LAKE COUNTY, ILLINOIS

2012 BIG AND LITTLE BEAR LAKE SUMMARY REPORT

PREPARED BY THE

LAKE COUNTY HEALTH DEPARTMENT

Population Health Environmental Services

Recreating on bike path Century Park, 2012

Big Bear and Little Bear Lakes are located within Century Park in the Village of Vernon Hills. Both lakes were created in the mid-1970's as residential and commercial areas were developed. Both lakes are situated along the Seavey Drainage Ditch. Big Bear Lake receives flow from the Seavey Ditch at the northwest corner of the lake. It is directly connected to Little Bear Lake by a short channel at its southwest corner. Little Bear Lake is the recipient of both Big Bear Lake but also from Harvey lake located to it's east. Once water passes through these lakes it is delivered via the outlet back into the Seavey Drainage Ditch, and eventually the Des Plaines River. Big Bear Lake covers 25.14 acres, and has a maximum depth of 9.98 feet and Little Bear Lake is 26.44 acres, and has a maximum depth of 21.88 feet.

Due to the connectivity of the two lakes, this report will discuss the study results for both lakes.

The water clarity in both lakes has decreased since the LCHD last monitored the lakes in 2002. The eroding shorelines along Big Bear Lake and the shallow nature of this lake allow for wave and wind action to distrib-

SPECIAL POINTS OF INTEREST:

- *Phosphorus Impairment*
- *Total Suspended Solids Impairment*
- *Lack of Submerged Vegetation*
- *Persistent Algal Blooms*
- *Carp Infestation*

INSIDE THIS ISSUE:

ENVIRONMENTAL SERVICES WATER QUALITY SPECIALISTS

Kathy Paap
kpaap@lakecountyil.gov

Kelly Deem
kdeem@lakecountyil.gov

Gerard Urbanozo
gubanozo@lakecountyil.gov

SUMMARY (CONTINUED)

Lake Facts:

Major Watershed: Des Plaines

Sub-Watershed: Seavey Ditch/Indian Creek

Location: T46N, R10E, Section 34

Surface Area: Big and Little Bear Lakes 51.58 acres

Shoreline Length: Big Bear 1.00 miles; Little Bear 1.66 miles

Maximum Depth: Big Bear 9.98 feet; Little Bear 21.88 feet

Average Depth: Big Bear 5.01 feet; Little Bear 7.04 feet

Lake Volume: Big Bear,125.84 acre-feet; Little Bear, 186.03

Watershed Area: 4284.11 acres

Lake Type: Impoundment

Management Entity: Village of Vernon Hills

Current Uses: fishing, canoeing, kayaking, aesthetics

Access: Public

ute bottom sediments into the water column. Both lakes lack aquatic plant populations and have healthy carp populations exacerbating water clarity and quality issues. In 2012, a severe drought occurred and it is likely that this helped the Bear Lakes as the inputs from the watershed were minimized. In looking at the overall water quality of the lakes, it appears that at least in 2012, that Big Bear Lake provided a buffer to Little Bear Lake, by serving as a settlement basin for sediments coming in from the watershed as well as internally from Big Bear Lake. Both lakes experienced planktonic algal blooms in 2012. Total suspended solids (TSS) were high during in 1997, 2002 and 2012, consisting primarily of sediment, but also some planktonic algae.

Nutrients entering Bear Lakes' from the watershed, plus the factors described above likely contribute to the impaired concentrations of pollutants such as TSS , total Kjeldahl nitrogen (TKN) and total phosphorus (TP); (IEPA general use standards). Since both lakes have a high nutrient concentration and minimal aquatic plants, algal species were the only organisms present to take advantage of any surplus of these nutrients. Planktonic algal blooms were noted on both lakes in July, and persisted through September. Additionally a filamentous algal bloom was documented near the outlet of Little Bear Lake.

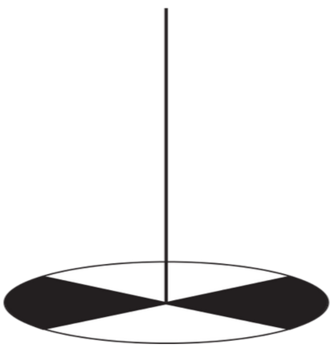
Due to the shallow nature of Big Bear Lake there was frequent mixing of the water column and therefore a good supply of dissolved oxygen (DO) available for aquatic life. Although the DO concentrations in the water column are not anoxic, the surface sediment can be anoxic, especially when the near bottom waters have DO levels that are at or below 2 mg/L. At these concentrations conditions in the surface sediments are favorable for phosphorus release into the water column, causing an increase in TP and potentially algal blooms. Unlike the well mixed conditions of Big Bear Lake, Little Bear Lake was stratified during the entire monitoring season (June—September) in 2012. During fall turnover, the concentrated nutrients trapped in the hypolimnion of Little Bear Lake mix with epilimnetic waters further contributing to algal blooms.

Chloride concentrations in the lakes are well above the county medians both in the surface and bottom waters. This is not surprising given that the lakes are situated in a very large and highly developed watershed.

It is recommended that practices be implemented in the watershed, as well as within the lakes to reduce phosphorus and chloride concentrations. Practices such as carp removal, shoreline stabilization and increasing plant abundance in the lakes is also recommended.

WATER CLARITY

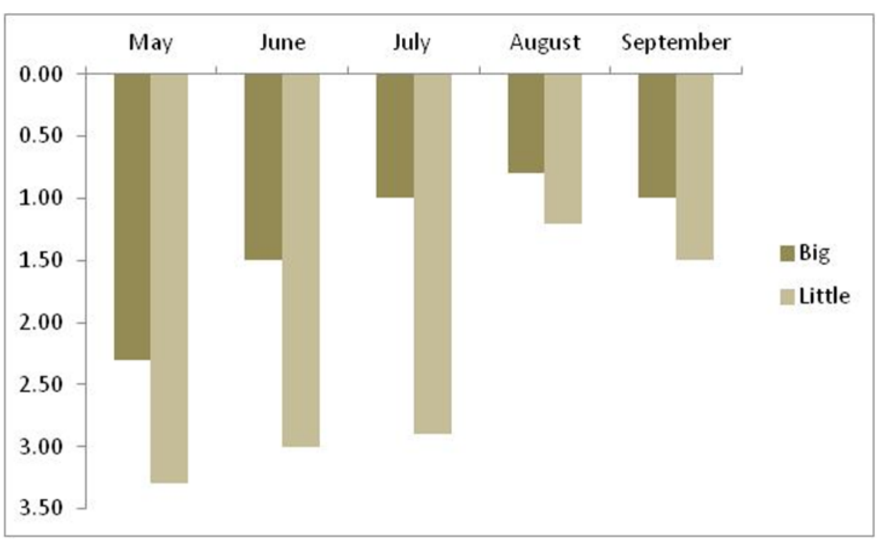
Water clarity (transparency), which is measured by a Secchi disk, is often an indicator of a lake's overall water quality. It is affected by a lake's water color, which is a reflection of the amount of total suspended solids and dissolved organic chemicals. Generally, the lower the clarity or Secchi depth, the poorer the water quality. A decrease in Secchi depth during the summer occurs as the result of an increase in suspended solids (algae or sediment) in the water column. Invasive common carp can deteriorate the Secchi depth through their mating and foraging activities as they suspend bottom sediments and decrease water clarity especially in shallow lakes. Aquatic plants play an important role in the level of water clarity and can, in turn, be negatively affected by low clarity levels. Plants compete with algae for resources such as nutrients (phosphorus and nitrogen) and also help to stabilize bottom sediments. If there are no plants within a lake, algae gains the competitive edge, plants cannot reestablish due to poor water clarity and low light conditions making it very difficult to improve water clarity. A lake with plants will almost always have higher water clarity than a lake without plants. Differences in water clarity can be dependent on factors such as rainfall amounts, nutrient loading (both from the watershed and from internal lake processes), plant density and water temperature, all which can affect algal growth.



It is important to have a good plant management in place because if too many plants are removed the lake will likely become dominated by algae and clarity will decrease. This makes it very difficult for plants to become re-established due to the lack of available sunlight and the lake will, most likely, remain turbid. Turbidity will be accelerated if the lake is very shallow and/or common carp are present. Wind/wave action also can lead to reduced water clarity in shallow lakes and are more likely to experience clarity problems if plants are not present to stabilize bottom sediments.

Poor water clarity can impact fish communities as well as vegetation in a lake. Fish populations will suffer as water clarity decreases due to a lack of food and decreased ability to successfully hunt for prey. Bluegills feed on invertebrates that inhabit aquatic plants. If low clarity results in the disappearance of plants, this food source will disappear too. Largemouth Bass hunt by sight and feed on other fish. As the water clarity decreases, this fish species find it more difficult to see and ambush prey. Fish populations can become stunted in size and declines in numbers may result. This eventually lead to an imbalance in the fish community.

The water clarity as measured by Secchi disk during 2012 in Big Bear Lake was poor (average =1.32 ft.), it ranked 135th out of 158 lakes whose Secchi depths have been measured since 2000. Secchi depths in the lake ranged from 2.30 feet in May to 0.8 feet measured in August. Little Bear Lake similarly had poor water clarity during 2012, with an average epilimnetic Secchi depth of 2.38 feet. Little Bear had slightly better Secchi depth ranking it 102nd out of 158 lakes. The Secchi depths ranged from 3.30 feet to 1.20 feet in August. A moderate rain that occurred within 48 hours of the August sampling likely contrib-



WATER CLARITY (CONTINUED)

uted to the lowest Secchi reading occurring at that time as the water clarity in both lakes improved slightly in September with Secchi depths of 1.00 feet and 1.50 feet respectively. This could be due to the lack of flow coming from the Seavey Ditch and Harvey Lake due to the extreme drought conditions during 2012. The median for other lakes monitored in the Indian Creek watershed during 2012 was 8.20 feet. The water clarity of the Bear Lakes decreased since the 2002 surveys (Fig. 1), possibly due to additional development within the watershed or due to the smaller lake volume caused by the drought concentrating pollutants in the lake. The elevation gage at the outlet of Little Bear indicated that the water elevations were down approximately 1 foot by September. Readings taken at the pier verify this drop with water levels falling 0.83 ft from May to September. Repairing eroding banks on Seavey ditch north of Big Bear Lake, as well as areas within Big and Little Bear Lake would help to alleviate some of the clarity issues experienced by Big and Little Bear, as there were many areas that were evaluated as having severe to moderate erosion.

Staff gauge at outlet.

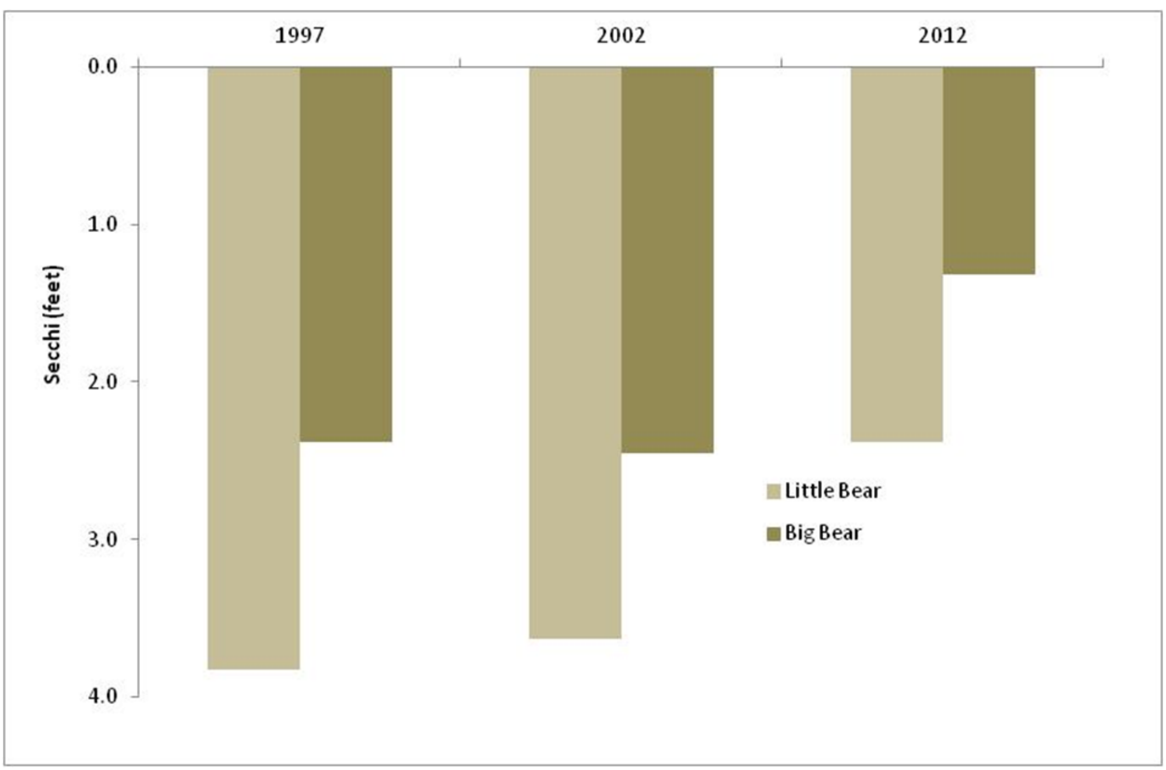
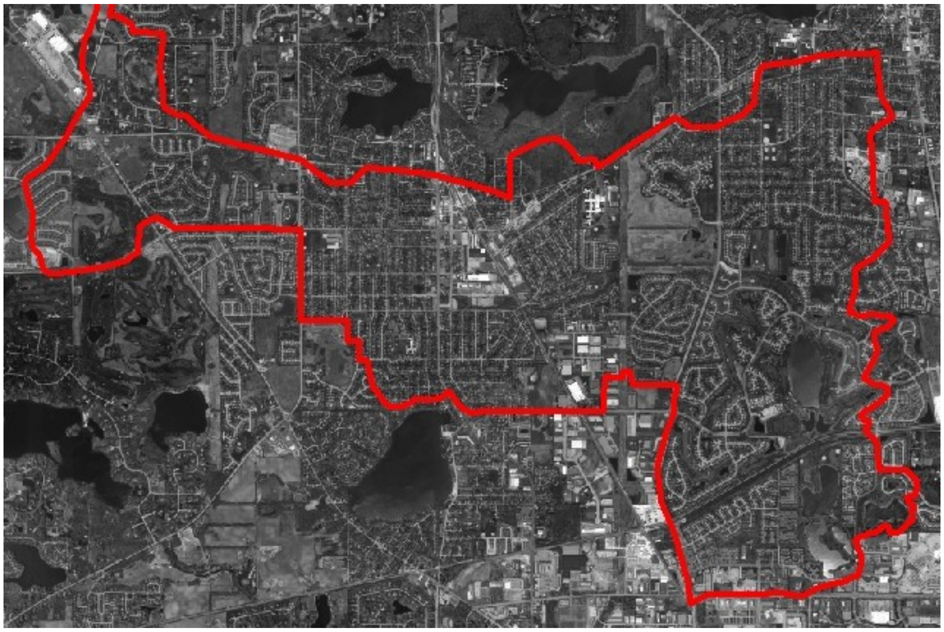
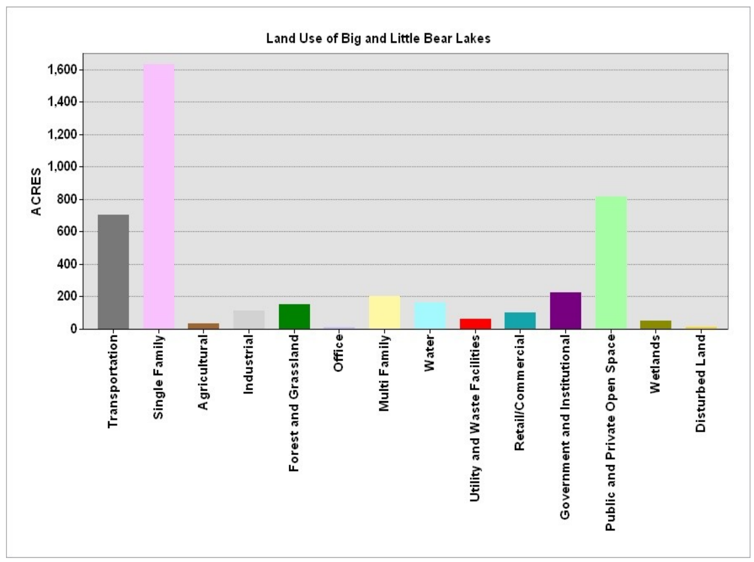


Figure 1. Average Water Clarity in Big and Little Bear Lakes, 1997, 2002, and 2012. (Measurements taken May —September)

WATERSHED



TP and Cl- Concentrations in Big and Little Bear Watershed		
Lake	TP	Cl
Charles	0.088	153.4
Big Bear	0.096	192.8
Harvey	0.032	151.8
Little Bear	0.068	205.4



The watershed of Big and Little Bear Lakes is estimated to be 4275 acres. It encompasses portions of Mundelein, Libertyville and Vernon Hills via a large drainage ditch known as the Seavey Ditch. The area was until recently part of a large drainage district. More on the history of the ditch can be found at (www.vernonhills.org/userfiles/file/public_works/seavey_drainage_ditch_06062011.pdf). Harvey Lake and the development around it are also included within the Big and Little Bear watershed.

Ninety four percent of the watershed is developed. Land use in the watershed was determined using 2010 aerial photography and is dominated by Single Family and Public and Private Open Space. Parks, golf courses, undeveloped parcels and common areas associated with developments are all incorporated into public and private open spaces.

Estimations of the percent runoff being attributed to each of the land uses impacting Big and Little Bear however, allocates the highest percentage runoff coming from Transportation (36.4%) and Single Family at (29.9%). It is important for single family homeowners and those who manage the roads in the watershed to be aware of good management practices when it comes to nutrients and winter deicer applications, as poor management decisions can have profound effects on their natural resources. The same pattern applied in lakes upstream of both Big and Little Bear Lake.

Total Suspended Solids

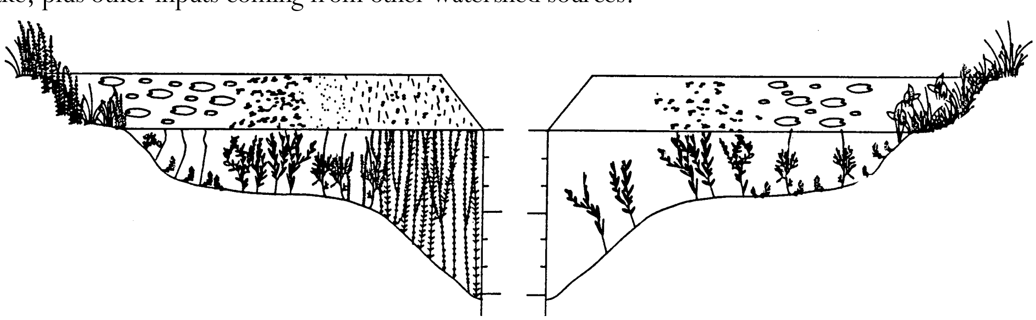
Total Suspended Solids (TSS) are made up of both volatile solids (flora, fauna) and non-volatile solids (sediments). TSS affects water clarity by reducing light penetration in littoral zones of a lake, inhibiting the growth of lake vegetation, as well as reducing the diversity of vegetation. Reduced lake vegetation allows for algal blooms to proliferate due to the lack of competition for nutrients and light by plants. Nuisance algal blooms can alter the uses of a lake by potentially harboring harmful algal blooms (HAB's) which could result in reduced recreational usages of the lake. Non-volatile solids are made up of sediments; either bottom sediments or those entering the lake from eroding shorelines or other sources within a watershed. Spawning and feeding common carp distribute bottom sediments in the water column. In shallow lakes, wind and wave action can have the similar outcomes as having carp in a lake.

Big and Little Bear Lakes both have average epilimnetic (near surface) TSS concentrations above the median (8.2 mg/L) of the lakes sampled in the Indian Creek watershed in 2012 with TSS concentrations of 18.1 mg/L and 11.4 mg/L respectively.

Big Bear Lake had a carp spawn noted during the May visit. In June, TSS concentrations became quite elevated (69% increase), likely due to an increase in algae, as the Total Volatile Solids increased. TVS measures the amount of organic material suspended in the water, it was not until July when an algal bloom was visibly noted. Carp removal and remediating eroding shorelines in the channel connecting Charles and Big Bear as well as around the Bear Lakes should be among the top management priorities for this lake to help reduce TSS. It appears that shorelines have been repaired around much of the lakes, however about half of the entire lake shoreline still has some degree of erosion.

Common carp can re-distribute eroded sediments from the bottom further reducing light penetration and releasing nutrients into the water column. The reduced light penetration reduces the ability for vegetation to establish. Lack of vegetation in the lake promotes algae blooms due to the lack of competition between plants and algae for the available nutrients.

From July to August the amount of TSS measured in Little Bear increased by 73%. A moderate rain event was noted to have occurred in the area at least 48 hours prior to the August sampling event, bringing the water level in Big Bear Lake up one foot. Interestingly, Big Bear TSS concentrations did not respond as dramatically to the rainfall as did those in Little Bear Lake. This indicates that Little Bear Lake may be more susceptible to watershed issues than Big Bear, due to the overall difference in water quality between the two lakes, and Little Bear being the direct recipient of the poor water quality of Big Bear Lake, plus other inputs coming from other watershed sources.



A KEY TO A HEALTHY LAKE IS A WELL-BALANCED AQUATIC PLANT POPULATION

NUTRIENTS

Phosphorus and nitrogen are essential, naturally occurring nutrients needed for plant growth, however when in excess they can impair water quality in lakes. High phosphorus levels in water bodies can lead to excessive algae and aquatic plant growth which can harm aquatic life and impair recreational use. It can cause toxic algae blooms, reduce water clarity, and deplete oxygen levels. Like many of the lakes within Lake County both Big and Little Bear Lake are impaired for total phosphorus (TP) under Illinois Environmental Protection Agency (IEPA) standard. For general use, TP concentrations in a lake are considered impaired if median concentrations are >0.05 mg/L. Big Bear Lake had epilimnetic TP concentrations ranging from 0.050 mg/L to 0.130 mg/L. Epilimnion TP concentrations in Little Bear Lake were lower, ranging from 0.046 mg/L to 0.096 mg/L. The hypolimnion TP concentrations in Little Bear ranged from 0.068 mg/L to 0.893 mg/L. The TP concentrations in both these lakes have increased every year that LCHD-ES monitored the lake.

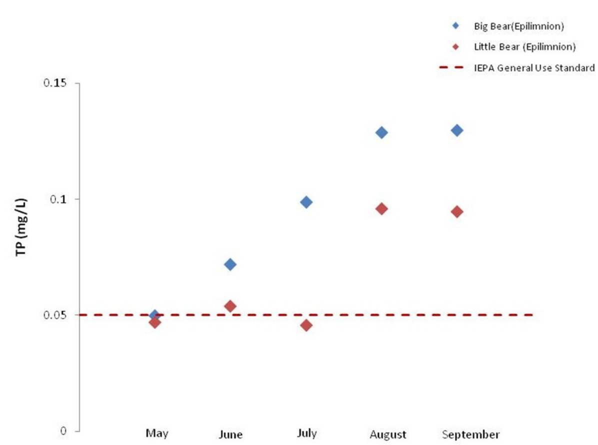
A ratio between total nitrogen and total phosphorus (TN:TP) has been utilized to determine what if any nutrient is limiting in a lake. Ratios of less than 10:1 indicate a system that is limited by nitrogen, while lakes with ratios greater than 20:1 are limited by phosphorus. Introduction of the limited nutrient into a lake will result in potential nuisance populations of either plants or algae. Big Bear Lake had a TN:TP score of 9:1 indicating that it is limited by nitrogen, this is due to there being just too much phosphorus in the lake, and Little Bear Lake had TN:TP scores of 16:1 indicating that both nutrients were plentiful enough to result in increased algae or excessive plant growth.

TP Concentrations in Big and Little Bear Lake (2012, 2002, 1997)

	Big Bear Lake			Little Bear Lake		
Month	**2012**	**2002**	**1997**	**2012**	**2002**	**1997**
May	0.050	0.084	0.052	0.047	0.076	NR
June	0.072	0.060	0.026	0.054	0.038	0.026
July	0.099	0.082	0.077	0.046	0.045	0.048
August	0.129	0.093	0.104	0.096	0.051	0.077
September	0.130	0.084	0.060	0.095	0.065	0.046
Average	0.096	0.081	0.064	0.068	0.055	0.049

Controlling as many factors as possible which contribute to phosphorus additions into the lake from within the watershed should be practiced, from phosphorus free fertilizer applications to picking up dog waste. Removal of carp and remediation of erosion from shorelines along both lakes and Seavey Ditch between Charles and Big Bear would assist in reducing phosphorus concentrations and additionally improve light penetration making conditions more favorable for plant spread. During July, 2012, there was a dramatic spike in TP likely from internal cycling, it was at that visit that a planktonic algae bloom was visibly noted on Little Bear Lake.

Although the Bear Lakes are not impaired for nitrogen, the nitrogen levels were high. The median epilimnetic TKN for lakes in the watershed was 1.16 mg/L, Big Bear Lakes average TKN was 1.58 mg/L. Nitrogen availability in the spring especially when combined with high phosphorus is indicative of a lake predisposed to nuisance plant or algal growth. Both lakes have very little vegetation to compete for nutrients with algae. Nitrogen is a more difficult nutrient to control as there are inputs from the atmosphere as well as from other sources. Therefore it is recommended to formulate a plant management plan for the lakes to promote growth of native submerged plants while managing populations of invasive species such as Eurasian water milfoil to encourage completion to algal species.



DISSOLVED OXYGEN (DO)

Dissolved Oxygen (DO) becomes important especially in lakes that support game fish. This is due to fish becoming stressed when DO concentrations fall below 5.0 mg/L. Since Big Bear Lake has a fishing pier it is assumed that it is the wish of the park district to have a sport fishery.

Fifty-seven percent of the lake volume had sufficient DO concentrations (>5.0 mg/L) in which to support a healthy fish population. A sport fishery would be possible given the DO concentrations present, however, there is no structure in either Big Bear or Little Bear Lake to support fish, it is recommended that either structure be installed into the lakes until vegetation is established.

Little Bear Lake had DO concentrations that fell below the 5.0 mg/L threshold during September, at that time, 38.3% of the lake had DO concentrations capable of maintaining a healthy fishery.

A bathymetric map was completed in 2008 for both Big and Little Bear Lakes. This map was helpful for determining whether there was a DO problem in the lakes in terms of supporting fish. DO concentrations in either lake are prohibitive of a sport fishery. What is severely lacking in both lakes are plants to provide structure for fish and their prey.

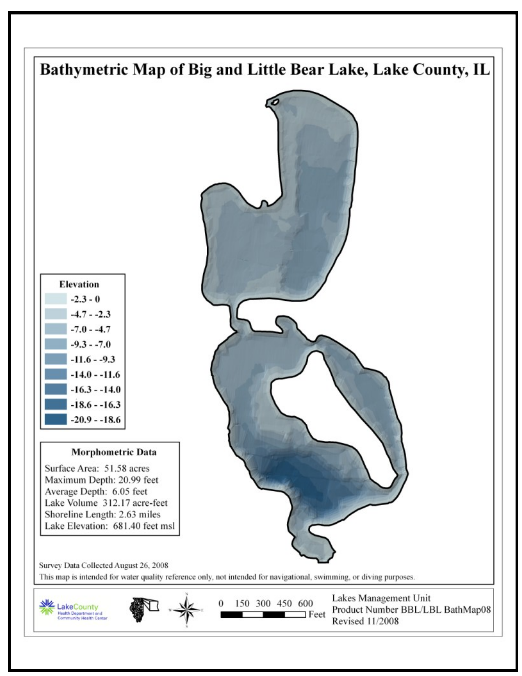
DO concentrations in the hypolimnion of Little Bear Lake are more problematic, as the bottom layer of water is anoxic (DO <1.0 mg/L) . Once the bottom sediments become anoxic phosphorus is released into the hypolimnion. This can contribute to algae blooms in the lake. It is recommended that the Park District consider installing aeration into the main footprint of Little Bear Lake to help alleviate internal cycling of phosphorus. There are three aerators on the east lobe of Little Bear Lake that are present for aesthetic reasons, however, they do little to prevent the lake from becoming anoxic, nor were they designed for that purpose.

BATHYMETRIC MAP

LCHD-ES completed a bathymetric map of Big and Little Bear Lake in 2008. The map is available on the County website at:

http//www.health.lakecountyil.gov/Population/LMU/Pages/Bathymetric -Lake-Maps.aspx.

Morphometric data can assist the LCHD-ES in making appropriate recommendations to lake managers. Lake managers can further use this information for formulating their lake management plan.



CHLORIDES/CONDUCTIVITY

It only takes1 teaspoon of salt to pollute 5 gallons of water .

Conductivity measures the amount of ions contained in a waterbody. The more ions or salts that a waterbody contains the higher it's conductivity. Conductivity has been used to estimate both total dissolved solids (TDS) and chloride concentrations. LCHD-ES has monitored conductivity during all years that Big and Little Bear Lake was monitored. In 1997 and 2002, TDS was additionally collected. In 2012, chloride (Cl^-) concentration were collected and TDS was estimated from conductivity levels.

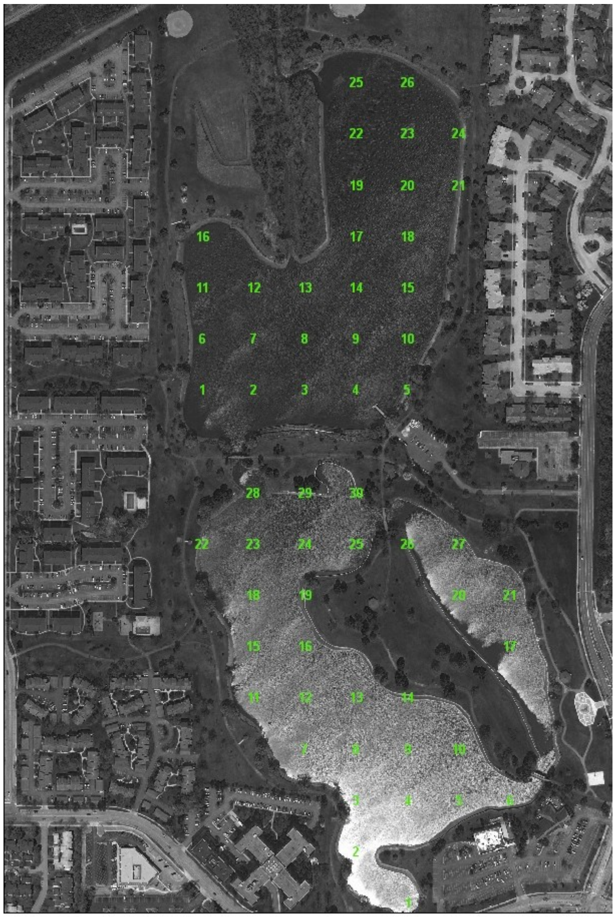
The average epilimnetic conductivity level increased each year the LCHD-ES monitored the lakes. In 2012, chloride concentrations of 193 mg/L and 205 mg/L were measured in Big and Little Bear Lake, respectively. These concentrations remain below the USEPA's critical concentration of 230 mg/L. It is at this concentration that significant impacts to aquatic life begin to occur. Conductivity and chloride are strongly correlated ($R^2 = 0.87$) with conductivity increasing by 24% and 23% in Big and Little Bear respectively since 2002, it is possible that these lakes could reach the critical concentration in the near future. In recent years, chloride levels in lakes and streams as well as some shallow groundwater wells within the county were exhibiting increased concentrations. Increased conductivity and chloride levels in waters have been linked to road salt use during winter road maintenance, as chloride is a major component in most de-icing or anti icing material. Once in water chloride stays in the water. It only takes 1 tablespoon of salt (chloride) to pollute 5 gallons of water (230 mg/L). It has been found that some aquatic organisms are sensitive to concentrations well below the USEPA critical concentration. Increased chloride concentrations potentially can disrupt an entire lake ecosystem due to the accumulation of denser saltwater in the bottom of our freshwater lakes. This can change the dynamics of lake stratification and mixing in our deeper lakes, as the denser saltwater does not readily mix with the upper layer.

The LCHD-ES and Lake County Stormwater Management Commission have been holding annual training sessions targeting deicing maintenance personnel for both public and private entities. This is an attempt to educate winter road maintenance crews on the recommended application rates for applying deicers and hopefully reduce the amount of chloride being introduced into our environment. Since the largest contributors of runoff in the Bear Lake watershed comes from Transportation and single family land usage, homeowners should be also be aware of proper application and choice of deicing materials. Almost all deicing products contain chloride so it is important to read product label for proper application rates. At 10° Farenheit, rock salt is not at all effective in melting ice and will blow away before it melts anything. Additionally calling your local township office to ask them if they are taking any actions to minimize salt usage is encouraged.

What can I do to help?

- Shovel (or use a snow blower) before you use any product; never put a deicing product on top of snow.
- Read the product label, before applying product.
- Sweep up un-dissolved product after a storm is over for reuse.
- Consider switching to a non-chloride deicer.
- Support changes in chloride application in your municipality.
- Inform a neighbor about the impacts chlorides have on our lakes rivers and streams.

AQUATIC PLANTS



Aquatic plants are a critical feature in most water bodies; they compete against algae for nutrients, improve water quality and provide fish habitat for nesting and nursery. The LCHD-ES recommends plant cover in a lake be between 15– 35% to maximize fish habitat.

An aquatic vegetation survey was conducted in July, 2012. A 60-meter grid was randomly overlaid on an aerial photo of Big and Little Bear lakes.

A total of 26 points were sampled in Big Bear Lake during July 2012, and an additional 30 were sampled in Little Bear Lake. In Big Bear Lake, plants were only discovered at two sites representing 7.7% of all sites sampled. Little Bear Lake had plants found at six (20%) of the locations sampled. Eurasian Water Milfoil (EWM) , a non-native invasive plant species, and Sago Pondweed were found in both lakes. Coontail was detected in Little Bear Lake. Sago and Coontail are widespread natives. The fact that EWM was found in such low densities on the lakes speaks for the poor water clarity of the lakes. Like Coontail, EWM can tolerate low light conditions and the two are known to co-occur. Both lakes ranked low in terms of floristic quality (FQI), Little Bear Lake ranked 140 of 160 lakes in the county with an FQI of 7.5, and Big Bear ranked 148th with an FQI value of 5.0.

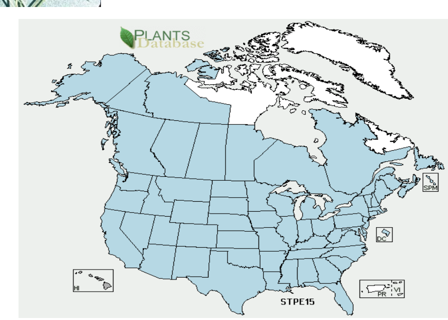
LCHD-ES recommends management of common carp, to help plant establishment in the lake. With an combined average depth of 6.05 feet for Big Bear and Little Bear Lakes, there should be much more vegetation than was is currently present in the lakes. Establishment of aquatic vegetation would help to alleviate algal blooms and provide habitat for fish. If water quality improves, and plants establish, it is likely that EWM will need to be managed throughout both lakes.

COONTAIL

Coontail (*Cerataphyllum demeserum*) is a widespread native in and around the United States and Canada. It is identified by its forked whorl of leaves which extends the length of the stem. Early in the season, plants can be confused with Chara, a macroalgae.

SAGO PONDWEED

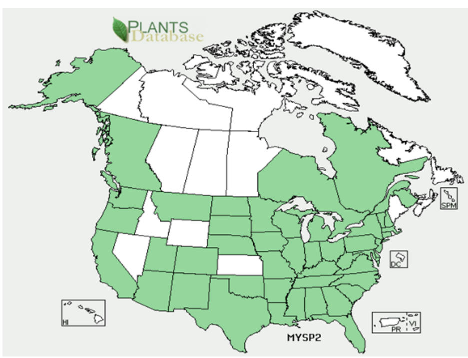
Sago Pondweed (*Stuckenia pectiantus*) has narrow leaves that some say remind them of pine needles. It is an important food source for ducks. This species can be confused with flat stemmed pondweed especially early season plants, however upon close inspection Sago has rounded stem.



EURASIAN WATER MILFOIL (EWM)

Eurasian water milfoil is a non native, invasive submerged aquatic weed whose origins are in Europe, Asia, and North Africa. Since it's introduction from as early as the 1880's EWM has been a successful invader of shallow areas within lakes and streams throughout North America (see below), usually forming dense mats which outcompete and displace native vegetation.

Recently it has been discovered that EWM hybridizes with our native northern water milfoil. The hybrid appears to be much more aggressive as well as more difficult to manage. This has implications for management of this plant that may require different strategies.



Distribution map of EWM invasions.

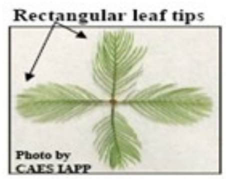
COMMON NAMES:
EURASIAN WATERMILFOIL

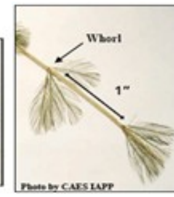
ORIGIN: EXOTIC
EUROPE AND ASIA. FOUND THROUGHOUT LAKE COUNTY AND ILLINOIS

IMPORTANCE:
THIS INVASIVE PLANT SPREADS RAPIDLY, CROWDING OUT NATIVE SPECIES, CLOGGING WATERWAYS, AND BLOCKING SUNLIGHT AND OXYGEN FROM UNDERLYING WATERS.

LOOK ALIKES:
NORTHERN WATERMILFOIL
WHICH HAS FEWER THAN 12 LEAFLET PAIRS PER LEAF, AND GENERALLY HAS STOUTER STEMS.

KEY CHARACTERISTICS





KEY FEATURES:

STEM: LONG, OFTEN ABUNDANTLY BRANCED STEMS FORM A REDDISH OR OLIVE-GREEN SURFACE MAT IN SUMMER.

LEAF: LEAVES ARE RECTANGULAR WITH ≥12 PAIRS OF LEAFLETS PER LEAF AND ARE DISSECTED GIVING A FEATHERY APPEARANCE, ARRANGED IN A WHORL, WHORLS ARE 1 INCH APART.

FLOWER: SMALL PINKISH MALE FLOWERS THAT OCCUR ON REDDISH SPIKES, FEMALE FLOWERS LACK PETALS AND SEPALS AND 4 LOBED PISTIL.

COMMON LOOK ALIKES

Northern Watermilfoil, up to 11 segments per leaflet. Whorled. Lacks reddish tint to stem. Not mat forming. Forms winter buds (turions).

Coontail - Forked leaflets whorled around stem. Flowers and seeds formed in axils rather than terminally.

White Water Crowfoot - Leaf alternate, appearing whorled, Leaves divided into thread-like segments. Leaf has distinct petiole. When in bloom inflorescence with white petals.

Permit Requirements for Applying Pesticides in Waters

For full details of the rule see:

http://www.epa.state.il.us/water/permits/pesticide/index.html

As of October 2010, new regulations went into effect that significantly affect how pesticides are used in Illinois waters. A National Pollutant Discharge Elimination System (NPDES) permit will now be required to apply any type of pesticides over or into waters of the State. In Illinois, the permitting process will be administrated through the Illinois Environmental Protection Agency (IEPA).

Who has to get a permit? According to the language in the permit, anyone who qualifies as an "operator", which is defined as: "any person, persons, group, or entity in control over the financing for, or over the decision to perform pest control activities, or applying pesticides that will result in a discharge to waters of the State". Homeowner associations or even individuals may need to get a permit. However, it is believed that it will be primarily aimed at commercial applicators. Regardless of the size of treatment, a permit will be needed. If the treatment area or total annual area exceeds certain thresholds then additional requirements will be required such as a Pesticide Discharge Management Plan and an annual report. The thresholds vary depending on type of treatment. For weed and algae control, the threshold is 20 acres of treatment or 20 linear miles along the water's edge. The threshold is an annual total, so for example, algaecides applied to five acres four times during the year, would meet this 20 acre threshold requirement.

Anyone or any group planning to treat their pond or lake with pesticide after the October, 2010 date need to take into account these new requirements.

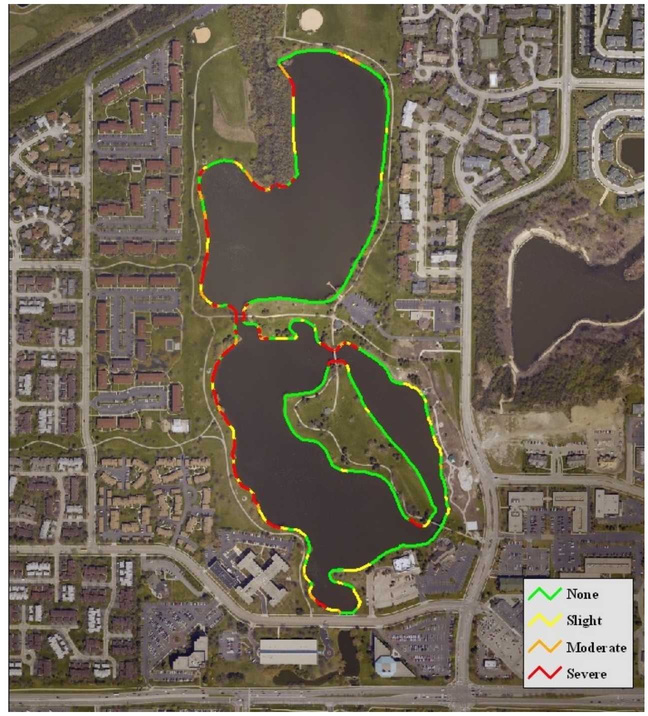
Correspondence with the Park District was that there were no chemical applications on either Big or Little Bear in 2012.

Algicide application, needs a notice of intent filed with IEPA.

SHORELINE EROSION

Erosion of shorelines contributes to poor water quality by increasing both the total suspended solids and phosphorus concentrations in a lake with either one of two outcomes, a very weedy lake due to an increase in a limiting nutrient (phosphorus) or a lake with few weeds due to decreased water clarity due to either excessive amounts of sediment or algae being in the water column. In a system without plants, algae can become a problem due to the lack of competition for nutrients by plants. Sedimentation can potentially cause destruction of habitat for fish and other macroinvertebrates due to the deposition of sediment on nests and plants reducing sights for egg laying.

In 2012, Sixty percent of the shoreline has successfully either had some type of hardscaping installed to alleviate erosion or exhibited no degree of erosion. However, forty percent of the shoreline had some degree of erosion occurring on it and 23.7% of the erosion noted was evaluated to be moderate to severe. Some of these areas experiencing erosion were subject of past control efforts and should be re-evaluated and improved. Continued efforts to remediate erosion on all shorelines is advisable. Big and Little Bear lakes receive water from an enormous watershed, and it is probable that when heavy rains occur the water elevation shifts rapidly as large amounts of storm water come rushing in from the watershed. Some shorelines may be able to be repaired by installing native plants, however, many of the shorelines had very steep slopes so hardscaping to secure the shoreline or a mixture of both might be necessary.



Degree of Erosion on Big and Little Bear Lake, 2012		
Erosion	Miles	Percent
None	1.57	60.0
Slight	0.43	16.3
Moderate	0.19	7.4
Severe	0.43	16.3

Example of eroding banks along previous stabilized banks.

Area with plantings incorporated above hardscaping

FISH

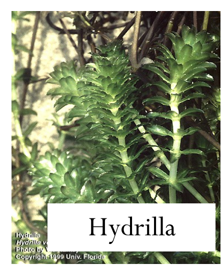
In 2008, the IDNR surveyed the fish population and found 12 species in the lakes, bluegill and yellow bass and large mouth bass were the most abundant species found in the lake. However, due to the catch rate of yellow bass they were considered more abundant. The remaining species with exception of warmouth and yellow perch, are tolerant of poor water quality.

Fish Survey Results (IDNR, 2008)
Large Mouth Bass
Bluegill
Pumpkin Seed Sunfish
Green Sunfish
Warmouth
Black Crappie
Yellow Bass
Yellow Perch
Channel Catfish
Carp
Golden Shiner
Gizzard Shad

The IDNR, similarly recommended strategic plant management to reduce turbidity in the lake, and to provide habitat for small fish, they additionally indicated the need to repair shorelines, providing naturalized shorelines whenever possible. Part of their recommendations on managing the fish population included, posting regulations at all access points, and promoting the removal of carp and yellow bass by fishermen. Additionally they suggested stocking species such as northern pike and channel catfish , as well as provided recommendations for managing the fish population, including stocking northern pike and channel catfish. Installing fish cribs or other structures (see photos below) near fishing piers and other access points to attract fish was also cited as helpful for the fishery.

INVASIVE SPECIES

In 2012, Common Buckthorn was noted along areas of naturalized shoreline areas. Some areas colonized by this species were experiencing severe erosion due to the inability of vegetation to establish under the dense canopy. Shorelines areas colonized by invasive grass species such as Reed Canary Grass with shallow roots also allowing for bank cutting and sloughing with rapidly changing water elevations and flows. It is recommended that in areas with species such as these



Hydrilla

It is recommended that the Park District keep watch for the arrival of Hydrilla into Big and Little Bear lakes. Hydrilla has not yet been detected in Illinois, but has been found in neighboring states, likely as accidental introductions likely it was an accidental introductions through aquarium or nursery stock. Hydrilla detection in a lake in Indiana had it's launches closed for five years, while making ensuring it's eradication from the lake. There will soon be educational material out for distribution.

Buckthorn shorelines exhibiting erosion.

Environmental Services

Senior Biologist: Mike Adam

madam@lakecountyil.gov

Population Health Services
500 W. Winchester Road
Libertyville, Illinois 60048-1331

Phone: 847-377-8030
Fax: 847-984-5622

For more information visit us at:

http://www.lakecountyil.gov/Health/want/BeachLakeInfo.htm

Protecting the quality of our lakes is an increasing concern of Lake County residents. Each lake is a valuable resource that must be properly managed if it is to be enjoyed by future generations. To assist with this endeavor, Population Health Environmental Services provides technical expertise essential to the management and protection of Lake County surface waters.

Environmental Service's goal is to monitor the quality of the county's surface water in order to:

- Maintain or improve water quality and alleviate nuisance conditions
- Promote healthy and safe lake conditions
- Protect and improve ecological diversity

Services provided are either of a technical or educational nature and are provided by a professional staff of scientists to government agencies (county, township and municipal), lake property owners' associations and private individuals on all bodies of water within Lake County.

Recommendations

LCHD-ES recommends the following actions for improving the water quality and overall health of Big and Little Bear lakes:

- Reduction of the Carp population in the lakes.
- Promote the spread of vegetation in the lake to compete with algae species. However, as plant community is developing it may become necessary to control EWM as it was the most common aquatic plant encountered in the lakes. Encourage plant growth to provide habitat for fish.
- Consider taking recommendations from the 2008 IDNR fish survey on providing fish structures.
- Eroded shorelines be repaired to minimize sediments from entering into lake. There are many options available to secure shorelines, naturalizing the shoreline with native plants provides a buffer for nutrient inputs as well as an attractive viewscape, in areas where this is not feasible a combination of hardscaping and shoreline naturalization should be considered.

APPENDIX A

FIGURES AND TABLES
BIG AND LITTLE BEAR LAKES
2012

Figure 1. LCHD Water Quality Sampling Point – Big and Little Bear Lakes 2012

Table 1A. Water quality data for Big Bear Lake 1997, 2002, and 2012.

2012	Epilimnion																
DATE	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N	TP	SRP	Cl-	TDS**	TSS	TS	TVS	NVSS	SECCHI	COND	pH	DO
9-May	3	188	1.02	<0.100	<0.05	0.050	<0.005	179	563	8.3	600	91	3.37	2.30	0.9970	8.12	7.69
13-Jun	3	178	0.75	<0.100	<0.05	0.072	0.007	197	640	14.0	668	136	2.87	1.50	1.1260	7.96	6.46
11-Jul	3	167	1.00	<0.100	<0.05	0.099	0.007	221	616	22.0	688	134	11.87	1.00	1.0850	8.09	7.18
15-Aug	3	118	1.53	<0.100	<0.05	0.129	<0.005	183	474	23.2	575	135	17.28	0.80	0.8480	8.73	10.94
12-Sep	3	131	1.55	<0.100	<0.05	0.130	<0.005	184	492	23.0	549	95	13.87	1.00	0.8770	7.32	6.58
	Average	156	1.17	0.100^k	0.05^k	0.096	0.006^k	193	557	18.1	616	118	9.85	1.32	0.9866	8.04	7.77

2002	Epilimnion																
DATE	DEPTH	ALK	TKN	NH3-N	NO3-N	TP	SRP	Cl-**	TDS	TSS	TS	TVS	NVSS	SECCHI	COND	pH	DO
14-May	3	170	1.04	<0.100	0.108	0.084	<0.005	229	606	13.3	633.0	118	10.82	2.17	1.1150	7.95	8.77
18-Jun	3	159	1.07	<0.100	0.361	0.060	<0.005	101	392	9.3	479.0	126	6.85	4.33	0.7486	8.43	8.97
23-Jul	3	148	0.88	<0.100	<0.05	0.082	0.006	131	492	18.0	540.0	142	13.27	2.1	0.8354	8.19	5.54
20-Aug	3	131	1.15	<0.100	<0.05	0.093	<0.005	94	424	17.0	454.0	125	12.32	1.71	0.7287	8.13	6.53
17-Sep	3	118	1.47	<0.100	<0.05	0.084	<0.005	30	304	13.0	345.0	97.5	9.33	1.93	0.5441	8.68	8.76
	Average	145	1.12	0.100^k	0.235^k	0.081	0.006^k	117	444	14.1	490.2	122	10.52	2.45	0.7944	8.28	7.71

1997	Epilimnion																
DATE	DEPTH	ALK	TKN	NH3-N	NO3-N	TP	SRP	Cl-**	TDS	TSS	TS	TVS	NVSS	SECCHI	COND	pH	DO
20-May	3	165	0.74	<0.100	0.623	0.052	<0.005	269	658	17.0	734	117	14.29	1.80	1.2290	8.39	11.10
24-Jun	3	166	0.87	0.162	0.268	0.026	<0.005	251	626	6.2	696.0	152	4.85	3.50	1.1780	8.08	8.50
22-Jul	3	138	0.97	<0.100	<0.05	0.077	<0.005	170	528	15.0	577.0	119	11.91	2.00	0.9460	8.10	7.30
19-Aug	3	112	1.37	<0.100	0.119	0.104	<0.005	111	454	24.0	498.0	142	17.16	1.30	0.7770	8.07	8.00
23-Sep	3	122	0.84	<0.100	0.068	0.06	<0.005	92	390	10.0	442.0	104	7.65	3.30	0.7230	8.08	8.70
	Average	141	0.96	0.162^k	0.270^k	0.064	<0.005	179	531	14.4	589.4	127	11.17	2.38	0.9706	8.14	8.72

Table 1B. Water quality data for Little Bear Lake 1997, 2002, and 2012.

2012	Epilimnion															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_3-N	TP	SRP	TDS	Cl-	TSS	TS	TVS	SECCHI	COND	pH	DO
5/9/2012	3	178	1.18	<0.100	<0.050	0.047	<0.005	592	210	6.3	645	88	3.30	1.083	8.24	7.67
6/13/2012	3	168	0.75	<0.100	<0.050	0.054	<0.005	638	209	8.0	671	131	3.00	1.153	8.10	7.78
7/11/2012	3	163	0.76	<0.100	<0.050	0.046	<0.005	595	223	9.8	680	127	2.90	1.089	8.14	7.22
8/15/2012	3	124	1.38	<0.100	<0.050	0.096	<0.005	685	195	17.0	580	122	1.20	0.889	8.53	10.43
9/12/2012	3	132	1.23	<0.100	<0.050	0.095	<0.005	561	190	16.0	543	87	1.50	0.896	7.30	5.67
	Average	153	1.06	0.100^k	0.050^k	0.068	<0.005	614	205	11.4	624	111	2.38	1.022	8.06	7.75

2002	Epilimnion															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_3-N	TP	SRP	TDS	Cl-	TSS	TS	TVS	SECCHI	COND	pH	DO
5/14/2002	3	177	1.20	0.159	0.051	0.076	<0.005	708	287	9.6	732	127	2.17	1.2810	7.82	7.35
6/18/2002	3	147	0.83	0.106	0.305	0.038	<0.005	478	121	3.7	497	119	7.45	0.8045	8.16	7.61
7/23/2002	3	131	0.89	<0.1	<0.050	0.045	<0.005	422	120	11.0	496	130	3.02	0.8018	8.60	7.98
8/20/2002	3	132	0.97	<0.1	<0.050	0.051	<0.005	434	107	7.5	487	140	3.18	0.7652	8.46	8.65
9/17/2002	3	109	1.32	<0.1	<0.050	0.065	<0.005	268	16	9.5	297	75	2.33	0.5043	8.44	6.85
	Average	139	1.04	0.133^k	0.178^k	0.055	<0.005	462	130	8.3	501.8	118	3.63	0.8314	8.30	7.69

1997	Epilimnion															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_3-N	TP	SRP	TDS	Cl-	TSS	TS	TVS	SECCHI	COND	pH	DO
6/24/1997	3	160	1.05	0.133	0.283	0.026	<0.005	720	274	6.5	718	153	4.80	1.2420	8.14	8.70
7/22/1997	3	133	0.74	<0.1	<0.050	0.048	<0.005	562	188	6.3	610	144	3.50	0.9970	8.32	8.99
8/19/1997	3	116	1.22	<0.1	0.053	0.077	<0.005	458	129	14.0	512	134	1.60	0.8280	8.32	9.78
9/23/1997	3	119	0.95	0.202	<0.050	0.046	<0.005	412	108	6.6	445	89	5.40	0.7680	7.84	6.39
	Average	132	0.99	0.168^k	0.168^k	0.049	<0.005	538	175	8.4	571	130	3.83	0.9588	8.16	8.47

Table 1B. Water quality data for Little Bear Lake 1997, 2002, and 2012 (Continued).

2012	Hypolimnion															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_3-N	TP	SRP	TDS	Cl-	TSS	TS	TVS	SECCHI	COND	pH	DO
5/9/2012	17	189	1.33	0.359	<0.050	0.097	0.012	645	241	14	712	96.0	NA	1.189	7.74	0.79
6/13/2012	14	182	0.90	0.108	<0.050	0.068	0.005	627	206	9	667	119.0	NA	1.174	7.62	1.38
7/11/2012	17	264	6.22	5.190	<0.050	0.893	0.615	653	235	20	735	122.0	NA	1.204	6.98	0.42
8/15/2012	18	149	2.51	1.200	<0.050	0.159	0.008	494	198	18	589	113.0	NA	1.267	7.15	0.61
9/12/2012	17	137	1.95	0.617	<0.050	0.138	0.007	497	192	16	551	91.0	NA	1.167	6.55	0.60
	Average	184	2.58	1.495	0.050[k]	0.271	0.129	583	214	15	651	108	NA	1.200	7.21	0.76

2002	Hypolimnion															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_3-N	TP	SRP	TDS	Cl-	TSS	TS	TVS	SECCHI	COND	pH	DO
5/14/2002	18	178	1.12	0.16	0.050	0.077	0.008	714	293	20.6	738	131	NA	1.299	7.64	5.24
6/18/2002	18	207	2.77	2.07	<0.050	0.423	0.197	724	298	11.0	763	156	NA	1.312	7.18	0.11
7/23/2002	17	225	3.66	2.88	<0.050	0.547	<0.005	654	293	12.0	719	159	NA	1.297	7.14	0.13
8/20/2002	18	264	5.73	4.84	<0.050	0.827	0.147	688	308	17.0	745	155	NA	1.342	6.85	0.15
9/17/2002	18	234	5.83	4.86	<0.050	0.834	0.793	559	314	16.0	617	123	NA	1.359	6.83	0.04
	Average	222	3.82	2.962	0.050[k]	0.542	0.286k	668	301	15.3	716	145	NA	1.322	7.13	1.13

1997	Hypolimnion															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_3-N	TP	SRP	TDS	Cl-	TSS	TS	TVS	SECCHI	COND	pH	DO
6/24/1997	19	199	3.02	2.36	0.251	0.242	0.177	730	335	6.4	834	163	NA	1.418	7.26	0.09
7/22/1997	17	221	3.42	2.90	<0.050	0.265	0.164	744	326	8.0	833	173	NA	1.393	7.11	0.06
8/19/1997	20	268	6.66	5.85	$0.050	0.630	0.529	738	339	8.5	786	124	NA	1.430	6.87	0.09
9/23/1997	18	250	5.75	5.82	<0.050	0.494	0.384	674	167	7.5	729	122	NA	0.937	7.29	0.10
	Average	235	4.71	4.23	0.151[k]	0.408	0.314	722	292	7.6	796	146	NA	1.295	7.13	0.09

Glossary

ALK = Alkalinity, mg/L $CaCO_3$	TDS = Total dissolved solids, mg/L
TKN = Total Kjeldahl nitrogen, mg/L	TSS = Total suspended solids, mg/L
NH_3-N = Ammonia nitrogen, mg/L	TS = Total solids, mg/L
NO_2+NO_3-N = Nitrate + Nitrite nitrogen, mg/L	TVS = Total volatile solids, mg/L
NO_3-N = Nitrate + Nitrite nitrogen, mg/L	SECCHI = Secchi disk depth, ft.
TP = Total phosphorus, mg/L	COND = Conductivity, milliSiemens/cm
SRP = Soluble reactive phosphorus, mg/L	DO = Dissolved oxygen, mg/L
Cl^- = Chloride, mg/L	

k = Denotes that the actual value is known to be less than the value presented.

NA= Not applicable

* = Prior to 2006 only Nitrate - nitrogen was analyzed

** = Parameters estimated from conductivity reading.

Table 2. 2000 – 2012 Water Quality Parameters, Statistics Summary

	ALKoxic <=3ft00-2010			ALKanoxic 2000-2010	
Average	**165**		Average	**201**	
Median	**160**		Median	**192**	
Minimum	**65**	**IMC**	Minimum	**103**	**Heron Pond**
Maximum	**330**	**Flint Lake**	Maximum	**470**	**Lake Marie**
STD	**42**		STD	**52**	
n =	**812**		n =	**249**	

	Condoxic <=3ft00-2010			Condanoxic 2000-2010	
Average	**0.8629**		Average	**1.0125**	
Median	**0.7800**		Median	**0.8678**	
Minimum	**0.2260**	**Schreiber Lake**	Minimum	**0.3210**	**Lake Kathyrn, Schreiber Lake**
Maximum	**6.8920**	**IMC**	Maximum	**7.4080**	**IMC**
STD	**0.5215**		STD	**0.7821**	
n =	**812**		n =	**248**	

	NO3-N, Nitrate+Nitrite,oxic <=3ft00-2010			NH3-Nanoxic 2000-2010	
Average	**0.489**		Average	**2.132**	
Median	**0.160**		Median	**1.360**	
Minimum	**<0.05**	***ND**	Minimum	**<0.1**	***ND**
Maximum	**9.670**	**South Churchill Lake**	Maximum	**18.400**	**Taylor Lake**
STD	**1.054**		STD	**2.345**	
n =	**812**		n =	**249**	

*ND = Many lakes had non-detects (74.5%)
Only compare lakes with detectable concentrations to the statistics above
Beginning in 2006, Nitrate+Nitrite was measured.

*ND = 20.1% Non-detects from 32 different lakes

	pHoxic <=3ft00-2010			pHanoxic 2000-2010	
Average	**8.37**		Average	**7.33**	
Median	**8.36**		Median	**7.30**	
Minimum	**7.07**	**Bittersweet #13**	Minimum	**6.24**	**Banana Pond**
Maximum	**10.40**	**Summerhill Estates**	Maximum	**9.16**	**White Lake**
STD	**0.46**		STD	**0.43**	
n =	**810**		n =	**248**	

Table 2. 2000 – 2012 Water Quality Parameters, Statistics Summary

	All Secchi 2000-2010	
Average	**4.33**	
Median	**2.95**	
Minimum	**0.25**	**McDonald Lake 2/Ozaukee Lake**
Maximum	**23.50**	**West Loon Lake**
STD	**3.66**	
n =	**758**	

	TKNoxic <=3ft00-2010	
Average	**1.399**	
Median	**1.180**	
Minimum	**<0.1**	***ND**
Maximum	**10.300**	**Fairfield Marsh**
STD	**0.819**	
n =	**812**	

*ND = 3.8% Non-detects from 15 different lakes

	TKNanoxic 2000-2010	
Average	**2.866**	
Median	**2.130**	
Minimum	**<0.5**	***ND**
Maximum	**21.000**	**Taylor Lake**
STD	**2.302**	
n =	**249**	

*ND = 3.2% Non-detects from 4 different lakes

	TPoxic <=3ft00-2010	
Average	**0.099**	
Median	**0.065**	
Minimum	**<0.01**	***ND**
Maximum	**3.880**	**Albert Lake**
STD	**0.169**	
n =	**812**	

*ND = 2.2% Non-detects from 7 different lakes

	TPanoxic 2000-2010	
Average	**0.305**	
Median	**0.174**	
Minimum	**0.012**	**Independence Grove**
Maximum	**3.800**	**Taylor Lake**
STD	**0.394**	
n =	**249**	

	TSSall <=3ft00-2010	
Average	**15.6**	
Median	**8.1**	
Minimum	**<0.1**	***ND**
Maximum	**165.0**	**Fairfield Marsh**
STD	**20.8**	
n =	**812**	

*ND = 1.7% Non-detects from 10 different lakes

	TVSoxic <=3ft00-2010	
Average	**127.6**	
Median	**123.0**	
Minimum	**34.0**	**Pulaski Pond**
Maximum	**298.0**	**Fairfield Marsh**
STD	**39.7**	
n =	**767**	

No 2002 IEPA Chain Lakes

Table 2. 2000 – 2012 Water Quality Parameters, Statistics Summary

	TDSoxic <=3ft00-2004	
Average	**470**	
Median	**454**	
Minimum	**150**	**Lake Kathryn, White**
Maximum	**1340**	**IMC**
STD	**169**	
n =	**745**	

No 2002 IEPA Chain Lakes.

	CLanoxic <=3ft00-2010	
Average	**193**	
Median	**111**	
Minimum	**3.5**	**Schreiber Lake**
Maximum	**2390**	**IMC**
STD	**324**	
n =	**162**	

	CLoxic <=3ft00-2010	
Average	**181**	
Median	**142**	
Minimum	**2.7**	**Schreiber Lake**
Maximum	**2760**	**IMC**
STD	**220**	
n =	**552**	

LakeCounty
Health Department and
Community Health Center

Anoxic conditions are defined <=1 mg/l D.O.
pH Units are equal to the -Log of [H] ion activity
Conductivity units are in MilliSiemens/cm
Secchi Disk depth units are in feet
All others are in mg/L

Minimums and maximums are based on data from all lakes
from 2000-2010
(n=1357).

Average, median and STD are based on data from the most
recent water quality sampling year for each lake.

LCHD Environmental Services ~ 01/20/2011

Table 3. Average Secchi Depths Measured from Lakes in Lake County, 2000-2012			
RANK	**LAKE NAME**	**SECCHI AVE**	**TSIsd**
1	Windward Lake	14.28	38.79
2	Lake Carina	13.21	39.92
3	Druce Lake	12.25	41.00
4	Pulaski Pond	11.69	41.68
5	West Loon Lake	11.55	41.85
6	Indpendence Grove	11.50	41.92
7	Sterling Lake	11.35	42.10
8	Lake Zurich	10.40	43.37
9	Davis Lake	9.65	44.44
10	Harvey Lake	9.47	44.72
11	Little Silver Lake	9.42	44.79
12	Old School Lake	9.40	44.82
13	Lake Kathryn	9.39	44.84
14	Dugdale Lake	9.22	45.10
15	Dog Training Pond	9.04	45.39
16	Banana Pond	8.85	45.69
17	Deep Lake	8.83	45.72
18	Stone Quarry Lake	8.81	45.76
19	Lake of the Hollow	8.74	45.87
20	Bangs Lake	8.70	45.94
21	Cedar Lake	8.42	46.41
22	Cross Lake	8.18	46.83
23	Ames Pit	8.14	46.90
24	Briarcrest Pond	8.00	47.15
25	Sand Lake	7.48	48.12
26	Sand Pond (IDNR)	7.42	48.23
27	Cranberry Lake	7.40	48.27
28	Timber Lake (North)	7.37	48.33
29	Lake Miltmore	7.35	48.37
30	Lake Leo	7.31	48.45
31	Schreiber Lake	7.25	48.57
32	Nielsen Pond	7.23	48.61
33	Honey Lake	7.17	48.73
34	Lake Minear	7.13	48.81
35	Round Lake	7.01	49.05
36	Highland Lake	6.97	49.14
37	Channel Lake	6.65	49.81
38	Lake Catherine	6.58	49.97
39	Lake Helen	6.43	50.30
40	Third Lake	6.40	50.37
41	Sun Lake	6.33	50.52
42	Lake Lakeland Estates	6.31	50.57
43	Lake Barrington	6.00	51.30
44	Wooster Lake	5.92	51.49
45	Lake Fairfield	5.89	51.56
46	Lake Fairview	5.59	52.32
47	Gages Lake	5.45	52.68

Table 3. Average Secchi Depths Measured from Lakes in Lake County, 2000-2012			
RANK	**LAKE NAME**	**SECCHI AVE**	**TSIsd**
48	Owens Lake	5.30	53.08
49	Valley Lake	5.05	53.78
50	McGreal Lake	5.04	53.81
51	Old Oak Lake	4.85	54.36
52	Waterford Lake	4.70	54.82
53	North Tower Lake	4.61	55.10
54	Lake Linden	4.60	55.13
55	Peterson Pond	4.51	55.41
56	Crooked Lake	4.39	55.79
57	Butler Lake	4.35	55.93
58	Mary Lee Lake	4.35	55.93
59	Tower Lake	4.31	56.07
60	Crooked Lake	4.28	56.17
61	Deer Lake	4.20	56.45
62	Seven Acre Lake	4.18	56.51
63	Lambs Farm Lake	4.17	56.54
64	Countryside Lake	4.10	56.79
65	Grays Lake	4.08	56.86
66	Lake Naomi	4.05	56.96
67	White Lake	3.96	57.29
68	Hook Lake	3.95	57.32
69	Turner Lake	3.92	57.43
70	Leisure Lake	3.85	57.69
71	Salem Lake	3.77	58.00
72	Countryside Glen Lake	3.64	58.50
73	Hastings Lake	3.52	58.99
74	Taylor Lake	3.52	58.99
75	Timber Lake (South)	3.51	59.03
76	Duck Lake	3.49	59.11
77	Bishop Lake	3.47	59.19
78	Fish Lake	3.47	59.19
79	Lake Holloway	3.40	59.49
80	Stockholm Lake	3.38	59.57
81	East Loon Lake	3.30	59.92
82	Bresen Lake	3.28	60.00
83	Summerhill Estates Lake	3.27	60.05
84	Lucky Lake	3.22	60.27
85	Diamond Lake	3.17	60.50
86	Liberty Lake	3.16	60.54
87	International Mining and Chemical Lake	3.08	60.91
88	Lake Christa	3.01	61.24
89	Lucy Lake	2.99	61.34
90	Long Lake	2.96	61.48
91	Island Lake	2.90	61.78
92	Bluff Lake	2.85	62.03
93	St. Mary's Lake	2.79	62.34
94	Werhane Lake	2.71	62.76

Table 3. Average Secchi Depths Measured from Lakes in Lake County, 2000-2012			
RANK	LAKE NAME	SECCHI AVE	TSIsd
95	Lake Napa Suwe	2.66	63.02
96	Petite Lake	2.66	63.02
97	East Meadow Lake	2.61	63.30
98	Kemper Lake 1	2.56	63.58
99	Broberg Marsh	2.50	63.92
100	Antioch Lake	2.48	64.03
101	Spring Lake	2.46	64.15
102	Little Bear Lake	2.38	64.63
103	Lake Marie	2.25	65.44
104	Rivershire Pond 2	2.23	65.57
105	Lake Charles	2.20	65.76
106	College Trail Lake	2.18	65.89
107	Loch Lomond	2.17	65.96
108	Echo Lake	2.11	66.36
109	Eagle Lake (S1)	2.10	66.43
110	West Meadow Lake	2.07	66.64
111	Forest Lake	2.04	66.85
112	Columbus Park Lake	2.03	66.92
113	Grand Ave Marsh	2.03	66.92
114	Grassy Lake	2.00	67.14
115	Bittersweet Golf Course #13	1.98	67.28
116	Sylvan Lake	1.98	67.28
117	Fischer Lake	1.96	67.43
118	Pistakee Lake	1.88	68.03
119	Fourth Lake	1.77	68.90
120	Kemper Lake 2	1.77	68.90
121	Deer Lake Meadow Lake	1.73	69.23
122	Nippersink Lake	1.73	69.23
123	Woodland Lake	1.72	69.31
124	Lake Louise	1.68	69.65
125	Slough Lake	1.63	70.09
126	Willow Lake	1.63	70.09
127	Lake Farmington	1.62	70.17
128	Rasmussen Lake	1.62	70.17
129	Half Day Pit	1.60	70.35
130	Dunn's Lake	1.54	70.91
131	Longview Meadow Lake	1.51	71.19
132	Lake Matthews	1.41	72.18
133	Fox Lake	1.37	72.59
134	Grass Lake	1.33	73.02
135	Big Bear Lake	1.32	73.13
136	Lake Nipperink	1.28	73.57
137	Redhead Lake	1.27	73.68
138	Lake Eleanor	1.16	74.99
139	McDonald Lake 1	1.13	75.37
140	Buffalo Creek Reservoir	1.10	75.76
141	Rollins Savannah 1	1.05	76.43

Table 3. Average Secchi Depths Measured from Lakes in Lake County, 2000-2012			
RANK	**LAKE NAME**	**SECCHI AVE**	**TSIsd**
142	Osprey Lake	1.03	76.70
143	Slocum Lake	1.03	76.73
144	Manning's Slough	1.00	77.13
145	Rollins Savannah 2	0.95	77.87
146	Dog Bone Lake	0.94	78.02
147	Redwing Marsh	0.88	78.97
148	Flint Lake Oulet	0.83	79.82
149	Fairfield Marsh	0.81	80.17
150	Oak Hills Lake	0.79	80.53
151	South Churchill Lake	0.73	81.67
152	Lake Forest Pond	0.71	82.07
153	ADID 127	0.66	83.12
154	Albert Lake	0.64	83.57
155	North Churchill Lake	0.61	84.26
156	Hidden Lake	0.56	85.54
157	Ozaukee Lake	0.51	86.84
158	McDonald Lake 2	0.5	87.12

Table 4. Lake County average TSI phosphorus (TSIp) ranking 2000-2012.

RANK	LAKE NAME	TP AVE	TSIp
1	Lake Carina	0.0100	37.35
2	Sterling Lake	0.0100	37.35
3	Indpendence Grove	0.0130	41.14
4	Lake Zurich	0.0135	41.68
5	Druce Lake	0.0140	42.00
6	Cedar Lake	0.0160	44.13
7	Windward Lake	0.0160	44.13
8	Sand Pond (IDNR)	0.0165	44.57
9	West Loon	0.0170	45.00
10	Pulaski Pond	0.0180	45.83
11	Gages Lake	0.0200	47.00
12	Banana Pond	0.0200	47.35
13	Lake Kathryn	0.0200	47.35
14	Lake Minear	0.0200	47.35
15	Highland Lake	0.0202	47.49
16	Lake Miltmore	0.0210	48.00
17	Timber Lake (North)	0.0210	48.05
18	Cranberry Lake	0.0220	48.72
19	Cross Lake	0.0220	48.72
20	Dog Training Pond	0.0220	48.72
21	Sun Lake	0.0220	48.72
22	Bangs Lake	0.0230	49.36
23	Deep Lake	0.0230	49.36
24	Lake of the Hollow	0.0230	49.36
25	Round Lake	0.0230	49.36
26	Stone Quarry Lake	0.0230	49.36
27	Little Silver Lake	0.0250	50.57
28	Lake Leo	0.0260	51.13
29	Dugdale Lake	0.0270	51.68
30	Peterson Pond	0.0270	51.68
31	Fourth Lake	0.0360	53.00
32	Lake Fairfield	0.0300	53.20
33	Third Lake	0.0300	53.33
34	Lake Catherine	0.0310	53.67
35	Lambs Farm Lake	0.0310	53.67
36	Old School Lake	0.0310	53.67
37	Grays Lake	0.0310	54.00
38	Harvey Lake	0.0320	54.50
39	Hendrick Lake	0.0340	55.00
40	Honey Lake	0.0340	55.00
41	Sand Lake	0.0380	56.00
42	Sullivan Lake	0.0370	56.22
43	Channel Lake	0.0380	56.60
44	Ames Pit	0.0390	56.98
45	Diamond Lake	0.0390	56.98
46	East Loon	0.0400	57.34
47	Schreiber Lake	0.0400	57.34
48	Waterford Lake	0.0400	57.34
49	Hook Lake	0.0410	57.70

Table 4. Lake County average TSI phosphorus (TSIp) ranking 2000-2012.

RANK	LAKE NAME	TP AVE	TSIp
50	Duck Lake	0.0430	58.39
51	Nielsen Pond	0.0450	59.04
52	Wooster Lake	0.0450	59.04
53	Seven Acre Lake	0.0460	59.36
54	Turner Lake	0.0460	59.36
55	Willow Lake	0.0460	59.36
56	East Meadow Lake	0.0480	59.97
57	Lucky Lake	0.0480	59.97
58	Old Oak Lake	0.0490	60.27
59	College Trail Lake	0.0500	60.56
60	Hastings Lake	0.0520	61.13
61	Lake Lakeland Estates	0.0520	61.13
62	Butler Lake	0.0530	61.40
63	West Meadow Lake	0.0530	61.40
64	Lucy Lake	0.0550	61.94
65	Lake Linden	0.0570	62.45
66	Lake Napa Suwe	0.0570	62.45
67	Lake Christa	0.0580	62.70
68	Owens Lake	0.0580	62.70
69	Briarcrest Pond	0.0580	63.00
70	Lake Naomi	0.0620	63.66
71	Lake Tranquility (S1)	0.0620	63.66
72	Liberty Lake	0.0630	63.89
73	Werhane Lake	0.0630	63.89
74	Countryside Glen Lake	0.0640	64.12
75	Davis Lake	0.0650	64.34
76	Lake Fairview	0.0650	64.34
77	Leisure Lake	0.0650	64.34
78	Tower Lake	0.0660	64.56
79	St. Mary's Lake	0.0670	64.78
80	Little Bear Lake	0.0680	65.00
81	Mary Lee Lake	0.0680	65.00
82	Crooked Lake	0.0700	65.41
83	Lake Helen	0.0720	65.82
84	Grandwood Park Lake	0.0720	66.00
85	ADID 203	0.0730	66.02
86	Bluff Lake	0.0730	66.02
87	Spring Lake	0.0730	66.02
88	Broberg Marsh	0.0780	66.97
89	Redwing Slough	0.0822	67.73
90	Petite Lake	0.0830	67.87
91	Lake Marie	0.0850	68.21
92	Potomac Lake	0.0850	68.21
93	Timber Lake (South)	0.0850	68.21
94	White Lake	0.0862	68.42
95	Grand Ave Marsh	0.0870	68.55
96	North Churchill Lake	0.0870	68.55
97	McDonald Lake 1	0.0880	68.71
98	North Tower Lake	0.0880	68.71

Table 4. Lake County average TSI phosphorus (TSIp) ranking 2000-2012.

RANK	LAKE NAME	TP AVE	TSIp
99	Long Lake	0.0900	69.04
100	Rivershire Pond 2	0.0900	69.04
101	South Churchill Lake	0.0900	69.04
102	McGreal Lake	0.0910	69.20
103	Lake Charles	0.0930	69.40
104	Deer Lake	0.0940	69.66
105	Dunn's Lake	0.0950	69.82
106	Eagle Lake (S1)	0.0950	69.82
107	International Mine and Chemical Lake	0.0950	69.82
108	Valley Lake	0.0950	69.82
109	Big Bear Lake	0.0960	69.97
110	Fish Lake	0.0960	69.97
111	Lochanora Lake	0.0960	69.97
112	Island Lake	0.0990	70.41
113	Woodland Lake	0.0990	70.41
114	Nippersink Lake	0.1000	70.56
115	Sylvan Lake	0.1000	70.56
116	Longview Meadow Lake	0.1020	70.84
117	Countryside Lake	0.1050	71.26
118	Lake Barrington	0.1050	71.26
119	Lake Forest Pond	0.1070	71.53
120	Bittersweet Golf Course #13	0.1100	71.93
121	Fox Lake	0.1100	71.93
122	Kemper 2	0.1100	71.93
123	Middlefork Savannah Outlet 1	0.1120	72.00
124	Osprey Lake	0.1110	72.06
125	Bresen Lake	0.1130	72.32
126	Round Lake Marsh North	0.1130	72.32
127	Deer Lake Meadow Lake	0.1160	72.70
128	Taylor Lake	0.1180	72.94
129	Columbus Park Lake	0.1230	73.54
130	Lake Nipperink	0.1240	73.66
131	Echo Lake	0.1250	73.77
132	Grass Lake	0.1290	74.23
133	Lake Holloway	0.1320	74.56
134	Redhead Lake	0.1410	75.51
135	Antioch Lake	0.1450	75.91
136	Slocum Lake	0.1500	76.40
137	Lakewood Marsh	0.1510	76.50
138	Pond-A-Rudy	0.1510	76.50
139	Lake Matthews	0.1520	76.59
140	Forest Lake	0.1540	76.78
141	Buffalo Creek Reservoir	0.1550	76.88
142	Middlefork Savannah Outlet 2	0.1590	77.00
143	Pistakee Lake	0.1590	77.24
144	Grassy Lake	0.1610	77.42
145	Salem Lake	0.1650	77.78
146	Half Day Pit	0.1690	78.12
147	Lake Eleanor	0.1810	79.11

Table 4. Lake County average TSI phosphorus (TSIp) ranking 2000-2012.

RANK	LAKE NAME	TP AVE	TSIp
148	Lake Farmington	0.1850	79.43
149	Lake Louise	0.1850	79.43
150	ADID 127	0.1890	79.74
151	Patski Pond	0.1970	80.33
152	Dog Bone Lake	0.1990	80.48
153	Summerhill Estates Lake	0.1990	80.48
154	Redwing Marsh	0.2070	81.05
155	Stockholm Lake	0.2082	81.13
156	Bishop Lake	0.2160	81.66
157	Ozaukee Lake	0.2200	81.93
158	Kemper 1	0.2220	82.08
159	Hidden Lake	0.2240	82.19
160	McDonald Lake 2	0.2250	82.28
161	Fischer Lake	0.2280	82.44
162	Oak Hills Lake	0.2790	85.35
163	Loch Lomond	0.2950	86.16
164	Heron Pond	0.2990	86.35
165	Rollins Savannah 1	0.3070	87.00
166	Fairfield Marsh	0.3260	87.60
167	ADID 182	0.3280	87.69
168	Manning's Slough	0.3820	90.22
169	Slough Lake	0.3860	90.03
170	Rasmussen Lake	0.4860	93.36
171	Flint Lake Outlet	0.5000	93.76
172	Rollins Savannah 2	0.5870	96.00
173	Albert Lake, Site II, outflow	1.1894	106.26
174	Almond Marsh	1.9510	113.00

Table 5. Multiparameter Data - Big Bear Lake, 2012

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission
5/9/2012	0	0.51	16.86	9.55	98.8	0.992	8.01	1074	Surface	
5/9/2012	1	1.04	16.90	7.73	80	0.996	8.10	858	Surface	100%
5/9/2012	2	1.99	16.89	7.76	80.4	0.996	8.11	357	0.239	33%
5/9/2012	3	2.99	16.88	7.69	79.6	0.997	8.12	193	1.237	18%
5/9/2012	4	4.02	16.88	7.63	78.9	1.030	8.09	83	2.269	8%
5/9/2012	5	5.00	16.86	7.74	80.1	0.996	8.13	48	3.254	4%
5/9/2012	6	5.99	16.81	7.58	78.3	0.997	8.13	30	4.236	3%
5/9/2012	7	7.00	16.78	7.61	78.6	0.996	8.14	20	5.249	2%
5/9/2012	8	8.02	16.77	7.57	78.2	1.036	8.10	13	6.268	1%
5/9/2012	9	9.02	16.07	7.15	72.7	1.004	8.09	9	7.269	1%
5/9/2012	10	10.015	15.14	3.25	32.4	1.001	7.82	3		

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission
6/13/2012	0	0.52	24.26	7.64	91.5	1.146	8.11	3112	Surface	
6/13/2012	1	1.00	24.24	7.23	86.4	1.147	8.07	2955	Surface	100%
6/13/2012	2	2.05	23.97	7.14	85.1	1.147	8.10	1388	1.212	52%
6/13/2012	3	2.96	23.81	6.46	76.7	1.148	8.03	727	2.262	27%
6/13/2012	4	4.01	23.71	5.94	70.4	1.126	7.96	378	3.254	14%
6/13/2012	6	5.00	23.64	5.90	69.8	1.151	7.97	192	4.255	7%
6/13/2012	7	6.01	23.59	5.91	69.9	1.152	7.95	102	5.316	3%
6/13/2012	8	7.07	23.44	5.36	63.2	1.155	7.90	47	6.257	1.3%
6/13/2012	9	8.01	23.37	5.36	63.1	1.154	7.88	18	7.202	0.5%
6/13/2012	10	8.95	23.24	4.72	55.5	1.156	7.84	8	-1.75	0.0%

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average
7/11/2012	0	0.507	27.92	8.42	107.7	1.086	7.89	3624	Surface	
7/11/2012	1	1.010	27.61	8.07	102.7	1.088	8.09	3545	Surface	100%
7/11/2012	2	2.020	26.89	7.87	98.9	1.086	8.11	7	25.14	0%
7/11/2012	3	3.033	26.84	7.18	90.1	1.086	8.10	5	25.09	0%
7/11/2012	4	3.987	26.71	6.50	81.4	1.086	8.05	7	24.96	0%
7/11/2012	5	4.973	26.71	6.55	82.0	1.087	8.03	78	24.96	2%
7/11/2012	6	6.013	26.58	6.14	76.7	1.088	8.02	28	24.83	0.8%
7/11/2012	7	7.110	26.54	5.01	62.6	1.088	7.95	11	24.79	0.3%
7/11/2012	8	6.981	26.53	4.87	60.7	1.088	7.92	11	24.78	0.31%

Table 5. Multiparameter Data - Big Bear Lake, 2012

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average
8/15/2012	0	0.487	24.14	9.05	108.1	0.849	8.39	0.0	Surface	
8/15/2012	1	1.025	24.14	9.15	109.2	0.847	8.65	3535.6	Surface	NA
8/15/2012	2	1.986	24.08	10.91	130.1	0.847	8.69	1122.5	0.236	NA
8/15/2012	3	3.004	23.98	10.94	130.3	0.848	8.73	394.3	1.254	NA
8/15/2012	4	4.023	23.14	8.85	103.6	0.850	8.65	0.4	2.273	NA
8/15/2012	5	5.040	22.58	8.13	94.2	0.842	8.57	69.3	3.29	NA
8/15/2012	6	6.010	22.39	4.69	54.2	0.846	8.39	24.8	4.26	NA
8/15/2012	7	7.077	22.16	3.85	44.2	0.850	8.29	7.4	5.327	NA
8/15/2012	8	7.992	22.00	2.99	34.3	0.849	8.18	3.3	6.242	NA
8/15/2012	9	9.081	21.99	1.93	22.1	0.850	8.06	1.2	7.331	NA
8/15/2012	10	10.009	22.00	1.13	12.9	0.836	7.87	0.0		

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average
9/12/2012	0	0.49	22.06	6.84	78.6	0.878	7.00	3484	Surface	
9/12/2012	1	1.02	21.97	6.77	77.5	0.878	7.12	3468.3	Surface	NA
9/12/2012	2	2.03	21.92	6.62	75.8	0.895	7.26	1159.8	0.279	NA
9/12/2012	3	3.04	21.80	6.58	75.1	0.877	7.32	277.3	1.29	NA
9/12/2012	4	4.01	21.72	6.30	71.9	0.878	7.35	86.6	2.256	NA
9/12/2012	5	5.02	21.67	6.10	69.5	0.877	7.35	29.2	3.272	NA
9/12/2012	6	6.02	21.63	5.97	68.0	0.877	7.37	9.8	4.273	NA
9/12/2012	7	7.00	21.58	5.77	65.6	0.878	7.37	3.3	5.246	NA
9/12/2012	8	8.02	21.58	5.33	60.6	0.878	7.36	1.3	6.273	NA
9/12/2012	9	9.03	21.59	5.32	60.5	0.877	7.36	0	7.279	NA
9/12/2012	10	9.922	21.57	2.03	23.1	0.875	7.25	-0.1		

Table 5. Multiparameter Data - Little Bear Lake, 2012

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average
5/9/2012	0.25	0.494	16.54	8.13	83.6	1.083	8.2	593	Surface	100%
5/9/2012	1	0.998	16.55	7.9	81.2	1.084	8.22	512.7	-0.672	86%
5/9/2012	2	2.02	16.56	7.67	78.9	1.084	8.23	208.7	0.35	35%
5/9/2012	3	3.035	16.56	7.67	78.9	1.083	8.24	118.6	1.365	20%
5/9/2012	4	3.988	16.56	7.77	79.9	1.084	8.24	72.2	2.318	12%
5/9/2012	6	6.055	16.57	7.61	78.3	1.083	8.25	33.2	4.385	6%
5/9/2012	8	7.998	16.56	7.67	78.9	1.084	8.25	19.3	6.328	3%
5/9/2012	10	10.04	14.82	5.92	58.7	1.1230	8.11	10.8	8.372	2%
5/9/2012	12	12.02	12.52	3.13	29.5	1.1630	7.98	4	10.352	1%
5/9/2012	14	14.00	12.00	1.47	13.7	1.1730	7.86	1.8	12.327	0%
5/9/2012	16	16.00	11.69	0.57	5.3	1.1840	7.79	0.7	14.332	0%
5/9/2012	18	18.01	11.49	1.01	9.3	1.1940	7.69	0.3	16.338	0%
	20	20.01	11.24	1.03	9.5	1.2050	7.63	-0.2		

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average
6/13/2012	0.25	0.591	23.93	7.95	94.6	1.166	8.13	3388.7	Surface	
6/13/2012	1	0.588	23.94	8.39	99.8	1.166	8.13	3461.5	Surface	100%
6/13/2012	2	1.055	23.94	7.8	92.9	1.168	8.13	3288.4	-0.615	95%
6/13/2012	3	2.01	23.9	7.78	92.6	1.153	8.1	1602.4	0.34	46%
6/13/2012	4	3.05	23.82	7.76	92.2	1.167	8.12	1085.9	1.38	31%
6/13/2012	6	4.047	23.57	7.44	87.9	1.167	8.09	712.4	2.377	21%
6/13/2012	8	6.014	23.4	6.84	80.6	1.168	8.02	269.2	4.344	8%
6/13/2012	10	8.022	23.19	5.59	65.6	1.172	7.93	138.9	6.352	4%
6/13/2012	12	10.022	22.41	3.16	36.5	1.175	7.77	59.5	8.352	2%
6/13/2012	14	11.993	21.57	1.38	15.7	1.174	7.62	25.9	10.323	1%
6/13/2012	16	13.997	19.05	0.55	6	1.185	7.47	11.7	12.327	0%
6/13/2012	18	16.085	16.95	0.46	4.8	1.208	7.34	4.6	14.415	0%

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average
7/11/2012	0.25		28.32	7.69	99.1	1.086	8.1	3667	Surface	
7/11/2012	1		28.31	7.59	97.8	1.091	8.11	3494	Surface	100%
7/11/2012	2		28.06	7.51	96.5	1.085	8.14	1120	26.39	32%
7/11/2012	3		27.31	7.22	91.3	1.089	8.14	1046	25.64	30%
7/11/2012	4		27.1	6.78	85.5	1.083	8.1	720	25.43	21%
7/11/2012	6		26.99	6.04	75.6	1.086	8.04	228	25.32	7%
7/11/2012	8		26.88	5.28	66.3	1.084	7.97	66	25.21	2%
7/11/2012	10		26.77	4.79	60.1	1.087	7.9	13	25.1	0.4%
7/11/2012	12		24.51	1.19	13.5	1.097	7.59	1.5	22.84	0.0%
7/11/2012	14		19.87	0.59	6.3	1.096	7.4	0.8	18.2	0.0%
7/11/2012	16		15.7	0.42	4.3	1.166	7.13	0.3	14.03	0.0%
7/11/2012	18		14.94	0.42	4	1.241	6.82	0.1	13.27	0.0%
7/11/2012	20		13.46	0.41	3.9	1.262	6.72	0	11.79	0.0%

Table 5. Multiparameter Data - Little Bear Lake, 2012

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average
8/15/2012	0.25	0.50	24.92	8.65	104.7	0.894	8.16	3688.5	Surface	
8/15/2012	1	1.07	24.86	11.3	136.8	0.888	8.38	3544.3	Surface	100.0%
8/15/2012	2	2.05	24.26	11.08	132.5	0.896	8.52	1645.5	0.377	46.4%
8/15/2012	3	3.00	23.6	10.43	123.3	0.889	8.53	202.6	1.333	5.7%
8/15/2012	4	4.06	23.19	9.83	115.3	0.898	8.51	245.7	2.389	6.9%
8/15/2012	6	6.09	22.89	5.4	63	0.898	8.31	39.1	4.421	1.1%
8/15/2012	8	7.96	22.56	3.96	45.9	0.899	8.17	9	6.289	0.3%
8/15/2012	10	12.03	22.33	3.02	34.8	0.901	8.03	0.5	10.356	0.0%
8/15/2012	12	14.02	22.27	1.94	22.4	0.903	7.95	0.3	12.353	0.0%
8/15/2012	14	16.01	21.62	1	11.4	0.931	7.84	0.1	14.338	0.0%
8/15/2012	16	18.07	18.38	0.59	6.3	1.127	7.51	0	16.4	0.0%
8/15/2012	18	20.06	15.34	0.61	6.1	1.267	7.15	0.1	18.39	0.0%
8/15/2012	20	21.88	14.62	0.54	5.4	1.288	6.93	0	20.21	0.0%

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý	Depth of Light Meter feet	% Light Transmission Average
9/12/2012	0.25	0.483	22.39	6.68	77.2	0.896	7.29	0.1	Surface	
9/12/2012	1	1.977	22.11	5.59	64.2	0.895	7.3	1262.2	Surface	100%
9/12/2012	2	3.034	21.93	5.67	64.9	0.896	7.3	202.5	1.364	16%
9/12/2012	3	4.024	21.73	5.29	60.3	0.895	7.3	2.1	2.354	0%
9/12/2012	4	6.024	21.69	4.94	56.3	0.896	7.29	36.1	4.354	3%
9/12/2012	6	8.001	21.62	4.41	50.2	0.907	7.23	-0.1	6.331	0%
9/12/2012	8	10.003	21.6	3.98	45.3	0.898	7.24	1.5	8.333	0%
9/12/2012	10	12.031	21.6	3.63	41.3	0.898	7.22	0.4	10.361	0%
9/12/2012	12	13.996	21.54	2.47	28.1	0.9	7.16	0.2	12.326	0%
9/12/2012	14	16.041	21.18	0.82	9.3	0.917	7.04	0.7	14.371	0%
9/12/2012	16	18.056	19.06	0.48	5.2	1.113	6.72	0.2	16.386	0%
9/12/2012	18	20.036	17.45	0.71	7.4	1.221	6.38	0.4	18.366	0.0%

Figure 2. Annual Secchi Disk averages from 1997, 2002 and 2012, Big and Little Bear Lakes

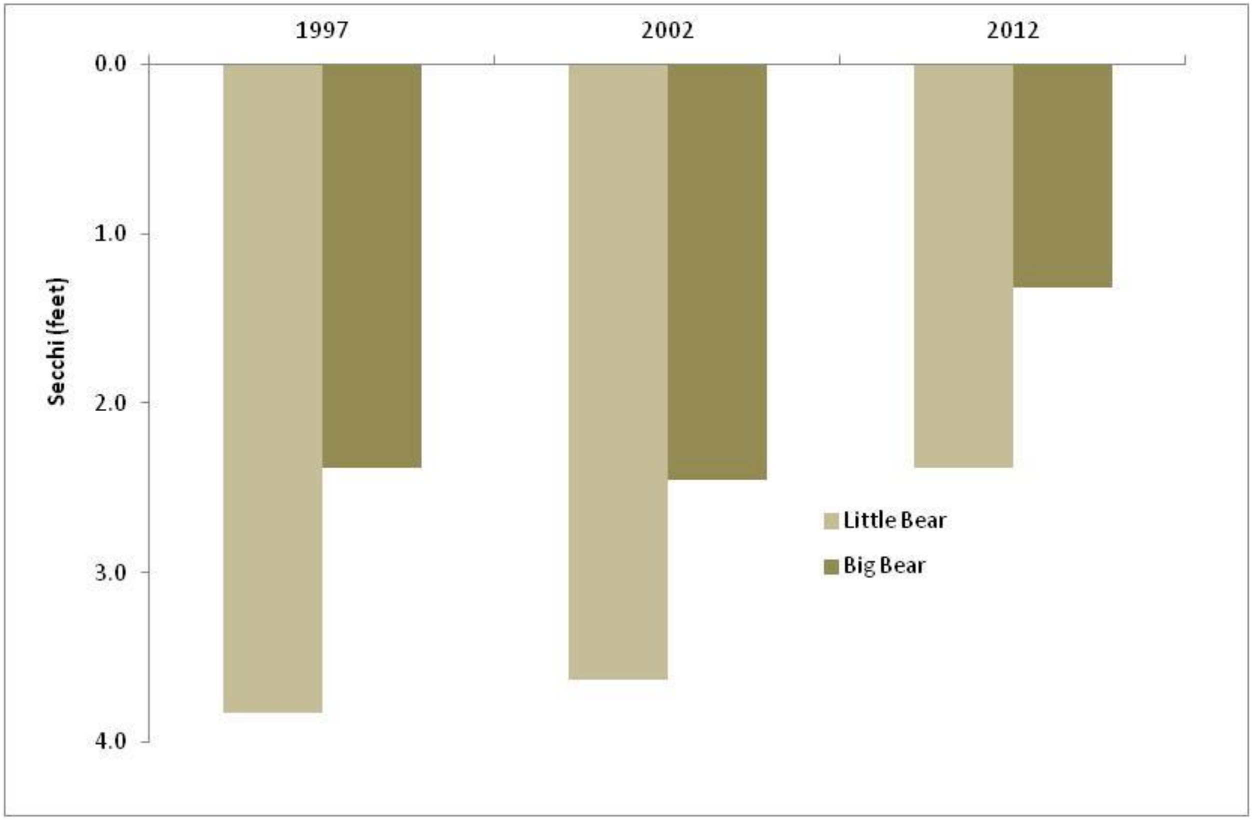


Table 6a. Aquatic vegetation species found at the 30 sampling sites on Little Bear Lake, July 2012. Maximum depth that plants were found was 2.7 feet.

Plant Density	Eurasian Water Milfoil
Absent	24
Present	1
Common	1
Abundant	0
Dominant	0
% Plant Occurrence	7.7

Table 6b. Distribution of rake density across all sampling sites, Big Bear Lake, 2012.

July, 2012		
Rake Density (Coverage)	**# of Sites**	**%**
No plants	24	92.3%
>0 to 10%	1	3.8%
>10 to 40%	1	3.8%
>40 to 60%	0	0.0%
>60 to 90%	0	0.0%
>90%	0	0.0%
Total Sites with Plants	2	7.7%
Total # of Sites	26	100.0%

Table 6c. Aquatic vegetation species found at the 30 sampling sites on Little Bear Lake, July 2012. Maximum depth that plants were found was 4.8 feet.

Plant Density	Coontail	Eurasian Water Milfoil	Sago Pondweed
Absent	28	26	28
Present	0	0	1
Common	2	2	1
Abundant	0	1	0
Dominant	0	1	0
% Plant Occurrence	6.7%	13.3%	6.7%

Table 6d. Distribution of rake density across all sampling sites, Little Bear Lake, July 2012.

Rake Density (Coverage)	# of Sites	%
No plants	24	80.0
>0 to 10%	0	0.0
>10 to 40%	4	13.3
>40 to 60%	1	3.3
>60 to 90%	1	3.3
>90%	0	0.0
Total Sites with Plants	6	20.0
Total # of Sites	30	100.0

Table 7. Lake County average Floristic Quality Index ranking 2000 – 2012

RANK	LAKE NAME	FQI (w/A)	FQI (native)
1	Cedar Lake	36.8	38.0
2	East Loon Lake	34.7	36.1
3	Bangs Lake	33.8	35.2
4	Little Silver Lake	29.6	31.6
5	Deep Lake	29.7	31.2
6	Round Lake Marsh North	29.1	29.9
7	Cranberry Lake	29.7	29.7
8	West Loon Lake	27.1	29.5
9	Sullivan Lake	26.9	28.5
10	Indpendence Grove	24.6	27.5
11	Fourth Lake	24.7	27.1
12	Lake Zurich	24.3	27.1
13	Sterling Lake	24.5	26.9
14	Sun Lake	24.3	26.1
15	Round Lake	23.5	25.9
16	Redwing Slough	24.0	25.8
17	Honey Lake	23.3	25.1
18	Lake of the Hollow	23.0	24.8
19	Schreiber Lake	23.9	24.8
20	Lakewood Marsh	23.8	24.7
21	Deer Lake	23.5	24.4
22	Cross Lake	22.4	24.2
23	Third Lake	21.4	24.0
24	Wooster Lake	22.2	23.9
25	Timber Lake (North)	20.9	23.4
26	Butler Lake	21.4	23.1
27	Duck Lake	21.1	22.9
28	Countryside Glen Lake	21.9	22.8
29	McGreal Lake	20.2	22.1
30	Druce Lake	19.1	21.8
31	Long Lake	19.6	21.5
32	Broberg Marsh	20.5	21.4
33	Davis Lake	21.4	21.4
34	Fish Lake	19.3	21.2
35	Redhead Lake	19.3	21.2
36	Turner Lake	18.6	21.2
37	Lake Kathryn	19.6	20.7
38	ADID 203	20.5	20.5
39	Salem Lake	18.5	20.2
40	Old Oak Lake	18.0	19.1
41	Grandwood Park Lake	17.2	19.0
42	Highland Lake	16.7	18.9
43	Lake Miltmore	16.8	18.7
44	Lake Helen	18.0	18.0
45	Bresen Lake	16.6	17.8
46	Potomac Lake	17.8	17.8
47	Hendrick Lake	17.7	17.7
48	Lake Barrington	16.7	17.7
49	McDonald Lake 1	16.7	17.7
50	Rollins Savannah 2	17.7	17.7
51	Windward Lake	16.3	17.6
52	Almond Marsh	16.3	17.3
53	Osprey Lake	15.5	17.3
54	Owens Lake	16.3	17.3

Table 7. Lake County average Floristic Quality Index ranking 2000 – 2012

RANK	LAKE NAME	FQI (w/A)	FQI (native)
55	Hastings Lake	15.0	17.0
56	Lake Tranquility (S1)	15.0	17.0
57	White Lake	16.0	17.0
58	Island Lake	14.7	16.6
59	Grand Ave Marsh	14.3	16.3
60	Lake Fairview	15.2	16.3
61	Manning's Slough	14.1	16.3
62	Nippersink Lake	14.3	16.3
63	Taylor Lake	14.3	16.3
64	Grays Lake	16.1	16.1
65	Crooked Lake	14.0	16.0
66	Dog Training Pond	14.7	15.9
67	Forest Lake	14.8	15.9
68	Dog Bone Lake	15.7	15.7
69	Ames Pit	13.4	15.5
70	Seven Acre Lake	17.0	15.5
71	Dugdale Lake	14.0	15.1
72	Eagle Lake (S1)	14.0	15.1
73	Heron Pond	15.1	15.1
74	Mary Lee Lake	13.1	15.1
75	Old School Lake	13.1	15.1
76	Bishop Lake	13.4	15.0
77	North Churchill Lake	15.0	15.0
78	Timber Lake (South)	12.7	14.7
79	Buffalo Creek Reservoir	13.1	14.3
80	Lake Carina	12.1	14.3
81	Lake Leo	12.1	14.3
82	Lambs Farm Lake	12.1	14.3
83	Dunn's Lake	12.7	13.9
84	Lake Minear	11.0	13.9
85	Lake Napa Suwe	11.7	13.9
86	Longview Meadow Lake	13.9	13.9
87	Summerhill Estates Lake	12.7	13.9
88	Stockholm Lake	12.1	13.5
89	Antioch Lake	11.3	13.4
90	Hook Lake	11.3	13.4
91	Kemper Lake 1	12.2	13.4
92	Rivershire Pond 2	11.5	13.3
93	Flint Lake Oulet	11.8	13.0
94	Briarcrest Pond	11.2	12.5
95	Crooked Lake	10.2	12.5
96	Gages Lake	10.2	12.5
97	Lake Naomi	11.2	12.5
98	McDonald Lake 2	12.5	12.5
99	Pulaski Pond	11.2	12.5
100	Rollins Savannah 1	12.5	12.5
101	Stone Quarry Lake	12.5	12.5
102	Loch Lomond	9.4	12.1
103	Pond-A-Rudy	12.1	12.1
104	Grassy Lake	12.0	12.0
105	Lake Matthews	12.0	12.0
106	Nielsen Pond	10.7	12.0
107	Werhane Lake	9.8	12.0
108	Lake Lakeland Estates	10.0	11.5
109	Fischer Lake	9.0	11.0
110	Redwing Marsh	11.0	11.0
111	Tower Lake	11.0	11.0

Table 7. Lake County average Floristic Quality Index ranking 2000 – 2012

RANK	LAKE NAME	FQI (w/A)	FQI (native)
112	West Meadow Lake	11.0	11.0
113	Lake Holloway	10.6	10.6
114	Sylvan Lake	10.6	10.6
115	Lake Fairfield	9.0	10.4
116	Lake Louise	9.0	10.4
117	Sand Lake	8.0	10.4
118	College Trail Lake	10.0	10.0
119	Countryside Lake	8.9	10.0
120	Valley Lake	9.9	9.9
121	Woodland Lake	8.1	9.9
122	Kemper Lake 2	8.5	9.8
123	Lake Christa	8.5	9.8
124	Lake Farmington	8.5	9.8
125	Lucy Lake	8.5	9.8
126	Banana Pond	7.5	9.2
127	Columbus Park Lake	9.2	9.2
128	Waterford Lake	9.2	9.2
129	Leisure Lake	6.4	9.0
130	Albert Lake	7.5	8.7
131	Fairfield Marsh	7.5	8.7
132	Lake Eleanor	7.5	8.7
133	Ozaukee Lake	6.7	8.7
134	East Meadow Lake	8.5	8.5
135	Lake Forest Pond	6.9	8.5
136	Peterson Pond	6.0	8.5
137	South Churchill Lake	8.5	8.5
138	Bittersweet Golf Course #13	8.1	8.1
139	Lake Linden	8.0	8.0
140	Little Bear Lake	5.8	7.5
141	International Mining and Chemical Lake	5.0	7.1
142	Slocum Lake	5.8	7.1
143	Lucky Lake	7.0	7.0
144	Deer Lake Meadow Lake	5.2	6.4
145	Diamond Lake	3.7	5.5
146	Lake Charles	3.7	5.5
147	ADID 127	5.0	5.0
148	Big Bear Lake	3.5	5.0
149	Half Day Pit	2.9	5.0
150	Harvey Lake	3.3	5.0
151	Liberty Lake	5.0	5.0
152	Lochanora Lake	2.5	5.0
153	Oak Hills Lake	5.0	5.0
154	Sand Pond (IDNR)	3.5	5.0
155	Slough Lake	5.0	5.0
156	Echo Lake	0.0	0.0
157	Hidden Lake	0.0	0.0
158	North Tower Lake	0.0	0.0
159	St. Mary's Lake	0.0	0.0
160	Willow Lake	0.0	0.0
	Mean	**13.9**	**15.2**
	Median	**12.7**	**14.3**

Figure 5. Shoreline Erosion assessed on Big and Little Bear Lakes, 2012