POTATO LAKE BASELINE ANALYSIS

LAKE MANAGEMENT PLANNING GRANT

PHASE I REPORT

December 2005

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Table of Contents

Introduction 1

Description of methods and activities and data collection 1

Limiting Factors 2

Project Study Area 2

Lake and Watershed Basin Characteristics 2

Geology and Soils 3

Zoning and Land Use 3

Water Quality 3

Water Clarity 6

Chlorophyll a 7

Total Phosphorus 8

Vegetation 9

Possible Pollutant Sources 12

Residential Density 12

Summary 13

Conclusions 14

Recommendations 15

General Recommendations for Lake Residents 15

Recommendations for Phase II 15

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Washburn County Lakes & Rivers Association and Potato Lake Group
Phase I Investigation
Baseline Analysis

December 2005

This report was prepared by Cooper Engineering Company, Inc. on behalf of the Washburn County Lakes & Rivers Association and Potato Lake Group.

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Introduction

In April 2005, the Wisconsin Department of Natural Resources approved funding for a Potato Lake baseline analysis study under Wisconsin's Lake Planning Grant Program. The Washburn County Lakes & Rivers Association (WCLRA) applied for and was awarded the grant on behalf of the Potato Lake Group (PLG). WCLRA's goal is to improve the overall health and aesthetics of the lakes and rivers in Washburn County. Therefore, they have an interest in the investigation and improvement of Potato Lake's water quality and were pleased to sponsor PLA in this effort.

The 2005 Baseline Analysis Study provided the background necessary to properly identify the issues requiring further investigation to determine what steps could be taken to improve the water quality and overall condition of Potato Lake. The residents of Potato Lake indicated that their main concern was excessive weed growth and frequent algae blooms, both of which brought up concerns of the possible contributing factors decreasing their lake's quality and aesthetics. Additional topics were raised during the year that were addressed and regarded for Phase II. The following list summarizes the activities conducted during the Phase I 2005 investigation in preparation for the future Lake Management Plan:

1. Analysis of Potato Lake's watershed basin including: boundary, geology, soil types, soil erodibility and permeability, and land use.
2. Determination of possible point and non-point sources of nutrient and sediment load into the lake.
3. Analysis of physical and chemical data collected by lake residents and Cooper Engineering to examine the current lake water quality status and determine what parameters needed to be analyzed during the next year to further characterize the water quality.
4. Identification of the types and density of the aquatic vegetation.
5. Analysis of precipitation and other climate data.
6. Summary of questionnaire data for use during study. Questionnaire results are located in Attachment 1.

Description of methods and activities and data collection

The lake's watershed was identified, sized, and mapped, and the physical characteristics such as soils, geology, and other historical data were determined from Cooper Engineering's in-house map files. A zoning map was acquired from the county zoning office; interviews and visual observations were used to determine land use within the lake's watershed. The area land use's potential for run-off and as a pollutant source was also determined and analyzed.

Data collection was performed by residents of Potato Lake and Cooper Engineering Company, Inc. Aquatic vegetation was identified to determine if plant growth is invasive or native and to establish community types. Diversity and dominance was also determined by surveying transects around the lake. Shoreline plant communities were evaluated in order to determine their role in bank stabilization and ability for erosion control and runoff pollutant attenuation.

Local precipitation and temperature data was collected throughout the study period. Potato Lake residents continued collecting their data through their self-help monitoring plan as they have since 1997. Potato Lake also kept a log of fluxes in aquatic vegetation density, occurrence of algae blooms, wildlife observed, and other pertinent data.

Limiting Factors

Potato Lake experienced several extreme events outside the relative average causing several limiting factors. Precipitation was highly variable, especially when compared to the 1971-2000 monthly averages (see Figure 1). June was a wet month, about 3 inches above normal, July and August each had less than one inch of rain. The mid-summer drought seemed to result in lower lake levels, which could also be considered a limiting factor. And finally, October was another wet month, over 3 inches above normal. Precipitation data was gathered from the Midwest Climate Center for the Spooner Agriculture Station and also compared to on-site observations. The drought also inhibited identification of some plant species as they either died back before flowering parts could be identified, or were out-competed by hardier species.

Project Study Area

Potato Lake is located approximately 10 miles east of the City of Spooner in eastern Washburn County, Wisconsin (see Figures 2 and 3). The main body of Potato Lake is described as being in Section 36, T39N-11W (Crystal Township), and the southern tip of the lake is in Section 1 of T38N-R11W (Madge Township).

The Potato Lake watershed extends to the west roughly 1.3 miles past Crystal Lake and just west of CTH M; to the southwest almost 1.8 miles but not reaching Baker Lake; to the south almost 1.4 miles; to the southeast about 1.4 miles; and to the east 0.1-0.5 miles. The watershed boundary is outlined in Figure 3. The red line indicates the subbasin boundary for Crystal Lake, which eventually drains into Potato Lake.

Lake and Watershed Basin Characteristics

Lake Area:	222 acres	Watershed Area:	3,397 acres
Maximum Depth:	20 feet	Watershed:Lake Ratio:	15:1
Mean Depth:	11 feet	Public accesses:	1
Shoreline:	2.9 miles	Inlets:	4
Volume:	2,548 acre-feet	Outlets:	1

Potato Lake is a mixed spring lake containing 3 main spring areas in the south end and various smaller springs located throughout the lake. The mean lake depth is 11 feet and it reaches a maximum depth of 20 feet in the northeast quadrant of the lake, southwest of the boat landing. The north bay and south end of the lake are shallow, and eventually get choked with weeds by mid-summer.

The lake is highly developed along its 2.9 miles of shoreline with more than 70 homes. The relief around the lake is mostly steep on the east and west sides, low to high slopes on the north end, and low on the south end. Shoreline vegetation ranges from wetland in the southwest and south end, mixed hardwood forest along the east shore and mixed hardwood and pine along the west side.

Geology and Soils

The area bedrock consists of Precambrian crystalline igneous and metamorphic rocks overlain by Cambrian sandstone (including Jordan, St. Lawrence, Franconia, Galesville, Eau Claire, and Mt. Simon formations). The glacial geology of the area is end moraine with till and stratified sand and gravel and pitted outwash with stratified sand and gravel. See Figure 4 for geology maps.

Soils in the Potato Lake drainage basin are predominantly sandy loams (see Figure 5 and 6). Less dominant soils are sand, silt loam and loamy sand. The majority of the soils in the basin are potentially highly erodible to highly erodible, which elevates the necessity for proper buffering around the lake since runoff will carry nutrients. The relief in the basin and specifically surrounding Potato Lake is undulating with rather steep slopes ranging from 6 to 45%. The only low slope areas adjacent to the lake are small and are located at the inlet and wetland at the south tip and at the outlet at Potato Creek.

The lake bottom is mostly muck but with some sand and gravel areas along the shore. Lake bottom sediments were determined by referencing the WDNR Lake Survey Map and with field observations.

Zoning and Land Use

Agricultural land, the dominant zoning designation in the Potato Lake area, is located in the west and central part of the basin. The next dominant is forest, located in the south and southeast portion of the basin. Residential zoning is located around each lake. There are four major inlets to Potato Lake (see Figure 3). These are basically identified as major drainages, but do have some intermittent flow into the lake. The table below outlines the land uses within each subbasin entering the lake. Additional smaller areas also drain into the lake via overland flow. Land uses were determined using aerial photographs and field observations and are illustrated in Figure 7.

Inlet #	Subbasin (acres)	Description of Subbasin Land Use
1	27	Residential, hardwood forest and wetland
2	121	Residential, hardwood forest and wetland
3	1,009	Private and county forest and wetlands, minimal residential
4	1,769	Crystal Lake, agricultural land (row crop, mixed agriculture, and pasture), forest and wetland

Even though agricultural is the dominant zoning category, not all of the agriculturally zoned land is used for agriculture purposes, as some is forest and wetland. Land use is actually dominated by forest and wetland; however, agriculture is the dominant land use in the largest subbasin that drains initially into Crystal Lake and then into inlet #4, which is the inlet that seems to carry the most sediment load into the lake. This was determined by observing water clarity at upstream culverts and the wash at inlet #4 after certain rain events.

Water Quality

Lake water quality is dependent on both physical and chemical characteristics, both of which are usually variable over time on either a daily or seasonal basis. Both the physical and chemical characteristics interact creating a balance within the lake. Therefore, when one or more of these attributes veer from its relative norm, the resulting imbalance may cause such things as excessive plant growth, algae blooms, or winter fish kills. Changes that occur on a daily basis are mostly chemical changes, such as phosphorus or pH. Seasonal changes tend to be physical changes, such as water clarity (turbidity or algae growth) or water levels as a result of precipitation. Specific events can also have severe effects on a lake, such as a flood bringing in high sediment load into the lake, or point source events, for example a failed septic system holding tank or a chemical spill.

Lakes naturally experience aging through the eutrophication process, that is, the progressing from an oligotrophic (young) to a eutrophic (mature) lake. Over time, an oligotrophic lake is enriched by nutrients, such as phosphorus and nitrogen, consequently increasing the quantity and severity of algae blooms and the density of the larger aquatic plants and very slowly transforming the lake into a eutrophic state. Eutrophication includes an array of physical, chemical and biological changes that occur after a plant nutrient load enters the lake by runoff and soil erosion from the lake's watershed. The table below outlines the Trophic State Indices (TSI) categories and values used to evaluate and categorize a lake and its water quality.

	TSI	TSI Description
Oligotrophic	**TSI < 30**	Classical oligotrophy: clear water, many algal species, oxygen throughout the year in bottom water, cold water, oxygen-sensitive fish species in deep lakes. Excellent water quality.
	TSI 30-40	Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.
Mesotrophic	**TSI 40-50**	Water moderately clear, but increasing chance of low dissolved oxygen in deep water during the summer.
Eutrophic	**TSI 50-60**	Lakes becoming eutrophic: decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only.
	TSI 60-70	Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.
Hypereutrophic	**TSI 70-80**	Becoming very eutrophic. Heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight).
	TSI > 80	Algal scums, summer fishkills, few plants, rough fish dominant. Very poor water quality.

http://www.dnr.state.wi.us/org/water/fhp/lakes/selfhelp/index.htm

Three main parameters are used to analyze a lake's Trophic State Index: total phosphorus which measures the amount of nutrients available for plant and algae growth, chlorophyll a which measures the amount of algae, and Secchi disk depth which is a water clarity indicator.

The Potato Lake Association is involved in the WDNR's Self Help Monitoring program and is currently measuring these parameters (see Attachment 2). For this, members of PLG measure or collect samples for the following parameters:

- Temperature (field measurement)
- Dissolved Oxygen (field test kit)
- Secchi Disk Depth (field measurement)
- Chlorophyll a (laboratory analysis)
- Total Phosphorus (laboratory analysis)

They also make general observations on lake water level, clarity and color. All their data is submitted to the WDNR and summarized in annual reports on the WNDR Lake's Partnership webpage. The data was also used in this report for preliminary analysis of water quality.

The Northern Lakes and Forests ecoregion parameter values according to Descriptive Characteristics of the Seven Ecoregions in Minnesota, by G. Fandrei, S. Heiskary, and S. McCollar, 1988, Minnesota Pollution Control agency were also used for comparison of Potato Lake's values (see Figure 8). The typical values for Northern Lakes and Forests are listed below. Potato Lake contained higher total phosphorus, some chlorophyll a values exceeded the mean and maximum, and Secchi depths were on average shallower.

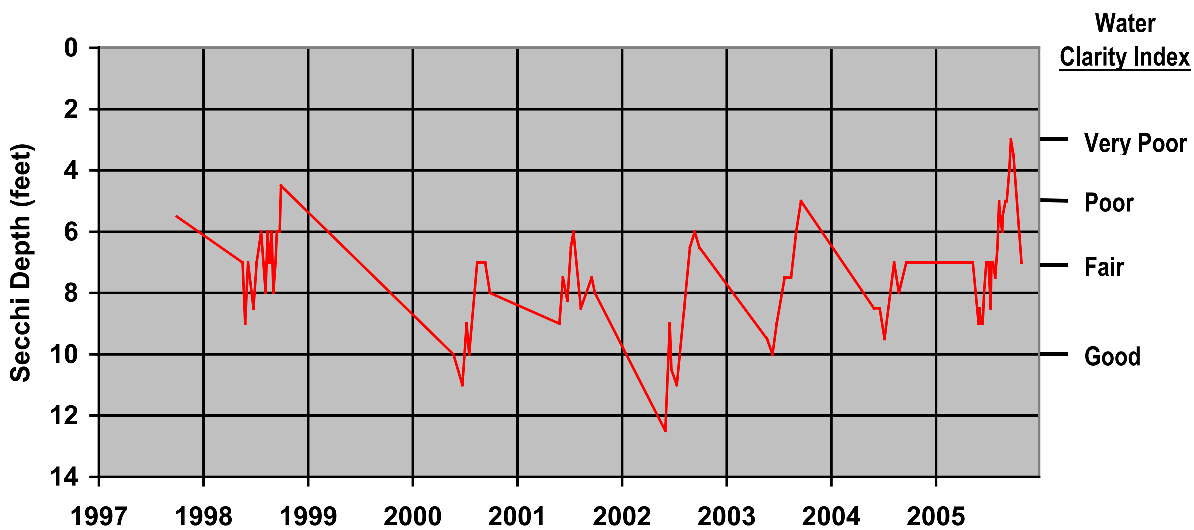
Parameter	Northern Lakes and Forests Typical Values
Total Phosphorus (ppb)	14-27
Chlorophyll a	
Mean	<10
Maximum	<15
Secchi Disk (feet)	8-15
(meters)	2.4-4.6

Water Clarity

The physical properties of a lake can be used to analyze the overall water quality by measuring the two components of water clarity, true color (dissolved matter) and turbidity (suspended matter). Though tubidity and color are not exact readings of water quality, they can be used as indicators for other parameters. Secchi disk measurements are used to determine water clarity by lowering the bi-colored disk into the water until it no longer can be seen. This is done twice at each measurement location and the two values averaged. Secchi disk readings are also inversely proportional to chlorophyll a values, and therefore, are an indirect measurement of the amount of algae present. Secchi disk readings that PLG have collected since 1997 at the Deep Hole sample point are summarized in the table and chart below:

Secchi Depth Results

	Depth 1997-2005 (feet)	Depth 2005 (feet)
Average	7.4	6.6
Median	7.0	7.0
Range	3-12.5	3-9
Average TSI	49	51
Median TSI	49	49
Range TSI	41-61	49-61



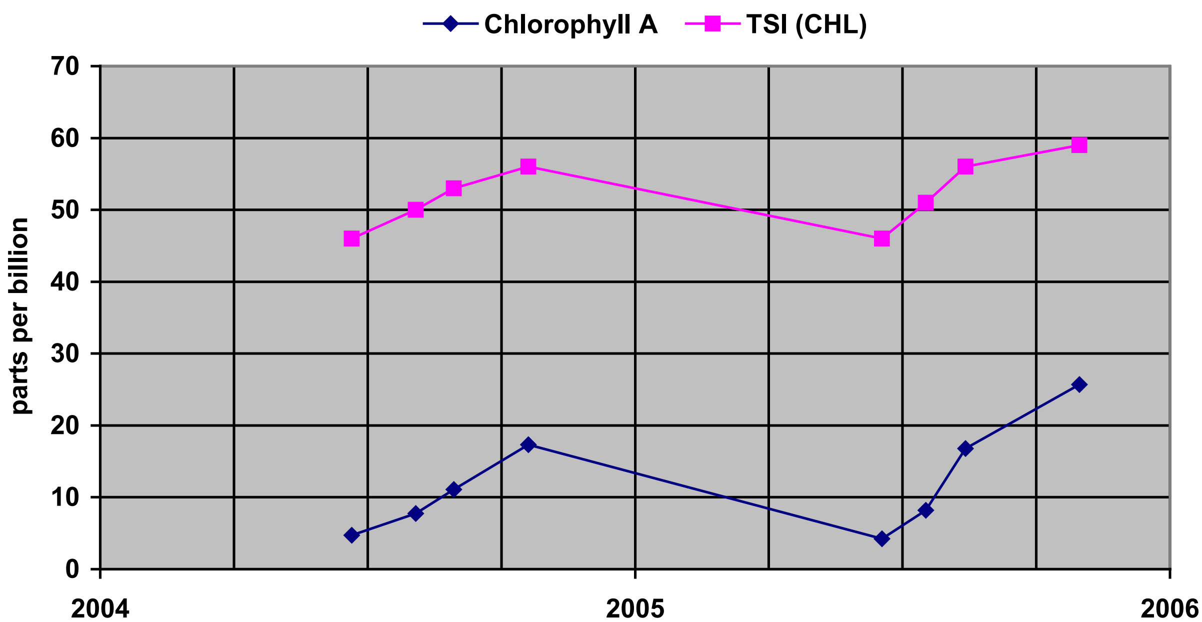
Typical values for Secchi depth for the Northern Lakes and Forest ecoregion are between 8-15 feet, which places Potato Lake below the ecoregion average. In 2005, Potato Lake rated from very poor to fair on the Water Clarity Index and has not been rated as "good" since 2003. Water clarity is best in the spring, before the growing season, and slowly declines, but with expected flucuations due to periodic algae blooms and sedimentation with heavy rains. Secchi disk readings alone place Potato Lake in the mesotrophic (TSI = 40-60) to eutrophic (TSI = 60+) range. Secchi depths in late summer and fall of 2005 were the lowest since measurements began in 1997.

Chlorophyll a

The compound found in all plant life that is necessary for photosynthesis is chlorophyll a, which can be measured directly. It is used as a water quality indicator since it determines the amount of algae present in a lake. The table and chart below summarize the data collected by Potato Lake's Self Help Monitoring program for the last two years and analyzes their TSI status.

Chlorophyll a

	2004-2005	2004	2005
Average (ppb)	12	10.2	13.7
Median (ppb)	9.6	9.4	12.5
Range (ppb)	4.2-25.7	4.74-17.3	4.21-25.7
Average TSI	52.1	51.3	53
Median TSI	52.0	51.5	53
Range TSI	46-59	46-56	46-59



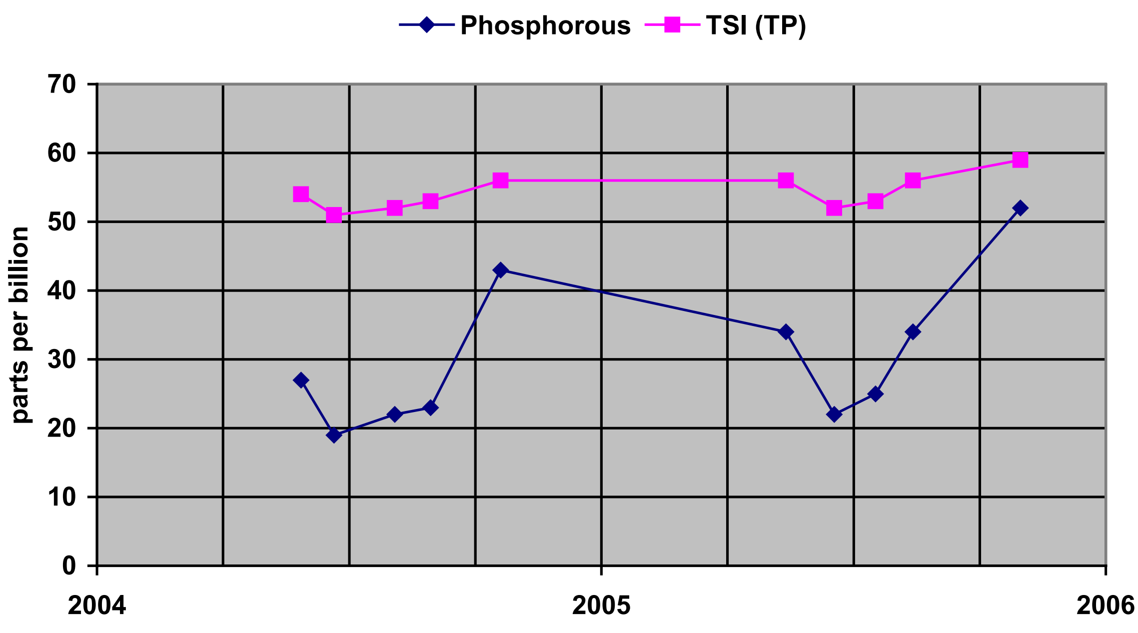
Chlorophyll a levels indicate mesotrophic conditions in the spring, but changing to eutrophic conditions in early summer with the first algae bloom. Algae blooms occurred in April, June, August and September during 2005. The average TSI value is 52 over the past two years, indicating a eutrophic state. The fall 2005 result was the highest so far.

Total Phosphorus

Phosphorus is primarily the 1st key nutrient in algae and weedy plant growth in over 80% of lakes in Wisconsin. Usually, phosphorus is the least available or limiting nutrient in lakes; therefore, the level of phosphorus, whether in excess or scarcity, determines the quantity of aquatic plant growth. Phosphorus is naturally occurring, but human activities tend to upset the lake's chemical balance by creating an excess of phosphorus. Major sources include: soil erosion, agriculture runoff, animal waste, lawn fertilizers, detergents, and septic systems. Phosphorus can also be released from lake bottom sediment in oxygen-depleted conditions and during lake turnover.

Total Phosphorus

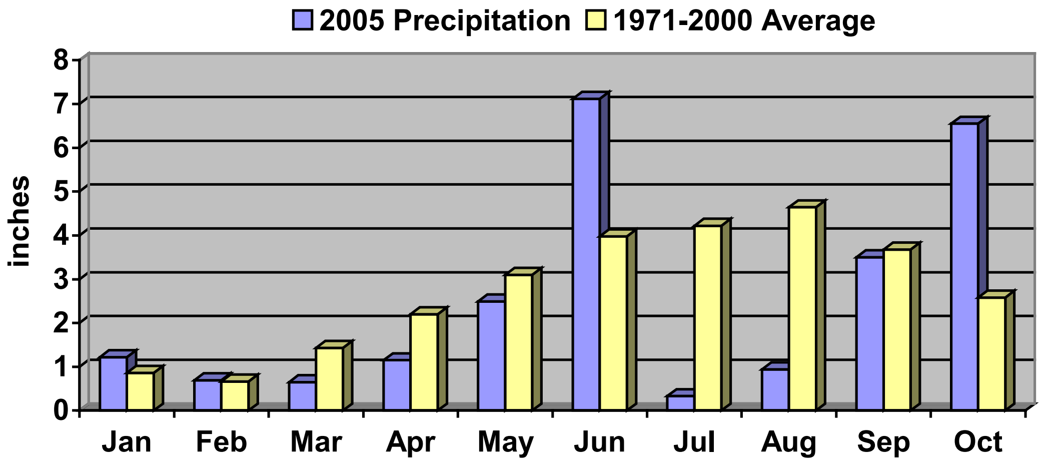
	2004-2005	2004	2005
Average (ppb)	30.1	26.8	33.4
Median (ppb)	26	23	34
Range (ppb)	19-52	19-43	22-52
Average TSI	54.2	53.2	55.2
Median TSI	53.5	53	56
Range TSI	19-52	19-43	52-59



The TSI values for phosphorus have all been above 50 during the last two years of self-help monitoring, which identifies Potato Lake as being eutrophic. Concentrations were highest in the spring and in the fall. Even though there is minimal mixing by turnover at Potato Lake, the high phosphorus concentrations in the fall may be an indication of phosphorus previously sorbed to lake sediment becoming released and adding to the lake's phosphorus load.

Vegetation

Several macrophyte sample points were established around the lake to observe general plant diversity and density as the growing season progressed. Cooper Engineering identified the dominant plants and performed an initial invasive species survey and the Potato Lake volunteers recorded density through the growing season. The limiting factor on the vegetation survey was precipitation.



Precipitation exceeded the 1971-2000 average values in June and October by 3 or more inches, while a drought occurred in July and August. According to lake residents, the lake was on its way toward the vegetation excess it had been experiencing in the past. A few residents even mentioned that June and early July were worse than past years. However, the drought in July and August resulted in an actual decrease in vegetation density. There are many possible causes of this reduction in the presence and growth, but with the limited data it is impossible to determine the actual cause. Possible causes are listed below, which could be further studied with the collection of additional parameters in 2006.

- The drought resulted in lower lake levels. This has contradictive possible outcomes. First: the lower lake level should have resulted in additional area of shallower lake depth more area for plant growth), which would have been conducive to additional plant growth, not its decrease. Second: lake temperatures were approximately 5 degrees higher when comparing 8/4/04 and 7/19/05 readings. This may have altered the lake chemistry enough to decrease plant growth; however, data for total phosphorus is limited and other parameters, for instance nitrogen that would have aided in further determination, were not sampled.
- The drought could have altered the concentrations of the limiting nutrients, phosphorus and nitrogen, decreasing favorable conditions for algae blooms and excess weedy growth. If the nitrogen to phosphorus (N:P) ratio became less than 10:1, this could limit algae growth. This also could explain the two blue-green algae blooms observed by lake residents who said they had never seen them there before. Blue-green algae would tolerate this lower ratio since they use atmospheric nitrogen instead of inorganic nitrogen or ammonium that is used by more common green algae and plants.

Further sampling to analyze the N:P ratio in 2006 may aid in explaining the decrease in green algae and weedy growth. More frequent temperature readings of the vertical lake gradient could also expand on the seasonal layering within the lake, and the possibility of turnover in the fall.

Invasive species, such as Eurasian water milfoil or curly leaf pondweed, were not observed during the 2005 season. Figure 9 illustrates the sample points set up to record vegetation diversity and density. The sample points were also chosen to determine if any areas became stressed during the season. Most areas were stressed or obviously altered by the drought conditions in July and August; stressed vegetation that could be the result of other influences was also observed at sample points C and M. Vegetative growth was the heaviest in the north bay, adjacent to the outlet in the northeast corner of the lake, and in the south third of the lake where water is more shallow, which includes sample point G (also named inlet #4).

Some species disappeared during the drought before proper identification could be made of the flowering parts or were out-competed by hardier plants, thus creating a limiting factor in the survey. However, this initial survey was mainly to determine if invasive species existed within the lake and to observe the increased vegetation density to determine if an Aquatic Management Plan is necessary and the degree of future investigation required to prepare such a plan. Since Eurasian water milfoil and curly leaf pondweed would be more dominant and hardy, it is not likely their presence was missed due to the drought. However, since these species could be introduced at any time, an invasive species survey should part of any future study, at least by residents of Potato Lake. Suspicious samples can always be taken to the WDNR in Spooner for identification.

Vegetation identified during 2005 is listed below and the dominant plants are indicated with a check mark:

2005 Preliminary Aquatic Vegetation Survey

Scientific Name	Common Name	Dominant?
Alisma triviale	Water plantain	
Carex comosa	Bottle brush sedge	
Ceratophyllum demersum	Coontail	✓
Chara sp.	Muskgrasses	
Elodea canadensis	Common waterweed	✓
Gratiola aurea	Dwarf hyssop	
Heteranthera dubia	Water star-grass	
Lemna minor	Small duckweed	✓
Lemna trisulca	Forked duckweed	
Myriophyllum sibericum	Northern water milfoil	✓
Myriophyllum verticillatum	Whorled water milfoil	
Najas flexilis	Bushy pondweed	
Nuphar variegata	Spatterdock	
Nymphaea odorata	White water lily	✓
Phalaris arundinacea	Reed canary grass	
Potamogeton amplifolius	Large-leaf pondweed	
Potamogeton epihydrus	Ribbon-leaf pondweed	
Potamogeton gramineus	Variable pondweed	✓
Potamogeton natans	Floating-leaf pondweed	
Potamogeton richardsonii	Clasping-leaf pondweed	✓
Potamogeton robbinsii	Robbin's pondweed	✓
Sagittaria graminea	Grass-leaved arrowhead	
Sagittaria latifolia	Common arrowhead	
Schoenoplectus tabernaemontani	Softstem bulrush	✓
Sparganium eurycarpum	Common bur-reed	
Typha latifolia	Broad-leaved cattail	✓
Utricularia minor	Small bladderwort	
Vallisneria americana	Wild Celery	
Zizania palustris	Northern wild rice	✓

Northern wild rice is the most dominant emergent plant in Potato Lake. Depending on the location, northern water milfoil, common waterweed, and coontail are dominant floating vegetation or submergent vegetation. Submergent pondweeds dominate in deeper water.

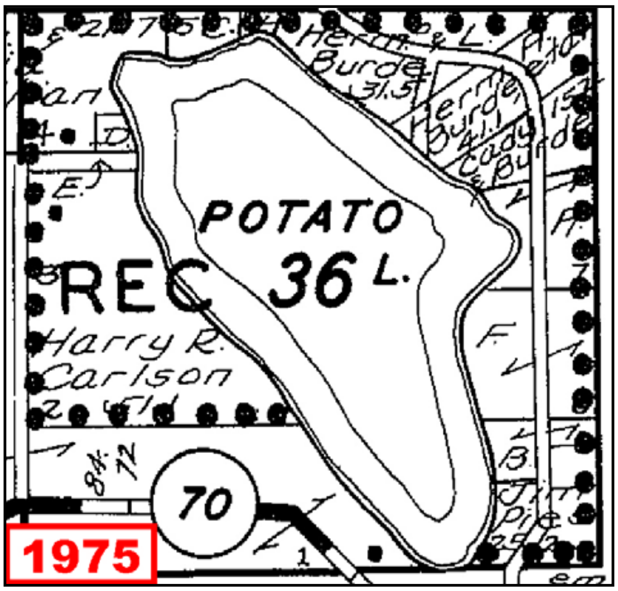
Bright pink anaerobic sulfur bacteria were identified at the south end of the lake surrounding the springs. Through correspondence with the WDNR, it was determined that this was not the first time the sulfur bacteria had existed at Potato Lake, having been identified in prior years by WDNR personnel.

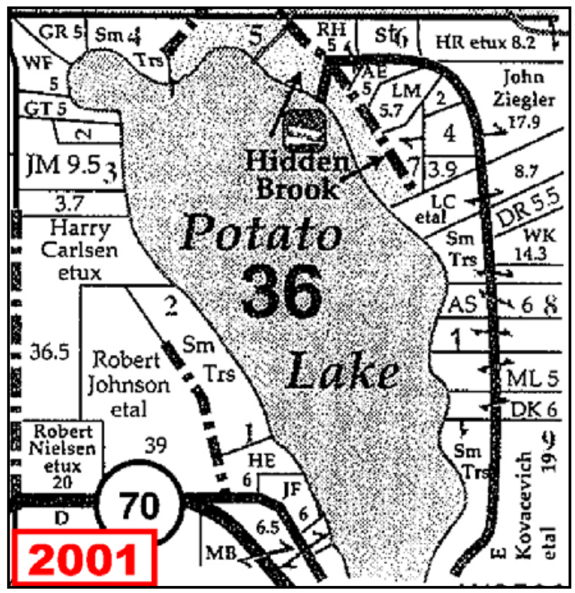
Possible Pollutant Sources

When trying to determine the possible contributors of pollutant load into the lake, contributors are classified as either point or non-point sources. Point sources come from a specific point or area, a clearly identifiable source. Non-point pollution occurs when rainwater and snowmelt travel over and through the environment and into the waterways or via the atmosphere and then onto the land or into the water.

Residential Density

Plat maps for 1975 and 2001 illustrate the heavy increase in the number of lots around Potato Lake. Even though most of the cabins are not year round residents, the change in the landscape and increase in traffic is substantial enough to cause an increase in load into the lake.





In 1975, there were approximately 25 cabins on Potato Lake. The number of cabins increased by over 60 percent by 2001 with additional construction still occurring to date bringing the number of cabins to over 70. With only 2.9 miles of shoreline, Potato Lake has a residential density of 24 homes per mile (15 homes/km). Habitat can start to decline at approximately 11 homes per mile of shoreline, depending on shoreline management practices. Generally speaking, the Potato Lake shoreline is in good condition. Major concerns relative to increased residential density include: shoreline erosion, increased erosion rates from changing the landscape from the natural woods to lawns, increased nutrient load from lawn fertilizers, animal waste, and/or septic systems.

Steep slopes have inhibited drastic change in landscape by residents and in most cases the slope landscape has remained, for the most part, natural. However, there are some areas that could be improved by creating or simply increasing their buffer zone. Also, erosion prevention could be applied to viewing corridors as some have exposed soil; water discoloration and sedimentation was observed in these areas.

- The buffer zone could be increased in the north bay where lawn extends almost to the lake. Planting natural vegetation would aid in filtering nutrients and holding back the amount of sediment load into the bay.
- Discoloration, odor, and sedimentation were observed at inlet #2 and #3, indicating that these areas should be investigated further for possible control measures, such as increased buffer along the inlet banks, and investigation of additional upstream sources, though it appears to be mostly wetland for inlet #2. Other possibilities could be a failed septic tank or runoff from 1st Street.

Another possible source of high nutrient and sediment load into the lake is the horse ranch located adjacent to Crystal Lake. The ranch has recently taken measures to improve their management practices, but could still be a major contributor to Potato Lake. One benefit is that there are numerous wetlands between the two lakes, which would aid in filtering nutrients and sediments out of runoff prior to reaching Potato Lake. This filtering capability could possibly be enhanced by the installation of a sedimentation basin before one of the major wetland areas. This, however, would require land acquisition, so would have to be closely evaluated as to its cost effectiveness.

In approximately the spring of 1998, a dam located on a wetland/pond south of Hwy 70 and Potato Lake broke and introduced sediment and nutrients into Potato Lake. The effect can be seen by the Secchi disk readings during that year, which were in the poor to fair range of the Water Clarity Index. The lake appeared to rebound from the event having depth readings greater than 12 feet in 2002. However, this does not mean the dam failure did not have an effect. The drainage route between the pond and Potato Lake contains two wetlands. Water volumes appeared to exceed the wetland filtering capability only during the heavy rain events in June and October of 2005. During these events, which were above the average, a sediment plume did enter the lake at inlet #4. However, since the dam area and Crystal Lake drain into the same inlet, it cannot be determined without additional data which source is the larger contributor of sediments and nutrients.

HWY 70 runs adjacent to the southern tip of Potato Lake and contains a stormwater drain, which feeds into inlet #3. Road salts and sediment could be entering the lake through this avenue though the location and density of the south wetland should aid in filtering some of the sediment.

Summary

Stratification: Only mild stratification was observed at Potato Lake. In July of 2005, a temperature gradient of 10 degrees was observed along with decreasing dissolved oxygen readings with depth. Higher total phosphorus readings in the fall of 2004 and 2005 could also indicate a fall turnover; however, heavy rains in October 2005 also introduced a heavy load of phosphorus into the lake. Based on the limited data, if stratification does exist at Potato Lake, it is minimal and brief. More frequent data would be required in order to draw a proper conclusion on stratification and if the phosphorus in the lake sediment is a major contributor to the lake's phosphorus load, or if the load is mostly from overland flow.

Seechi Depth: Average annual TSI Secchi disk readings ranged from 46, mesotrophic conditions, to 53, eutrophic conditions, averaging 49. Since Seechi disk readings are inversely proportional to chlorophyll a levels, Secchi depths were lower during algae blooms. Secchi depths decreased overall as the growing season progressed, transitioning from a mesotrophic state to a eutrophic one.

Chlorophyll a: Average TSI chlorophyll a results ranged from 46 to 59 with an average of 52, which is eutrophic. Algae blooms occurred in April, June, August and September. The highest readings for 2004 and 2005 were during the fall.

Total Phosphorus: Total phosphorus results for 2004 and 2005 place Potato Lake in the eutrophic range. The phosphorus TSI ranged from 51 to 59 with an average of 54. Phosphorus levels were the highest they have ever been this fall at 52 ppb (TSI of 59); however, October had some heavy rain events, which created higher than normal runoff into the lake. These higher readings could also have been due to a slight fall turnover, introducing more phosphorus containing sediment into the lake.

Excess weeds: Questions were raised as to what could be done about the excess weed growth, especially in the north bay. There are various remedial options, including chemical treatment and mechanical or manual removal of the weeds. Care must be taken in determining a corrective measure since any method will have side effects. For instance, chemical treatment of plants will increase the nutrient load in the lake as the plants die, possibly leading to algae blooms or blue-green algae blooms. Plants stabilize the lake bottom and mechanical removal of vegetation could greatly disturb the lake bottom especially in mucky sediments, and increase sediment in the water, reducing clarity and light penetration. Furthermore, additional study is needed into the chemical balance and load into the lake to hopefully prevent the severity of future problems and keep maintenance costs to a minimum, if implemented in the future.

Lake water level: Lake residents have expressed concerns that lake levels have decreased at least 0.5 feet. Since Potato Lake water levels have not been monitored officially, the Ordinary High Water Mark would need to be determined by an engineer. This requires extensive data collection and computer modeling and probably a grant unto itself. There are certain areas around the lake that may indicate higher water levels, but they also could be due to other occurrences: 2005 precipitation through October is down 3 inches, or ice scour and recession.

Conclusions

Even though Secchi disk readings indicated that Potato Lake is in a mesotrophic condition, chlorophyll a and phosphorus levels, the frequency of algae blooms, and excessive weedy growth during recent years place Potato Lake in the eutrophic category of lake status. Furthermore, though the lake may experience natural fluctuations in its trophic state, currently available scientific data and additional interview/questionnaire data indicate that the water quality has decreased over the past few years.

Recommendations

General Recommendations for Lake Residents

1. Increase shoreline buffer zone with native plants to help prevent erosion and nutrients from entering the lake.
2. With new development occurring on Potato Lake, erosion control measures are a concern during construction of new homes. The size of the construction area determines whether or not permits are required. These would have to be addressed on a case by case basis on either the federal, state, or local level.
3. Maintain septic systems and if in doubt of integrity, have it tested or replaced.
4. Coordinate with your township to establish a no wake zone in the north bay.

Recommendations for Phase II

1. Conduct a conductivity survey around the lake to determine the location of springs and possible septic system failures. Since the majority of residents are not full-time residents, this survey should be conducted following holiday weekends or major rain events, as to be more likely to catch intermittent discharges. Options available through the county zoning office could then be evaluated.
2. Since inlet #4 has a large basin containing two major nutrient and sediment load sources and other inlets contained sediments and odors, further physical and chemical analysis should be conducted within these subbasins to determine the extent of impact on Potato Lake. Stormwater management may be a future option to control input into the lake; however, additional analysis should be conducted to evaluate the cost effectiveness. The cost may outweigh the benefit.
3. Additional physical and chemical monitoring should be conducted to further analyze nutrient levels and reactions. This sampling would be above and beyond the Self Help Monitoring program. This will build on the 2005 study into the possible non-point and point pollutant sources coming into the lake.
4. Continuation of the plant monitoring program begun in 2005.
5. Analysis of the most cost effective and least damaging options for excess aquatic vegetation control. Chemical, mechanical, and manual options for removal and disposal of plants should be considered.
6. A permanent benchmark and possibly a staff gauge should be established to monitor lake levels. This should be a permanent device constructed in a way that ice will not dislodge the gauge. A staff gauge may have to be re-surveyed every year from an established land benchmark. Water levels will be monitored throughout the growing season to determine the seasonal variations and for long-term recording of lake levels.
7. Additional time should also be allotted for public education through activities, flyers and public presentations for such issues as shoreline enhancement, weed control, wild rice, etc.

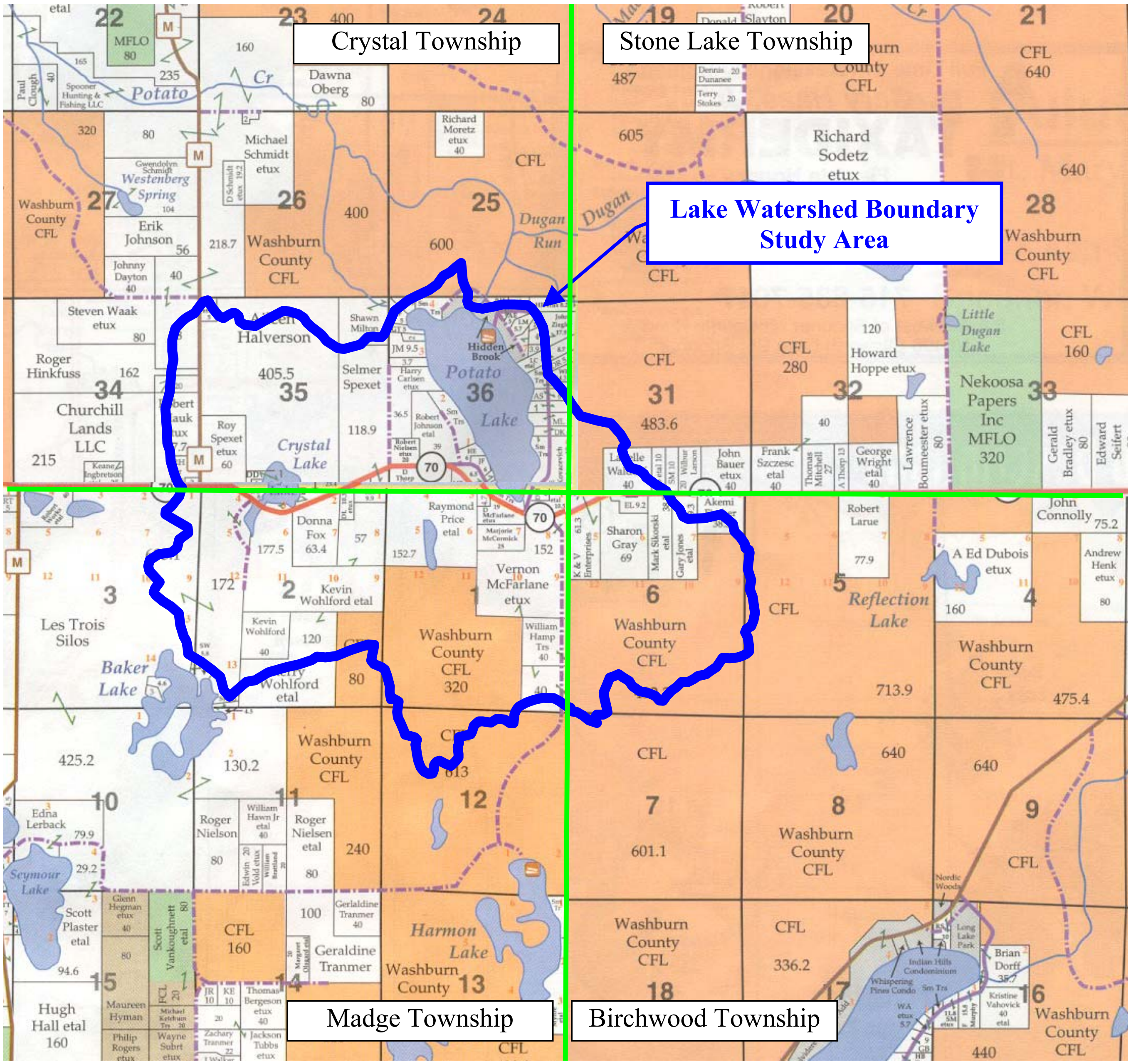


FIGURE 2
Potato Lake Study Area
Lake Location:
Section 36, T39N-11W (Crystal Township),
and the NE ¼ of Section 1 of T38N-R11W (Madge Township)
Washburn County, Wisconsin
91°40’17”W 45°49’12”N

FIGURE 8
Potato Lake Ecoregion:
Northern Lakes and Forests

Summary and Conclusions

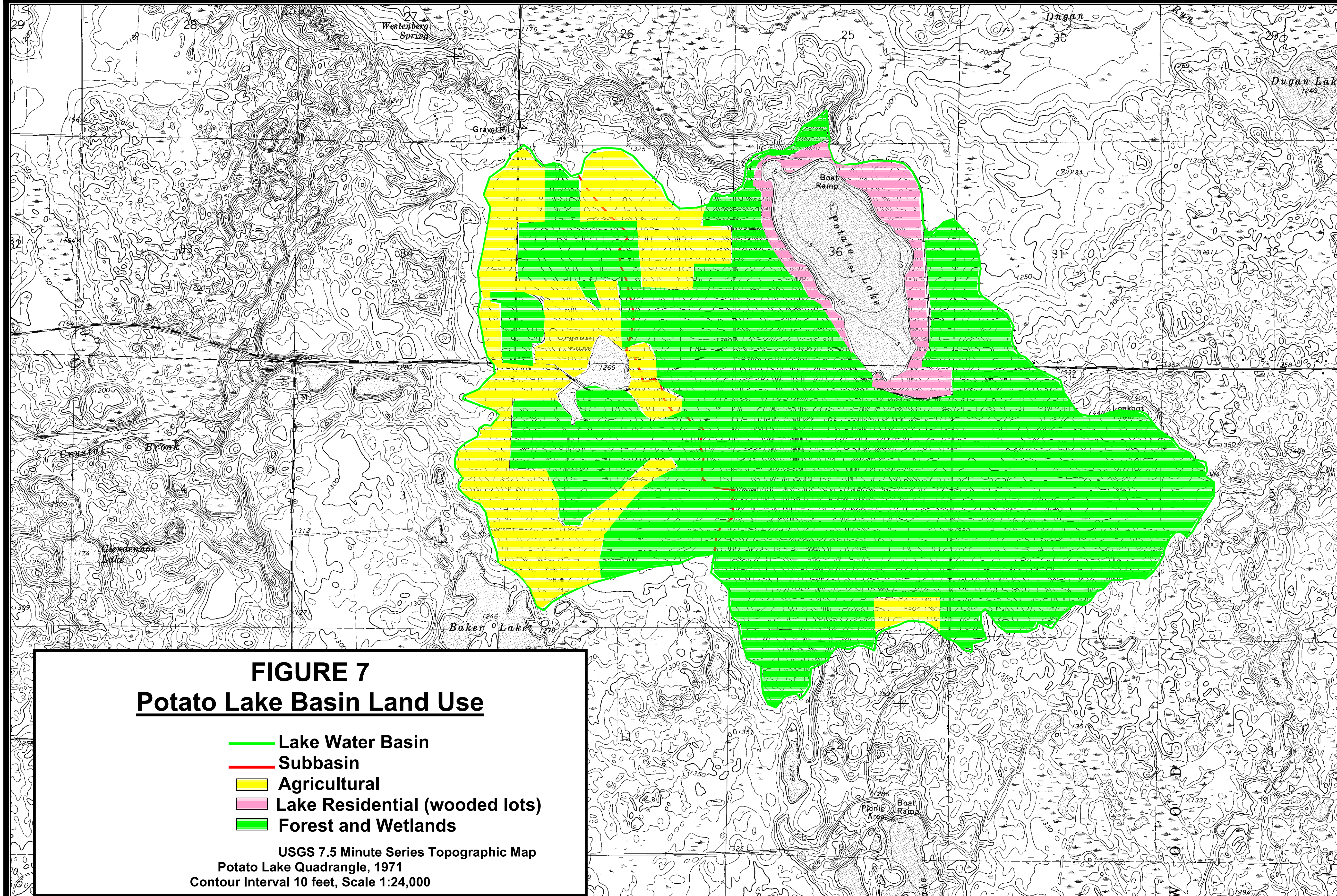


FIGURE 7
Potato Lake Basin Land Use

FIGURE 6
Washburn County Soil Survey – Map Unit Descriptions

Map Symbol	Soil Name	Drainage	Erodiblility
28B,C	Haugen Rosholt sandy loams	Moderately well drained (Haugen) to well drained (well drained)	potentially highly erodible
33B,C,D	Chetek sandy loam	somewhat excessively drained	potentially highly (B, C) to highly erodible (D)
38B,C,D	Rosholt sandy loam	well drained	not highly (A) to potentially highly (B, C) to highly erodible (D)
42D,E	Amery sandy loam	well drained	potentially highly (D) to highly erodible (E)
43A,B	Antigo silt loam	well drained	not highly (A) to potentially highly erodible (B)
63B	Crystal Lake silt loam	moderately well drained	potentially highly erodible
127D,E	Amery Rosholt sandy loams	well drained	highly erodible
160A	Oesterle sandy loam	somewhat poorly drained	not highly erodible
165C,D	Elderon sandy loam	somewhat excessively drained	potentially highly erodible (C, D)
312A	Glendenning sandy loam	poorly drained	not highly erodible
380C,D	Chetek Rosholt sandy loams	somewhat excessively drained	potentially highly (C) to highly erodible (D)
383D	Mahtomedi loamy sand	excessively drained	potentially highly erodible (D)
439B,C,D	Graycalm-Menahga sands	somewhat excessively drained (Graycalm) and excessively drained (Menahga)	not highly erodible
442C	Haugen-Greenwood complex	moderately well drained (Haugen) and very poorly drained hydric (Greenwood)	potentially highly erodible
443D	Amery-Greenwood complex	well drained (Amery) to very poorly drained hydric (Greenwood)	potentially highly erodible
456B	Magnor silt loam	somewhat poorly drained	not highly erodible
457C	Freeon silt loam	well drained	potentially highly erodible
542B,C	Haugen sandy loam	moderately well drained	not highly (B) to potentially highly erodible (C)
544E	Menahga and Mahtomedi sands	excessively drained	not highly erodible
615B,C	Cress sandy loam	somewhat excessively drained	potentially highly erodible (B, C)
632B	Aftad fine sandy loam	moderately well drained	potentially highly erodible
670D	Keweenaw-Pence sandy loam	well drained to somewhat excessively drained	highly erodible
726B	Sissabagama loamy sand	moderately well drained	not highly erodible
827A	Scoba sandy loam	moderately well drained	not highly erodible

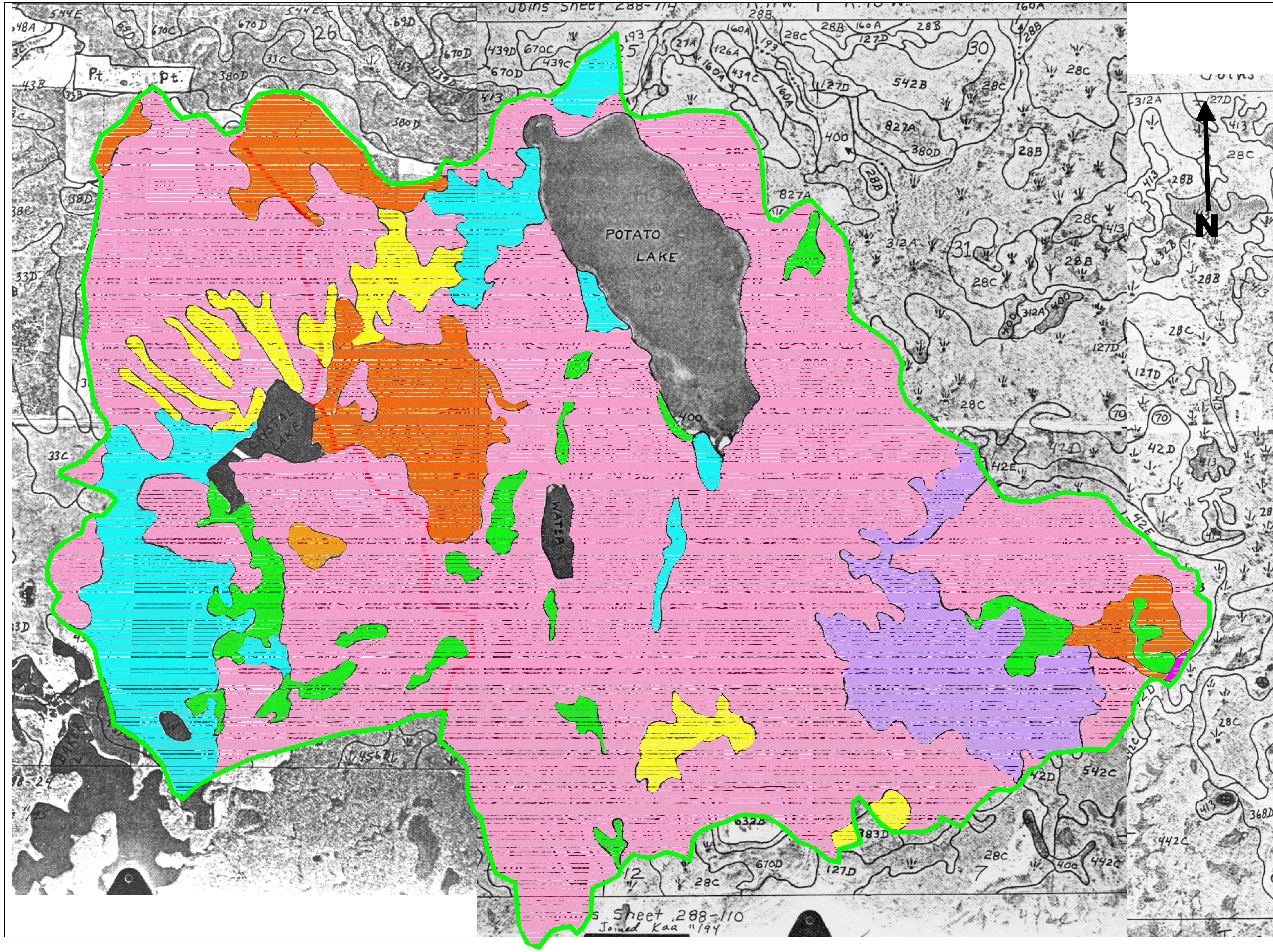


FIGURE 5

Potato Lake Watershed Basin

Washburn County Soil Survey

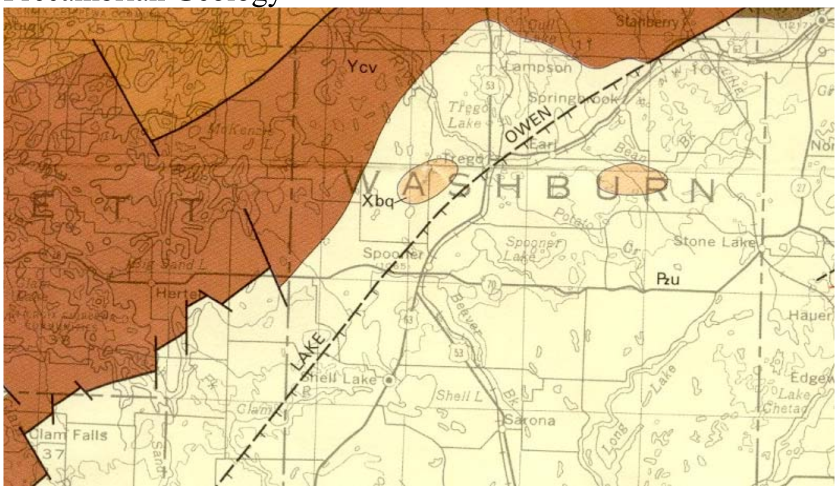
Soil Types within Basin

Key to Soil Types

- Sand
- Sandy Loam
- Loamy Sand
- Silt Loam
- Complex
- Hydric

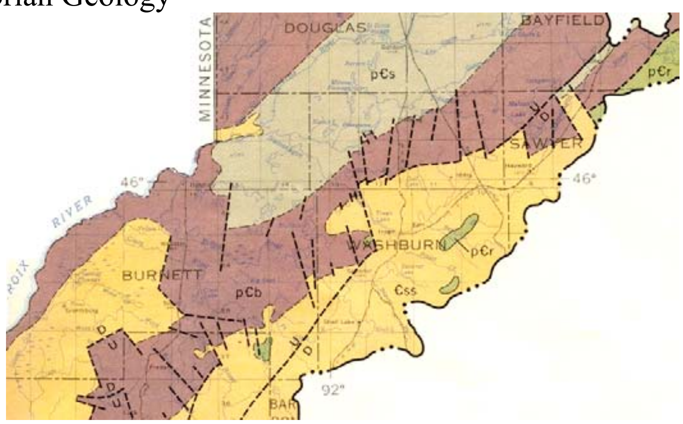
FIGURE 4
Potato Lake Watershed Basin Geology

Precambrian Geology



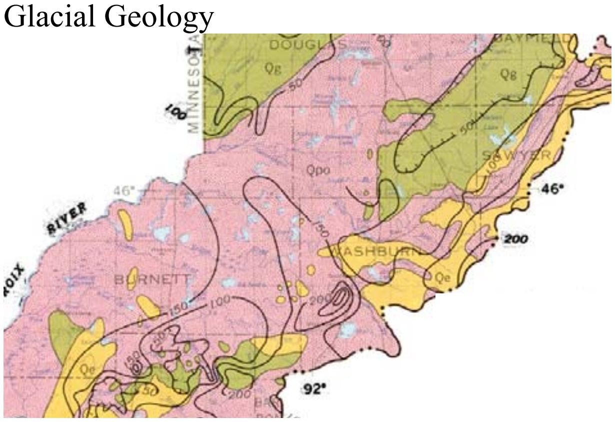
Pzu – Paleozoic rocks, undivided; Dominantly quartzose and glauconitic sandstone and siltstone with lesser amounts of carbonate rocks

Cambrian Geology



Css – Sandstone, undifferentiated; includes St. Lawrence Formation, and Franconia, Galesville, Eau Claire, and Mount Simon, 0-800
pCr – Crystalline igneous and Metamorphic rocks, Undifferentiated thickness very great, many thousands of feet

Glacial Geology



Qe - End Moraine; till and stratified sand and gravel
Qpo – Pitted outwash; stratified sand and gravel

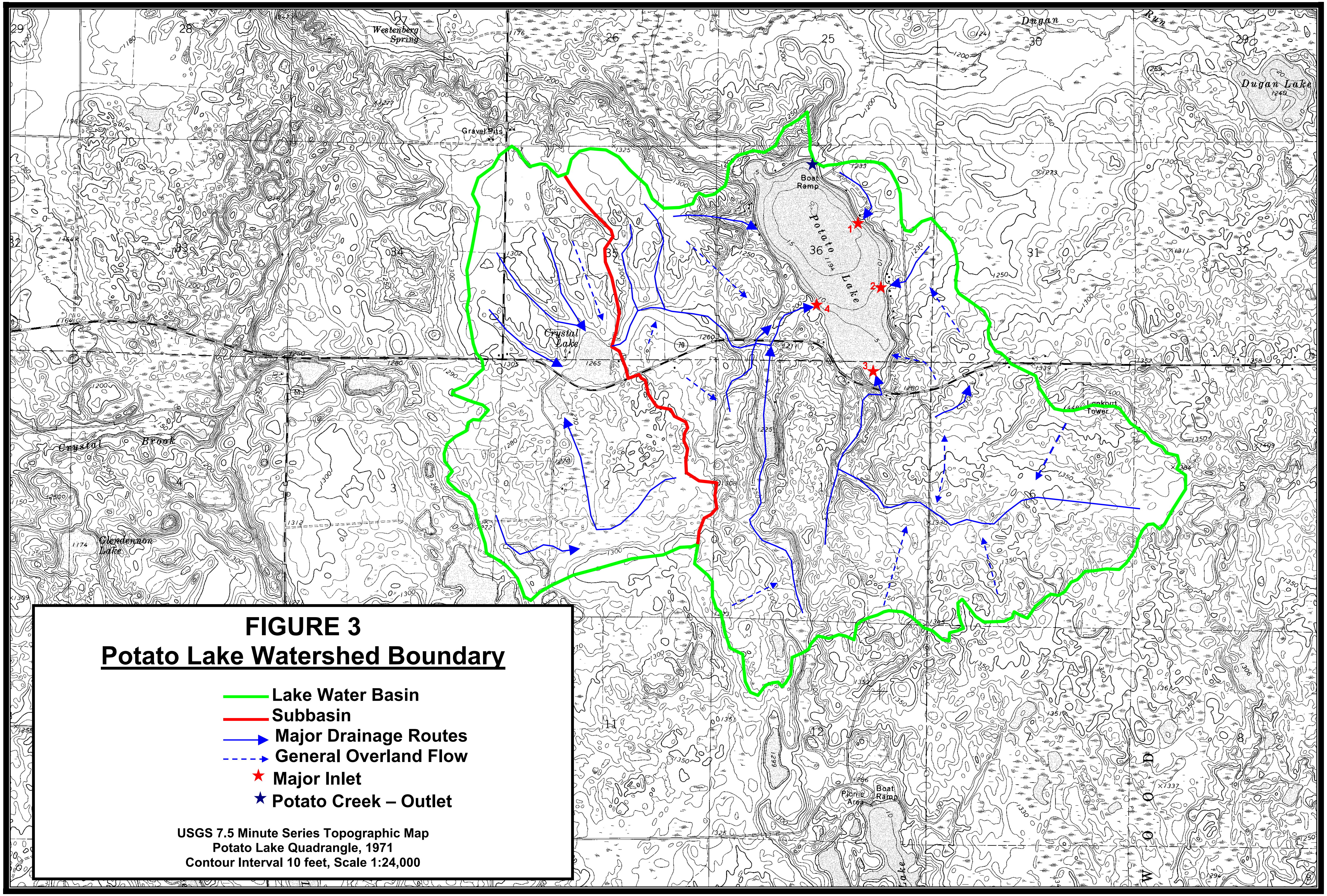


FIGURE 3
Potato Lake Watershed Boundary

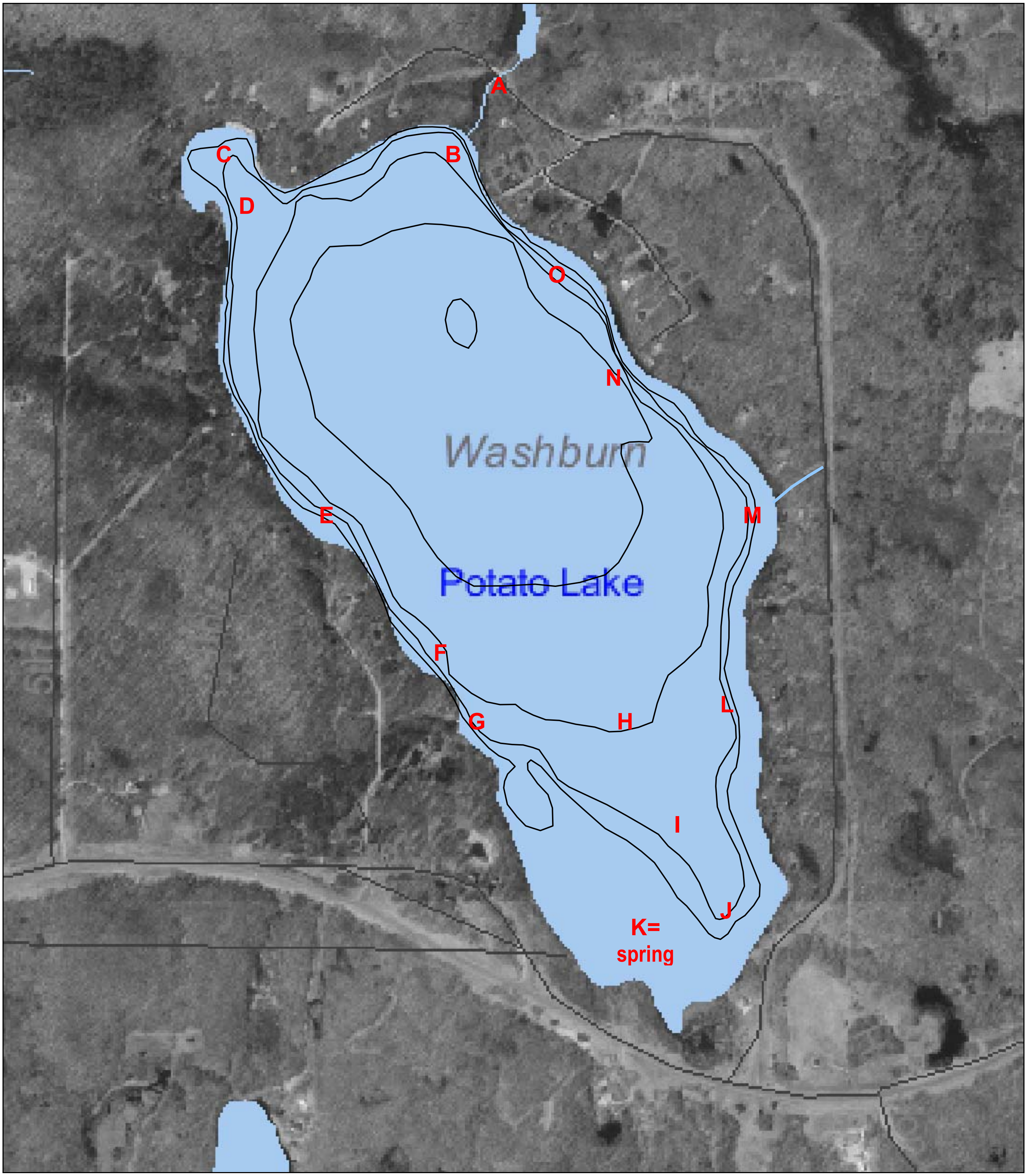


FIGURE 9
Potato Lake Vegetation Sampling and Observation Points

Attachment 1

2005 Spring Questionnaire Results

COOPER ENGINEERING
An Employee Owned Company

Phone: 715.234.7008
Fax: 715.234.1025
e-mail: info@cooperengineering.net
310 West South Street, P.O. Box 230
Rice Lake, WI 54868-0230

Potato Lake Group - Lake Management Planning Grant
Spring 2005 Resident Survey - Results

1. Since you have lived on Potato Lake, the overall quality has:

Improved	0%
Remained the same	25%
Degraded slightly	15%
Degraded considerably	55%
No Opinion	5%

How long have you lived on Potato Lake? Average of 8.8 years

2. How would you rank the water quality of Potato Lake? (Such as water clarity, algae, weeds or plants, swimming conditions or fishing conditions.)

	Overall	Winter	Spring	Summer	Fall
Excellent	5%	0%	6%	0%	0%
Good	26%	71%	50%	11%	6%
Fair	53%	14%	39%	32%	67%
Poor	16%	14%	6%	58%	28%

Comments:
- Weed are excessive and getting worse. Fishing has deteriorated considerably. Summer water clarity is poor.
- Once the rice comes out, it cuts the lake usage in half. You can't even go in the bay.
- Too many weeds leads to fish kill. That's what the lake has suffered.
- Last year weed growth before the 4th of July was unbelievable.
- Good clarity - heavy weeds.
- More weeds and algae every year. Water level is 6-10" lower than 1990
- Water is poor for a couple of weeks after the ice goes out. If the spring is cool then the water is good until warm-up.
- Sometimes heavy or high power boats tear up a lot of weeds, also my son has noticed last year there were more weeds out in deeper water 14' and more.

3. What do you enjoy most about Potato Lake? (Please rank preferences 1 through 8 with 1 being the highest rank)

Rank:	1	2	3	4	5	6	7	8
Fishing	15%	30%	25%	10%	5%	5%	10%	0%
Ice Fishing	6%	0%	0%	6%	0%	17%	11%	61%
Motorized Boating	16%	11%	21%	26%	11%	5%	0%	11%
Non-motorized Boating	6%	6%	6%	6%	28%	0%	33%	17%
Water Sports	5%	0%	0%	21%	5%	32%	16%	21%
Swimming	6%	28%	11%	6%	11%	17%	11%	11%
Aesthetics	62%	10%	5%	10%	0%	14%	0%	0%
Wildlife	17%	11%	28%	11%	28%	0%	6%	0%

Comments:

- The lake is too small for the big motors and jet skis. The fishing used to be top notch, but fishing pressure has damaged the fishery. We love the natural setting and like to hike and watch the eagles.
- Would swim but too much muck &weeds & rice prevent it.
- Lake too small for water skiing and the small fast motorized boat machine.
- From our cabin we feel we have a beautiful view of lake and opposing shoreline. It is really important that people do as much as they can to cover their cabin and restrict exposure to others. Paint or stain cabins natural color to blend.
- Excellent family fun- fishing…fishing quality is now poor. All small fish.
- Peace and quiet when available. Do not engage in other activities.
- Some of these activities are hampered by the lake/weed issue, but they are what I would like.
- We would really like to do more swimming at our lake property. The weeds & algae growth are definitely not appealing.

4. Are you familiar with boating and shoreline regulations? (For instance, WCLRA sent out a booklet to lake residents on this topic in 2004.)

 _16_ YES _3_ NO _5_ Would like more information

 Is more strict enforcement of boating and shoreline activities needed?
 _8_ YES _12_ NO _5_ Would like more information

5. What do you see as the most important issues regarding Potato Lake? (1 = important, 2 = somewhat important, 3 = not important. You can use numbers more than once.)

Rank:	1	2	3
Excessive weeds	20	1	0
Excessive algae	14	4	0
Water quality	14	1	1
Poor fishing	13	2	2
Lake water levels	11	7	0
Runoff	10	3	3

Rank:	1	2	3
Development	7	6	4
Lake crowding	6	5	6
Watercraft	6	5	5
Wildlife	6	2	5
Erosion	3	6	6
Nuisance animals	1	2	13

Comments:

- Why all-night out door lites? Wouldn't motion operated lites be better. ATV &pwc noise increasing.
- Fishing limits on smaller fish should be reduced.
- Lake is just about filled for land development
- We feel the algae & weed growth is a major problem that needs some answers. Growth is rampant in southeast area of lake.
- For small lake now <200 acres, large inboards and PWC are out of place.
- Limited lots minimize amount of use by pontoons with no muskie, walleyes fishing is limited
- Noise shooting near lake &pwc noise. Would like to see the development of a local park for potato lake residents
- Fishkill
- Beavers are cool. Increase lake level.

6. Many options exist for maintaining your lawn and landscaping. How is your yard maintained?

	# of responses
No fertilizer applied	19
Maintain natural landscape area	11
Use Type of Natural Landscape	6
Maintain a vegetative buffer	8
Fertilizer applied	2
Fertilize # of times per year	1
Fertilizer applied by commercial service	0

Comments:

- We only have a small beach area. The balance of our shoreline is natural.
- Except for pier area & view - 25' front sides and back sloping from land.
- This is a huge polluter this should be controlled.
- Probably the main cause of increasing weeds/algae and fewer fish due to less oxygen. Too much fertilizer used & runoff.
- Have some grass about 75 feet from shore line.
- I mow 3 times a year rake leaves once in fall and spring.
- We use no fertilizer.

7. Distance of septic system drain field from lake:

>200 ft	100-200 ft	0-100 ft
4	9	3

What is the type, capacity and age of your septic system?

__4__ 0-5 years old　　__6__ 6-20 years old　　__9__ >20 years old

Has your septic tank been recently pumped?

1-2 yrs or by annual Insp.	11
Pumped, but not on a regular basis	6
Not pumped	0

Does your septic system show any signs of problems?

_14_ Household drains flow freely. There are no sewage odors inside or outside. Soil over drain field is firm and dry.

_0__ Household drains run slowly. Soil over drain field is wet on occasion.

_0__ Household drains back up. Sewage odors can be noticed in the house or yard. Soil is wet or spongy in the drain field area.

Comments:

- drain field opposite from lakes sloping away
- we aren't familiar with this type of sewage control we're looking into it now that we own this type of home
- new holding tank 2004
- we put in a new holding tank 5 yrs ago leakage should be none. I wish all systems were like this!
- have not had any problems
- last year pumped. First time in 15 years
- drain field runs away from lake
- Holding tank pumped when needed - Holding tank only
- No information on this we plan to have ours pumped this summer. We guessed at the age of the tank.

8. Do you know of any specific areas of concern? (Examples: runoff coming into lake, high erosion areas, dense weedy areas, etc… Attach a page, if necessary, for comments. Please specify locations on attached map, if possible.)

- The entire south end of the lake and the bay is so chosked with weeds it's unsuitable for use
- I live in the bay. All the rice came up in the summer on the edges and also the weeds get so high that my motor has trouble getting clogged with weeds.
- North Bay: Rice has moved in over last 10 yrs. Most of lake shore full of weeds out 100' in summer. Frequent winter fish kill.
- On north and south side of lake there is an excessive weeds.
- dense weedy areas, high erosion
- runoff of grass chemicals and old septic systems a concern- but without government intervention this will never be better
- growth of weeds in lake, clumps of old weeds at bottom
- old farm S.W. corner of lake………Highway 70 project created excessive runoff maybe as far away as farm on the hill
- weed growth to the 15' level
- runoff coming into the lake and dense weedy areas
- weeds on south end
- North bay- loads of weeds by June. Hard to get in and out via shallow draft pontoon
- Both the north and south ends of the lake have severe weed problems year round. Wild rice that originally grew only at the south end now grows at both ends. In warm weather algae bloom is common. I believe that ice fishing should be limited in some way. Perhaps limits reduced
- Excessive weeds & algae
- North bay is choked with emersed &submerged vegitation from late June-late September. It becomes unnavigable for motors w/o stopping. Rice & cattails have surrounded our shorelines. Pocked are on map
- when we purchased our property in June 2004 we understood there was vegetation on the southern end of the lake, but never to the extent that it was. We were told that our grandchildren could swim off the

dock with no problem. That proved to be impossible due to the weeds & algae that took over as the summer progressed.

- Very weedy in the bay at the northwest end

9. What do you think should be done to improve lake quality? (Examples: wetland restoration, shoreline buffer strips, education, etc. Attach a page, if necessary, for comments.)
   - Some type of week control is a must. If weeds can be controlled, then a fish stocking program can be instituted. Perhaps winter aeration can help eliminate fish kills. Some kind of motor size limit and a time restriction so people can fish in calm, quiet conditions.
   - raise minimum water level by 6 to 12 inches. Kill off rice in North Bay. No wake boating.
   - remove weeds and control algae growth
   - do not know, education, remove weeds
   - education, The horse farm on 70 is a contender but are the individual septic and yard chemicals as bad… let's find out
   - eliminate all use of fertilizers around or near the lake. Rake bottom to collect " old " weeds
   - less weeds and algae so there is never a fishkill caused by a bad winter
   - runoff from crystal lake needs to be diverted from potato lake
   - waiting for suggestions from study
   - shore line buffer strips and continual education
   - From the studies that are being conducted it seems that the phosphorus level is too high. Something should be done to reduce the level. Surface weeds that are not essential to the health of the fish population should be pulled. Many old timers have reported that the water level of the lake has gone down and this has allowed weeds to grow even more. It has also been reported that the culverts under first street are too low so that too much water flows out of the lake.
   - get rid of the weeds and spreading of weeds
   - I believe we are asking your people for this!
   - Certain areas (North Bay & South End) may require weed treatment as well as boater education & possible Jet Ski/ motor-water sport hours.
   - something needs to be done now with the conditions of Potato lake. We will do anything to help in the process. There needs to be an answer why the lake has degraded so badly the last few years. We need to find out the reason why there is the excess weeds & algae growth &then how this can be eliminated.

Attachment 2

Self Help Monitoring Program
2004 and 2005 Annual Reports

Lake Monitoring 2004 Annual Report

POTATO LAKE
Washburn County
Waterbody Number: 2714500

Lake Type: Mixed Spring
DNR Region: NO
GEO Region: NW

Site Name	Storet #
Deep Hole	663055

Group	Date	SD(ft)	SD(m)	CHL	TP	TSI(SD)	TSI(CHL)	TSI(TP)	Lake Level	Clarity	Color	Perception
59598	05/28/2004				27			54				
40768	06/04/2004	8.5	2.59			46			High	Murky	Green	2
59598	06/21/2004			4.7	19		46	51				
40768	06/24/2004	8.5	2.59			46			Normal	Clear	Green	1
40768	07/10/2004	9.5	2.9			45			High	Clear	Green	1
59597	08/04/2004			7.8	22		50	52				
40768	08/13/2004	7	2.13			49			Normal	Clear	Brown	3
59594	08/30/2004	8	2.44	11.1	23	47	53	53	Normal	Clear	Green	1
40768	09/25/2004	7	2.13			49			Normal	Murky	Green	4
59577	10/20/2004			17.3	43		56	57				

05/28/2004

Depth	Temp.	D.O
1	62.6	
3	62	8.5
6	60	
9	58.8	8
12	58.1	8
12	58.2	
15	57.5	8
15	58.1	
18	56.1	8
18	57.5	
20	56.1	

06/21/2004

Depth	Temp.	D.O
1	69.2	7
3	69	7
6	69	
9	69	7
12	69	7
15	66.2	7
18	62	6
20	61.7	0

08/04/2004

Depth	Temp.	D.O
1	75.9	
3	75.3	7
6	75.2	
9	74.1	7
12	72.8	7
15	71.6	6
18	69	5
20	68.3	

08/30/2004

Depth	Temp.	D.O
1	67.2	
3	66.9	7
6	66.6	
9	66.3	7
12	66.2	7
15	66	7
18	66	7
20	65.1	

Date	Lab Comments
05/28/2004	Temp. at lab - iced.
06/21/2004	Temp. at lab - iced.
08/04/2004	Temp. at lab - iced.
08/30/2004	Temp at lab - iced.

Date	Collector Comments
06/04/2004	Weeds are up - water is high.
06/21/2004	McCabes are in the office on 8/30 to get info. put into the data base
06/24/2004	Water condition is good - weeds are thick. Fishing is poor.
07/10/2004	Wawter condition is good- water high. Ample weeds.
08/13/2004	Water condition good - water high - weed condition serious.
08/30/2004	Lake water very clear. Partly sunny, light breeze; Weed and wild rice influx serious. Algae increasing.
09/25/2004	Lake loaded with algae - weeds are down. Fishing poor all season.

Data Collectors (Source of Data):

40768 - Robert Siman (Self-Help Lake Monitoring)

59577 - Larry & Aida McCabe (Self-Help Lake Monitoring)

59594 - Larry & Aida McCabe and Robert Siman (Self-Help Lake Monitoring)

59597 - Glen Dummer & Larry McCabe (Self-Help Lake Monitoring)

59598 - Larry McCabe & Terrance Tarras (Self-Help Lake Monitoring)

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter(ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD), TSI(CHL), TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.

Lake Monitoring 2005 Annual Report

POTATO LAKE
Washburn County
Waterbody Number: 2714500

Lake Type: Mixed Spring
DNR Region: NO
GEO Region: NW

Site Name	Storet #
Deep Hole	663055

Group	Date	SD(ft)	SD(m)	CHL	TP	TSI(SD)	TSI(CHL)	TSI(TP)	Lake Level	Clarity	Color	Perception
59577	05/15/2005	7	2.13		34	49		56	Normal	Clear	Green	2
40768	06/05/2005	9	2.74			45			Low	Clear	Brown	3
59577	06/07/2005	8.5	2.59			46			Low	Clear	Green	3
40768	06/15/2005	9	2.74			45			High	Clear	Green	3
59577	06/15/2005	9	2.74			45			Low	Clear	Green	2
59577	06/19/2005	9	2.74	4.2	22	45	46	52	Low	Clear	Green	2
40768	06/23/2005	8	2.44			47			Normal	Murky	Green	3
59577	06/23/2005	9	2.74			45			Low	Clear	Brown	2
59577	07/01/2005	7	2.13			49			Low	Clear	Brown	2
59577	07/05/2005	7	2.13			49			Low	Clear	Green	2
40768	07/09/2005	7	2.13			49			Normal	Clear	Green	2
40768	07/17/2005	8.5	2.59			46			Low	Clear	Green	2
59577	07/19/2005	7	2.13	8.2	25	49	51	53	Low	Clear	Green	2
40768	07/25/2005	7	2.13			49			Low	Murky	Green	2
40768	08/02/2005	7.5	2.29			48			Low	Clear	Green	2
59577	08/02/2005	8	2.44			47			Low	Clear	Green	2
40768	08/10/2005	6	1.83			51			Low	Murky	Green	2
59577	08/10/2005	7	2.13			49			Low	Murky	Green	3
59577	08/15/2005	5	1.52	16.8	34	54	56	56	Low	Murky	Green	5
40768	08/18/2005	5.5	1.68			53			Low	Clear	Green	2
59577	08/26/2005	6	1.83			51			Low	Murky	Green	5
40768	08/27/2005	5.5	1.68			53			Normal	Murky	Green	2
40768	09/06/2005	5	1.52			54			Normal	Murky	Green	2
40768	09/11/2005	5	1.52			54			Low	Murky	Green	2
40768	09/20/2005	4	1.22			57			Normal	Murky	Green	3
59577	09/26/2005	3	.91			61			Low	Murky	Green	5
59577	10/05/2005	3.5	1.07			59			High	Murky	Green	5
59577	11/01/2005	7	2.13	25.7	52	49	59	59	Normal	Clear	Green	2

05/15/2005

Depth	Temp.	D.O
3	52.5	7
6	52.7	
9	52.8	7
12	52.8	7
15	52.7	7
18	51.9	7

06/19/2005

Depth	Temp.	D.O
3	72.5	8
6	71.9	
9	71.6	8
12	71.6	8
15	65.8	7
18	61.7	6

07/19/2005

Depth	Temp.	D.O
3	80	9
6	79.7	
9	79.5	9
12	78.8	8
15	73.2	7
18	69.6	2.5

08/15/2005

Depth	Temp.	D.O
3	73.2	7
6	73.2	7
9	73.2	7
12	73	7
15	72.8	7
18	72.3	6.5

09/26/2005

Depth	Temp.	D.O
3	64	7
6	63.8	
9	63.6	7
12	63.6	7
15	63.6	7
18	63.4	7

11/01/2005

Depth	Temp.	D.O
3	48.5	7
6	48.2	
9	48.2	7
12	48.2	7
15	48.2	7
18	48.2	7

Date	Lab Comments
05/15/2005	Temp at lab - iced.
06/19/2005	Temp at lab - iced.
08/15/2005	Temp at lab - iced.
11/01/2005	Temp at lab - iced.

Date	Collector Comments
05/15/2005	Day was cold and gray. Lake was slightly choppy from the wind.
06/15/2005	Lake clear except for duckweed on surface. partly Sunny with light wind.
06/19/2005	warm,sunny and windy. Lake appears to be very clear.
06/23/2005	Day was very windy and cloudy all day. Temp about 90 degrees.Water was choppy but clear
07/01/2005	Two storm days preceded this day. Water appeared darker
07/19/2005	calm, sunny day. There has been little rain for the last couple of weeks but frequent strong winds.
08/02/2005	Day warm and sunny. Water clear and calm.
08/15/2005	Calm & sunny. Water very green. Algae bloom. Air temp is 55 .
09/11/2005	water low- need rain- weeds down- fishing poor- water not bad
09/20/2005	water level ok- weeds down- fishing poor
09/26/2005	These readings were taken following a rainfall of 1.5 inches on the previous day. The lake has a very heavy pea-green algae bloom.
11/01/2005	Cool and windy. Sky overcast

Data Collectors (Source of Data):

40768 - Robert Siman (Self-Help Lake Monitoring)

59577 - Larry & Aida McCabe (Self-Help Lake Monitoring)

SD = Secchi depth measured in feet converted to meters; Chl = Chlorophyll a in micrograms per liter(ug/l); TP = Total phosphorus in ug/l, surface sample only; TSI(SD), TSI(CHL), TSI(TP) = Trophic state index based on SD, CHL, TP respectively; Depth measured in feet; Temp = Temperature in degrees Fahrenheit; D.O. = Dissolved Oxygen in parts per million.