portage Lake.

The Minnesota Department of Natural Resources (DNR) has classified Minnesota's lakes into 43 different types based on physical and chemical characteristics. Portage Lake is in lake class 39. Other area lakes in this same classification include First and Fourth Crow Wing Lakes, Paine Lake, and Peysenski.

The 2002 survey showed walleye abundance (4.2 walleye/gillnet) was down from the previous survey in 1997, but still within the range "typical" for this lake class. The current management goal for Portage Lake is 5.0 walleye/gillnet. Past surveys have shown that since 1986 walleye numbers have been above the range "typical" for this lake class, while surveys prior to 1986 showed low to moderate walleye numbers. Anglers can expect to find good numbers of walleye in the 14-16 inch range. While a limited amount of natural reproduction is occurring in Portage, the walleye population is being maintained by a successful stocking program by the DNR. Portage Lake is stocked with walleye fingerlings during even numbered years. Yellow perch, an important forage species for walleye, were found in very low numbers. Yellow perch numbers were very high in the 1980's, but since the early 1990's have been at very low numbers. The 2002 survey showed walleye growth rates to be slow and variable when compared to other area lakes. Due to the low perch numbers, walleye are utilizing other forage species such as the abundant bullhead population found in Portage.

Northern pike abundance (9.8 pike/gillnet) was similar to past surveys and within the range "typical" for this lake class. Anglers will find that small "hammer handle" northern pike are common in Portage. Sampled northern pike had an average length and weight of 19.1 inches and 1.3 pounds. The northern pike population in Portage is limited by high recruitment of young pike and very slow growth rates.

Past surveys have shown that the panfish populations in Portage have gone through "boom and bust" periods, fluctuating with the periodic and partial winter kills. The 2002 survey showed bluegill numbers (14.2 bluegill/trapnet) were up in Portage. Bluegill abundance in past surveys has generally been below or at the low end of the range "typical" for this class. Good numbers of bluegill in the 6-7 inch size range were sampled. Black crappie were sampled in low numbers, similar to recent surveys. Anglers can expect to find crappie in the 9-10 inch size range.

Black and brown bullhead were sampled in very high numbers, well above the range "typical" for this lake class and well above past surveys. Yellow bullhead are also present in low numbers.

Other species sampled include moderate numbers of white sucker and low numbers of largemouth bass, pumpkinseed, and rock bass.

For lakes in the Hubbard County area the Area Fisheries Supervisor is Doug Kingsley, 301 South Grove Avenue, Park Rapids, MN 56470, (218) 732-4153, doug.kingsley@dnr.state.mn.us
Mr. Kingsley and his colleagues have prepared a fisheries management plan for Portage Lake which is attached as an appendix to this citizen-based Lake Management Plan, and which is included in full as appendix I (page 32). The fisheries goals of the DNR plan for Portage Lake are to:

- Maintain or improve the quality of fishing for walleye by attempting to provide a population with a mean catch per effort (CPE) index of at least 5 per gill net lift and a proportional stock density (PSD) of 30 to 60. Attempt to maintain a relative stock density (RSD) of preferred length (≥20") walleye of at least 15.
- Walleye abundance should be balanced with abundance of preferred forage, yellow perch, by attempting to maintain a perch population with an average CPE index of at least 3 per gill net lift.
- Maintain related fish communities
- Protect or enhance desirable aquatic and riparian habitats (water quality, aquatic and riparian vegetation, and shoreline substrate).

3. Aquatic Vegetation

An invaluable resource is Ed Feiler at the MN Department of Natural Resources, Regional Fisheries Office, 1601 Minnesota Drive, Brainerd, MN 56401, (218) 825-3001, ed.feiler@dnr.state.mn.us). Ed has been helping several HLRP graduates survey the existing distribution of aquatic plants, and where necessary to work on Aquatic Vegetation Management Plans. He is also an excellent source of critical review for Lake Management Plans!

A Survey of Aquatic Vegetation of Portage Lake in 2004 & 2005 conducted by Donna Perleberg, DNR Aquatic Plant Ecologist, Brainerd, MN is included in Appendix II*. Her survey is very informative, though she warned me that it is difficult to directly compare the two surveys as they were taken during different times of the year and growing season. She hopes to do a 2006 survey—perhaps twice, once during May and a second survey in August if funding, staff, and time permit. A brief summary of her survey is below.*

1. *21 native aquatic plants were identified in the lake, including 13 submerged species, 5 free-floating and 3 floating-leaved such as waterlilies. Several emergent species such as cattails were also identified.*
2. *Two non-native plants were identified: curly leaf pondweed and a pink waterlily (Nymphaea sp.)*
3. *A total of 303 sites were sampled across the entire lake. These sample sites were placed on a grid with a sample point occurring every 75 meters.*
4. *Vegetation was found to a maximum depth of 15 feet.*
5. *In August 2004, 56% of sample sites contained vegetation. Sites in water depths less than 11 feet were more likely to contain vegetation than in deeper water.*
   In May 2005, 49% of the sample sites contained vegetation---with expectation that the percent of vegetated sites would increase over the growing season.
6. *Common native plant species included:*
   Coontail: found in 41% of sites in Aug. 2004 and in 13% of sites in May 2005
   Chara or muskgrass: found in 29% of sites in Aug. 2004 and in 31% of sites in May 2005
   Canada waterweed or elodea: found in 15% of sites in Aug. 2004 and in 10% of sites in May 2005.
   Always keep in mind that the May survey probably underestimates actual abundance of native species because they are not fully grown at that time of year.
   All other native plant species were found in less that 10% of the sites.
7. *Curly leaf pondweed occurred in water depths from 3 feet to 15 feet and the average depth at which it was found was 9 feet.*
8. *Curly leaf pondweed was found at less than1% of the sites in Aug 2004 and in 7% of the sites in May 2005.*

4. Wildlife

The "Blue Book," *Developing a Lake Management Plan* notes that:

> "Minnesota's lakes are home to many species of wildlife. From our famous loons and bald Portages to muskrats, otters, and frogs, wildlife is an important part of our relationship with lakes. In fact, Minnesota's abundant wildlife can be attributed largely to our wealth of surface water. From small marshes to large lakes, these waters are essential to the survival of wildlife.
>
> The most important wildlife habitat begins at the shoreline. The more natural the shoreline, with trees, shrubs and herbaceous vegetation, the more likely that wildlife will be there. Just as important is the shallow water zone close to shore. Cattail, bulrush, and wild rice along the shoreline provide both feeding and nesting areas for wildlife. Loons, black terns and red-necked grebes are important Minnesota birds that are particularly affected by destruction of this vegetation. Underwater vegetation is also important to wildlife for many portions of their life cycle, including breeding and rearing of their young.

The primary agency charged with the management of Minnesota's wildlife is the Department of Natural Resources, Division of Fish and Wildlife, Wildlife Section. Rod Naplin is the Wildlife Manager, 603 1st St. W, Park Rapids, MN 56470 TX: (218) 732-8452, email: rob.naplin@dnr.state.mn.us. Katie Haws is the Nongame Wildlife Manager, 2115 Birchmont Beach Road NE, Bemidji, MN 56601, (218) 755-2976, Katie.haws@dnr.state.mn.us.

The wildlife on Portage Lake is quite diverse and includes many species of ducks, Canada Geese, swans and loons. No nests were confirmed for either loons or swans during 2005.

Portage Lake also is home to several fur bearing species such as otter, muskrat, and beaver. The DNR Hubbard County Biological survey has not yet been completed per Steve Caron, DNR Wildlife Manager in Bemidji.

Bears in several areas around the lake have been destructive at times, destroying hummingbird feeders and sunflower feeders. Sometimes bears have bent the metal poles hanging bird feeders to the ground in order to get the seeds or sugar water.

The most destructive wildlife continues to be beaver. Historically, beaver have occasionally altered the water levels in the lake by adding to the dam on the Portage River from which Portage Lake is formed or by plugging the culvert at the East end of the lake. As a result, lake level can rise rapidly causing docks to go underwater and lakeside lawns to flood.

Beavers have also caused property damage by cutting trees near the lakeshore. During the 1980's beaver were very persistent in building a dam in the culvert under HWY 71, replacing sticks almost as fast as residents could remove them. The DNR finally had to blow up this dam. Traffic was halted on HWY 71 during this undertaking as debris flew way up in the air.

The latest incident involves the cutting of timber and the subsequent exposure of that timber through the ice on the manmade channel running along HWY 71 from the Southeast end of the lake on property belonging to Mel Gulsvig. This channel is a favorite path for snowmobilers during the winter months. It is only about 15 feet wide and is spanned by 2

steel walk bridges under which there is little clearance for snowmobiles. The partially submerged logs become a hazard which potentially can cause damage to both snowmobiles and their riders, either through collision with the logs or the bridge should the snowmobiles lose control.

The property owner has tried unsuccessfully to remove debris and to protect many trees using metal collars, but the beaver continue to prevail. Finally the owner has received permission from the DNR to use a backhoe to remove the branches piled up under the bridges and to trap or shoot some of the beaver.

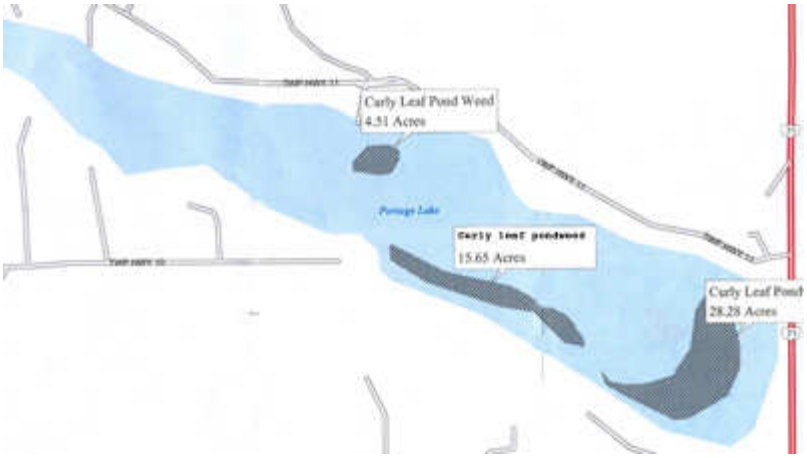
5. Invasive Species

Curly leaf pondweed probably entered Portage Lake sometime in the early to mid 1990's. Nobody knows for sure when or how. Neighboring lakes do not have curly leaf, but the Fish Hook Lake Association is concerned because Portage is connected to Fish Hook by a small river, (the Portage River) and Portage water flows into Fish Hook Lake. The only other lake with curly leaf in Hubbard County is Upper Twin. Lower Twin in Wadena County is connected to Upper Twin and Blueberry Lake by a river and all three lakes have curly leaf. A couple of older reports list Hinds Lake in Hubbard County and Round Lake east of Duck Lake as having curly leaf, but these reports have not been substantiated recently.

Portage was in trouble in 2002 when 48 acres of curly leaf mats formed on top of the water.
Portage Lake residents on the north shore, west of the Public Access have had curly leaf since the mid 90's, but it wasn't more than a nuisance along shore for a few residents till spring and early summer of 2002. Huge brown mats of curly leaf formed on the water surface in front of the southern and eastern shores. This was the first time residents had noticed it in the eastern half of the lake. People could not get their boats through it, making waterskiing and fishing difficult. Wind broke off plants and long rolls of curly leaf plants would wash up on all shores, depending on the wind direction. All this blown in vegetation required massive cleanup.

Knowing that Blueberry and the Twin Lakes had curly leaf too, I went on a photographic tour to see these lakes. I discovered that their curly leaf problems were worse than ours—larger, thicker, longer plants covering greater areas. Yet, residents on these lakes had done nothing other than harvesting and cutting paths through the curly leaf stands. We needed to do something to keep Portage Lake from getting worse, like these lakes. At the urging of residents, I contacted Professional Lake Management, a weed control firm we were using to treat some individual frontages for native weeds. In 2002, Portage residents were educated in the identification of curly leaf. We learned how it reproduced by turions and how the turions would float or blow into new areas to spread the weed. Professional Lake Management and aquatic herbicide applicator, Patrick Selter, are to be credited for taking the time to come and speak to us about curly leaf and possible solutions at our annual summer meeting in June after the surface mats on Portage had been surveyed.

On June 25, 2002, Professional Lake Management conducted a GPS survey of the major curly leaf mats and found a total of 48.44 acres of curly leaf. Location of the curly leaf mats on Portage is shown on the map below.



At a special meeting of Portage residents held in July 2002, we discussed harvesting pros and cons, chemical treatment pros and cons, tax districting for financing versus voluntary contributions. Harvesting was ruled out after talking with the experts as harvesting is almost like mowing a lawn. Curly leaf would grow back and still form turions. So much time would be used up, cutting, removing, and disposing of the vast amount of vegetation that it wouldn't be cost effective. ***We had several goals: 1. To eliminate the brown surface water mats of curly leaf—a visual goal. 2. To prevent turion formation, in order to decrease the amount of new plants, yet protect native weeds. 3. To quickly eliminate curly leaf vegetation causing navigational, water sports, and fishing problems. 4. To prevent massive phosphorus release from decaying curly leaf vegetation. Less curly leaf, less phosphorus release.***

Using a chemical treatment early in the season, at cool water temperatures of 55-60F, before turions formed or much native weed growth started, seemed the way to go. After much discussion and investigation, the lake association decided to mail out ballots to all property owners asking if they were in favor of chemically treating the curly leaf in 2003 in ***open water (over 150 ft. out from shore****) and if they would be willing to voluntarily financially support an abatement program which would require long term support.*

Out of 106 ballots sent out, 84 ballots were returned. 72 households voted yes or in favor of a chemical abatement program for open water—beyond 150 ft. out from shore. This was 67.9% of the 106 possible votes and 85.7% of the 84 returned ballots. The measure passed*! Since 2 of the 72 yes voters said they would not financially support the program, a decision was made to divide the proposed cost of treatment ($15,258) by 70 willing contributors for an individual "fair share" contribution of $218.* ***The treatment would cost $280/acre plus a DNR permit fee.*** *At this time (in 2003) the maximum or "cap" for multiple DNR permit fees for the whole lake was $200. The individual permit fee was $20, paid for by the association for association members only. This was an "incentive" to encourage people having curly leaf within 100 feet from shore to treat it. The association paid for actual treatment in open water only (150 ft. from shore and beyond). Residents were responsible for payment of any treatment done within 100 ft. from shore and to do this, each resident who wished to treat his lakeshore, needed a DNR treatment permit.* ***Cost of paying individual members' permit fees was factored in when calculating the total amount needed to be raised.***

2003-Funding & Treatment

Although the suggested contribution was $218, many residents contributed between $250-300. The Portage Lake Association raised $15,384 and spent $15,200 to treat 55 acres of curly leaf in the spring of 2003. 34 year round residents, 33 seasonal residents, a memorial, plus the Fish Hook Lake Association contributed. *It was also amazing that the association collected*

most of the money by January 1, 2003 because we wanted to know if we could raise the needed amount before signing a treatment contract as we were told to get our permit request in early. Portage residents had been warned by Doug Kingsley of Fisheries to expect a bumper crop of curly leaf in 2003, because snow cover during the winter of 2002-03 was very scarce. Less snow means more light comes through the ice, allowing more curly leaf to grow.

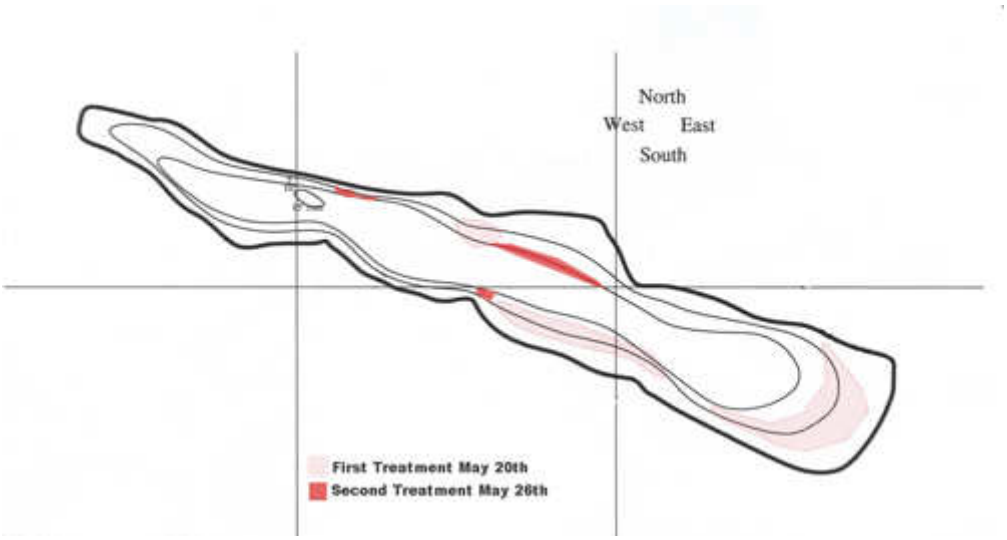
The original curly leaf beds consisting of 50 acres were treated on May 20,2003 with the aquatic herbicide, Aquathol K. On May 26, 2003 another 5 acres of curly leaf were treated in new locations along the north shore and near the Public Access, using a mixture of Aquathol K and Hydrothol 191 for faster knockdown*. Studies have shown no effects on fish or fry as the chemicals travel through their digestive system and do not accumulate in meaty tissues. I asked for and received several brochures showing results of various studies and how the rates of application varied according to water depth.**

Residents were made aware of the restrictions, via e-mails and distribution of fliers, for lake water use after treatment: 1. No swimming day of treatment; 2. No eating of fish from treated water for 3 days. Practice catch and release of fish. 3. No irrigation of lawns, gardens, or used for drinking for 2 weeks.

**List of brochures and studies concerning Aquathol and Hydrothol herbicides*

- *"Aquatic Habitat Management" by Elf Atochem, North America, Inc., 2000 Market Street, Philadelphia, PA 19103 www.cerexagri.com*
- *"Aquathol K & Aquathol Super K"(Aquatic herbicide for weed control) by Cerexagri, Inc. 630 Freedom Business Center, Suite 402, King of Prussia, PA 19406 www.cerexagri.com (Aquathol represents the inorganic endothall salts.)*
- *"Hydrothol 191" (Aquatic Herbicide and Algacide)by Cerexagri Inc., 2000 Market St. , Philadelphia, PA 19103 www.cerexagri.com 1-800-4538-6071*
  (Hydrothol represents the organic endothall salts.)
- *"Review of the Effects of Endothall Products on Aquatic Ecosystems" by Elf Atochem, North America, Inc., 2000 Market Street, Philadelphia, PA 19103*

Map of Curly Leaf Treatment Areas on Portage Lake During 2003



50 acres treated on May 20,2003-using Aquathol K
5 acres treated on May 26,2003-using Aquathol K & Hydrothol 191 mixture
Treatment was done in cool water temperatures of 55-60F, before turions were produced and also to protect native weeds, not yet up.
Method of Application of aquatic herbicides: *Water used to dilute the herbicides is pumped up from the lake through a large hose hanging over the boat. Water is mixed with the herbicide in a tank in the boat and pumped up to the boom in the front of the boat. The diluted herbicides are injected below the water surface through 4 hoses hanging from a boom in the front of the boat. Usually the herbicide concentration used is about 1-2 parts per million. The cost of the herbicides is about $60/gallon; about 3 gallons are used per acre.*
For personal lakeshore treatment and areas around and under docks and boatlifts, a hand spray nozzle was used, similar to a power washer.

Because less than 15% of the littoral area (410 acres) of the total acreage of Portage Lake (412 acres) was treated, a DNR vegetation management plan was not necessary*. 15% of 410 acres would allow 61.5 acres to be treated without a DNR vegetation management plan. Only 55 acres were treated in 2003.*
Refer to ***Professional Lake Management's Lake Management Report and Strategies found in Appendix IV prepared by Patrick Selter, aquatic herbicide applicator,*** *to learn the rationale for managing aquatic vegetation, management recommendations, goals of the Portage Lake Management Program and vegetation management options.*
Portage Lake is very fertile, warm (reaching over 80F sometimes during the summer) and shallow (usually less than 15 ft. deep) and has always produced much aquatic vegetation. Curly leaf has invaded areas previously occupied by wild rice, some reeds, and wild celery beds, but these will likely rebound or have started to come back already—not requiring reintroduction of native species. By August 2005, much wild celery has been observed in large areas of the lake.

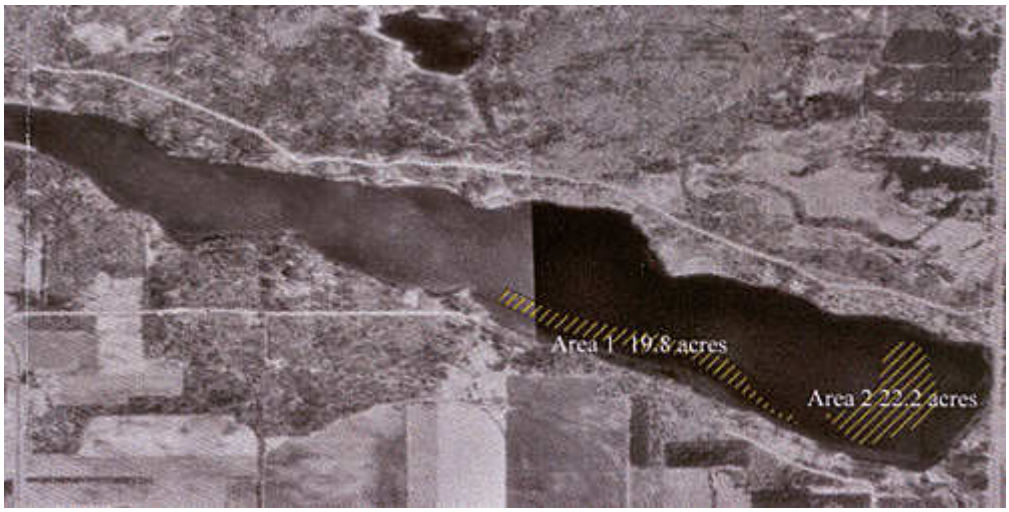
2004 Funding & Treatment

Portage residents were advised to be prepared to pay for a possible treatment of 50 acres of curly leaf in 2004. ***As in 2003, $218 was again the "suggested contribution" by 65-70 residents. A total amount of $15,470 was contributed by 34 year round residents, 30 seasonal residents, a memorial, plus the Fish Hook Lake Association, making treatment possible****.*

In 2004, our second year of treatment, only 20.5 acres of curly leaf were treated, leaving some money left over in the treatment fund for 2005. Rakes were dragged through the original curly leaf beds, but not enough plants were found to warrant treatment. Treatment was done in various small areas of the lake costing $6,370*. 2004 was also the first year with a $750 "cap" or the maximum total of DNR permit fees charged multiple parties on the whole lake. Individual permits were $35, paid for by the lake association for members only as a benefit of being a member of the association. 18 individuals signed up for individual shoreline chemical treatment. Cost of the permits was figured in the estimated total treatment cost, when calculating the suggested contribution per resident.*

2005 Funding & Treatment

After contributing $218/resident for two years, the suggested contribution amount dropped to $85/resident for the 2005 treatment as there was money left over from 2004. As a precaution, we were told, " Be prepared to treat 50 acres in 2005." Residents have contributed voluntarily—a suggested amount each year, though many contributed $100 or more in 2005. Yet, some residents have not contributed the full amount or anything at all. ***40 year round residents, 33 seasonal residents plus the Fish Hook Lake Association contributed $6,890 for the 2005 treatment to add to the leftover money ($9,472) including a little interest from 2004****. The Fish Hook Lake Association also contributed because Portage Lake empties into Fish Hook via the Portage River at the east end, and they are concerned curly leaf may spread to their lake. It was interesting that a couple of people who originally opposed treatment did contribute in 2005. Perhaps the price was right or they saw favorable results of the treatment. Looking back, total contributors varied from 64 to73 residents for each of the three years plus the Fish Hook Lake Association contributed all three years. In 2005, 23 individuals signed up for treatment of personal shorelines.*



2005 treatment areas

In 2005, our third year of treatment, a total of 45 acres was treated. Again, rakes were dragged through the original curly leaf beds finding enough plants scattered throughout the original beds, warranting treatment, plus a number of smaller areas costing us a total of $13,350*. Without treatment, these plants would have produced turions spreading curly leaf to new areas or to make each bed thicker, and increasing the "turion bank" as turions have several years of vitality. For a more complete report on the 2005 treatment, see* ***Professional Lake Management's 2005 Treatment Report in Appendix III.***

Looking Towards 2006 Funding & Treatment

Because the treatment fund shrank after treating 45 acres in 2005, the contribution amount for 2006 was raised to $150/resident with an estimated 65-70 contributors as we must be prepared to treat 45 acres again in 2006, costing $13,350. We have $3,093 left over in the savings account from 2005 so we must raise $10,257 for the 2006 treatment. *As in other years, the amount of curly leaf warranting treatment will be determined by a pretreatment survey of the lake. The amount of winter snow cover influences how much curly leaf comes up in the spring because its unique ability to grow under the ice during the winter gives it a head start over native weeds. Although curly leaf can grow in low light conditions, if it does get a lot of light, it grows rapidly. More snow, less light, less curly leaf!*

During 2003-2005, several homeowners have had their personal lakeshore treated for curly leaf and also for native weeds a few weeks later. Twenty-three residents signed up for personal frontage treatment in 2005. As an incentive to treat curly leaf, the $35 individual permit will again be paid for by the Portage Lake Association, for members only. Most of the residents who signed up for individual frontage treatment have received a permit to treat about 50 feet of shoreline X 100 ft. out from shore. Some years, Professional Lake Management has offered an incentive to get people to send their applications in early by a certain date and has subtracted a certain amount from their bills. The cost for individual frontage treatment in 2005 was $4.30/ft for 2 treatments or $2.50/ft for just one treatment.

Treatment accomplishments

Since 2003, and after three years of chemically treating curly leaf, the following things have been accomplished.

1. *No large curly leaf mats formed on the water surface since 2002.*
2. *Very little curly leaf vegetation blew in to shore, requiring clean up.*
3. *Fewer turions have been produced and floated to shore.*
4. *Navigation, fishing and water sports are easier.*
5. *No curly leaf has yet been found in Fish Hook Lake.*
6. *Hopefully, the "turion bank" in the sediment at the bottom of the lake has begun to decrease.*

However, I must repeat again; ***curly leaf can never be eradicated, just controlled.*** *Ed Feiler, MN DNR, Regional Fisheries Office, Brainerd, MN, during a September phone conversation, remarked, "If your program of curly leaf abatement is working for you, stick with it. Re-evaluate after five years to see if changes are needed."*

Donna Perleberg's (DNR aquatic plant ecologist, Ecological Services, Brainerd, MN) report on the Aquatic Vegetation Survey taken in Portage Lake during 2004-2005 found in Appendix II*, states that curly leaf pondweed was found in seven percent of the Portage lake sample sites during the May 2005 survey (Table1-p.9). It was scattered throughout about 2/3 of the lake and was not found in the western end. (Fig. 9-p. 11) Keep in mind that the 303 sampling sites were 75 meters apart, and all plant species were recorded within a one meter squared sample site at a pre-designated side of the boat so curly leaf may have been present in non sampled sites in the western end. Curly leaf was found in less than one percent of the sites in August 2004. This was after chemical treatment and curly leaf naturally dies back in late summer. Thirteen native submerged plant species were recorded in Portage Lake (Table1-p.9). The most common submerged native species are: coontail, muskgrass or chara, Canada waterweed or elodea, and*

bushy pondweed, in order of occurrence. ***The non-native species, curly leaf pondweed, was the fifth most common species****. Curly leaf was found in all water depths up to 15 feet, but was most common in water depths of seven to nine feet, where it reached its maximum frequency of 22 percent (Fig11-p.12).*

Portage Lake's Second Non-native or Exotic Species

The non-native or exotic, pink-flowered waterlily (Nymphaea sp.) pictured below, was found at scattered locations around the Portage Lake shoreline. The pink waterlily is a floating plant that is rooted in the lake bottom but has leaves floating on the water surface. While this species is not as easily transported as some invasives, it has the potential to out compete native plants and its population should continue to be monitored. Someone living on the northeast corner of the lake probably planted this non-native pink waterlily. Since many of these lilies sold for water gardens come from the southern states, other non-native organisms may be in the roots or soil. Wind and wave action and muskrats likely spread it through the culvert over to the pond by the dam where there is quite a cluster of the waterlilies and also to other locations along the lakeshore. The flowers are beautiful, but the plants could become a problem.

pink waterlily- Nymphaea sp.
Portage Lake's second exotic specie

A new sign will be placed at Portage Lake Public Access—informing people that Portage Lake has curly leaf and to watch for other exotic species.

Our invasive species focus group plans to have a sign designed and built by Portage sign painter, Ron Craig, to be placed at the Public Access in spring 2006. A portion of the first grant money received will be used to pay for making the sign. ***Estimated cost is about $75.*** *This sign will inform lake users that exotic curly leaf pondweed has infested Portage Lake and to be sure to remove all vegetation from boats, motors, and trailers before launching and reloading to prevent spread of exotic species to other lakes and rivers.*

A watertight, Plexiglas box (represented by the 3 black boxes in the photo) will be included on the sign in which to place a curly leaf pondweed identification sheet, along with Eurasian watermilfoil and zebra mussel identification cards to help people watch for these other exotic plants and animals. A northern watermilfoil card will also be included since Portage has this

beneficial native weed that is similar in appearance to Eurasian watermilfoil. This card should help lake users tell the difference between the two plants. ***A title of " Watch for These Exotic Species" will be above the 3 black boxes*** *in the watertight box on the sign.* ***The 3 exotic species to watch for will be: Curly leaf pondweed, Eurasian watermilfoil, and Zebra Mussels.***

A photo of the proposed sign is below.

Budget for Exotic Species Sign to be placed at public access
$75—cost of sign to be constructed and painted by Portage resident & sign painter, Ron Craig

Jed Anderson is the DNR's Aquatic Plant Manager for Hubbard County; 23070 North Lakeshore Drive, Glenwood, MN 56334, (320) 634-4573, jed.anderson@dnr.state.mn.us.

"Exotic" species -- organisms introduced into habitats where they are not native -- are severe would-wide agents of habitat alternation and degradation. A major cause of biological diversity loss throughout the world, they are considered "biological pollutants."

Introducing species accidentally or intentionally, from one habitat into another, is risky business. Freed from the predators, parasites, pathogens, and competitors that have kept their numbers in check, species introduced into new habitats often overrun their new home and crowd out native

species. In the presence of enough food and favorable environment, their numbers will explode. Once established, exotics rarely can be eliminated.

Most species introductions are the work of humans. Some introductions, such as carp and purple loosestrife, are intentional and do unexpected damage. But many exotic introductions are accidental. The species are carried in on animals, vehicles, ships, commercial goods, produce, and even clothing. Some exotic introductions are ecologically harmless and some are beneficial. But other exotic introductions are harmful to recreation and ecosystems. They have been caused the extinction of native species -- especially those of confined habitats such as islands and aquatic ecosystems.

The recent development of fast ocean freighters has greatly increased the risk of new exotics in the Great Lakes region. Ships take on ballast water in Europe for stability during the ocean crossing. This water is pumped out when the ships pick up their loads in Great Lakes ports. Because the ships make the crossing so much faster now, and harbors are often less polluted, more exotic species are likely to survive the journey and thrive in the new waters.

Many of the plants and animals described in this guide arrived in the Great Lakes this way. But they are now being spread throughout the continent's interior in and on boats and other recreational watercraft and equipment. This guide is designed to help water recreationalists recognize these exotics and help stop their further spread.

Eurasian watermilfoil (*Myriophyllum spicatum*)
Eurasian watermilfoil was accidentally introduced to North America from Europe. Spread westward into inland lakes primarily by boats and also by waterbirds, it reached Midwestern states between the 1950s and 1980s.

In nutrient-rich lakes it can form thick underwater stands of tangled stems and vast mats of vegetation at the water's surface. In shallow areas the plant can interfere with water recreation such as boating, fishing, and swimming. The plant's floating canopy can also crowd out important native water plants.

A key factor in the plant's success is its ability to reproduce through stem fragmentation and runners. A single segment of stem and leaves can take root and form a new colony. Fragments clinging to boats and trailers can spread the plant from lake to lake. The mechanical clearing of aquatic plants for beaches, docks, and landings creates thousands of new stem fragments. Removing native vegetation crates perfect habitat for invading Eurasian watermilfoil.

Eurasian watermilfoil has difficulty becoming established in lakes with well established populations of native plants. In some lakes the plant appears to coexist with native flora and has little impact on fish and other aquatic animals.

Likely means of spread: Milfoil may become entangled in boat propellers, or may attach to keeps and rudders of sailboats. Stems can become lodged among any watercraft apparatus or sports equipment that moves through the water, especially boat trailers.

Purple loosestrife (*Lythrum salicaria*)
Purple loosestrife is a wetland plant from Europe and Asia. It was introduced into the East Coast of North America in the 1800s. First spreading along roads, canals, and drainage ditches, then

later distributed as an ornamental, this exotic plant is in 40 states and all Canadian border provinces.

Purple loosestrife invades marches and lakeshores, replacing cattails and other wetland plants. The plant can form dense, impenetrable stands which are unsuitable as cover, food, or nesting sites for a wide range of native wetland animals including ducks, geese, rails, bitterns, muskrats, frogs, toads, and turtles. Many are rare and endangered wetland plants and animals are also at risk.

Purple loosestrife thrives on disturbed, moist soils, often invading after some type of construction activity. Eradicating an established stand is difficult because of an enormous number of seeds in the soil. One adult plant can disperse 2 million seeds annually. The plant is able to re-sprout from roots and broken stems that fall to the ground or into the water.

A major reason for purple loosestrife's expansion is a lack of effective predators in North America. Several European insects that only attack purple loosestrife are being tested as a possible long-term biological control of purple loosestrife in North America.

Likely means of spread: Seeds escape from gardens and nurseries into wetlands, lakes, and rivers. Once in aquatic system, moving water and wetland animals easily spreads the seeds.

Other Midwestern Aquatic Exotics

Curly-leaf pondweed (*Potamogeton crispus*) is an exotic plant that forms surface mats that interfere with aquatic recreation. The plant usually drops to the lake bottom by early July. Curly-leaf pondweed was the most severe nuisance aquatic plant in the Midwest until Eurasian watermilfoil appeared. It was accidentally introduced along with the common carp.

Flowering rush (*Botumus umbellatus*) is a perennial plant form Europe and Asia that was introduced in the Midwest as an ornamental plant. It grows in shallow areas of lakes as an emergent, and as a submersed form in water up to 10 feet deep. Its dense stands crowd out native species like bulrush. The emergent form has pink, umbellate-shaped flowers, and is 3 feet tall with triangular-shaped stems.

Round goby (*Neogobius melanostomus*) is a bottom-dwelling fish, native to Eastern Europe, that entered the eastern Great Lakes in ballast water. They can spawn several times per year, grow to about 10 inches, are aggressive, and compete with native bottom-dwellers like sculpins and log perch. They are expected to be harmful to Great Lakes and inland fisheries.

Rusty crayfish (*Orconectes rusticus*) are native to streams in the Ohio, Kentucky, and Tennessee region. Spread by anglers who use them as bait, rusty crayfish are prolific and can severely reduce lake and stream vegetation, depriving native fish and their prey of cover and food. They also reduce native crayfish populations.

White perch (*Morone americana*) are native to Atlantic coastal regions and invaded the Great Lakes through the Erie and Welland canals. Prolific competitors of native fish species, white perch have the potential to cause declines of Great Lakes walleye populations

6. Land Use and zoning

The water quality of a lake or river is ultimately a reflection of the land uses within its watershed. While the specific impacts to a lake from various land uses vary as a function of local soils, topography, vegetation, precipitation, and other factors, it is ultimately the land uses which citizens have the most control over through prudent zoning.

Many zoning regulations are based upon the Shoreland Management Act and/or the Minnesota Department of Natural Resources (DNR) classification of a given lake. The DNR has classified all lakes within Minnesota as General Development (GD), Recreational Development (RD), or Natural Environmental (NE) lakes, and assigned a unique identification number to the lake for ease of reference. Counties in turn have used these classifications as a tool to establish minimum lot area (width and setbacks) that is intended to protect and preserve the character reflected in the classification.

On any shoreland the permissible density and setbacks for virtually all new uses are determined by the lake or river classification standards established by the Department of Natural Resources. Portage Lake (#29-0250) is a **Recreational Development** Lake.

Natural Environment lakes are generally small, often shallow lakes with limited capacities for assimilating the impacts of development and recreational use. They often have adjacent lands with substantial constraints for development such as high water tables, exposed bedrock, and unsuitable soils. These lakes, particularly in rural areas, usually do not have much existing development or recreational use. In Hubbard County, an NE management district is "established to preserve and enhance high quality waters by protecting them from pollution and to protect shorelands of waters which are unsuitable for development; to maintain a low density of development; and to maintain high standards of quality for permitted development."

Recreational Development lakes are generally medium-sized lakes of varying depths and shapes with a variety of landform, soil, and ground water situations on the lands around them. They often are characterized by moderate levels of recreational use and existing development. Development consists mainly of seasonal and year-round residences and recreationally-oriented commercial uses. Many of these lakes have capacities for accommodating additional development and use. In Hubbard County the RD management district is established to "managed proposed development treasonable consistent with existing development and use; to provide for the beneficial use of public waters by the general public, as well as the riparian owners; to provide for multiplicity of lake uses; and to protect areas unsuitable for residential and commercial uses from development."

General Development lakes are generally large, deep lakes or lakes of varying sizes and depths with high levels and mixes of existing development. These lakes often are extensively used for recreation and, except for the very large lakes, are heavily developed around the shore. Second and third tiers of development are fairly common. The larger examples in this class can accommodate additional development and use. Hubbard County's Shoreland Ordinance notes that "the GD management district is established to provide minimum regulations in areas presently developed as high density, multiple use areas; and to provide guidance for future growth of commercial and industrial establishments which require locations on protected waters."

The Hubbard County's zoning standards for respective lake classifications are:

Standards:	General Development	Recreational Development - Unsewered	Recreational Development - Sewered	Natural Environment
Structure setback from OHW	75 ft	100 ft	100 ft	150 ft
Sewage soil treatment system setback from OHW	150 ft	150 ft	150 ft	150 ft
Maximum Impervious Coverage	25 percent	25 percent	25 percent	25 percent
Structure and ISTS setback from top of bluff	30 ft	30 ft	30 ft	30 ft
Minimum Lot Size: Single				
Riparian Lots	20,000 sq ft	40,000 sq ft	30,000 sq ft	80,000 sq ft
Non-riparian lots	40,000 sq ft	80,000 sq ft	same	120,000 sq ft
Minimum Lot Size: Duplex				
Riparian Lots	40,000 sq ft	80,000 sq ft	60,000 sq ft	120,000 sq ft
Non-riparian lots	80,000 sq ft	120,000 sq ft	same	160,000 sq ft
Minimum Lot Size: Triplex				
Riparian Lots	60,000 sq ft	120,000 sq ft	90,000 sq ft	160,000 sq ft
Non-riparian lots	120,000 sq ft	160,000 sq ft	same	240,000 sq ft
Lot Width – Single				
Riparian Lots	100 ft	150 ft	100 ft	200 ft
Non-riparian lots	100 ft	150 ft	100ft	200 ft
Lot Width-Duplex				
Riparian Lots	180 ft	225 ft	150 ft	300 ft
Non-riparian lots	265 ft	265 ft	150 ft	400 ft
Side Yard Setback	10 ft	10 ft	10 ft	10 ft

Clearly any local municipal jurisdiction may have additional (and usually more restrictive) standards as well.

Most lakes have numerous properties that are "grand fathered," or developed prior to the establishment of these restrictions. In general, these pre-existing uses are allowed to remain unless they are identified as a threat to human health or environment.

Details on shoreland standards and restrictions and answers to "frequently asked questions" regarding best management practices, resources of education or information, and additional assistance are provided through the Hubbard County Environmental Services/Planning & Zoning Department. Eric Buitenwerf, Environmental Services Officer, Hubbard County, 301 Court Avenue, Park Rapids, MN 56470-1483, Phone: (218) 732-2356, Fax: (218) 732-7993 Email: ebuitenwerf@co.hubbard.mn.us

Todd Township Land Use and Zoning includes the following restrictions and allowances for Portage Lake:

Todd Township has classified Portage Lake as a Recreational development lake. There are two areas... on one the west end of the lake, the other on the middle north side, neither touching the lake itself…that are zoned for public parks. The east river area is classified as a Tributary River

Segment. Most of the area around the lake is zoned for residential use. The south east side, from south of 210 St. to south of the south east point of the lake, includes agricultural use.

Certain types of uses are restricted to conditional use permits, including bed & breakfasts, campgrounds, day care centers greater than 14 children, most dwelling greater than single-family dwellings. Prohibited activities include automotive repair, sales, and salvage; contractor shops; mining; peat mining; outside storage/display of goods greater than two months; small engine repair, welding shop.

All Buildings must be setback 35 feet from road right-of-ways of all public roads.

Continuing activities which have a strong negative visual or auditory impact on adjacent or nearby neighboring properties are prohibited.

Accessory buildings not attached to the principal building shall not be less than fifteen feet from any other separate structure on the same lot. No more than two accessory buildings are allowed of which only one may be a garage for the storing of vehicles, including boats.

All dwellings must be at least 18 feet wide and on a foundation. There must be at least ten feet between a manufactured home and the side lot line of abutting property.

Permits are required for signs. There are regulations for signage for homes and home businesses. Illuminated signs are not allowed. There are also regulations regarding temporary signs, such as for banners, real estate, and portable signs. Garage sale signs are only permitted on private property.

Regarding occupation at one's home: no exterior display of equipment, materials or goods associated with the home occupation is allowed; vehicles with advertising on them are limited to two cars, trucks or vans; no persons, other than persons residing on the premises, shall be allowed as employees of the home occupation; and no more than twenty percent of the living space of the dwelling shall be used for the home occupation.

Driveway permits are required for all new driveways connecting to Township roads.

Phosphorus fertilizers are prohibited unless soil testing indicates "phosphorus poor" soils.

Agricultural activities are permitted in rural residential areas, but must not be expanded or intensified in these areas.

Animals and birds other than household pets may be kept providing that the lot area is a minimum of two acres per animal and the use does not constitute a public nuisance.

Sewage treatment systems must comply with Hubbard County Individual Sewage Treatment System Ordinance and the MPCA Minnesota Rules, chapter 7080.

Hubbard County Land Use Plan includes the following regarding Portage Lake: *(The Hubbard County Land Use Plan has been approved but no ordinance has been passed for it yet.)*

Hubbard County exceeds state standards regarding Individual Sewage Treatment Systems by imposing a minimum vertical separation of four feet between the septic system drainfield and seasonal high water table, as opposed to the three foot required separation. The county also mandates a fifty-foot setback from wells.

The County plans to control development density in the area just north of Portage Lake to maintain the rural character by limiting lot sizes to a 2.5 to 3 acre minimum, by implementing strong cluster development incentives, and by implementing limitations on the locations of commercial development.

The closest commercial development center to Portage Lake will be south of the south easternmost tip of Portage Lake.

A local wetland conservation ordinance regulates the draining or filling of wetland areas. Wetlands identified on the National Wetland Inventory are located on the west end of Portage Lake and in two areas north of the lake.

***Trends** around Portage Lake have been from seasonal cabins to year round occupancy. South of Portage Lake has been and remains agricultural. Also there has been a trend of larger tracts of land being platted and developed.*

The area around Fisherman's Drive (around the middle south side of the lake) was agricultural land and has recently been developed for residential lots.

Russ Johnsrud, District Conservationist, USDA Natural Resources Conservation Service, Park Rapids, MN calculated the acreage in agricultural use (including tree farms) within the 1000 foot buffer zone from the lake. The acreage was calculated two different ways because two different sources listed different acreages for Portage Lake. The acreage in agricultural use was determined to be 707.3 acres using one source and 698.1 acres using the other source.

The west side of the lake is classified as wetland, is undeveloped, but is privately owned.

*Most **homes** around the lake are consistent with modern standards. Although there are older homes, there are no clusters of sub-standard homes.*

*All development around the lake is residential with single-family homes so **wastewater treatment** around the lake consists solely of individual septic systems. Laird Hensel, Hubbard County Environmental Services, Park Rapids, MN determined there were 15 non-compliant septic systems within 1000 feet of Portage Lake, out of 179 parcels counted. Non-compliant septic system locations are: 2 on the east, 3 on the south, 9 on the north, and 1 to the east of HWY 71. Owners must comply by June 1, 2006. Hensel stated that some of these septic systems may have become compliant already, but the inspector may not have submitted the paperwork yet.*

*Regarding **natural features** around the lake: most lots around the lake have moderately steep slopes to the lake. The more recently developed areas have maintained a natural vegetative buffer. The soil type varies. Though the area around Portage Lake is considered a sandplain, there are clay pockets close to the lake. Storm water discharges need to be examined.*

***Member Involvement**: members of the Lake Association have reviewed requests for variances. An attempt will be made to establish more routine attention to plat and variance requests, to keep up with changes in local ordinances and to systematically share this information with lake residents.*

Usually the Hubbard County Environmental Services Office in Park Rapids, MN sends a Notice of Public Hearing for Variance Appeal to the Portage Lake Association President and makes an effort to notify all the property owners within 500 feet of the premises concerned. There is also a notation, "To ensure that everyone has been notified, please share this notice with any interested property owners that may have not been notified by mail." Notices usually are mailed out about a week to 10 days before the lot viewal date or hearing date.

Possible Lake Water Contaminants Information Sheet

Prepared by Zoning and Land Use Committee of Portage Lake Management Plan

Two types of pollution sources:

Point source pollution comes from a specific point like a pipe.

Nonpoint source pollution comes from improper land management, such as overfertilization, erosion, and sedimentation. Though the amount from one source may be small, the cumulative amounts from various sources can result in water quality problems.

***Septic systems:** Upgrades have been mandated, but proper maintenance is also important.*

Do not use additives in the septic system. They can cause sludge to increase in volume or float and result in being flushed into the drain field. Some additives may also be carcinogens.

Have the septic tank pumped once a year to remove solids and scum. Although it may seem costly, it can save replacing the entire system.

Excessive water use is the most common cause of septic failure. Reduce water use with low-volume toilets, low-flow showerheads, washing only full loads of clothes and full dishwasher loads.

Other ways to keep septic system in good shape: use toilet tissue that breaks up easily when wet; don't use the toilet as a waste basket; eliminate the use of garbage disposals (causes rapid buildup of solids and can clog pipes and soil pores); do not put coffee grounds down the drain; dispose of hazardous waste through the twice a year collection at the recycling center; use liquid laundry detergent; minimize use of household chemicals and cleaners, which can harm bacterial action in the septic system.

***Phosphorus:** Fertilizers for lawns and gardens containing phosphorus (banned for lawn fertilizer unless a soil test confirms the need for phosphorus.) Some Minnesota soils are naturally high in phosphorus.*

Phosphorus has been eliminated from laundry detergents but not from dishwashing detergents. Look for low-phosphate dishwasher detergents. Minnesota allows 11% phosphorus by weight, but you can get brands with less. (Electrosol tabs have 8.7%, Electrosol powder nor more than 6.1%, Electrosol Gel 4.5%, Cascade powder has 7.5% or less, Cascade Gel 4.4%, and Palmolive gel 2%. Phosphate free products include Bi-O-Kleen, Seventh Generation, Ecover or

look on www.wholepeople.com) (Chlorine bleaches stains but breaks down into by-products such as chloroform and dioxin, which are considered to be some of the most toxic, hardest-to-remove pollutants.)

Water softeners have traditionally used phosphorus. EDTA is a common substitute for phosphorus, which degrades more slowly in the environment. Alternatives to phosphorus and EDTA, which soften water without harmful impact are sodium carbonate, sodium bicarbonate, sodium citrate, and sodium silicate.

Organic matter: *a natural vegetative buffer near the shoreline reduces the amount of leaves and other organic matter entering the lake. If there is no buffer, leaves should be raked and disposed of away from the lake. Vegetation that is floating near the shoreline should be removed.*

Nitrogen/nitrates: *Lawns do not need as much fertilizer as many people use. Fertilizing late in the season is the best time for encouraging healthy root system. Simply leaving grass clippings (not bagging clippings) provides adequate nitrogen. On sandy soils, split nitrogen applications to half the recommended amount and apply twice. Or use slow release fertilizers or natural organic nitrogen sources.*

Shoreline buffer: *Surface water needs buffer/filter strips along the shoreline to reduce and slow runoff and to filter the runoff. Preservation and restoration of native vegetation on shorelines and throughout the watershed provides protection against runoff and good filtering of runoff. The best filter is mature woodland with full ground-level, mid-story, and upper-story growth. Full-height native prairie grasses along the shore are more effective as filters than short mowed lawns. Diversity in plant and animal communities is beneficial for the lake as well as providing healthier, more disease resistant habitat. The width of the filter strip also affects filtering capability.*

Soil erosion: *contains nutrients that promote excessive algae and bacteria in lakes. Natural vegetation will prevent erosion. A berm along the shoreline, a slight hump in the ground near and parallel to the shoreline, serves as an obstacle to rapid and direct runoff into the lake.*

Toxic chemicals: *Besides limiting household chemicals or replacing with biodegradable products, gasoline and motor oils should be handled so spills are prevented and disposed of properly.*

Storm water runoff: *Natural storm water runoff can usually be handled by the natural landscape. Increased runoff can be caused by buildings, roads, driveways, and patios. These changes add "hard" surfaces that are impermeable to water. Concentrations of storm water can cause flooding, erosion, and loss of valuable water, which otherwise would infiltrate and recharge groundwater systems. Building sizes and hard surfaces should be minimized to help reduce the amount of runoff. Rain gardens are a way to handle runoff from hard surfaces to improve filtering into the groundwater. Lawns are poor filters.*

Awareness: *Be aware of shoreline regulations. Before initiating any projects, contact the local conservation officer. Some restrictions (which may require permits or restrictions) are beach sand blankets, rock riprap, seasonal docks, permanent docks, and boat ramps.*

In June 2005, the Portage Lake Association was invited to participate in the Northwest Minnesota Foundation's Healthy Lakes and Rivers Partnership program along with seven other lake and river associations in Hubbard County.

Each lake association held an inclusive community planning/visioning session designed to identify key community concerns, assets, opportunities and priorities. An outcome of this meeting was to send out a questionnaire to all Portage Lake residents to help prioritize goals and guide "Plan of Action".

The following questions in this questionnaire will direct the committee in developing and prioritizing the "Plan of Action".

1. Do you have a well? How deep is your well?

a. When was the last time you had the well water tested?

b. What were the test results?

2. When was the last time your septic system was inspected?

a. If you have a holding tank, how often is it pumped out?

3. Do you have a spring on your property?

a. If so, approximately where is it located on your property?

b. Has this spring been tested for chemicals?

c. When? Who did the testing?

d. Do you have the test results? If yes, would you include the results when you return the questionnaire?

4. If you fertilize on your property, do you use 0% phosphorus fertilizer?

a. How often do you fertilize?

5. Do you have any old garbage dumps on your property that you know of? (bed springs, appliances, lumber)

If so, where is it located on your property?

6. *Is there a buffer zone (native vegetation) between your buildings and the shoreline that is left undisturbed?*

   If so, how wide is it?

7. *Is there an area on your property where storm runoff takes place?*

   a. *Where are these areas? (Gutters, drive ways, open patios or other hard surfaces)?*
   b. *What, if anything, have you done to slow the runoff?*

8. *Do you have any problems with erosion?*

9. *Do you use an automatic dishwasher?*

   Do you use phosphorus free detergent?

10. *Do you remove floating vegetation near the shoreline?*
    (blown in vegetation, broken off vegetation not living plants in the water)

11. *Are you interested in the most current lake landscaping and shore land management practices?*

    a. *What information would you like access to?*

    b. *Would you attend a seminar addressing lake landscaping and shoreland management?*

Plan of Action Questionnaire Summary

Committee members
Carol Ashley
Patti Clark
Joanne Knoblich
Linda Rogers
Jim Westra

Presented June 24, 2006

Introduction:

In June 2005, the Portage Lake Association was invited to participate in the Northwest Minnesota Foundation's Healthy Lakes and Rivers Partnership program along with seven other lake and river associations in Hubbard County.

Each lake association held an inclusive community planning/visioning session designed to identify key community concerns, assets, opportunities and priorities. An outcome of this meeting was to send out a questionnaire to all Portage Lake residents to help prioritize goals and guide "Plan of Action".

A total of 103 questionnaires were sent to the residents/property owners of Portage Lake with 46 being returned and included included in the results.

Review of questions and recommendations gathered by the survey:

Forty four of the forty six responding had a well on their property. Four of the respondents had no well but also did not have a permanent structure on the property. Of those who had wells: 13 were between (0 and 50 feet); 9 were between (51 and 100 feet); and 4 were greater than 100 feet deep. 21 property owners were unable to provide well depth information.

Thirty one well owners have had their well tested within the past ten years. One had decaying organic material in their well which was treated with chlorine, but they did not use it for drinking purposes. One well owner had coliform present (1mg/100ml), treated and checked out ok. Several well owners reported high iron content in the well water. Several reported low nitrate levels in their wells. Many had their wells tested but could only report that they passed the safety test. Very few of the people who had their wells tested were able to report the exact results. Only one person was able to send in a copy of what was tested in their well.

Thirty seven home owners have had their septic system inspected within the pas six years. Seven new systems have been installed since 2001. Three responders did not have a septic system on their property.

Out of 46 responding only one did not have their septic system in compliance with the new standards. This property owner was having that corrected this year.

Fifteen of those responding indicated that they have their holding tank pumping at least once every five years or less.

Three people reported that there was a natural spring on their property. One indicated springs along the lake shore, one on the west end of their property and the third indicated one by their boathouse near the shore line.

Nine property owners indicated that they fertilize their lawns but do not use fertilizer with phosphorus. One of the property owners used spikes around their trees and garden plants. These same property owners fertilized from twice a year to as little as once during the last eighteen years.

Only one property owner indicated that there was an old dump ground on their property. It was located back in the trees away from the lake.

All of the property owners who responded to the questionnaire indicated that they left a buffer zone between their buildings and the shore of the lake. The buffer zone widths range from as little as three to four feet up to their entire lot. This consisted of doing nothing with that area to minimum maintenance of it.

Runoff was not a major problem for the vast majority of the responding property owners with a few exceptions. Driveways and near buildings were the current problem areas for them with concern of how to use landscaping as a method of curtailing the water movement.

Most of the properties around Portage Lake have steep access to the lake from their building sites and would like information on what native plants to use and how to acquire those plants locally.

Those responding to the questionnaire who had and used their dishwasher used detergent that had very low or no Phosphorus content.

All but one property owner who responded indicated that they remove any floating vegetation from the shore line and carry it away from the water's edge.

Twenty six of the forty six property owners who responded indicated they would be interested in seminars that would present the most current landscaping and shore line management practices.

The types of information requested ranged from literature on the subjects to where to get the appropriate plants for the buffer zone. There were also questions on how to; improve the clarity of the lake, shore line plants, how to stop the loss of shore line to general information.

Twenty two of those who responded to the questionnaire indicated that they would attend a seminar that provide the information about improving their buffer zones, appropriate plant use, runoff reduction practices, how to increase lake clarity and general information about current requirements and regulations.

Several specific comments were:

1. Landscaping ideas, rain garden grants available and most effective types of plants for a steep bank.

2. If there are any rules or regulations pertaining to animal kennels where there is runoff into the lake or possible leeching into the ground water.

3. Our property has steep bank to the lake that is mowed. I would like some natural vegetation that would hold soil, survive hot dry times and not obstruct the view of the lake.

4. Whether there are regulations in place for mitigations during home construction to minimize soil runoff.

   What types of fertilizers are being applied through the irrigation units on the south side of the lake?

   What are the amounts of estimated chemical drift through aerial application on nearby farm fields?

Summary:

The questionnaire has indicated that we have a well versed and educated group of property owners who take a great deal of pride in their life at the lake. They show concern about the quality of their shore line, their wells, their septic systems and the conditions of the lake water.

It also reinforces the initial concepts outlined in the Management Plan for Portage Lake that the property owners want to do the right things to enjoy the quality of life that is represented in a healthy lake.

7. Managing water surface use conflicts

The goal of lake management is to ensure that the lake can continue to provide the benefits that attract homeowners and users. However, conflicts among uses arise almost invariably. Successful resolution of conflicts lies in the ability of the users to work collaboratively to arrive at acceptable compromises.

The primary agency responsible for managing surface water use conflicts is the Minnesota Department of Natural Resources, Bureau of Information and Education. The Boat and Water Safety Section within the Bureau oversees surface water use and is in charge of administering the Water Surface Use Management (WSUM) program. The goal of this program is to enhance the recreation use, safety and enjoyment of the water surfaces in Minnesota and to preserve these water resources in a way that reflects the state's concern for the protection of its natural resources.

Within this context, any governmental unit may formulate, amend or delete controls for water surface use by adopting an ordinance. Submit the ordinance for approval by the MDNR Boat and Water Safety Coordinator by calling 1 (800) 766-6000 or (651) 296-3336. To gain approval the ordinance must:

- Where practical and feasible accommodate all compatible recreational uses;
- Minimize adverse impacts on natural resources

- Minimize conflicts between users in a way that provides for maximum use, safety and enjoyment, and
- Conform to the standards set in WSUM Rules.

From a practical standpoint, any community considering this action should also consult with their local law enforcement agency (that will largely enforce the local ordinance) to ensure that any restrictions can be effectively enforced.

An alternative or complementary approach is to encourage education and a "community standard" of acceptable behavior. Annual distribution of state standards for hours of operation, setbacks from shorelands, loon nests, swimming areas, and other hazards or sensitive areas helps create "peer pressure" to minimize the types of behavior that tend to lead to the most conflicts.

Portage Lake waters are used for boating, fishing, hunting and swimming, all of which produce few if any conflicts and or damage to shoreline or property. The lake is used largely for fishing and there are few powerboats, jet skies, and water skiers/tubers.

In the winter there are between 9 and 20 fish houses on a normal year. The lake is used as part of a local snowmobile trail and there are seldom any conflicts between snowmobilers and ice fisherman.

The Hubbard County Sheriff was unable to provide any information relating to vandalism or citations given and could only provide anecdotal information regarding damage to outhouses and garbage cans at the public access as well as damage to mail boxes in that area. Greg Hensel of Hubbard County Parks and Recreation was able to confirm the replacement of the outhouses and garbage cans and they no longer provide picnic tables because of vandalism.

8. Public water access

Research has shown that Minnesotans rely heavily upon public access sites to access lakes and rivers. A 1988 boater survey conducted by the University of Minnesota showed that three-fourths of the state's boat owners launch a boat at a public water access site at least once a year. In addition, over 80 percent of boat owners report using public water access sites for recreation activities other than boating.

The primary agency responsible for pubic water accesses in Minnesota is the Minnesota Department of Natural Resources, Trails and Waterways Unit. They are responsible for the acquisition, development and management of public water access sites. The DNR either manages them as individual units or enters into cooperative agreements with county, state, and federal agencies, as well as local units of government such as townships and municipalities. The DNR's efforts to establish and manage public water access sites are guided by Minnesota Statutes and established written DNR policy. The goal of the public water access program is free and adequate public access to all of Minnesota's lake and river resources consistent with recreational demand and resource capabilities to provide recreation opportunities.

The Minnesota Department of Natural Resources (DNR) Fisheries Survey notes that there is one public access on Portage Lake:

Ownership Type Description

County	Earthen	A county-owned access with an earth ramp is located on the south shore.

Summary of Visioning/Planning Session

Who? What? Where? When?

The Portage Lake visioning session was facilitated by Will Yliniemi on Saturday, August 27, 2005, at the Gulsvig Picnic Shelter, 20446 Forest Park Drive, located at the southeast end of the lake. Refreshments were enjoyed by everyone before the meeting and during breaks. Many nice door prizes, donated by Portage Lake business people and residents, were given away. We were fortunate to receive enough non-lead fishing lures donated by the Minnesota Office of Environmental Assistance, in charge of lead tackle exchange, so everyone who attended received a free non-lead fishing lure.

Twenty-nine lake residents attended, including six grant committee members. Year round residents (26) outnumbered the seasonal residents (3). The seasonal residents who did attend also come up here for occasional winter weekends. Geographically, 15 residents from the south side of the lake attended, 12 from the north side and 2 from the east. All people were lake association members, except one, a long time resident who does not own lakeshore, but her dad does. After the meeting, she signed up as a new association member.

Most people who attended were retired, older residents. Two were over 80 years old, several in their 70's, and the rest were in the 50-70 age group. Only one was under 50. Most attending residents, who are still working, live in the Twin Cities area. The younger, locally employed residents with children did not attend. Several residents had other plans, company coming, construction projects, or work.

Residents not attending the visioning session could read about it in the Portage Lake 2005 Summer Newsletter and also view the Portage Lake Draft Lake Management Plan posted on the association's website: http://webpages.charter.net/paul-peterson/portage

***Assets**:*

As the Portage Lake Assoc. president, I utilized many of the assets of our membership when I requested donations for door prizes. I knew people who were handcrafters, Portage business people who could donate certain prizes, and who could possibly provide a place for the meeting. The lake association was pleased with the location at the Gulsvig Picnic Shelter and we were invited to use this facility again in the future. Mel Gulsvig, we discovered, is an excellent source of Portage Lake History. Resident Patti Clark obtained additional information through the historical society, Jerry Fuller, and William Karlson, a former resident of Portage. We have in our membership many talented people: a forester, a retired college chemistry professor, a retired college botany professor, a professional musician, a retired coronary care nurse, a photographer, a candle maker, a basket maker, several other handcrafters, woodworkers, accomplished fishermen and hunters, gardeners and many with computer skills. Transplanted from Nebraska, residents Lloyd & Linda Harless have donated printing, ink and paper for printing the Portage Lake Newsletter every year. Resident Paul Peterson built the Portage Lake Website in 2004 and maintains it free of charge. Resident Mike Hartung, art teacher and artist, donates a print of his every year as a door prize at the annual association picnic meeting.

Welcome:

Portage Lake Association president, Marilyn Peterson, welcomed everyone and explained that we were meeting at the edge of a tree plantation of 40,000 Norway pines planted in 1981 by the owners, the Gulsvig family. The purpose of the grant committee's gathering the lake's residents together was to gain input from the residents regarding concerns they had about the lake, in order to obtain funding to benefit or improve the health of Portage Lake.

History:

Marilyn Peterson presented the History of Portage Lake and also the History of the Portage Lake Association. Both are printed in the Introduction/History on page 6.

Status of the Lake Message

Charlie Pieper reported that the lake is eutrophic with a high phosphorus average of 50, a high chlorophyll a average of 21.4 covering 8 yrs. of data. Portage has a low average Secchi disk reading of 4 feet over 19 years of data and the TSI average is 59. This is a concern as the MPCA supports swimming only if the phosphorus average is 35 or below. Although the MPCA tells us that Portage has no definite trend either up or down in transparency, based on twenty years of Secchi disk data, perhaps we should be doing more to improve Portage lake water quality. Two feet transparency and a phosphorus reading of over 80 in August are not good.

Charlie also walked among the residents with his picture board showing and explaining the grant committee's "likes" as well as concerns about the lake.

Identifying and Choosing Focus Areas:

Each group of people seated at tables was instructed to vote for 3 focus areas which they were most concerned about. ***The eight focus areas to choose from were: water quality, fisheries management, aquatic vegetation, wildlife, exotic species, land use and zoning, managing water surface use conflicts, and public access.*** *The three areas receiving the most votes at each table were reported and recorded by Will Yliniemi on the "flip charts". Next, everyone was instructed to vote 3 times for 3 top focus areas that we could realistically do something about and could have some sign of success with measurable results.* ***Residents chose these three focus areas: 1. Water Quality, 2. Land Use and Zoning, 3. Exotic Species.*** *Next, each person was asked to choose one focus area of particular interest to them and move to its assigned table. Each focus group specified actions to be taken in the next 90 days, writing down what people or organizations needed to be contacted and why and what achievements we could point to if successful.*

The ***Water Quality*** *focus group (in an attempt to locate phosphorus sources)would:*

1. *Identify springs for sampling within 60 days.*
2. *Obtain GIS maps & will coordinate with Land Use & Zoning group.*
3. *Obtain Nitrogen/Phosphorus ratio within 30 days.*

The ***Land Use & Zoning*** *focus group would:*

1. *Contact Steve Pachel for GIS mapping on land use/vegetation & underground watershed maps.*
2. *Contact Planning & Zoning Commission for existing zoning regulations for Hubbard county & Todd township.*
3. *Contact MPCA for info on possible contaminants.*
4. *Contact Soil & Water Conservation Office for maps and building code info.*

*The **Exotic Species** focus group would:*

1. *Contact Professional Lake Management (Patrick Selter) to determine how much money will be needed for 2006 curly leaf pondweed abatement.(within 30 days)*
2. *Determine "suggested contribution" per contributor for 2006 curly leaf treatment, by dividing total amount needed by approximate number of contributors. (within 30 days) Contributions due by April 1, 2006.*
3. *Inform in the newsletter that residents are required to remove cut vegetation from the lake in order to prevent release of phosphorus nutrients. (within 30 days)*
4. *Contact DNR (Donna Perleberg) about results of native plant survey done before and after curly leaf treatment in 2004 & 2005 on Portage Lake. (within 30 days)*
5. *Contact Ron Craig (sign painter) about drawing up plans for exotic species sign to be placed at the Public Access in May, 2006. (within 30 days)*

Visioning Session was adjourned about 4:15 pm and the remaining door prizes were given away.

Prioritized Goals and Action Plan

The final chapter of our lake management plan summarizes the conclusions and priority action we have chosen to work on at this time. Specifically, for each priority action we have down our best to answer (for each goal presented):

- What are the criteria for measuring success (measured as outcomes, not effort)?
- What is our schedule for implementation (What needs to happen in the next 30 days, 60 days, one-year out)?
- Who is responsible for implementation or measurement (name names!)?
- What is the budget for this action/goal?
- Is this an on going action/goal, or a one-time effort? If on-going will we require additional funds for full implementation?

Exotic/Invasive Species Priority Actions

1.Determine estimated total cost of 2006 curly leaf chemical treatment up to 45 acres by contacting Professional Lake Mgmnt.(completed by 9-30-05 by Marilyn Peterson) Outcome: Same as in 2005-estimated total cost: $13,350---Money will be raised by resident contributions.

2.Determine "suggested contribution" amount per resident.(completed by 9-30-05 by Marilyn Peterson) Outcome: "Suggested contribution" amount was calculated to be $150/for each of approx. 65-70 contributors to raise an additional $10,257 to add to leftover cash from 2005. Contribution will be due by April 1, 2006. Residents have come through in the past so it is expected that the amount needed for curly leaf abatement will be raised.

3.Notify residents concerning amount of contribution needed.(to be completed by January 31,2006—mailing to lake residents by Marilyn Peterson)Estimated mailing cost is $35.10 due to postage increase. Ongoing—this notification is done early each treatment year.

4.Treatment of curly leaf in late May or early June 2006 by Professional Lake Management. Outcome: All residents will be measuring success by noticing if there is better appearance of lake, easier navigation, fishing and water sports as well as no surface water mats and less turion production. Abatement program is ongoing, long term, and will require additional funds in the future.

5.Plan and design an exotic species sign to be placed at the public access. Outcome: completed sign wording, scene, design, colors and size by 9-30-05 by Carol Allison, Ron Craig, and Marilyn Peterson—estimated cost --$75

6.Obtain Doug Kingsley's approval of sign contents for accuracy and purpose. (Outcome: approval obtained Oct., 2005 by Marilyn Peterson)

7.Obtain Greg Hensel's (Hubbard County Parks & Recreation) approval of proposed sign and discuss placement at public access by May 2006 by the Portage Lake Improvement Assoc. (Outcome : Hensel approved the sign idea-would like to see photo-contacted by Marilyn Peterson in Nov. 2005) Sign will be successful if lake users are educated about invasive/exotic species and curly leaf is not spread from Portage Lake.

Budget for the Exotic/Invasive Species Focus Group
$ 75.00-- exotic/invasive species sign—1 time effort
$ 35.10--postage for notifying residents of "suggested contribution" amount
$533.00--donation to the curly leaf treatment savings account
$643.10--Total

The curly leaf abatement program will be in its 4th year in 2006 as it is an ongoing program and will likely continue for several years. In the future, it is hoped that the amount of treatment needed every year will gradually decrease and perhaps not even treat for a year or so if the "turion bank" is diminished. We will need additional funds in the future and would like to take advantage of any possible available grants, including "match grants" we would be eligible for, in order to give residents some financial relief.

Budget for the Land Use & Zoning Focus Group
$ 18.75 Initial research material
175.00 Information & questionnaire mailing
70.00 Seminar informational mailing
100.00 Seminar incidentals
260.00 Well Testing
$623.75 Total

Budget for the Water Quality Focus Group
$350---Lab work costs for objectives #1 & 2
$350—Materials, workshop & other associated costs for objective #3
$700---Total

Portage Lake Improvement Association Budget
$2400.00----Base Grant
- 300.00----Cost of visioning session facilitator
$2100.00---to be split between the 3 focus groups

$ 643.10---Exotic/Invasive species focus group
$ 623.75---Land Use & Zoning focus group
$ 700.00---Water Quality focus group
$1966.85---Total budgeted
Extra $133 would be available for additional expenses incurred by any of the 3 groups.

Initiative Foundation
Grantee Action Plan and Evaluation Form

Grantee Organization:	*Portage Lake Improvement Association*
Project Coordinator:	*Ken Keller and Jerry Knoblich*
Phone/Email:	*(Ken: weluge@northlc.com 218-732-8645) (Jerry: jjknob@unitelc.com 218-732-7687)*
Project Title:	*Water Quality Improvement*

Summary of Project (1 or 2 sentences)	*Test and identify sources of phosphorus in the lake water. Research, develop, and implement a plan to improve water quality.*

*Note: At least one objective should answer the question, "So What?" What difference will your project make in your community, in changed lives, in new skills, knowledge, behaviors, or attitudes? Can you measure that change?

***Objective #1** (must be measurable results, not just effort)

Determine water quality of Portage Lake.

Action Plan- What steps need to be done to achieve this objective**:**

Action	**By When**	**Person Responsible**
1.*Take water samples from lake.*	*9-30-05 & ongoing*	*Jerry Knoblich* *Marilyn Peterson* *Ken Keller*
2.*Continue Secchi disk readings.*	*ongoing*	*Marilyn Peterson* *Jerry Knoblich*
3.*Obtain nitrogen/phosphorus ratio to establish if phosphorus is the limiting agent.*	*1 yr.*	*Jerry Knoblich*
4.		

Expected Result:

Results: *Please note: the remaining questions are to be filled out at mid term (if grant exceeds $5,000) and at end of grant period for evaluation purposes.

Objective #1 Mid-point Result (fill out at mid-point ONLY if grant exceeds $5,000)

Objective #1 Actual Result (to be completed at end of grant period for final report)

	Initiative Foundation use only

*** Objective #_2__** (must be measurable results, not just effort)

Identify sources that contribute to high phosphorus levels in lake.

Action Plan-What steps need to be done to achieve this objective:

Action	**By When**	**Person Responsible**
1. *Water testing of springs and other known sources of water input to lake*	*9-30-05 & 1 yr.*	*Jerry Knoblich* *Ken Keller*
2. *Obtain and evaluate land use maps for possible sources of phosphorus.*	*1 yr.*	*Jerry Knoblich* *Ken Keller*
3. *Sample different areas of lake for phosphorus levels.*	*1 yr.*	*J. Knoblich* *K. Keller*
4. *Try to get Portage L. into Tim James, MPCA, NSF, Sedimentation Core Sampling Study to determine historical phosphorus level of lake. This historical info will be helpful in establishing the future lake phosphorus target goal.*	*Time table of study*	*J. Knoblich* *Tim James*

Action Plan-What steps need to be done to achieve this objective:	**5.** *Check if all septic systems around lake are now in compliance and identify those not compliant.*	*1 yr.*	*Ken Keller*
	6. *Obtain ortho (soluble) phosphate level in lake.*	*1 yr.*	*Jerry Knoblich*
Expected Result:			

Results: *Please note: the remaining questions are to be filled out at mid term (if grant exceeds $5,000) and at end of grant period for evaluation purposes.

Objective #___ **Mid-point Result** (fill out at mid-point ONLY if grant exceeds $5,000)		
Objective #___ **Actual Result** (to be completed at end of grant period for final report)		Initiative Foundation Use Only

***Please copy this page for any additional objectives you have that pertain to this project**.

*** Objective #_3__** (must be measurable results, not just effort)

Identify ways to reduce high phosphorus levels in the lake.

Action Plan-What steps need to be done to achieve this objective:

Action	By When	Person Responsible
1. *Try to reduce phosphorus levels by education in use of buffer strips.*	*2 yrs.*	*Portage Lake Association*
2. *Try to reduce phosphorus levels by education in use of phosphorus fertilizers.*	*2 yrs.*	*Portage Lake Association*
3. *Apply for a grant to reduce phosphorus levels in lake. 1. Hogen Process 2. Research CWTI Refer to Appendix V-Clear Water Technologies, Inc.* http://cwtiusa.com/how/	*1 yr.*	*Jerry Knoblich Ken Keller Sue Keller*
4.		

Expected Result:

Results: *Please note: the remaining questions are to be filled out at mid term (if grant exceeds $5,000) and at end of grant period for evaluation purposes.

Objective #___ Mid-point Result (fill out at mid-point ONLY if grant exceeds $5,000)

Objective #___ Actual Result (to be completed at end of grant period for final report)

Initiative Foundation Use Only

***Please copy this page for any additional objectives you have that pertain to this project**.

Initiative Foundation
Grantee Action Plan and Evaluation Form

Grantee Organization:	*Portage Lake Improvement Association*
Project Coordinator:	*Marilyn Peterson*
Phone/Email:	*218-732-4760 peteport@charter.net*
Project Title:	*Exotic Species (curly leaf pondweed) Abatement*

Summary of Project (1 or 2 sentences)	*Continue curly leaf abatement program for the 4th year in 2006. Place exotic species sign at Public Access to educate lake users.*

*Note: At least one objective should answer the question, "So What?" What difference will your project make in your community, in changed lives, in new skills, knowledge, behaviors, or attitudes? Can you measure that change?

***Objective #1** (must be measurable results, not just effort)

Plan for 2006 chemical treatment of 45 acres of curly leaf on Portage Lake.

Action Plan- What steps need to be done to achieve this objective**:**

Action	**By When**	**Person Responsible**
1. *Obtain cost estimate from Professional Lake Management for treating up to 45 acres of curly leaf in 2006. (same as 2005-$13,350)*	*9-30-05 Done*	*Marilyn Peterson*
2.*Raise $10,257 as we have $3,093 left over from 2005 for the 2006 treatment.*	*4-1-06*	*Portage Lake Assn.*
3.*Calculate individual contribution amount by estimating 65-70 contributors. ($150)*	*9-30-05 Done*	*Marilyn Peterson*
4. *Notify residents by mail about suggested contribution of $150. (postage cost-$35.10)* ***Done- Actual postage cost= $39.00***	*Jan. 2006*	*Marilyn Peterson*

Expected Result: *Raising enough money to treat up to 45 acres of curly leaf in 2006.*

Results: *Please note: the remaining questions are to be filled out at mid term (if grant exceeds $5,000) and at end of grant period for evaluation purposes.

Objective #1 Mid-point Result (fill out at mid-point ONLY if grant exceeds $5,000)

Objective #1 Actual Result (to be completed at end of

	Initiative Foundation use only

grant period for final report)

*** Objective #_2__** (must be measurable results, not just effort)

Prevent formation of curly leaf surface mats and turion formation, making navigation, water recreation, and fishing easier on Portage Lake.

Action Plan-What steps need to be done to achieve this objective:

Action	By When	Person Responsible
1.*Treat up to 45 acres of curly leaf at water temp. of 55-60F to protect native weeds and before turion formation.*	*May or June 2006* *Long term project over several years*	*Professional Lake Mgmnt*
2. *Develop a vegetation management plan for Portage Lake.*	***Summer 2006***	***Larry & Julie Fleisher, Marilyn Peterson***
3.		

Expected Result:

Successful treatment—preventing turion production and further spread of curly leaf. Curly leaf surface mats will be prevented. Navigation, fishing and water sports will be easier. A great decrease of curly leaf vegetation blown up on shoreline, needing cleanup and hauling away.

Vegetation management plan will be written and approved.

Results: *Please note: the remaining questions are to be filled out at mid term (if grant exceeds $5,000) and at end of grant period for evaluation purposes.

Objective #___

Mid-point Result (fill out at mid-point ONLY if grant exceeds $5,000)

Objective #___ **Actual Result** (to be completed at end of grant period for final report)		Initiative Foundation Use Only

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*** Objective #__3_** (must be measurable results, not just effort)	*Plan exotic species sign to be placed at public access to educate lake users that Portage Lake has the exotic species curly leaf pondweed and to prevent its spread to other lakes. "Watch for exotic species" ID cards for Zebra Mussels, Eurasian watermilfoil, and curly leaf pondweed ID sheet will be included in watertight box on sign.*

Action Plan-What steps need to be done to achieve this objective:

Action	By When	Person Responsible
1. *Design scene & wording for sign.*	*30 days Done*	*Carol Allison* *Marilyn Peterson*
2. *Contact sign painter, Ron Craig, concerning cost of sign, color, size, & materials needed.* ($75)	*30 days Done*	*Carol Allison* *Marilyn Peterson*
3. *Obtain approval of sign plans by Doug Kingsley, DNR Fisheries.*	*30 days Done*	*Marilyn Peterson*
4. *Obtain county approval (Greg Hensel) of sign plans and arrange placement of sign in 2006.*	*Approval obtained-Nov 2005 Placement of sign-May 2006*	*Marilyn Peterson* *Portage L. Assn.*

Expected Result:	*Sign placed at public access informing lake users that Portage Lake has an exotic species, making people aware we have it and to take care not to spread it.*

Results: *Please note: the remaining questions are to be filled out at mid term (if grant exceeds $5,000) and at end of grant period for evaluation purposes.

Objective #___ **Mid-point Result** (fill out at mid-point <u>ONLY</u> if grant exceeds $5,000)	

Objective #___ **Actual Result** (to be completed at end of grant period for final report)		Initiative Foundation Use Only

***Please copy this page for any additional objectives you have that pertain to this project**.

Initiative Foundation
Grantee Action Plan and Evaluation Form

Grantee Organization:	*Portage Lake Improvement Association*
Project Coordinator:	*Jim Westra & Carol Ashley*
Phone/Email:	*Jim: 218-732-6660 jostensphotoofidaho@yahoo.com* *Carol: 218-732-9607 ashleyc@uitelc.com*
Project Title:	*Land Use & Zoning*

Summary of Project (1 or 2 sentences)	*Identify potential lake contaminants & educate land owners about them. Investigate possibility of lake contamination from agricultural practices.*

*Note: At least one objective should answer the question, "So What?" What difference will your project make in your community, in changed lives, in new skills, knowledge, behaviors, or attitudes? Can you measure that change?

***Objective #1** (must be measurable results, not just effort)

Identify potential lake contaminants and identify possible sources.

Action Plan- What steps need to be done to achieve this objective**:**

Action	By When	Person Responsible
1.*Research potential lake contaminants via DNR, MPCA, University research, Extension service, etc. (Done)*	*12-30-2005*	*Carol Ashley*
2.*Prepare written copy of contaminants and possible sources (Done)*	*1-28-2006*	*Carol Ashley*
3. *Determine number of non-compliant septic systems according to current standards. (Done)*	**2/28/06**	***Lynda Rogers***
4.		

Expected Result:	Develop a base of knowledge for pursuing possible local sources of lake contamination and for educating land owners around the lake.

Results: *Please note: the remaining questions are to be filled out at mid term (if grant exceeds $5,000) and at end of grant period for evaluation purposes.

Objective #1	

Mid-point Result (fill out at mid-point ONLY if grant exceeds $5,000)		
Objective #1 Actual Result (to be completed at end of grant period for final report)		Initiative Foundation use only

*** Objective #__2_** (must be measurable results, not just effort)

Educating land owners around the lake of potential lake contaminants.

Action Plan- What steps need to be done to achieve this objective:

Action	By When	Person Responsible
1. *Develop questionnaire for lake residents to elicit information regarding potential sources of contamination and to identify interest in having more information for dealing with specific problems, such as erosion control on slopes and storm drainage management.* *(Done)*	*2-10-2006*	*Jim Westra & committee*
2. *Mail questionnaire and information of potential lake contaminants.* ***Done***	*Spring Lake Association Newsletter (Feb-March) 2006*	*Carol Ashley via Marilyn Peterson*
3.*Follow up on questionnaire at June meeting of Portage L. Association.*	*June 2006*	*Patti Clark*
4. *Determine interest in seminar.* ***5.*** *Plan seminar if interest is shown.* ***6.*** *Hold seminar.*	*July 2006* *Oct. 2006* *March 2007*	*Joanne Knoblich* *Carol Ashley* *Jim Westra*

Expected Result: *Greater knowledge and interest among residents as shown by filling out questionnaires and by communicating with residents one-to-one at the June 2006 annual meeting.*

Results: *Please note: the remaining questions are to be filled out at mid term (if grant exceeds $5,000) and at end of grant period for evaluation purposes.

Objective #___

Mid-point Result (fill out at mid-point ONLY if grant exceeds

$5,000)		
Objective #___ Actual Result (to be completed at end of grant period for final report)		Initiative Foundation Use Only

***Please copy this page for any additional objectives you have that pertain to this project**.

*** Objective #_3__** (must be measurable results, not just effort)	*Investigate agricultural use of land on the south side of Portage Lake as indicated by the Todd Township Zoning Plan.*

Action Plan-What steps need to be done to achieve this objective:

Action	By When	Person Responsible
1.*Check with Todd township to determine if agricultural use is allowed on the south side of the lake as indicated by their map of land use.* ***(Done)***	*Jan. 31, 2006*	*Lynda Rogers*
2. *Request no additional or new agricultural use within1000 feet of lake except as indicated for residential use. (dependent on findings)*	*Township meeting as indicated*	*Lynda Rogers & Patti Clark*
3.		
4.		

Expected Result:	*Limit agricultural use within 1000 feet of lakeshore.*

Results: *Please note: the remaining questions are to be filled out at mid term (if grant exceeds $5,000) and at end of grant period for evaluation purposes.

Objective #___ Mid-point Result (fill out at mid-point ONLY if grant exceeds $5,000)		
Objective #___ Actual Result (to be completed at end of grant period for final report)		Initiative Foundation Use Only

***Please copy this page for any additional objectives you have that pertain to this project**.

*** Objective #_*4*__** (must be measurable results, not just effort)	*Investigate possible contamination from agricultural practices.*

Action Plan-What steps need to be done to achieve this objective:

Action	**By When**	**Person Responsible**
1. *Determine groundwater flow by locating available information.*	*2-28- 2006*	*Jim Westra*
2. *Spot testing of wells on the south side of lake.*	*August 2006*	*Jim Westra*
3. *Compile and report information.*	*Sept. 2006*	*Jim Westra*
4.		

Expected Result:	*Determine if there is sufficient reason to pursue investigation of contamination of groundwater by agricultural practices.*

Results: *Please note: the remaining questions are to be filled out at mid term (if grant exceeds $5,000) and at end of grant period for evaluation purposes.

Objective #___ Mid-point Result (fill out at mid-point <u>ONLY</u> if grant exceeds $5,000)		
Objective #___ Actual Result (to be completed at end of grant period for final report)		Initiative Foundation Use Only

***Please copy this page for any additional objectives you have that pertain to this project**.

Initiative Foundation
Grantee Action Plan and Evaluation Form

Grantee Organization:	
Project Coordinator:	
Phone/Email:	
Project Title:	

Summary of Project (1 or 2 sentences)	

*Note: At least one objective should answer the question, "So What?" What difference will your project make in your community, in changed lives, in new skills, knowledge, behaviors, or attitudes? Can you measure that change?

***Objective #1** (must be measurable results, not just effort)

Action Plan- What steps need to be done to achieve this objective**:**

Action	**By When**	**Person Responsible**
1.		
2.		
3.		
4.		

Expected Result:	

Results: *Please note: the remaining questions are to be filled out at mid term (if grant exceeds $5,000) and at end of grant period for evaluation purposes.

Objective #1 Mid-point Result (fill out at mid-point ONLY if grant exceeds $5,000)		
Objective #1 Actual Result (to be completed at end of grant period for final report)		Initiative Foundation use only

*** Objective #___** (must be measurable results, not just effort)	

Action Plan-What steps need to be done to achieve this objective:	**Action**	**By When**	**Person Responsible**
	1.		
	2.		
	3.		
	4.		

Expected Result:	

Results: *Please note: the remaining questions are to be filled out at mid term (if grant exceeds $5,000) and at end of grant period for evaluation purposes.

Objective #___ Mid-point Result (fill out at mid-point ONLY if grant exceeds $5,000)	

Objective #___ Actual Result (to be completed at end of grant period for final report)		Initiative Foundation Use Only

***Please copy this page for any additional objectives you have that pertain to this project**.

Appendix I

DNR Fisheries Management Plan

Region	Area	D.O.W. Number	County	D.O.W. Lake Name	Lake Class	Acreage
1	Park Rapids (F11H)	29-0250	Hubbard	Portage	39	412 plan. 410 littoral

LONG RANGE GOALS:

X Maintain or improve the quality of fishing for walleye by attempting to provide a population with a mean catch per effort (CPE) index of at least 5 per gill net lift and a proportional stock density (PSD) of 30 to 60. Attempt to maintain a relative stock density (RSD) of preferred length (≥20") walleye of at least 15.

X Walleye abundance should be balanced with abundance of preferred forage, yellow perch, by attempting to maintain a perch population with an average CPE index of at least 3 per gill net lift.

X Maintain related fish communities

X Protect or enhance desirable aquatic and riparian habitats (water quality, aquatic and riparian vegetation, and shoreline substrate).

OPERATIONAL PLANS:

X Conduct special sampling, population assessments or lake surveys about every five years (2007, 2012...), or as needed to evaluate management efforts. Special fall electrofishing may be conducted if desirable to evaluate natural reproduction or stocking success of walleye, and if feasible within time and staffing constraints.

X Stock walleye fingerlings at a rate of ½ pound per littoral acre (205 pounds total) in even numbered years. Consider stocking walleye fry at a rate of 1,000 per littoral acre (410,000 total) in odd numbered years, evaluating survival by fall electrofishing to estimate abundance of fingerlings, and stocking reared walleye fingerlings if survival of fry does not appear adequate (see *Stocking Plans*). Walleye fry may also be stocked at the rate of 1,000 per littoral acre (410,000 total) following known winter fish kills. Stocking rate, frequency, or size of fish may be adjusted if necessary to maintain desirable levels of abundance and size structures of walleye and forage fishes at minimum costs.

X Monitor winter levels of dissolved oxygen when conditions appear conducive for a fish kill.

X Monitor winter fishing pressure by conducting aerial fish house counts.

X Provide free and adequate public water access to Portage Lake.

X Work with educators, groups, agencies, individuals or news media to provide aquatic education opportunities. Efforts may include presentations, news releases, personal contacts or special projects.

X Provide recommendations on permit applications that will minimize impacts to aquatic resources associated with projects in Portage Lake, its tributaries, or its watershed.

X Encourage, support and assist efforts of local, state or federal groups or agencies to improve water quality, and maintain or improve fisheries habitat in Portage Lake. Work with the Portage Lake Association to manage the exotic curly leaf pondweed.

MID RANGE OBJECTIVES:

X Evaluate population characteristics (abundance, size and age structure, and growth) of walleye, yellow perch, northern pike, black crappie, and bluegill. Continue to refine definitions of desirable levels of abundance and size structure for managed fish species.

X Continue to evaluate the extent of natural reproduction of walleye, and the contribution of stocked walleye. Adjust stocking rates, schedule or size of fish if necessary to maintain desirable levels of abundance and size structures of walleye and forage fishes at minimum costs.

POTENTIAL PLAN:

X Conduct an angler creel and recreational use survey of Portage Lake, in conjunction with other lakes in the Park Rapids area. **SUBTOTAL $** Costs depend on which lakes are involved

X Inventory extent and composition of aquatic and riparian vegetation using Geographic Positioning System (GPS), Geographic Information Systems (GIS), digital or digitized photography. This information could be used to monitor long-term habitat trends. **SUBTOTAL $** Costs would be shared with other area lakes

X Attempt to estimate stocked walleye fingerling survival and contribution to year class strength by marking stocked walleye with fin clips, tags, or oxytetracycline, recapturing marked fish during assessments or surveys, and estimating relative proportion of stocked and non-stocked fish.

SUBTOTAL $ 5,000

X Use fee title purchase or easements to protect known spawning areas or other critical habitat.

SUBTOTAL $ Costs depend on size or extent of projects

<table>
<tr><td colspan="2">NARRATIVE: (Historical perspectives - various surveys; past management; social considerations; present limiting factors; survey needs; land acquisition; habitat development and protection; commercial fishery; stocking plans; other management tools; and evaluation plans)

(see following)</td><td>FOR CENTRAL OFFICE USE ONLY

Entry Date: | Year Resurvey:
Stock Species-Size-Number per Acre
Schedule: | Year Beginning
Population Manipulation
_____YES _____NO Year</td></tr>
<tr><td>Primary Species Management:
Walleye</td><td>Secondary Species Management:
Yellow perch, Northern pike, Black crappie, Bluegill</td><td>Development
_____YES _____NO Year</td></tr>
<tr><td>Area Supervisor’s Signature:</td><td>Date</td><td>Creel or Use Survey
_____YES _____NO Year</td></tr>
<tr><td>Regional Manager’s Signature:</td><td>Date</td><td>Other:
Year</td></tr>
</table>

Portage Lake is located about four miles northwest of Park Rapids, in southwestern Hubbard County. Portage Lake has a planimetered surface area of 412 acres, a maximum depth of 17 feet, is 99% littoral (410 acres), and has been assigned to lake class 39. Portage Lake has no major inlets. A dam controls the outlet of the lake, and the stream is too small to allow boat access.

PAST MANAGEMENT:

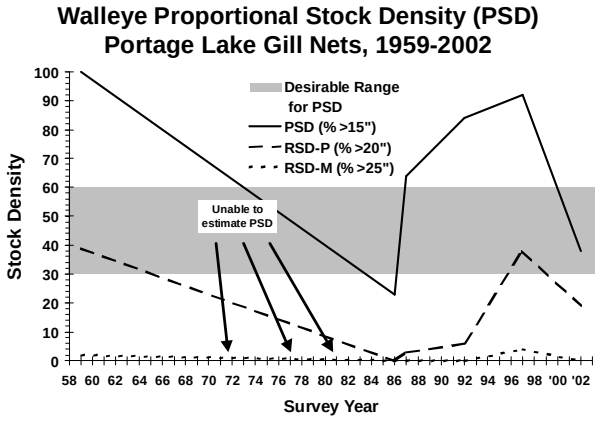
Minnesota fishing lakes can be grouped based on similar physical and chemical characteristics. These groups of lakes have similar fish communities. Portage Lake has been grouped in lake class 39. Populations of northern pike, walleye, yellow perch, pumpkinseed, brown bullhead, black crappie, bluegill, yellow bullhead, black bullhead, or white sucker generally characterized these lakes. Bowfin may also be found in some of these lakes.

Since 1987, the fishery of Portage Lake has been managed primarily for walleye with secondary emphasis on northern pike, black crappie and bluegill. Management activities have consisted of: statewide fishing regulations; a special regulation for northern pike; special management for winter fish kills; fish stockings; fish removal; improvement of angler access and efforts to protect aquatic habitat.

From 1912 to 1945 (walleye) pike, bass, northern pike, sunfish and crappies were stocked in Portage Lake. Walleyes and northern pike fry and fingerlings were stocked sporadically from 1946 to 1958. In 1959 the lake was classified as a largemouth bass-panfish-walleye lake for management purposes. Walleye fingerling stocking was recommended because fry stocking failed to produce the desired population. Walleye fry stocking continued, however, until 1977 when the stocking schedule was changed to fingerlings only. Northern pike stocking was discontinued in 1975 and natural reproduction has maintained a high-density population. In 1981 the lake was classified as a Centrarchid (Sunfish) lake. Walleye fingerling stocking was recommended at a rate of ½ pound per littoral acre, and stockings were scheduled for alternate (even numbered) years to allow evaluation of natural reproduction in non-stocked years, and to improve chance of stocking success.

Portage Lake is very shallow and eutrophic. These conditions have lead to occasional winter fish kills. When thick layers of snow and ice cover shallow, productive bodies of water in the winter, sunlight cannot penetrate. Vegetation dies and decomposes, using up dissolved oxygen. If dissolved oxygen levels decline too low it can result in a fish kill. The lake was opened to liberalized fishing in 1948 and 1965 due to low oxygen levels, but there is no record of a fish kill in those years. The lake was also opened to liberalized fishing in 1986. Partial winterkills occurred on Portage in 1985-86, 1988-89 and 1995-96. Those winterkills affect fish abundance and size structure, and appeared to be most detrimental to largemouth bass and bluegill populations. Winter dissolved oxygen levels are closely monitored each year when conditions appear conducive for a fish kill.

Declining size structure, consistent recruitment, and lack of quality size northern pike prompted implementation of a special regulation in 1988. That regulation increased the possession limit of northerns to six. It was hoped that the density of small northern pike would be reduced, and growth rates of remaining fish would improve. No improvements in size structure or growth were observed, and the regulation was rescinded in 1994. It was felt that anglers were not willing to harvest additional, small northern pike.



VARIOUS SURVEYS:

Portage Lake was mapped in 1941 and remapped in1969. The lake was initially surveyed in 1959 and resurveyed in 2002. Population assessments were conducted in 1972, 1977, 1981, 1987, 1992, and 1997. Winterkill assessments were conducted in the springs of 1986 and 1989. The Portage Lake Association has been involved in the Hubbard County Coalition of Lake Associations (COLA) lake water quality monitoring program in 1997-2002 and lake water transparency has been recorded through the Citizen Lake Monitoring Program annually since 1986. Aerial fish house counts have been conducted annually since 1983 to monitor trends in ice fishing pressure. Counts have ranged from 3 to 44 and averaged 21.

Mean gill net catch rates provide the best index of walleye abundance. Average gill net catch rates of walleye in Portage Lake were near the low end of the interquartile or "normal" range (1.5 to 5.8/gill net) in 1959 through 1981 samples (Figure 1). Abundance increased above the high end of the normal range in 1986 and has fluctuated between 4.2 and 9.3 per gill net since then. The long range goal 5 per gill net was set between the long term average and 75th percentile of historic walleye gill net catch rates from Portage. Walleye abundance met that goal in 1986 through 1997 samples, and was slightly lower than the goal in 2002.

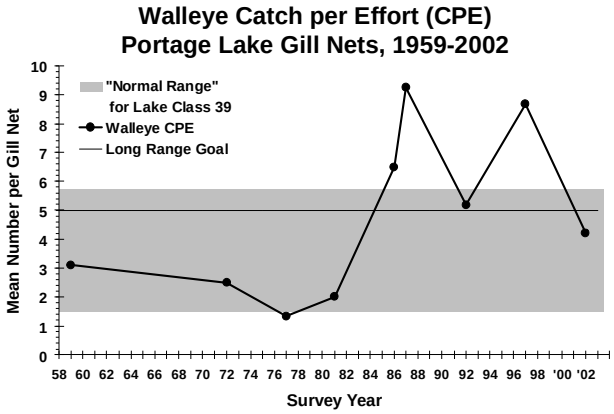


Figure 2

Proportional Stock Density (PSD) is an index of population size structure that measures the proportion of stock sized (10" or larger) walleye that are also a quality size of 15" or larger. In 1972 through 1981 samples too few walleye were collected to estimate PSD. In most other years the PSD of walleye has been above a desirable range of 30-60 (Figure 2). High PSDs are a reflection of a high proportion of large fish and fewer small fish in the sample, probably indicating low recruitment. Low PSDs are due to a high proportion of small fish and relatively few large fish, a less desirable condition for anglers. More desirable mid-range PSDs indicate enough small fish recruiting into the population to provide good fishing in the future, and enough large fish to provide good fishing now.

Relative Stock Densities measure the proportion of stock sized walleye that are also a preferred size of 20 inches or larger (RSD-P or RSD-20), or the proportion that are also a memorable size of 25 inches or larger (RSD-M or RSD-25). The proportion of 20 inch or larger walleye (RSD-P) in Portage Lake followed a similar pattern of fluctuations as PSD. RSD-P was quite good in 1959, 1997 and even 2002 samples. The proportion of 25 inch or larger walleye (RSD-M) has been low in all samples. The long

range goal of 15 for RSD-P was set near the average of all Portage Lake samples with enough walleye to accurately estimate size structure indices.

It has been somewhat difficult to evaluate natural reproduction of walleye and the contribution of stocking in Portage, because there have been so many years that walleye were stocked in the lake, there have been relatively few samples of the lake's fishery, walleye were often stocked in consecutive years, and different sizes of walleye were occasionally stocked in the same year. In general, it appears that fingerling walleye stockings are contributing somewhat to the walleye population in Portage Lake. Mean gill net catch rates of year classes of walleye from years stocked with fingerlings appear to be somewhat higher (about 50%) than non-stocked years at the same age. However, sample sizes are small so conclusions about the effectiveness of stocking must be viewed cautiously.

Average gill net catch rates of yellow perch in Portage Lake were below or near the low end of the interquartile range for similar lakes (8.0 to 40.3/gill net) from 1959 through 1977, increased above the high end of the range in 1981, decreased to below the normal range in 1992, and has remained very low since then (Figure 3). The long range goal of at least 3 perch per gill net was set near the 25th percentile of catch rates from all samples at Portage. The average catch rates of perch since 1992 have been below that goal. Too few perch were collected in most samples to accurately estimate size structure indices. When PSD could be estimated, it has varied but was usually lower than the desired range of 30-60. Very few perch have been collected that were 10 inches or larger so RSD values have usually been 0. Low numbers and small size of yellow perch in Portage limit their value as a fishery for anglers. However, they are an important source of food for the lake's predator fish species, particularly walleye and northern pike. It is important to maintain an adequate perch population to provide forage for the lake's predators.

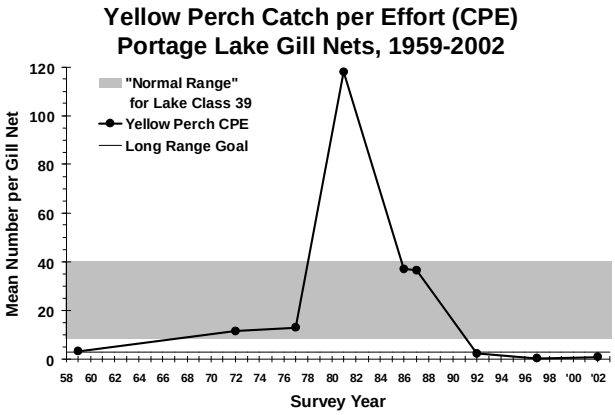


Figure 3

Average gill net catch rates of northern pike in Portage Lake have been relatively stable, generally fluctuating within the range typically found in similar lakes (4.6 to 11.6/gill net). Abundance was slightly below that range in 1959, and only in 1987 was abundance considerably higher than the normal range. PSD of the northern pike population was at or above the desirable range of 30-60 in 1959 through 1986 samples, then declined below the desirable range in 1992 through 2002. The decline in size structure of northern pike appears to be due to increasingly favorable conditions for successful reproduction and recruitment, and a resulting abundance of small northern pike. Proportions of 28 inch or larger pike (RSD-P) and 34 inch or larger pike (RSD-M) followed a similar pattern of fluctuations as PSD and have been lower than might be desired, especially in recent years. Low proportions of large pike may be an indication of high mortality, including angler harvest. Northern pike growth rates in 2002 were very slow compared to other similar lakes.

Average trap net catch rates probably provide the best index of black crappie abundance. The average trap net catch rate of crappie in Portage Lake was above the interquartile range for similar lakes (0.8-5.7/trap net) in 1959, declined to the low end of the normal range in 1972, increased above the normal range again in 1977 and 1981 samples, then declined to near the low end or below the interquartile range since 1981. Too few crappies were collected in most samples to accurately estimate population size structure indices. When it could be estimated, PSD appears to have increased from well below a desirable range of 30-60 in 1959 to well above the desirable range since 1981. When it could be estimated, the proportion of 10 inch or larger crappie (RSD-P) was low in 1959 through 1987 samples, and higher in 1992 and 2002 samples.

Mean trap net catch rates also provide the best index of bluegill abundance. Bluegill trap net catch rates in Portage Lake were near the middle of the interquartile range for similar lakes (2.5 to 25.0/trap net) in 1959, declined to near the low end or below the normal range from 1972 through 1997, then increased to near the middle of the normal range again in 2002. Too few bluegill were collected in half the lake's samples to accurately estimate population size structure indices. When it could be estimated, PSD of bluegills has increased from below a desirable range of 20-60 in 1959 to fluctuate around the top end of the desirable range in more recent samples. Proportions of preferred size (8 inches or larger) bluegill have been more stable, but generally low. No memorable sized (10 inches or larger) bluegill have ever been sampled in Portage Lake. Growth rates of younger bluegill in 2002 were fairly fast compared to other similar lakes, but growth rates slowed in older bluegill.

Largemouth bass have been collected with both gill nets and trap nets during the course of population assessments and lake surveys, but those gears do not do a very good job of sampling bass. Catch rates with both gears have fluctuated widely. Catch rates with both gears were high in 1959, declined to 0 in 1972 and 1977 samples, appeared to increase during the 1980s, declined to 0 again in 1997, then increased slightly in 2002. Too few bass have been collected in most samples to accurately estimate population size structure indices.

Bullheads have been a concern with lake residents and those interested in the lake. Gill and trap net catch rates of yellow bullhead were quite high in 1977, but otherwise have been within or below the normal range for similar lakes. On the other hand, catch rates of brown and black bullhead were quite low through the late 1980s, then began to increase, and in 2002 gill net catch rates of these two species were quite high. Bullheads are tolerant of low dissolved oxygen and winterkill conditions. Partial winterkills often results in increased abundance of those species. Increased abundance of black bullheads in particular can be indicative of eutrophic or poorer water quality conditions.

SOCIAL CONSIDERATIONS:

Portage Lake and its fishery are an important feature and recreational attraction for the Park Rapids area and surrounding communities. The lake and its fishery have the potential to contribute substantially to local and state economies. There were 85 homes/cabins observed on Portage Lake during a 1997 population assessment. There were 91 homes/cabins reported during the 2002 resurvey, representing a 7% increase of homes/cabins during that five year period.

PRESENT LIMITING FACTORS:

Increased use and development on Portage Lake and within its immediate watershed has resulted in removal of riparian vegetation and probably increased contribution of nutrients to the lake. High nutrients and shallow depths make the lake conducive to growth of aquatic vegetation. Degraded water

quality or dense growth of submerged plants could negatively affect fish populations, reduce recreational opportunities, and reduce the aesthetic quality of the lake. The exotic plant curly leaf pondweed was first observed in Portage Lake in the mid-1990s. Curly leaf pondweed is a submerged aquatic plant that begins growing much earlier in the season than most other plants, often under the ice. It can become quite dense, often interfering with fishing, swimming or other recreation. By 2002 it had spread to cover nearly 50 acres of the lake. Emergent vegetation like bulrush provides spawning habitat for fish like black crappie, bluegill and largemouth bass. Emergent vegetation also helps stabilize substrates, helps remove nutrients and protects shoreline from erosion. It is important to protect this type of vegetation.

High nutrients, shallow depths and abundant vegetation also make Portage Lake susceptible to dissolved oxygen depletion and fish kills. Periodic partial winter fish kills have affected abundance and size structure of the lake's fish populations to varying degrees. Fish kills generally reduce abundance of certain species or certain sizes of fish that are less tolerant of low oxygen conditions, but may result in increased production of fish in subsequent years. Unfortunately, the increased production may be of undesirable fish species like bullheads if they are able to tolerate low oxygen conditions.

Both natural reproduction/recruitment of walleye, and survival of stocked walleye may be limited by habitat or other fish populations. Yellow perch are an important source of food for walleye and may influence walleye survival or growth. An abundant walleye population may negatively affect abundance of black crappie. It appears that there is a fairly significant inverse relationship between walleye abundance and abundance of crappie. When walleye abundance was high, crappie abundance has been low and vice versa.

Northern pike reproduction and recruitment are regulated by the amount of seasonally flooded vegetation and marsh areas that provide suitable spawning habitat. The amount of habitat in Portage Lake for pike production appears to be more than adequate. Good recruitment of pike has resulted in an abundance of small fish, poor growth, and poor size structure. A lack of older, larger size northerns appears to be due to high mortality, probably a result of overharvest. Large northern pike can act as a predatory control of smaller pike. Removing too many large pike can lead to even higher abundance of small northerns. Previous attempts to improve northern pike size structure by liberalizing bag limits were unsuccessful. Rather than harvesting more of the small pike, it appears that anglers continued to harvest the largest size northerns. Those attending a meeting to review the Portage Lake Management Plan suggested that efforts could be made to educate anglers about the benefits and desirability of selectively harvesting small northern pike and returning larger pike. Anglers could be advised of methods of preparing small northern pike.

Increasing numbers of bullheads may be affecting other fish populations or interfering with angling for other species. Attempts to reduce bullhead numbers at other lakes by removal have generally been unsuccessful. Too few are removed to make a noticeable difference, or the reduction may result in stimulated production in the remaining fish. Commercial fishermen have been contacted to harvest and utilize bullheads at Portage, but they have not been interested.

Increased fishing pressure and harvest in recent decades may be affecting abundance, size, or age structure of other game fish populations besides northern pike. Persons interested in the fishery of

Portage Lake have particularly commented about a decline in abundance and size structure of crappies and bluegills.

SURVEY NEEDS:

Fisheries surveys or assessments should be conducted at a minimum of about every five years to monitor population trends of managed fish species. If walleye fry stockings are being considered or conducted, fall electrofishing should be conducted to sample young of the year walleye, evaluate natural production during non-stocked years, and evaluate contribution of fry stockings during stocked years. More frequent sampling may be necessary to determine management needs or better evaluate management efforts. Complete lake surveys should be conducted regularly at Portage Lake to provide information about physical and chemical characteristics of the lake and its watershed that can be used to monitor long term habitat trends.

An angler creel survey should be considered for Portage Lake, in conjunction with other lakes in the Park Rapids area. A creel survey could provided needed information on fishing pressure, catch, harvest, angler characteristics, and recreational use for the Park Rapids area in general, and for Portage Lake in particular.

The extent and composition of aquatic and riparian vegetation could be inventoried using Geographic Positioning System (GPS), Geographic Information Systems (GIS), digital or digitized photography. This information could be used to better monitor changes in habitat, and long term habitat trends. A mark and recapture tagging study could be undertaken to estimate stocked walleye fry or fingerling survival and contribution to year class strength. Such a study could be conducted by marking stocked walleye with fin clips, tags or oxytetracycline, recapturing marked fish during special sampling, assessments or surveys, and estimating relative proportion of stocked and non-stocked fish.

LAND ACQUISITION:

Portage Lake has a county owned public access with an earth ramp. Public access appears to be adequate for the present. However, additional land acquisition may be considered in the future to satisfy increased recreational demand or to ensure accessibility for shore fishermen, elderly or disabled. Any improvements in access should be weighed with anticipated negative effects of increased use.

Consideration should be given to acquiring property or using cost-share programs to protect identified spawning areas or other critical habitat from development or further degradation, or to improve habitat in those areas. Consideration might also be given to acquiring property or using cost-share programs to protect marginal land and critically eroding areas, or to provide vegetative buffer strips along the lakeshore or tributaries.

HABITAT DEVELOPMENT AND PROTECTION:

Fisheries personnel will continue efforts to inform and educate the public about the value of riparian and aquatic habitats (water quality, vegetation and substrates), and the need to protect or restore them. Efforts of local, state or federal groups, agencies or individuals to maintain or improve water quality or fisheries habitat in Portage Lake will continue to be encouraged, supported and assisted. Work in protected waters permit applications will be reviewed, and recommendations will be provided to minimize loss or degradation of riparian and aquatic habitats. In cases of erosion, property owners should be advised of options to protect their shorelines. Options may include reshaping, revegetation, or as a last resort in severe cases, rip-rap. Recommendations can be provided on a case by case basis.

Fisheries personnel will also work with developers of private land whenever possible, to provide recommendations to minimize impacts to aquatic resources.

During a meeting to review and revise the lake management plan, those interested in Portage Lake expressed a concern about the extent of aquatic vegetation, particularly submerged plants. Fisheries personnel will continue to work with individuals or groups interested in aquatic plant management. Lakeshore property owners should be advised of the benefits of riparian and emergent aquatic vegetation as habitat and shoreline protection. They should be encouraged to maintain existing or restore destroyed emergent vegetation. They should be given options to obtain access to open water or to reasonably use lakeshore property by removing submergent vegetation, but still maintain as much emergent vegetation as possible. Lake property owners hired a commercial applicator to chemically treat portions of shoreline properties to control submerged vegetation in 2001 and 2002. Fisheries personnel will also continue to work with those interested in managing the exotic curly leaf pondweed by providing information or advice, and by assisting with permits. In 2003, the Portage Lake Association organized property owners to hire a commercial applicator to chemically treat about 50 acres of the lake where curly leaf was the most prevalent in addition to individual shorelines.

The possibility of installing an aeration system was discussed at the meeting to review and revise the management plan. The relative infrequency and severity of fish kills reduces the benefits of aeration to the point where it is questionable whether benefits would exceed costs. It was pointed out that a local group or agency would have to participate in operation and maintenance, and there didn't seem to be enough interest. An aeration system may become more beneficial, and should be reconsidered if winter fish kills increase in frequency or severity.

STOCKING PLANS:

Walleye fingerlings should continue to be stocked at a rate of ½ pound per littoral acre (205 pounds total) in even numbered years. Walleye fry may be stocked at the rate of 1,000 per littoral acre (410,000 total) following known winter fish kills. Recommendations for future changes in walleye stocking schedules, rates, or sizes of fish will be based on results of evaluations. Walleye stocking frequency or rates could be adjusted in an attempt to increase abundance of walleye, but only if abundance of yellow perch warrants, if other fish populations are not negatively affected, if growth or condition of walleye are not jeopardized, and if walleye stockings appear to be contributing significantly to the walleye population. Walleye stocking frequency or rates may be decreased if walleye stockings do not appear to be contributing significantly to the walleye population or if other fish populations (particularly yellow perch) are being negatively affected.

Although walleye fingerling stockings appear to be contributing to the walleye population in Portage Lake, it appears that walleye fry stockings could be successful based on physical and chemical conditions of the lake. Fall electrofishing should be conducted a minimum of three years prior to any experimental fry stocking, to establish baseline estimates of young of the year walleye abundance from natural reproduction, and to set a goal for catch rates to define a successful fry stocking. If walleye fry stocking is attempted, fall electrofishing will be conducted following the stocking. If goals for catch rates of young of the year walleye are met, the fry stocking will be considered successful and no further stocking will be necessary. If electrofishing catch rates of young of the year do not meet goals the fry stocking will be considered unsuccessful, and walleye fingerlings will be stocked at the rate of ½ pound per littoral acre yet that fall.

EVALUATION PLANS:

Fisheries sampling information will be used to evaluate population characteristics (abundance, relative abundance, size structure, age structure, growth or condition) of walleye, yellow perch, northern pike, largemouth bass, black crappie, bluegill, and forage fishes. Fisheries sampling information will also be used to build a more complete database, allow better comparisons of species' population characteristics over time, and might aid with evaluation of community interactions. Results will be used to evaluate and adjust management efforts, including stocking, if necessary to achieve desirable levels of abundance and size structure for managed fish species and forage fishes at minimum costs. Complete lake surveys will provide information about physical and chemical characteristics of the lake and its watershed that can be used to monitor and evaluate long term habitat trends.

If a creel survey can be conducted at Portage Lake, particular attention should be placed on determining harvest of walleye, northern pike, bass, black crappie and bluegill, and resulting impacts to those populations. Such a survey could include a late winter/early spring period to determine the extent of black crappie and bluegill harvest during the spawning period, and consideration may be given to identifying spawning areas and estimating harvest in those locations. Consideration may also be given to marking walleye, northern pike, bass, crappie, or bluegill in conjunction with an angler creel survey to attempt to estimate exploitation. Results of the angler creel survey should be used to evaluate the potential to improve abundance and size structure of managed species (walleye, northern pike, bass, crappie, and bluegill) with regulation changes (seasons, bag limits, size limits). Analysis of creel surveys on other, similar, lakes may be used to consider regulation changes if funding or staffing limitations prevent a survey being done on Portage.

Appendix II

Aquatic Vegetation of Portage Lake
Hubbard County, Minnesota
(DOW 29-0250-00)
August 10-11, 2004
and
May 20, 2005

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Portage Lake (29-0250-00) Hubbard Co. 2004-2005 Vegetation Surveys

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Lake sampling: Donna Perleberg, MnDNR Division of Ecological Services
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Data Entry: Josh Knopik, MnDNR Division of Ecological Services
Data Analysis: Donna Perleberg, Patrick McGowan, Josh Knopik, Cody Peterson, MnDNR
Division of Ecological Services
Report Review: Wendy Crowell, MnDNR Division of Ecological Services
Funding: Collection of these data was made possible by support from the Heritage Enhancement Fund.

This report should be cited as:

Perleberg, D. 2005. Aquatic vegetation of Portage Lake, Hubbard County, Minnesota (DOW 29-0250-00), August 10-11, 2004 and May 20, 2005. Minnesota Department of Natural Resources, Ecological Services Division, 1601 Minnesota Dr., Brainerd, MN 56401
. 16 pp Perleberg, D., MnDNR Ecological Services Division. October 4, 2005 Page 2 of 16 Portage Lake (29-0250-00) Hubbard Co. 2004-2005 Vegetation Surveys

Summary

Portage Lake is a shallow, nutrient rich lake located near Park Rapids, Minnesota. Vegetation surveys were conducted in August 2004 to assess the native aquatic plant community and in early May 2005 to assess the non-native, curly-leaf pondweed population. These surveys provide quantitative estimates of the frequency at which the common submerged plant species occur.

Submerged aquatic plants occur throughout the lake but are most frequent in water depths less than 10 feet. The native plant community is dominated by coontail (*Ceratophyllum demersum*), a species tolerant of low light and high turbidity. Twelve other native plant species were found but were generally restricted to water depths less than 10 feet where sufficient light is available for growth.

The non-native submerged plant, curly-leaf pondweed (*Potamogeton crispus*) has been present in Portage Lake since at least 2002. In early summer 2002, it formed dense surface mats and the lake association began efforts to control the plant through herbicide applications. On May 20, 2005, seven percent of the sample sites contained curly-leaf pondweed.

Introduction

Portage Lake (DOW 29-0250-00) is located three miles north of the city of Park Rapids in Hubbard County, Minnesota within the ecological region called the Laurentian Mixed Forest Province (Fig. 1).

The lake lies at the northern edge of the Crow Wing River Watershed and is one of several lakes in this watershed where the non-native plant, curly-leaf pondweed (*Potamogeton crispus*) has been found (Fig. 2). Flow leaves the eastern end of Portage Lake through a creek to Fish Hook Lake, then south through the Fish Hook River, east through the Shell River, and then to the Crow Wing River.

Hubbard County, MN.

Figure 1: Location of Portage Lake, Hubbard County, MN.

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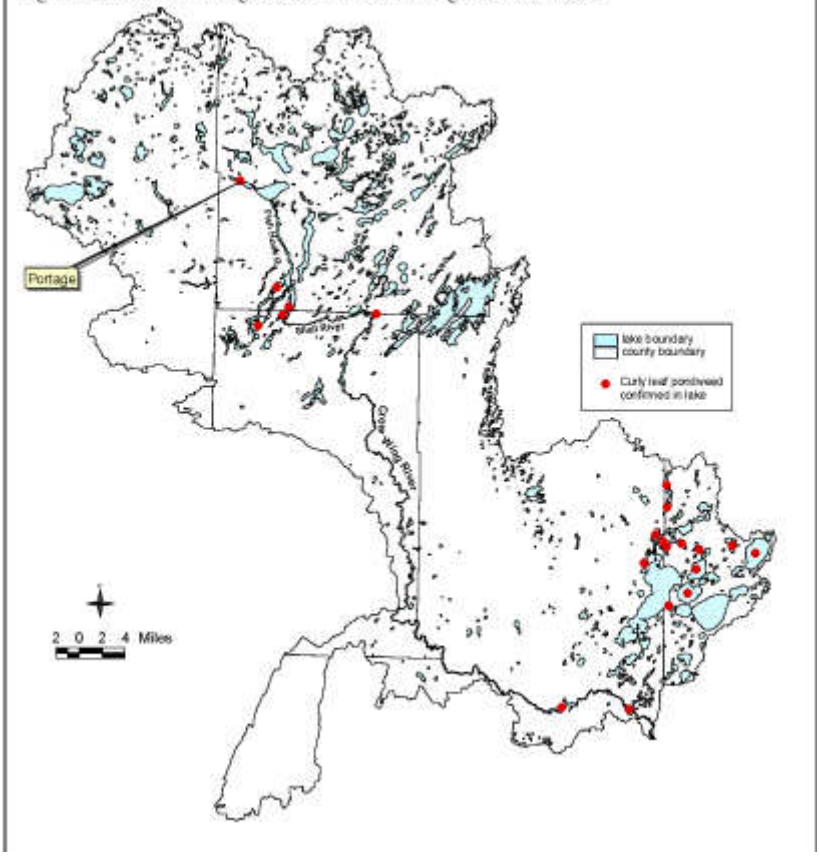
Figure 2: Location of Portage Lake within Crow Wing River Watershed.



Within the sub-watershed containing Portage Lake, land use is a mix of forested and agricultural land. Much of the shoreline adjacent to Portage Lake remains forested but it has been developed for seasonal and permanent residences (Fig. 3.) A public boat launch is located on the south shore.

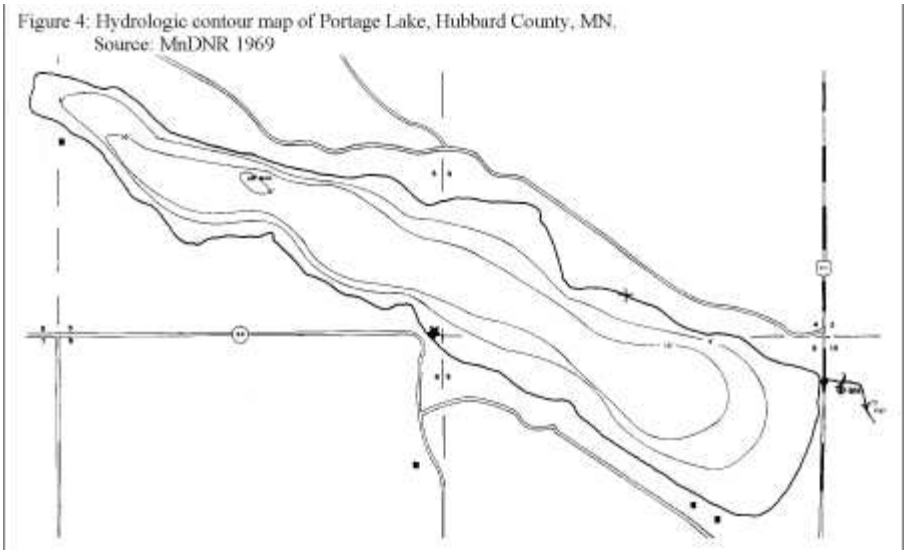
Portage Lake is an elongated basin that with a surface area of about 412 acres. It is shallow, with a maximum depth of 17 feet (Fig. 4).

The lake is described as eutrophic (moderate-high nutrients) with low water clarity as indicated by the 2004 mean summer Secchi depth of three feet (MPCA 2004). In recent years, reports of mid-summer algal blooms have been common.

Figure 3. Aerial photograph of Portage Lake, Hubbard County
source: Farm Service Agency, 2003.

1000100200MetersPortage Lake

Figure 4: Hydrologic contour map of Portage Lake, Hubbard County, MN.
Source: MnDNR 1969



Vegetation Survey Objectives

The purpose of vegetation surveys of Portage Lake was to describe the current aquatic plant community including:

1) Estimate the maximum depth of rooted vegetation
2) Estimate the percent of the lake occupied by rooted vegetation
3) Record the aquatic plant species that occur in the lake
4) Estimate frequencies of occurrence of individual species
5) Develop maps of the distribution of the common species

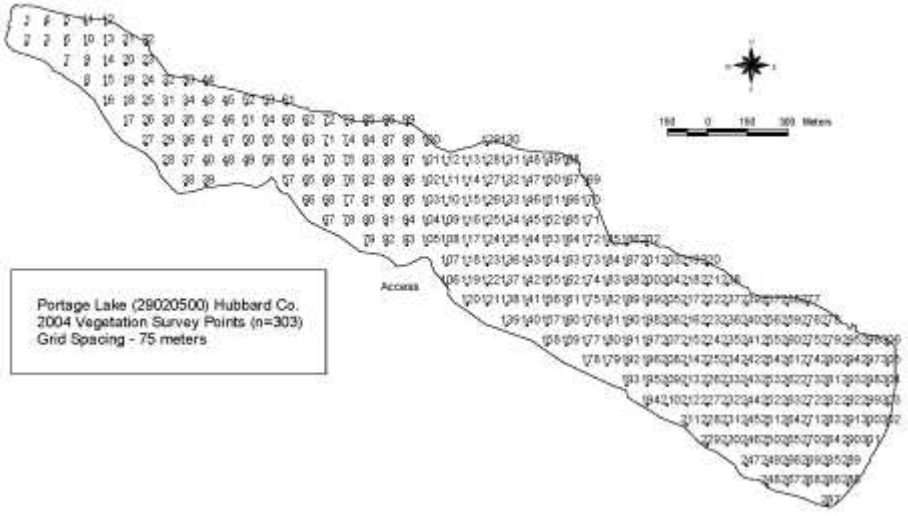
The August 2004 survey assessed the native plant community and the survey was repeated in May 2005 to specifically estimate the abundance and distribution of curly-leaf pondweed, a non-native species that reaches its peak growth in late spring.

Methods

Aquatic Vegetation Survey Methods

A Point-Intercept vegetation survey of Portage Lake was conducted on August 10 and 11, 2004 following the methodology described by Madsen (1999). The survey was repeated on May 20, 2005. Sample points were established using a GIS software program using a 75 meter by 75 meter grid across the lake surface (Fig. 5). A total of 303 sites were sampled during each survey.

Figure 5. Vegetation survey points on Portage Lake (29-0250-00), Hubbard County, Minnesota.



Survey waypoints were created and downloaded into a Global Positioning System (GPS) receiver. The GPS unit was used to navigate the boat to each sample point. One side of the boat was designated as the sampling area. At each site, water depth was recorded in one foot increments using a measured stick in water depths less than eight feet and an electronic depth finder in water depths greater than eight feet. The surveyors recorded all plant species found within a one meter squared sample site at the pre-designated side of the boat. A double-headed, weighted garden rake, attached to a rope was used to survey vegetation not visible from the surface (Fig. 6). If curly-leaf pondweed was present at a site, surveyors recorded whether or not it formed surface mats at that site.
Nomenclature followed Crow and Hellquist (2000). Voucher specimens were collected for most plant species.
Data were entered into a Microsoft Access database and frequency of occurrence was calculated for each species as the number of sites in which a species occurred divided by the total number of sample sites.

Figure 6. Rake used to sample vegetation.

Example:
There were 303 samples sites.
In 2004, Coontail occurred in 124 of those sample sites.
Frequency of coontail in 2004 = 124/303 (*100) = 41%
Frequency was calculated for the entire vegetated lake and sampling points were also grouped by water depth and separated into six depth zones for analysis: 0 to 3 feet, and 4 to 6 feet, 7 to 9 feet, 10 to 12 feet, 13 to 15 feet, and 16 feet.

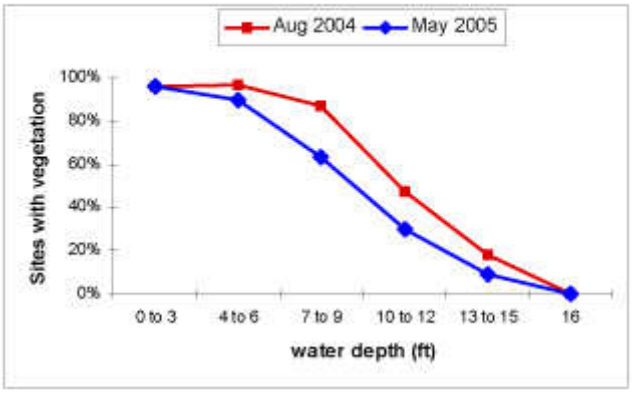
Results / Discussion

The data from the August 2004 survey cannot be directly compared to the May 2005 survey data because native plant species reach peak biomass in late summer and the exotic, curly-leaf pondweed reaches peak biomass in mid to late spring. Lower frequency values for native species during the May 2005 survey are expected and do not necessarily indicate that these native species have actually decreased in abundance in the lake. Similarly, curly-leaf pondweed naturally senesces by mid-summer and a low frequency value for this species in August may not be predictive of its potential growth in the following spring. In order to compare changes in native species abundance, a survey should be repeated in late summer. To estimate changes in curly-leaf pondweed abundance, a survey should be repeated in spring, prior to any plant management activities.

Maximum depth of vegetation and percent of lake with vegetation

In both the summer 2004 and spring 2005, vegetation in Portage Lake occurred to a maximum depth of 15 feet. In August 2004, 56 percent of the sites contained vegetation, compared to 49 percent in May 2005 when most plant species were still in early growth stages. Plant growth was most abundant in water depths of six feet and less and at least 90 percent of the sites in this zone contained vegetation. Plant abundance decreased with increasing water depth and in depths greater than 12 feet, fewer than 20 percent of the sites contained vegetation (Fig. 7).

Figure 7. Frequency of vegetation vs. water depth
Portage Lake, Hubbard Co., MN (29-0250-00)



Number of species recorded

A total of 26 native aquatic plant species were recorded in Portage Lake, including 13 submerged species, five free-floating, three floating-leaved, and five emergent. In addition, several wetland emergent plant species were also recorded (Table 1).

Two non-native aquatic plant species were documented in the lake. Curly-leaf pondweed (*Potamogeton crispus*) is an exotic, submerged aquatic plant and a hybrid pink waterlily (*Nymphaea* sp.) is a non-native floating-leaved plant.

Fewer species were found during the May 2005 survey because most native species do not reach their peak biomass until later in the summer. For this reason, direct comparisons between species abundance in May and August are not useful. For example, the fact that coontail (*Ceratophyllum demersum*) was present in only 24 percent of the sites in May, compared to 41 percent of the sites in August is most likely because it is not fully grown in May. It does not indicate that the plant has actually decreased in abundance from 2004 to 2005.

Table 1. Aquatic Plants of Portage Lake Hubbard County (29-0250-00)
August 10-11, 2004

Frequency calculated for vegetated zone (shore to 15 feet depth)
Frequency = percent of sites in which species occurred
300 sample sites

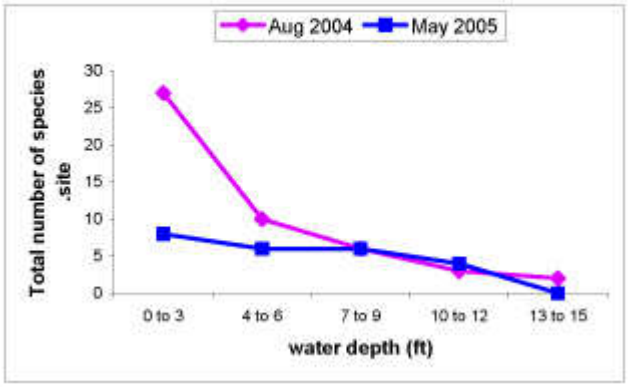
Life Form	Common Name	Scientific Name	Frequency	
			Aug 10-11, 2004	May 20, 2005
SUBMERGED-ANCHORED These plants grow primarily under the water surface. Upper leaves may float near the surface and flowers may extend above the surface. Plants are often rooted or anchored to the lake bottom.	Coontail	Ceratophyllum demersum (v)	41	24
	Muskgrass	Chara sp. (v)	29	31
	Canada waterweed	Elodea canadensis (v)	15	10
	Bushy pondweed	Najas flexilis (v)	8	
	Curly-leaf pondweed	Potamogeton crispus (v)	<1	7
	Illinois pondweed	Potamogeton illinoensis (v)	5	
	Sago pondweed	Stuckenia pectinata (v)	5	<1
	Northern watermilfoil	Myriophyllum sibiricum (v)	2	1
	Water stargrass	Zosterella dubia (v)	2	1
	Wild celery	Vallisneria americana (v)	2	
	Narrow-leaf pondweed	Potamogeton sp.	1	
	White water buttercup	Ranunculus longirostris (v)	1	1
	Whitestem pondweed	Potamogeton praelongus	<1	
	Greater bladderwort	Utricularia vulgaris (v)	<1	
FREE-FLOATING These plants float on the water and drift with water currents.	Star duckweed	Lemna trisulca	2	5
	Greater duckweed	Spirodela polyrhiza	<1	
	Lesser duckweed	Lemna minor	<1	
	Watermeal	Wolffia sp.	<1	
	Water moss	Drepanocladus sp. (v)	1	
FLOATING These plants are rooted in the lake bottom and have leaves that float on the water surface. Many have colorful flowers that extend above the water	Yellow waterlily	Nuphar variegata	5	3
	Floating leaf pondweed	Potamogeton natans	<1	
	Hybrid Pink Waterlily	Nymphaea sp. x (v)	present*	
	Water smartweed	Polygonum amphibium (v)	present	
EMERGENT These plants extend well above the water surface and are usually found in shallow water, near shore.	Wild Rice	Zizania palustris (v)	4	
	Hardstem bulrush	Scirpus acutus (v)	<1	
	Spikerush	Eleocharis sp.	present	
	Cattail	Typha sp.	present	present
	Giant cane	Phragmites australis	present	present
WETLAND EMERGENTS There plants grow along shore and may extend into wet soils	Swamp Milkweed	Asclepias incarnata (v)	present	
	Marsh marigold	Caltha palustris		present
	Sedges	Carex sp.	present	
	Joe-pye weed	Eupatorium maculatum	present	
	Water dock	Rumex sp.	present	
	Reed Canary Grass	Phalaris arundinaceae	present	present
	Marsh Skullcap	Scutellaria galericulata (v)	present	

* present indicates plant was found during survey but did not occur within a specific sample site.
V = voucher specimen collected
Highlite = non-native species

Distribution of species by water depth

The highest number of plant species was found during the August survey, in shallow water, in depths less than four feet. In this depth zone, during August 2004, 25 native species and the two non-native species were found (Fig. 8). Emergent and floating-leaf species were restricted to this shallowest depth zone. During the May 2005 survey, only eight species were found in the shore to three feet depth zone (Fig. 8) because most native species had not yet begun growth. As water depth increased, fewer species were found (Fig. 8).

Figure 8. Total number of species found at each depth zone. Portage Lake, Hubbard Co., MN (29-0250-00)



Common submerged plant species

Because plant species differ in their habitat preferences and reproductive strategies, some species are better adapted to certain lake conditions than other species. Although fourteen different submerged species were found in Portage Lake, only a few species were commonly occurring. The most common submerged plants were native species: coontail (*Ceratophyllum demersum*), muskgrass (*Chara* sp.), Canada waterweed (*Elodea canadensis*), and bushy pondweed (*Najas flexilis*). The non-native species, curly-leaf pondweed (*Potamogeton crispus*) was the fifth most common species. All other submerged species found were native.

Coontail is the most common submerged flowering plant in Minnesota and is adapted to a broad range of lake conditions, including turbid water. Coontail is perennial and can overwinter as a green plant under the ice and then begins new growth early in the spring. It is loosely rooted to the lake bottom and spreads primarily by stem fragmentation. In Portage Lake, coontail dominated the submerged plant community in August 2004 and was found in 41 percent of the sample sites (Table 1). It was found throughout the lake basin (Fig. 9) and occurred at all water depths to a maximum of 15 feet. Coontail was most common in the seven to nine feet depth zone, where it was found in 87 percent of the sample sites (Fig. 10). In both the August and May surveys, it was the most abundant species in depths greater than six feet (Figs. 10 and 11).

Figure 9. Distribution of common aquatic plant species in Portage Lake, Hubbard Co. (29-2025-00).

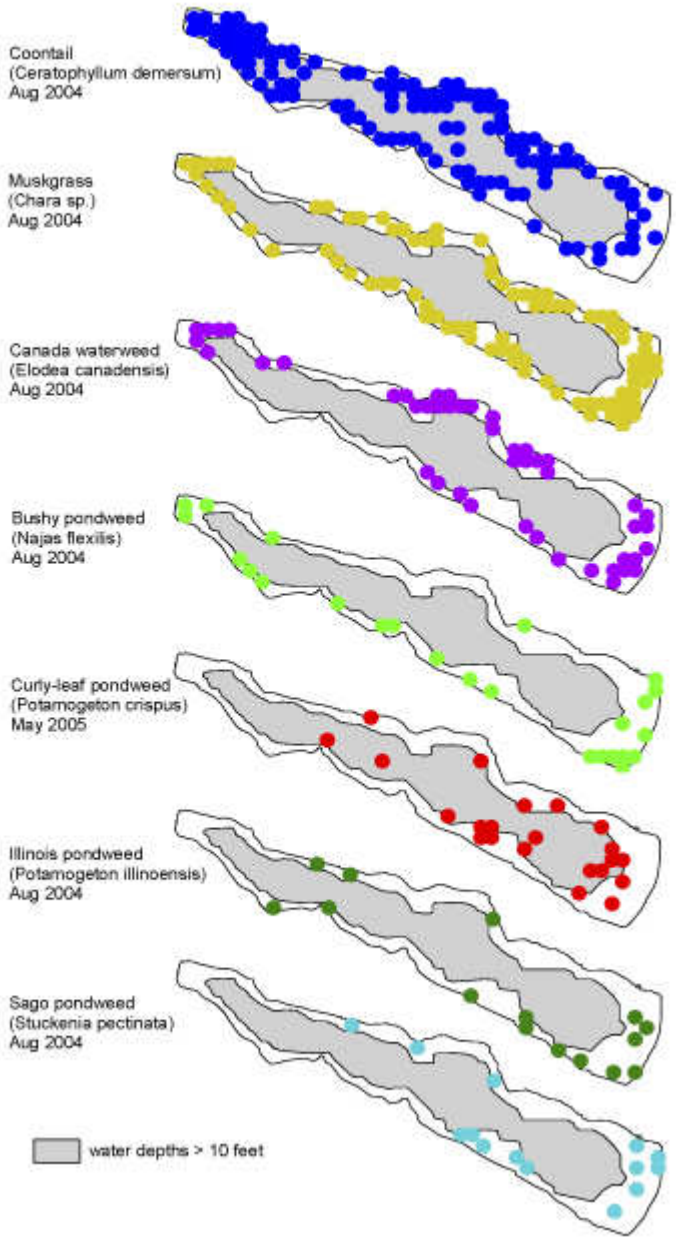


Figure 10. Frequency of common aquatic plants vs. water depth.
Portage Lake, Hubbard County (29-0250-00), **August 10-11, 2004**

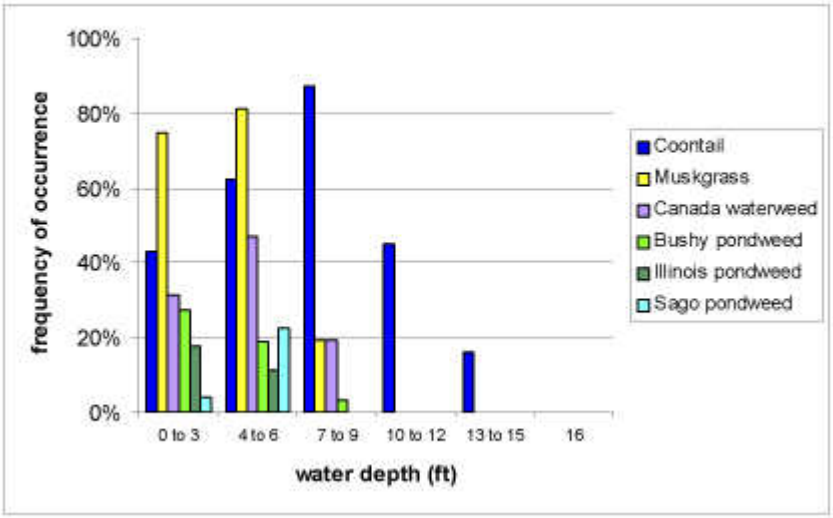
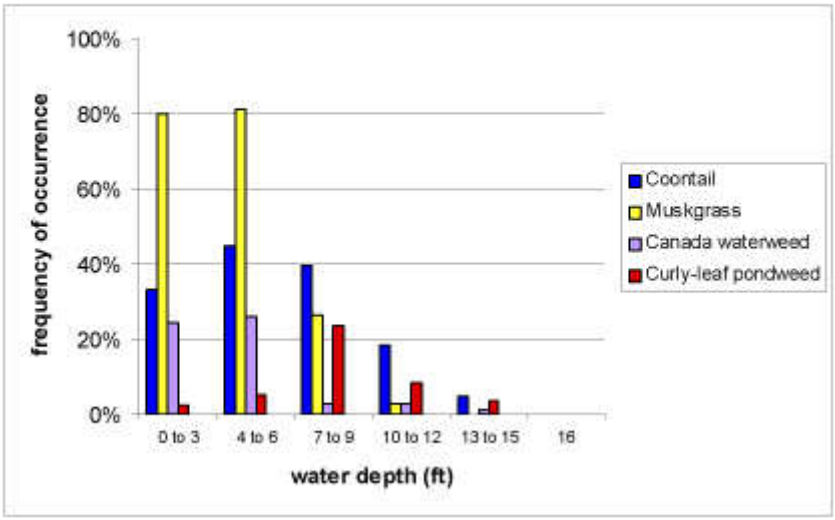


Figure 11. Frequency of common aquatic plants vs. water depth.
Portage Lake, Hubbard County (29-0250-00) **May 20, 2005**



Muskgrass is a macroscopic algae that is common in many hardwater Minnesota lakes. It is named for its characteristic musky odor. Because this species does not form true stems, it is a low-growing plant, often found entirely beneath the water surface where it may form low "carpets" on the lake bottom. Muskgrass is adapted to variety of substrates and is often the first species to invade open areas of lake bottom where it can act as a sediment stabilizer. In Portage Lake, muskgrass occurred in 29 percent of the sample sites in August 2004 (Table 1). It was well distributed around the lake but was restricted to water depths of ten feet and less (Fig. 9). Muskgrass was most common in depths of six feet and less where it was the most abundant species in both August and May (Figs. 10 and 11).

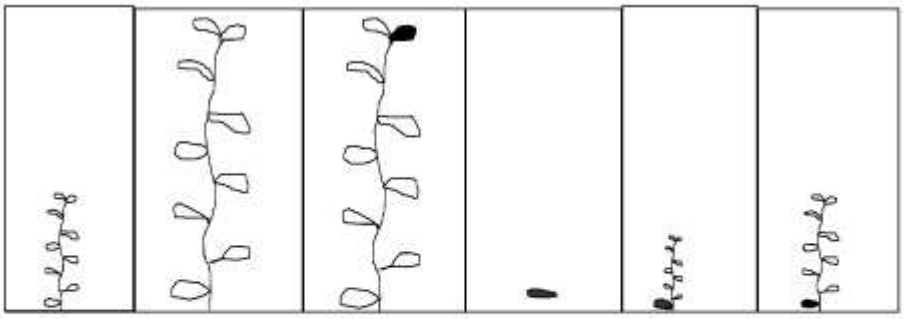
Canada waterweed is another perennial submerged species that is widespread throughout Minnesota because it is adapted to a variety of conditions. It is tolerant of low light and prefers soft substrates. This species can overwinter as an evergreen plant and spreads primarily by fragments. In Portage Lake, it was present in 15 percent of the August 2004 sample sites (Table 1). It was most often found in shallow water in depths less than 10 feet (Fig. 9). Canada waterweed reached is maximum abundance in depths of six feet and less (Fig. 10).

Bushy pondweed is unique because it is one of the few annual submerged species in Minnesota and must re-establishes every year from seed. It is most commonly found in mid to late summer, following seed germination and growth. In Portage Lake, bushy pondweed occurred in eight percent of the sample sites in August 2004 but was not found during the May 2005 survey (Table 1). In August 2004, bushy pondweed was primarily found along the south shore and in the shallow east and west ends of the lake (Fig. 9). It was most common in depths of three feet and less and was not found in depths greater than nine feet (Fig. 10).

Curly-leaf pondweed is a non-native, submerged plant that has been present in Minnesota since at least 1910 (Moyle and Hotchkiss 1945) and is now found in at least 700 Minnesota lakes (Invasive Species Program 2005). Like coontail and Canada waterweed, it is perennial but it has a unique life cycle which gives it a competitive advantage over native species. Curly-leaf
pondweed is actually dormant during late summer and begins new growth in early fall (Fig. 12). Winter foliage is produced and continues to grow under ice (Wehrmeister and Stuckey, 1978). Curly-leaf reaches its maximum growth in May and June, when water temperatures are still too low for most native plant growth. In late spring and early summer, curly-leaf plants form structures called "turions" which are hardened stem tips that break off and fall to the substrate. Turions remain dormant through the summer and germinate into new plants in early fall (Catling and Dobson, 1985).

Curly-leaf pondweed was found in seven percent of the Portage Lake sample sites during the May 2005 survey (Table 1.) It was scattered throughout about two-thirds of the lake and was not found in the western end (Fig. 9). Plants did not reach the surface at the time of the early spring survey but turions (overwintering buds) were present on some plants. Curly-leaf was found in all water depths up to 15 feet, but was most common in water depths of seven to nine feet, where it reached its maximum frequency of 22 percent (Fig. 11).

Figure 12. Life cycle of Curly-leaf pondweed (Potamogeton crispus).



Winter	**Spring**	**Late Spring**	**Summer**	**Fall**	**Winter**
Plants Continue Growing under ice	Plants reach maximum growth	Plants begin to die back and form turions	Turions remain dormant	Turions germinate	Newly sprouted plants continue growth

Illinois pondweed (*Potamogeton illinoensis*) and **sago pondweed** (*Stuckenia pectinata*) were each found in five percent of the sites in August 2005 (Table 1), were widely scattered around the lake (Fig. 9) and were restricted to depths of six feet or less (Fig. 10). All other submerged species occurred in less than five percent of the sites (Table 1).

Floating-leaf and emergent plant community

While the focus of this survey was on the submerged plant community, the floating and emergent plants of Portage Lake also provide critical fish and wildlife habitat as well as benefits such as shoreline stabilization and water clarity maintenance. Common emergent plants include **wild rice** (*Zizania aquatica*) and **bulrush** (*Scirpus acutus*) and the most common floating-leaved plant was **yellow waterlily** (*Nuphar variegata*).

The non-native, **pink-flowered waterlily** (*Nymphaea* sp.) was found at scattered locations around Portage Lake shoreline. While this species is not as easily transported as some invasives, it has the potential to out-compete native plants and its population should continue to be monitored.

Monitoring changes in aquatic plant community

Data from the 2004 and 2005 vegetation surveys can be used to monitor annual changes in the native and non-native plant species composition. To analyze change in the native plant community, this survey should be repeated in late summer and results compared to the August 2004 survey. Detecting change in the curly-leaf population may be more complicated.

Figure 12. Marsh marigold (Caltha palustris) and other emergent and Wetland emergent plants in Portage Lake (29-0250-00). May, 2005.

It is often impossible to know whether a decline in curly-leaf is due to environmental conditions, or due to management activities, or a combination of both. Because curly-leaf pondweed reaches peak biomass in late spring, a spring survey is appropriate to estimate its distribution and abundance in the lake. However, in lakes such as Portage, where early season herbicide applications occur, it is not possible to survey curly-leaf pondweed during its peak biomass. Therefore, repeat spring vegetation surveys should be conducted as close to the spring herbicide treatment date as possible.

In general, factors that may lead to change in native and non-native aquatic plant communities include:

• Change in water clarity

If Portage Lake clarity increases, submerged vegetation may be more common at depths greater than 10 feet.

• Snow cover

Curly-leaf pondweed, in particular, may fluctuate in abundance in response to snow cover. Many native submerged plants also have the ability to grow under the ice, particulary if there is little snow cover and sunlight reaches the lake bottom. In years following low snow cover, curly-leaf and some native submerged plants may increase in abundance.

• Water temperatures / length of growing season

In years with cool spring temperatures, submerged plants may be less abundant than in years with early springs and prolonged warm summer days.

• Natural fluctuation in plant species.

Many submerged plants are perennial and regrow in similar locations each year. However, a few species such as wild rice (*Zizania aquatica*) and bushy pondweed (*Najas flexilis*) are annuals and are dependant on the previous years seed set for regeneration.

• Aquatic plant management activities

Herbicide and mechanical control of aquatic plants can directly impact the aquatic plant community. Monitoring these control activities can help insure that non-target species are not negatively impacted.

Literature Cited

Catling, P.M. and I. Dobson. 1985. The biology of Canadian weeds. 69. Potamogeton crispus L. Canadian Journal of Plant Science 65:655-668.

Crow, G.E. and C.B. Hellquist. 2000. Aquatic and wetland plants of Northeastern North America. 2 volumes. The University of Wisconsin Press.

Hotchkiss, N. 1932. Marsh and aquatic vegetation of Minnesota and its value to waterfowl. U.S. Dept. of Agriculture. Bureau of Biological Survey. Division of Food Habits. Washington D.C.

Invasive Species Program. 2005. Invasive Species of Aquatic Plants and Wild Animals in Minnesota: Annual Report for 2004. Minnesota Department of Natural Resources, St. Paul, MN.
http://files.dnr.state.mn.us/ecological_services/invasives/annualreport.pdf

Madsen, J. D. (1999). "Point intercept and line intercept methods for aquatic plant management."
APCRP Technical Notes Collection (TN APCRP-M1-02). U.S. Army Engineer Research and Development Center, Vicksburg, MS.
www.wes.army.mil/el/aqua

Minnesota Dept. of Natural Resources. Division of Fisheries Lake files. 500 Lafayette Rd., St. Paul, MN 55155.

MPCA. 2004. Minnesota Pollution Control Agency website. Lake Water Quality Assessment Program.
http://www.pca.state.mn.us/water/clmp/clmpSearchResult.cfm?lakeid=29-0250

Moyle, J.B. and N. Hotchkiss. 1945. The aquatic and marsh vegetation of Minnesota and its value to waterfowl. Minnesota Department of Conservation. Technical Bulletin 3. 122 pp.

Appendix III

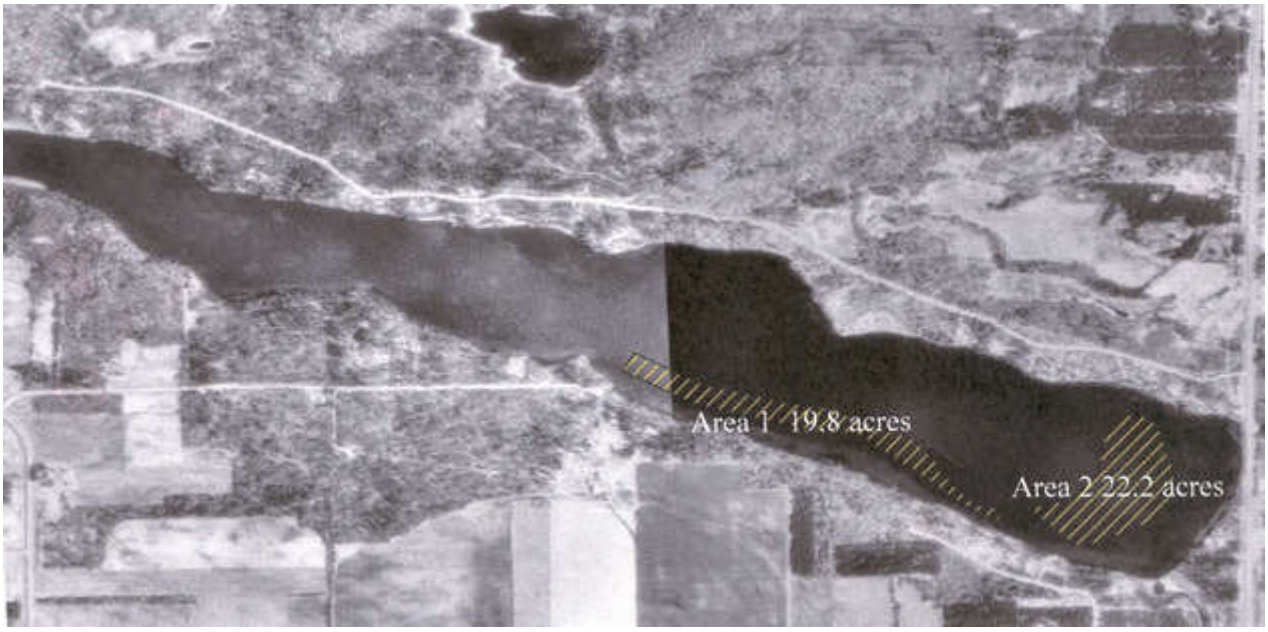
2005 Curly Leaf Pondweed Treatment Report

Off Shore Curly Leaf Pondweed

On June 2, 2005 Professional Lake Management applied 110 gallons of Aquathol K to 45 acres of off shore Curly Leaf Pondweed Beds. At the time of treatment plants were approximately 3 feet in length. Water Temperatures ranged from 55 degrees to 64 degrees at 2 feet below the surface.

On June 17, Professional Lake Management performed surveys of the open water treatment areas. All areas surveyed off shore had been controlled with the exception of a small patch adjacent to the public access.

Off Shore Treatment Areas



Near Shore Treatment
The near shore treatment performed on June 2, 2005 did not, however, show the same results as the offshore areas. A few of the heaviest infested properties showed a "Resistance" to the herbicide used.

This has raised several questions as to the treatment of near shore treatments using Aquathol K.

Q. Why was Aquathol K used instead of Reward or Hydrosol 191?

A. We did not use Hydrothol or Reward because of several reasons.

1. Reward will not work in colder water and is more damaging to the native plants as it is a broad-spectrum herbicide. Also Reward tends to bind to organic materials in lakes making it ineffective on target plants. When working near shore our props will turn up sediment and all the Reward would bind to it.

2. Although Hydrothol is cheaper than Aquathol K, Aquathol K is the protocol that the MNDNR is using for the early season treatments. Wendy Crowell and the Army Core of Engineers have established this. In the case of Portage Lake, as you know in the past on our "mop ups", we use Hydrothol to obtain quick knockdown. We used Aquathol K throughout the lake to be in line with the current DNR protocol. This does not mean that in the future we won't be using it near shore in Portage Lake.

Q. Is the Aquathol K treatment of curly leaf beds in open water getting better results than near shore in the personal frontages?

A. Yes, but not because of the product. When treating large sections such as the two beds of open water, we did see better results than the much smaller 50 X 100 ft increments in Portage Lake. The cause of the "failure" remains unknown, however, in the future we will be approaching the individual frontages much differently.

Conclusions

The total Cost of the Curly Leaf Pondweed project for the 2005 season will be 45 acres at a cost of $280.00 per acre totaling $12,600.00. To prepare for the next year it is recommended to prepare for the same cost for 2006. Additionally, Professional Lake Management will collect turion samples from the lake as a study to see the effects of treatments and to determine if there may be a reduction in populations.

Appendix IV

PORTAGE LAKE

LAKE MANAGEMENT REPORT AND STRATEGIES

Prepared For :

Portage Lake Association

By: Patrick Selter

This guide is intended to assist the association in solutions for Aquatic Plant Management

BACKGROUND INFORMATION

Description of Portage Lake

Portage Lake is a public 412-acre lake in Hubbard County, in the state of Minnesota managed by Professional Lake Management. The lake is located Just northwest of the town of Park Rapids. The access site is located on the South side of the lake. The entire lake is classified as littoral area and midsummer water clarity is sufficient to allow submersed plant growth to the maximum depth of the lake. Portage Lake is a multi-use lake, used for swimming, boating, water skiing, and fishing. The lake also has aesthetic value to local residents and provides habitat for fish and wildlife. The lake supports a sport fishery consisting of northern pike, largemouth bass, walleye and bluegill. Wildlife known to use the lake includes muskrats, waterfowl, and wading birds.

Rationale for Managing Aquatic Vegetation

The need to manage aquatic vegetation arises when vegetation cover and biomass become sufficiently high to disrupt the natural balance of a lake and interfere with recreation. Excessive growth of aquatic plants interferes with nearly all forms of recreation and causes many biological problems. Dense plant growth at the water surface impedes exchange of gases between the air and water, thereby contributing to nighttime dissolved oxygen depletion and large daily pH fluctuations. These conditions are detrimental to fish and other aquatic life. Production of desirable sport fish (e.g., largemouth bass) is maximal at intermediate levels of plant cover and biomass. Excessive plant cover makes it difficult for larger fish to capture smaller food fish, which can lead to reduced production of larger piscivorous fish and to stunted populations of small forage fish.

Exotic aquatic plants (i.e., plants that do not naturally occur in this area) often are the cause of severe problems when they invade lakes. For example, Eurasian watermilfoil (Myriophyllum spicatum L.) and Curly Leaf Pondweed (Potamogeton crispus) expand rapidly to replace native vegetation and form dense monospecific beds. Compared with most native aquatic plants, these exotic species concentrate their stems and leaves at the water surface, interfering with recreation to a much greater extent than comparable quantities of native plants. Highly developed lakes and those used intensively for recreation are more susceptible to invasion and degradation by opportunistic exotic plant species.

At moderate density levels, aquatic plants provide important benefits to the lake, including oxygen production, invertebrate habitat and cover for small fish. Thus, management of problem aquatic plant growth should be conducted in such a way as to preserve desirable aquatic vegetation. Management can preserve beneficial aquatic vegetation in a number of ways. Selective techniques control problem species with minimal effect on desirable ones. Limiting the application of control techniques to areas where they are needed can also preserve desirable vegetation. In general, some areas in every lake should be set aside for little or no management in order to preserve species that are sensitive even to selective controls.

Previous Management of Portage Lake

Aquatic Plant Management

Prior to the initiation of aquatic plant management in 2003, exotic submersed plants (Curly Leaf Pondweed) covered 50 acres of Portage Lake. In early May 2003, Professional Lake Management performed surveys to determine the approximate coverage of this exotic plant. Curly Leaf Pondweed dominated approximately 55 acres of the littoral area. Curly Leaf Pondweed was scattered throughout the water body however not dense enough to require treatment. On May 20, 2003 mechanical sprayer injecting 3 gallons/acre approximately one foot below the surface to off shore areas applied 152 gallons of Aquathol K. In addition, areas alongshore were also treated. On May 26, 2003 surveys of the area treated resulted in little to no topped out Curly Leaf Pondweed found. An additional 5 acres of Curly Leaf Pondweed were treated along the north shoreline in open water with 5 gallons of Aquathol K and to stimulate quick knockdown an additional 5 gallons of Hydrothol191 was applied. Plants were also sampled to ensure efficacy of treatment. Cellular structure of sampled plants indicated severe cellular mutation indicating that plants were unable to survive. On June 24, 2003 individual homeowners with various dimensions in frontage were treated with a total of 5 gallons Hydrothol 191 ,

10 gallons of Aquathol K, 40 Ibs of copper sulfate and 10 gallons of DMA4-IVM.

MANAGEMENT RECOMMENDATIONS

Despite isolated treatment of patches of Curly Leaf Pondweed, this plant continues to expand, to the point that it was widespread in Portage Lake in 2003. If effective control measures are not implemented, it will likely continue to spread. Nuisance native plants, such as thin leaf pondweed, and broad leaf pondweed should be managed only where absolutely necessary, such as around boat moorages, swimming areas, etc.

Goals of the Portage Lake Management Program

Reduce Curly Leaf Pondweed to the lowest practical level of Littoral Area.

.Manage native aquatic plant species to provide high quality habitat for fish and other aquatic organisms and good bottom cover of all plant growing zones.

Vegetation Management Options

There are two management options that could be used or implemented during 2004 to achieve the primary goals of the proposed Portage Lake management plan. Pre-treatment monitoring is required to determine plant growth rates in May.

Options

Option 1

The Herbicide Aquathol K could be used again at a rate of 3 gallons/ acre to Curly Leaf Pondweed. (Same as 2003) Additionally, individual property owners may have native vegetation managed to allow for recreational uses of Portage Lake.

Option 2

To avoid herbicide resistance, Professional Lake Management, frequently rotates the herbicides used for aquatic plant management. Aquathol K could be used in conjunction with Hydrothol 191 to avoid any possible treatment failure. This approach would expose the plants to two types of endothol products. This is an old technology and could yield longer-term control than using only Aquathol K.

. **Appendix V**

CLEAR WATER
TECHNOLOGIES, INC.

How This Process Works for Lake Treatment and Wastewater Treatment at Low Cost

The Hogen Process creates a low cost source of useable iron because free iron is created within the system instead of being manufactured at a chemical plant.

How the Process Works within a Lake

Under anaerobic conditions in the sludge (or sediment) layer on the bottom of the lake, specialized bacteria use oxygen from ferrites for respiration. This respiration frees up Iron to bind with phosphorous and sulfur. These elements are then precipitated out of the water column, rendering them unusable for aquatic plant growth.

How the Process Works with Wastewater

Ferrite is added to an existing treatment system. A unique bacteria is also added which metabolizes the ferrite, freeing up iron to bind with phosphorus, sulfur, and other nutrients as well as heavy metal compounds. These insoluble compounds are precipitated out of the water column, rendering them inactive.

| W

As the iron is used up, more ferrite must be added to the system. The specialized bacteria will continue to thrive within the system and does not require any further inoculations.

The environment created within this process promotes an efficient and healthy biomass that improves settleability and sloughing.

Further Explanation on How the Process Works

In the dark, oxygen free sludge or sediments (depending on the type of system.), a bacterium attaches itself to a particle of iron and begins to feed on organics (BOD) at a high rate.

As the specialized bacteria feeds on the organic matter in the system, it releases carbon dioxide

along with an impressive list of heavy metals.

Free iron binds and precipitates phosphorous and sulfur by a chemical bond between iron and phosphorous or iron and sulfur.

When Ferrous Iron [Fe+2] is oxidized by exposure to air or other oxidizing agents, Iron is converted to the Ferric state [Fe+3]. Ferric Iron having a +3 charge will bind (or bond) with Phosphate [PO4] having a –3 charge creating Iron Phosphate [Fe(PO4)] which precipitates out of the water column.

Ferrous Iron [Fe+2] will also bind with Phosphate. Adding three +2 Irons together gives a +6 charge, which in turn binds with two Phosphates having a –3 charge each giving a total Phosphate charge of –6 thus the Phosphorous is precipitated out as Fe3(PO4)2.

Under anaerobic (No oxygen present) conditions, ferrous sulfide bonds are slightly stronger than ferrous phosphate bonds. Thus, excess sulfide ions can and will release phosphate as an ion, where it is available as a nutrient. Under aerobic (Oxygen present) conditions the situation is reversed. Phosphate is removed from the water column and the sulfide is oxidized to sulfate where it becomes inactive.

| Wastewater Treatment | Lake Treatment | Patents | History | Contact Us | Home |
| How The Process Works | Septic Systems |

CLEAR WATER
TECHNOLOGIES, INC.

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Comments, Questions to info@cwtiusa.com

Glossary

Aerobic: Aquatic life or chemical processes that require the presence of oxygen.

Algal bloom: An unusual or excessive abundance of algae.

Alkalinity: Capacity of a lake to neutralize acid.

Anoxic: The absence of oxygen in a water column or lake; can occur near the bottom of eutrophic lakes in the summer or under the ice in the winter.

Benthic: The bottom zone of a lake, or bottom-dwelling life forms.

Best Management Practices: A practice determined by a state agency or other authority as the most effective, practicable means of preventing or reducing pollution.

Bio-accumulation: Build-up of toxic substances in fish (or other living organism) flesh. Toxic effects may be passed on to humans eating the fish.

Biological Oxygen Demand: The amount of oxygen required by aerobic microorganisms to decompose the organic matter in sample of water. Used as a measure of the degree of water pollution.

Buffer Zone: Undisturbed vegetation that can serve as to slow down and/or retain surface water runoff, and assimilate nutrients.

Chlorophyll a: The green pigment in plants that is essential to photosynthesis.

Clean Water Partnership (CWP) Program: A program created by the legislature in 1990 to protect and improve ground water and surface water in Minnesota by providing financial and technical assistance to local units of government interested in controlling nonpoint source pollution.

Conservation Easement: A perpetual conservation easement is a legally binding condition placed on a deed to restrict the types of development that can occur on the subject property.

Cultural eutrophication: Accelerated "aging" of a lake as a result of human activities.

Epilimnion: Deeper lakes form three distinct layers of water during summertime weather. The epilimnion is the upper layer and is characterized by warmer and lighter water.

Eutrophication: The aging process by which lakes are fertilized with nutrients.

Eutrophic Lake: A nutrient-rich lake – usually shallow, "green" and with limited oxygen in the bottom layer of water.

Exotic Species: Any non-native species that can cause displacement of or otherwise threaten native communities.

Fall Turnover: In the autumn as surface water loses temperature they are "turned under" (sink to lower depths) by winds and changes in water density until the lake has a relatively uniform distribution of temperature.

Feedlot: A lot or building or a group of lots or buildings used for the confined feeding, breeding or holding of animals. This definition includes areas specifically designed for confinement in which manure may accumulate or any area where the concentration of animals is such that a vegetative cover cannot be maintained. Lots used to feed and raise poultry are considered to be feedlots. Pastures are not animal feedlots.

Groundwater: water found beneath the soil surface (literally between the soil particles); groundwater is often a primary source of recharge to lakes.

Hardwater: Describes a lake with relatively high levels of dissolved minerals such as calcium and magnesium.

Hypolimnion: The bottom layer of lake water during the summer months. The water in the hypolimnion is denser and much colder than the water in the upper two layers.

Impervious Surface: Pavement, asphalt, roofing materials or other surfaces through which water cannot drain. The presence of impervious surfaces can increase the rates and speed of runoff from an area, and prevent groundwater recharge.

Internal Loading: Nutrients or pollutants entering a body of water from its sediments.

Lake Management: The process of study, assessment of problems, and decisions affecting the maintenance of lakes as thriving ecosystems.

Littoral zone: The shallow areas (less than 15 feet in depth) around a lake's shoreline, usually dominated by aquatic plants. These plants produce oxygen and provide food, shelter and reproduction areas for fish & animal life.

Local Unit of Government: A unit of government at the township, city or county level.

Mesotrophic Lake: A lake that is midway in nutrient concentrations (between a eutrophic and oligotrophic lake). Characterized by periodic problems with algae blooms or problem aquatic vegetation.

Native Species: An animal or plant species that is naturally present and reproducing.

Nonpoint source: Polluted runoff – nutrients or pollution sources not discharged from a single point. Common examples include runoff from feedlots, fertilized lawns, and agricultural fields.

Nutrient: A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to lake eutrophication and nonpoint source pollution.

Oligotrophic Lake: A relatively nutrient-poor lake, characterized by outstanding water clarity and high levels of oxygen in the deeper waters.

Nutrient: A substance that provides food or nourishment, such as usable proteins, vitamins, minerals or carbohydrates. Fertilizers, particularly phosphorus and nitrogen, are the most common nutrients that contribute to lake eutrophication and nonpoint source pollution.

pH: The scale by which the relative acidity or basic nature of waters are accessed,

Photosynthesis: The process by which green plants produce oxygen from sunlight, water and carbon dioxide.

Phytoplankton: Algae – the base of the lake's food chain, it also produces oxygen.

Point Sources: Specific sources of nutrient or pollution discharge to a water body, i.e., a stormwater discharge pipe.

Riparian: The natural ecosystem or community associated with river or lake shoreline.

Secchi Disc: A device measuring the depth of light penetration in water.

Sedimentation: The addition of soils to lakes, which can accelerate the "aging" process by destroying fisheries habitat, introducing soil-bound nutrients, and filling in the lake.

Spring turnover: After ice melts in the spring, warming surface water sinks to mix with deeper, colder water. At this time of year all water is the same temperature.

Thermocline: During summertime deeper lakes stratify by temperature to form three discrete layers; the middle layer of lake water in known as the thermocline.

Trophic Status: The level of growth or productivity of a lake as measured by phosphorus, content, algae abundance, and depth of light penetration.

Watershed: The surrounding land area that drains into a lake, river, or river system.

Zooplankton: Microscopic animals.

Common Biological or Chemical Abbreviations

BOD	Biological Oxygen Demand
°C	degree(s) Celsius
cfs	cubic feet per second (a common measure of rate of flow)
cfu	colony forming units (a common measure of bacterial concentrations)
chl *a*	Chlorophyll *a*
cm	centimeter
COD	Chemical Oxygen Demand
Cond	conductivity
DO	dissolved oxygen
FC	fecal coliform (bacteria)
ft	feet
IR	infrared
l	liter
m	meter
mg	milligram
ml	milliliter
NH_3-N	nitrogen as ammonia
NO_2-NO_3	nitrate-nitrogen
NTU	Nephelometric Turbidity Units, standard measure of turbidity
OP	Ortho-phosphorus
ppb	parts per billion
ppm	parts per million
SD	Standard Deviation (statistical variance)
TDS	total dissolved solids
TN	total nitrogen
TP	total phosphorus
TSI	trophic status index
TSI (C)	trophic status index (based on chlorophyll *a*)
TSI (P)	trophic status index (based on total phosphorus)
TSI (S)	trophic status index (based on secchi disc transparency)
TSS	total suspended solids
µg/l	micrograms per liter
µmhos/cm	micromhos per centimeter, the standard measure of conductivity
UV	Ultraviolet

Guide to common acronyms

State and Federal Agencies

BWSR	Board of Soil & Water
COE	U.S. Army Corps of Engineers
CRP	Conservation Reserve Program - A federal government conservation program
DNR	Department of Natural Resources
DOJ	United States Department of Justice
DOT	Department of Transportation
DTED	Department of Trade and Economic Development
EPA	U.S. Environmental Protection Agency
EQB	MN Environmental Quality Board
ICOLA	Hubbard Coalition of Lake Associations
LCMR	Legislative Commission on Minnesota Resources
MDH	Minnesota Department of Health
MHB	Mississippi Headwaters Board
MPCA	Minnesota Pollution Control Agency
NRCS	Natural Resource Conservation Service
OEA	MN Office of Environmental Assistance
OSHA	Occupational Safety and Health Administration
RIM	Reinvest In Minnesota - a State of Minnesota Conservation Program
SCS	Soil Conservation Service
SWCD	Soil & Water Conservation District
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USFWS	United States Fish & Wildlife Service

Regional, watershed, community development, trade and advocacy groups

AMC	Association of Minnesota Counties
APA	American Planning Association
COLA	Coalition of Lake Associations
IF	Initiative Foundation
LMC	League of Minnesota Cities
MAT	Minnesota Association of Townships
MLA	Minnesota Lakes Association
MSBA	Minnesota School Board Association
MCIT	Minnesota Counties Insurance Trust
Mid-MnMA	Mid-Minnesota Association of Builders
MLA	Minnesota Lakes Association
MnSCU	Minnesota State Colleges and Universities
RCM	Rivers Council of Minnesota
TIF	Tax Increment Financing

Codes and Regulations

103B.301	The Minnesota law that regulates non-metro county water plans
ADA	American Disabilities Act
B & B	Bed and Breakfast
BOA	Board of Adjustment
Chapter 70/80	Individual Sewage Treatment Standards
CIC Plat	Common Interest Community Plat
Class V	Class Five "Injection" well; any well which receives discharge
CSAH	County State Aid Highway
CUP	Conditional Use Permit
CWA	Clean Water Act
EAW	Environmental Assessment Worksheet
EIS	Environmental Impact Statement
EOA	Equal Opportunity Act
FOIA	Freedom of Information Act
GD	General Development (lake)
GLAR	Greater Lakes Area Association of Realtors
IAQ	Indoor Air Quality
ISTS	Individual Sewage Treatment System
LMP	Lake Management Plan
LQG	Large Quantity Generator (of hazardous waste)
MAP	Minnesota Assistance Program
OHW	Ordinary High Water
PUD	Planned Unit Development
RD	Rural Development (lake)
ROD	Record of Decision
ROW	Right-of-Way
SBC	State Building Code
SDWA	Safe Drinking Water Act
SF	Square feet
SIZ	Shoreland Impact Zone
SQG	Small Quantity Generator (of hazardous waste)
SWMP	Stormwater Management Plan
UBC	Universal Building Code