LAKE COUNTY, IL

2015 BUTLER LAKE SUMMARY REPORT

PREPARED BY THE LAKE COUNTY HEALTH DEPARTMENT

ECOLOGICAL SERVICES

Butler Lake

Butler Lake is a 55.19 acre natural glacial slough lake located in the Village of Libertyville. It is part of the Bull Creek drainage of the Des Plaines River Watershed. Two lakes, St. Mary's Lake and Loch Lomond, are located upstream. A third lake within Butler Lake's watershed is IMC Lake, which drains into St. Mary's Lake. Water enters Butler Lake from Bull Creek on the west end of the lake and leaves at the north end, eventually draining into the Des Plaines River. Butler Lake is listed as an ADID (advanced identification) wetland by the U.S. Environmental Protection Agency. This indicates that the lake and surrounding natural environments have potential to have high quality aquatic resources based on water quality and hydrology values.

The lake is publicly owned and managed by the Village of Libertyville Parks and Recreation Department (LPRD) for non-motorized boating, fishing, aesthetics and plant management. The primary land uses within Butler's watershed are single family homes and transportation. There are no boat launches but canoes or kayak are permitted on the lake with permission.

Water quality parameters, such as nutrients, suspended solids, oxygen, temperature, water clarity were measured from May-September 2015. The 2015 water quality parameters

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BUTLER LAKE

LAKE FACTS

Township:
Libertyville Township
T44N, R11E, Section 16, 17
Major Watershed:
Des Plaines River
Sub-Watershed:
Bull Creek
Surface Area:
55.19 acres
Shoreline Length:
2.48 miles
Maximum Depth:
9 feet
Average Depth:
4.1 feet
Lake Volume:
230.38 acre-feet
Watershed Area:
3919.36 acres
Lake Type:
Glacial / Impoundment
Current Uses:
Fishing, non-motorize boating, and aesthetics

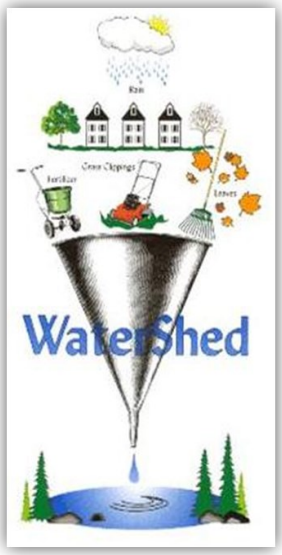
in Butler Lake has improved since 2005. Total phosphorus concentration in Butler Lake averaged 0.032 mg/L which is a 39% decrease from the 2005 concentration of 0.053 mg/L and lower than the Illinois Environmental Protection Agency impairment rate of 0.050 mg/L. The Lake County median for phosphorus is 0.068 mg/l. Sources of phosphorus include inputs from the watershed, local sources (i.e., lawn fertilizers and agricultural runoff) and internal loading from the sediment. Butler Lake has a healthy aquatic plant population that competes with algae for the limited amount of phosphorus. Nitrogen is the other nutrient critical for algal growth. The average Total Kjeldahl nitrogen (TKN) concentration for Butler Lake was 0.80 mg/L, which was lower than the county median of 1.20 mg/L. A total nitrogen to total phosphorus (TN:TP) ratio of 27:1 indicates that phosphorus was the nutrient limiting aquatic plant and algae growth in Butler Lake. By using phosphorous as an indicator, the trophic state index (TSIp) ranked Butler Lake as eutrophic with a TSIp value of 54.3. This means that the lake has high nutrients which can result in plant and algae growth. The 2015 average total suspended solids (TSS) concentration for Butler Lake was 2.3 mg/L, which was lower than the county median of 8.2 mg/L and a 63% decrease from the 2005 average of 6.3 mg/L. The water quality is better than Loch Lomond and St. Mary's Lake due to the abundant aquatic plants found in Butler Lake.

Water clarity was measured by Secchi depth, with the lowest reading in May (3.8 ft) and the deepest was in June (8.9 ft). The average Secchi depth for the season was 6.49 ft, which was deeper than the county median (2.96 ft). The average conductivity of Butler Lake was 0.9946 mS/cm which is higher than the county median (0.7920 mS/cm). This was a 14% decrease from the 2005 average (1.1602 mS/cm). The average chloride concentration in Butler Lake in 2015 was 205 mg/L which was higher than the county median of 139 mg/L.

The aquatic plant community was assessed in July when most of the plants are likely to be present. Ten aquatic plant species and one macro-algae was found in 2015. Coontail and White Water Lily were the dominant aquatic plant species. Two exotic aquatic plants, Eurasian Water Milfoil and Curlyleaf Pondweed, were found in Butler Lake. Diversity was higher in 2005 when fourteen aquatic plants in 2005 with Elodea, Leafy pondweed, Small pondweed, and Water Stargrass were present.

BUTLER LAKE WATERSHED

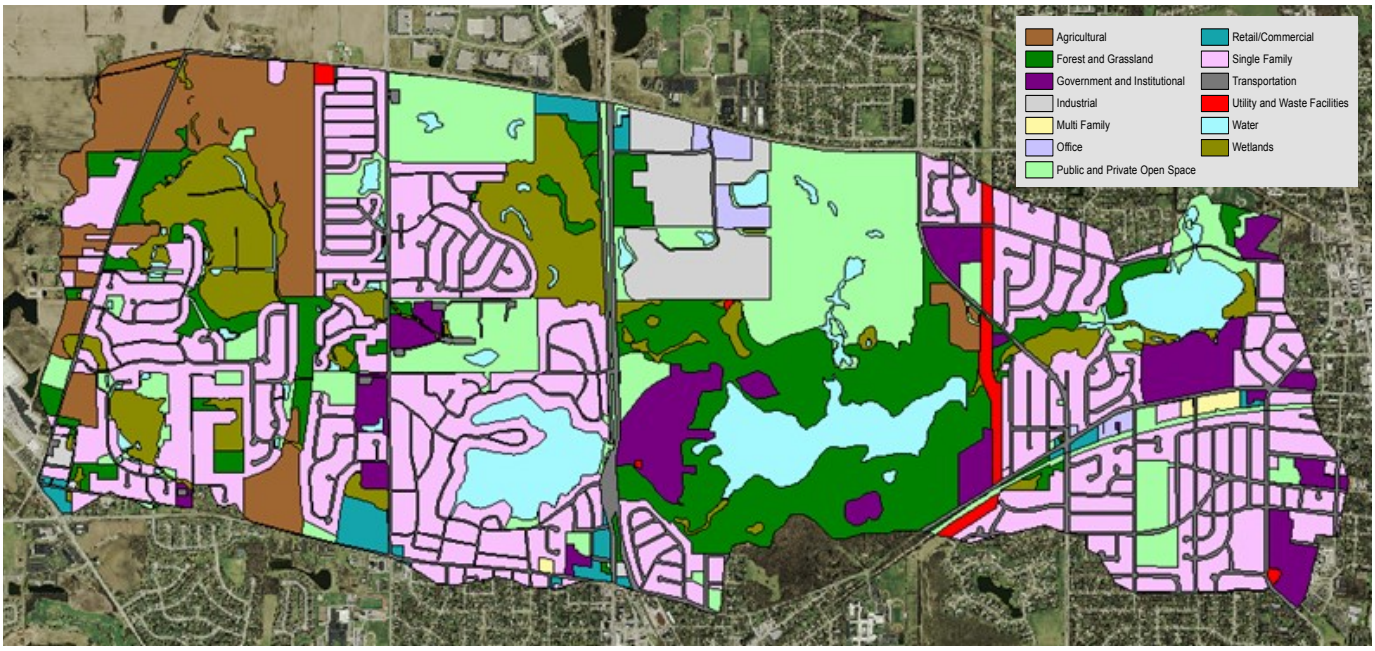
The lake is located in the Bull Creek sub basin, within the Des Plaines River watershed. A watershed is a drainage basin where water from rain or snow melt drains into a body of water, such as a river, lake, reservoir, wetland or storm drain. The source of a lakes water supply is very important in determining its water quality and choosing management practices to protect the lake. Two lakes, St. Mary's Lake and Loch Lomond, are located upstream. A third lake within Butler Lake's watershed is IMC Lake, which drains into St. Mary's Lake. Water enters Butler Lake from Bull Creek on the west end of the lake and leaves at the north end, eventually draining into the Des Plaines River. The retention time, the time it takes for water entering a lake to flow out again was calculated to be approximately 29 days.



Although Butler Lake receives a majority of its water from St. Mary's Lake, it has better water quality due to the large amount of aquatic plants found in the lake. The aquatic plants compete with algae for nutrients in the water column and their root system help stabilize sediments.

The major sources of runoff for Butler Lake were Residential (32.9%), Transportation(26.4%) Government and Institutional (10.3%) and Industrial (9.9%). The impervious surfaces (parking lots, roads, buildings, compacted soil) do not allow rain to infiltrate into the ground. Land management practices of the large amount of residential area in the water shed impacts the lake. Controlling water that runs from the land's surface into the lake is important for drainage lakes.

Butler Lake Watershed and Land use



Butler Lake Area Land Use 2015

Land Use	Acreage	Runoff Coeff.	Estimated Runoff, acft.	% Total of Estimated Runoff
Agricultural	273.67	0.05	37.6	1.3
Forest and Grassland	490.39	0.05	67.4	2.3
Government and Institutional	221.93	0.50	305.2	10.3
Industrial	133.47	0.80	293.6	9.9
Multi Family	8.81	0.50	12.1	0.4
Office	27.23	0.85	63.7	2.2
Public and Private Open Space	559.22	0.15	230.7	7.8
Retail/Commercial	50.76	0.85	118.7	4.0
Single Family	1181.67	0.30	974.9	32.9
Transportation	334.92	0.85	782.9	26.4
Utility and Waste Facilities	35.98	0.30	29.7	1.0
Water	284.97	0.00	0.0	0.0
Wetlands	316.64	0.05	43.5	1.5
TOTAL	**3919.67**		**2959.9**	**100.0**

Comparison of Epilimnetic Averages for Secchi Disk Transparency, Total Suspended Solids, Total Phosphorus, and Conductivity Readings in the Bull Creek Watershed (Loch Lomond Lake, St. Mary's Lake, and Butler Lake— IMC was not sampled in 2015)

	Loch Lomond Lake	Loch Lomond Lake	Loch Lomond Lake	Loch Lomond Lake	IMC Lake	IMC Lake	St. Mary's Lake	St. Mary's Lake	St. Mary's Lake	St. Mary's Lake	Butler Lake	Butler Lake	Butler Lake	Butler Lake
Year	1999	2004	2005	2015	2003	2005	1995	2002	2005	2015	1995	2001	2005	2015
Secchi (feet)	1.89	3.27	2.17	2.74	4.96	3.08	2.26	2.68	2.79	2.98	5.83	6.65	4.35	6.49
TSS (mg/L)	19.2	13.2	13.1	10.96	4.4	9.7	12.2	11.8	10.8	8.52	3.1	2.1	6.3	2.3
TP (mg/L)	0.235	0.245	0.295	0.196	0.039	0.095	0.065	0.075	0.067	0.068	0.031	0.048	0.053	0.032
Conductivity (milliSiemens/cm)	0.7076	0.8232	1.3298	0.7736	1.9958	6.1436	0.5958	1.0272	1.1774	0.998	0.5852	1.0893	1.1602	0.9946

VLMP —WATER QUALITY

VOLUNTEER LAKE MONITOR PROGRAM

VOLUNTEERS MEASURE WATER CLARITY USING THE SECCHI DISK TWICE A MONTH MAY THROUGH OCTOBER. IN 2015 THERE WERE 56 LAKES PARTICIPATING IN LAKE COUNTY.

IF YOU WOULD LIKE MORE INFORMATION PLEASE CONTACT:

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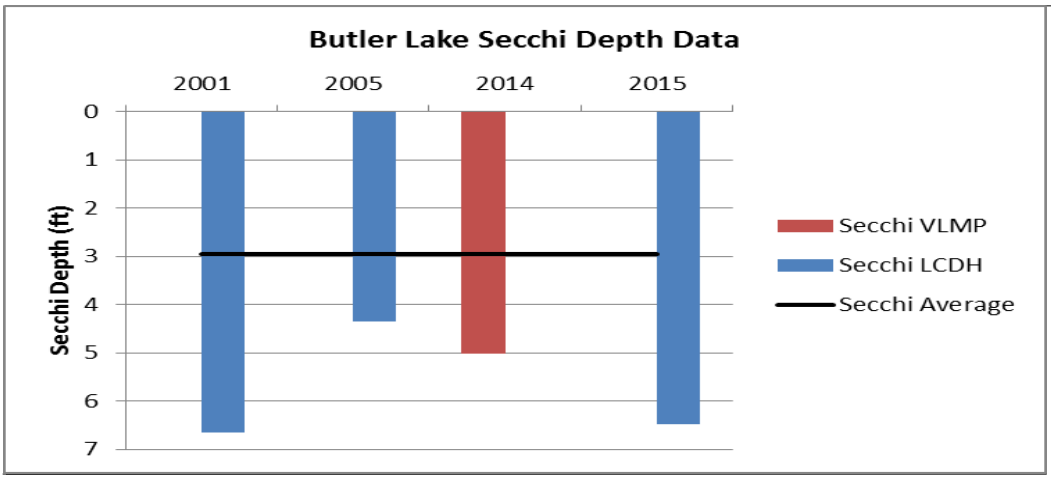
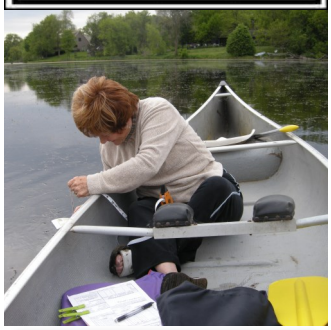
The VLMP was established in 1981 by the Illinois Environmental Protection Agency (IEPA) to be able to collect information on Illinois inland lakes, and to provide an educational program for citizens. The volunteers are primarily lakeshore residents, lake owners/managers, members of environmental groups, and citizens with interest in a particular lake. The VLMP relies on volunteers to gather information on their chosen lake. The primary measurement by volunteers is Secchi depth (water clarity). Water clarity can provide an indication of the general water quality of the lake. Other observations such as water color, suspended algae and sediment, aquatic plants and odor are also recorded. The sampling season is May through October with measurements taken twice a month.

Continued participation provides annual data that helps document water quality impacts and support lake management decisions. The VLMP program has provides Lakes with annual baseline data that can be used to determine long term water quality trends and support current lake management decision making. The volunteers will provide data that is vital for the management of this lake. If you would like to participate or need more information about becoming a VLMP please contact the LCHD-ES. The average Secchi for Butler Lake since 2001 is 5.83 feet.





WATER CLARITY

Water clarity is an indicator of water quality related to chemical and physical properties. Measurements taken with a Secchi disk indicate the light penetration into a body of water. Algae, microscopic animals, water color, eroded soil, and resuspension of bottom sediment are factors that interfere with light penetration and reduce water transparency. If light penetration is reduced significantly, macrophyte growth may be decreased which would in turn impact the organisms dependent upon them for food and cover.

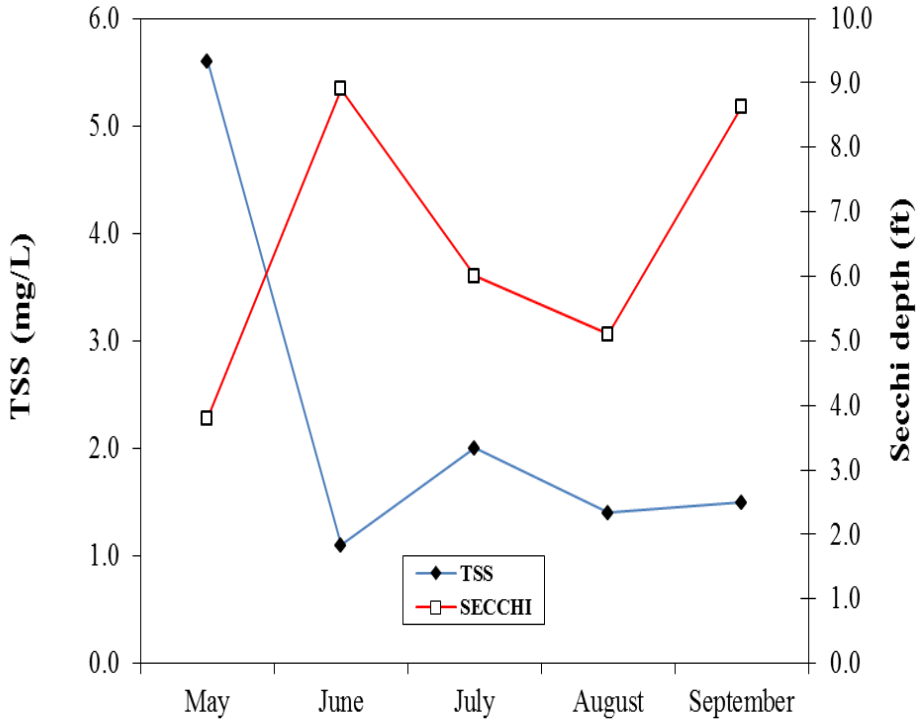
The 2015 average clarity for Butler Lake was 6.49 feet (ES); this was a 49% increase in the lakes transparency since 2005 of 4.35 feet and the water clarity was above the county median of 2.96 feet. The shallowest Secchi depth for Butler Lake was in May at 3.8 (ft) and the deepest was in June (8.9 ft). Overall, the good water clarity in Butler Lake can be attributed to a healthy plant population. Aquatic plants compete with algae for nutrients and stabilize bottom substrate, which in turn improves water clarity.

TOTAL SUSPENDED SOLIDS

Another measure of water clarity is turbidity, which is caused by particles of matter rather than the dissolved organic compounds. Suspended particles dissipate light, which may limit the depth plants can grow. The total suspended solid (TSS) parameter (turbidity) is composed of nonvolatile suspended compounds (NVSS), non-organic clay or sediment materials, and volatile suspended solids (TVS) (algae and other organic matter).

Seasonal Secchi readings changes are affected by algal growth. The absence or low density of algae in early spring usually provides deeper clarity but as the water warms clarity decreases with more algae present in the water. High turbidity caused by sediment or algae can shade out native aquatic plants, resulting in their reduction or disappearance from the littoral zone. This eliminates the benefits provided by plants, such as habitat for many fish species and stabilization of the lake bottom. The 2015 TSS concentrations in Butler Lake averaged 2.3 mg/L which was below the county median of 8.2 mg/L and but 63% lower than the 2005 average concentration of 6.3 mg/L. High TSS values are typically correlated with poor water clarity (Secchi disk depth) and can be detrimental to many aspects of the lake ecosystem including the plant and fish communities. Lakes with NVSS values ≥ 12 mg/l could cause impairment for aquatic life in inland lakes.

There are internal and external sources of sediment affecting the turbidity in Butler Lake. Internal sources of sediment suspension include wind and wave action along with carp spawning and feeding activity especially along eroded shoreline. External sources include sediments that are transported into the lake from a feeder creek, bank erosion and other sources in the watershed. The average calculated nonvolatile suspended solids (NVSS) was 1.55 mg/L. The high NVSS means that the majority of the TSS concentration in 2015 can be attributed to solids that are non-organic clay and sediments.



TSS
Total Suspended Solids

TSS are particles of algae or sediment suspended in the water column.

TVS
Total Volatile Solids

TVS represents the fraction of total solids that are organic in nature, such as algae cells

NVSS
Non-Volatile Suspended Solids

NVSS represents the non-organic clay and sediments that are suspended in the water column.

TDS
Total Dissolved Solids

TDS are the amount of dissolved substance such as salts or minerals in the water after evaporation.

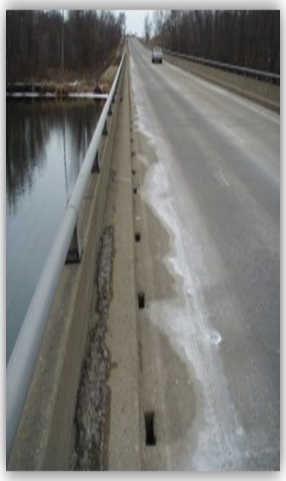
DATE	TSS	SECCHI
May	5.6	3.8
June	1.1	8.9
July	2	6
August	1.4	5.1
September	1.5	8.63

WHAT HAS BEEN DONE TO REDUCE PHOSPHORUS LEVELS IN BUTLER LAKE

March 2015– Libertyville becomes the 11th community in Lake County to ban the use of fertilizer containing phosphorus.

July 2010- The State of Illinois passed a law to reduce the amount of phosphorus content in dishwashing and laundry **detergents.**

July 2010- The State of Illinois passed another law restricting the use of lawn fertilizers containing



SALTS DISSOLVE AND MOVE DOWNHILL OR INTO THE NEAREST STORM DRAIN WITH STORMWATER AND SNOWMELT RUNOFF TO THE NEAREST LAKE, RIVER OR POND. THEY DO NOT SETTLE OUT; THEY REMAIN IN THE WATER CYCLE VIRTUALLY FOREVER.

NUTRIENTS

The nutrients organisms need to live or grow are typically taken in from the environment. In a lake the primary nutrients needed for aquatic plant and algal growth are phosphorus and nitrogen. In most lakes, including Butler Lake, phosphorus is the limiting nutrient, which means everything that plants and algae need to grow is available in excess: sunlight, warm temperature, and nitrogen.

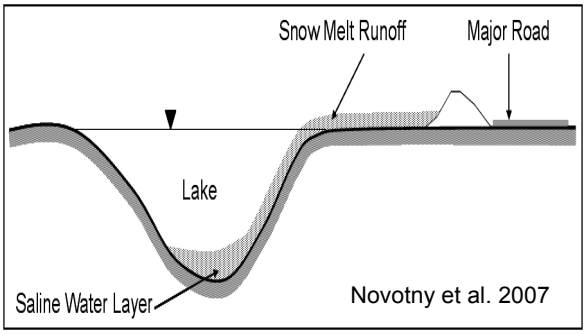
Phosphorus has a direct effect on the amount of plant and algal growth in lakes. The 2015 average total phosphorus (TP) epilimnion (near surface sample) concentration in Butler Lake was 0.032mg/L, this was an 39% decrease from the 2005 concentration (0.053 mg/L). Lakes with concentrations exceeding 0.050 mg/L can support high densities of algae and aquatic plants, which can reduce water clarity and dissolved oxygen levels and are considered impaired by the IEPA. Phosphorus originates from a variety of sources, many of which are related to human activities which include: human and animal waste, soil erosion, septic systems, common carp, and runoff from farmland and lawns. Butler Lakes healthy plant population is responsible for keeping the TP level low preventing severe algae blooms during the summer.

Nitrogen is the other nutrient critical for algal growth. Total Kjeldahl nitrogen is a measure of organic nitrogen, and is typically bound up in algal and plant cells. The average 2015 TKN for Butler Lake was 0.80 mg/L. If inorganic nitrogen (NO2, NO3, NH4) concentrations exceed 0.3 mg/L in spring, sufficient nitrogen is available to support summer algae blooms. However, low nitrogen levels do not guarantee less algae blooms. The TN:TP ratio for Butler Lake was 27:1, which means that the limiting nutrient for aquatic plants was phosphorus.

CONDUCTIVITY AND CHLORIDE

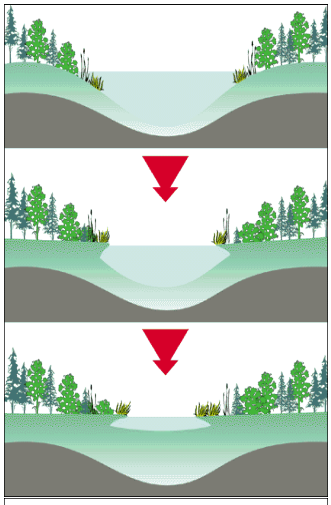
Conductivity is a measure of a waters ability to conduct electricity, measured by the water's ionic activity and content. The higher the concentration of (dissolved) ions the higher the conductivity becomes. Conductivity readings, which are influenced by chloride concentrations, have been increasing throughout the past decade in Lake County. Lakes with residential and/or urban land uses in their watershed often have higher conductivity readings and higher Cl^- concentrations because of the use of road salts. Storm water run-off from impervious surfaces such as roads and parking lots can deliver high concentrations of Cl^- to nearby water bodies. Road salt used in the winter road maintenance consists of the following ions: sodium chloride, calcium chloride, potassium chloride, magnesium chloride, or ferrocyanides which are detected when chlorides are analyzed.

The 2015 average conductivity for Butler 0.9946 mS/cm. This parameter was above the county median of 0.7920 mS/cm which is a 14.27% decrease from the 2005 value of 1.1602 mS/cm. These values are influenced by the winter road maintenance of roads in the surrounding residential areas. The United States Environmental Protection Agency has determined that chloride concentrations higher than 230 mg/L can disrupt aquatic systems and prolonged exposure can harm 10% of aquatic species. Butler Lake's Cl– concentration was 205 mg/L which is lower than the 2005 value of 244 mg/l. Chlorides tend to accumulate within a watershed as these ions do not break down and are not utilized by plants or animals. High chloride concentrations may make it difficult for many of our native species to survive. However, many of our invasive species, such as Eurasian Watermilfoil, Cattail and Common Reed, are tolerant to high chloride concentrations.

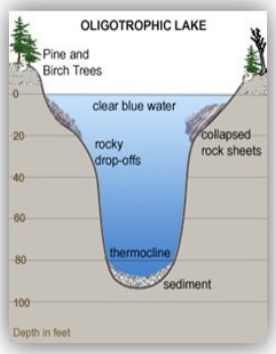


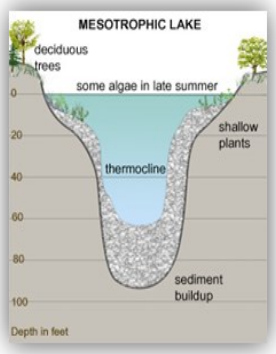
Trophic State Index

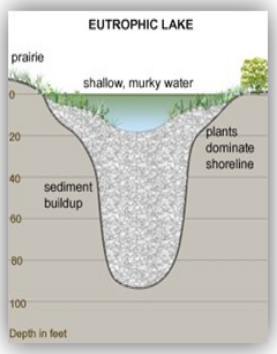
Another way to look at phosphorus levels and how they affect lake productivity is to use a Trophic State Index (TSI) based on phosphorus (TSIp). TSIp values are commonly used to classify and compare lake productivity levels (trophic state). A lakes response to additional phosphorus is an accelerated rate of eutrophication. Eutrophication is a natural process where lakes become increasingly enriched with nutrients. Lakes start out with clear water and few aquatic plants and over time become more enriched with nutrients and vegetation until the lake becomes a wetland. This process takes thousands of years to take place. However, human activities on a lake or in the watershed accelerate this process by resulting in rapid soil erosion and heavy phosphorus inputs. This accelerated aging process on a lake is referred to as cultural eutrophication. The TSIp index classifies the lake into one of four categories: oligotrophic (nutrient-poor, biologically unproductive), mesotrophic (intermediate nutrient availability and biological productivity), and eutrophic (nutrient rich, highly productive), or hypereutrophic (extremely nutrient-rich, productive). In 2015, Butler Lake was eutrophic with a TSIp Value of 54.33, placing it 36st out of 173 lakes in the county. Lake Carina was 1st with a 37.4 TSIp Value.



"When human activities accelerate lake eutrophication, it is referred to as cultural eutrophication. Cultural eutrophication may result from shoreline erosion, agricultural and urban runoff, wastewater discharges or septic seepage, and other non-point source pollution sources."







Source: RMB Environmental

Lake Level

Lakes with stable water levels potentially have less shoreline erosion problems. The lake level in Butler Lake was measured from a the southwest corner of the fishing pier. The lake level decreased from May to September by only 2.64 inches. The highest water level recorded occurred in May (2.28 ft) and the lowest level in August (2.55 ft). The most significant water level fluctuation occurred from June to July with a decrease in the lake level of 2.4 inches. Butler Lake's water level appear to be influenced by rain events. The watershed's primary land use of single family homes surrounding the lake has the potential to deliver significant amounts of storm water. In order to accurately monitor water levels it is recommended that a staff gauge be installed and levels measured and recorded frequently (daily or weekly). The data provides lake managers a much better idea of lake level fluctuations relative to rainfall events and can aid in future decisions regarding lake level. Staff gauge is a great tool for measuring water level in lakes, rivers, reservoirs. The data collected can be compiled to help understand the natural fluctuations of the lake. Lakes with fluctuating water levels potentially have poorer water quality and have more shoreline erosion problems.

Month	Level (ft)	Seasonal Change (ft)	Monthly Change (ft)
May	2.28		
June	2.30	0.02	0.02
July	2.50	0.22	0.20
August	2.55	0.27	0.05
September	2.50	0.22	-0.05

Example of a permanent Staff Gauge

BATHYMETRIC MAPS

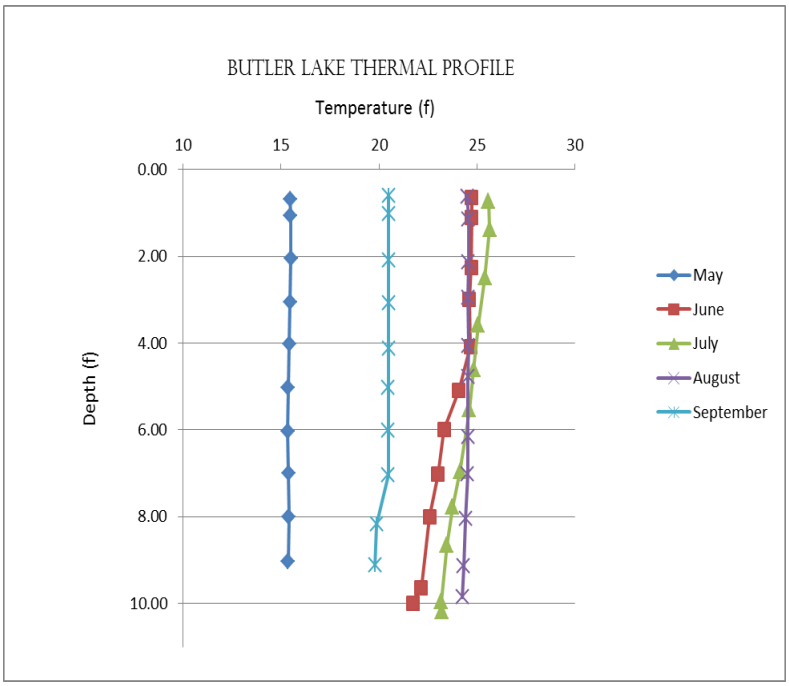
Bathymetric maps are also known as depth contour maps and display the shape and depth of a lake. They are valuable tools for lake managers because they provide information about the surface area and volume of the lake at certain depths. This information can then be used to determine the volume of lake that goes anoxic, how much of the lake bottom can be inhabited by plants, and is essential in the application of whole-lake herbicide treatments, harvesting activities and alum treatments of your lake. Other common uses for the map include sedimentation control, fish stocking, and habitat management.

The LCHD-ES collects field data using a Lowrance and transducer. Once collected, the data will be analyzed and imported into ArcGIS for further analysis.

STRATIFICATION

A lake's water quality and ability to support fish are affected by the extent to which the water mixes. The depth, size, and shape of a lake are the most important factors influencing mixing, but climate, lakeshore topography, inflow from streams and vegetation also play a role. Variations in density caused by different temperatures can prevent warm and cold water from mixing, called stratification.

For example: when lake ice melts in early spring, the temperature and density of lake water will be similar from top to bottom. Since it is uniform throughout the water column, the lake can mix completely recharging the bottom water with oxygen and bringing nutrients up to the surface. Some lakes in summer experience stratification where the lake is dividing into three zones: epilimnion (warm surface layer), thermocline (transition zone between warm and cold water) and hypoliminion (cold bottom water). Stratification traps nutrients released from bottom sediments in the hypoliminion and prevents mixing.



Monthly depth profiles were measured on Butler Lake by measuring water temperature, dissolved oxygen, conductivity, and pH every foot from the lake surface to the lake bottom. The relative thermal resistance to mixing (RTRM) value can be calculated from this data which can tell us if the lake stratifies, how great the stratification is, and what depth it occurs.

Shallow lakes like Butler, typically do not stratify during the summer. The lake was weakly stratified only in the month of June at about 6 feet and was destratified the rest of the year. Lakes that don't have the plant density of Butler Lake may suffer from nutrient cycling during the summer as the nutrients mixes in the water column.

Blue-green Algae

Algae are important to the freshwater ecosystems, and most species of algae are not harmful. Algae blooms are often caused by blue-green algae, or "cyanobacteria", which are similar to bacteria in structure but utilize photosynthesis to grow. They have no nucleus and lack the photosynthetic pigments found in algae. They usually are too small to be seen individually, but can form visible colonies that can cover large areas of lakes. Certain species of blue-green algae can produce toxins that could pose a health risk to people and animals when they are exposed to them in large enough quantities.

Butler Lake did not have a seasonal algae bloom due to a healthy aquatic plant population that competed with algae for nutrients and stabilize bottom substrate, which in turn improves water clarity. This allowed the total phosphorus levels to remain low at an average of 0.032 mg/l during the season.

When a bloom occurs, the water can appear blue-green, bright green, brown, or red and may look like paint floating on the water. Not all blue-green algae produce harmful toxins. The three types of cyanobacteria that are often associated with Harmful Algal Bloom (HAB) are the Anabaena, Aphanizomenon, and Microcystis. The presence of these cyanobacteria does not generally mean that the toxins are present in the water. The presence of toxins can only be verified through a sample analyzed in the lab. Poisoning has caused the death of cows, dogs, and other animals. Most human cases occurred when people swim or ski in affected recreational water bodies during a bloom.

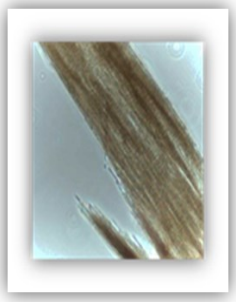
If you suspect that you are experiencing symptoms related to exposure to blue-green algae such as stomach cramps, diarrhea, vomiting, headache, fever, muscle weakness, or difficulty breathing contact your doctor or the poison control center. For more information or to report a blue-green algae bloom, contact the Lake County Health Department Environmental Services (847) 377-8030.

For More Information On Blue-green algae:
www.epa.state.il.us/water/surface-water/blue-green-algae.html

To report blue-green algae bloom:
Lake County Health Department
847-377-8030

Anabaena Sp.

Microcystis Sp.



Aphanizomenon Sp.

Floristic Quality Index

Lake County Average
FQI = 13.4

Butler Lake
FQI = 16.1

Rank = 63/170

Aquatic Plants Species Observed = 10

Floristic quality index (FQI) is an assessment tool designed to evaluate the closeness that the flora of an area is to that of undisturbed conditions. It can be used to: 1) identify natural areas, 2) compare the quality of different sites or different locations within a single site, 3) monitor long-term floristic trends, and 4) monitor habitat restoration efforts. Each aquatic plant in a lake is assigned a number between 1 and 10 (10 indicating the plant species most sensitive to disturbance). This is done for every floating and submersed plant species found in the lake. These numbers are averaged and multiplied by the square root of the number of species present to calculate an FQI. A high FQI number indicates that there are a large number of sensitive, high quality plant species present in the lake. Non-native species were counted in the FQI calculations for Lake County lakes. In 2015, Butler Lake had an FQI of 16.1 ranking 63 out of 170 in Lake County. The median FQI of lakes that we have studied from 2000-2015 is 13.4. Cedar Lake is 1st with an FQI of 37.4.

In many lakes macrophytes contribute to the aesthetically pleasing appearance of the setting and are enjoyable in their own right. but even more important, they are an essential element in the life systems of most lakes.

Aquatic Plants: Where Do They Grow?

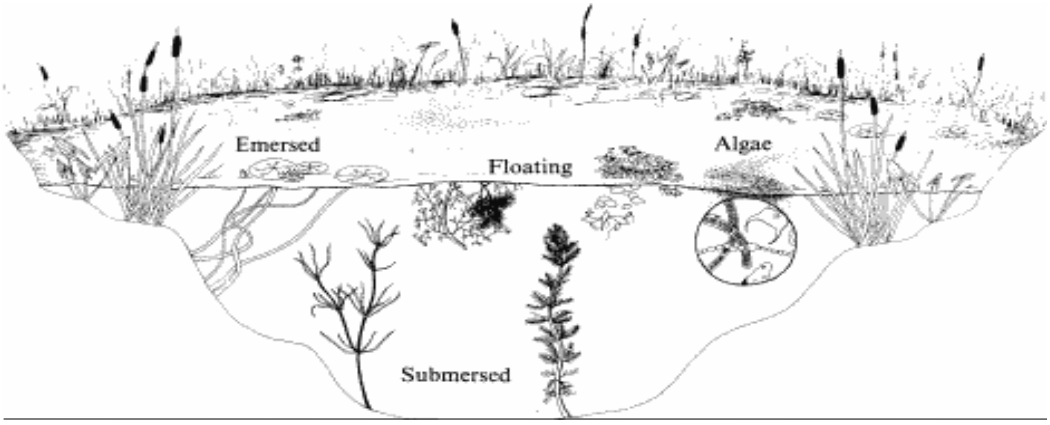
Littoral Zone– the area that aquatic plants grow in a lake.

Algae– have no true roots, stems, or leaves and range in size from tiny, one-celled organisms to large, multicelled plant-like organisms.

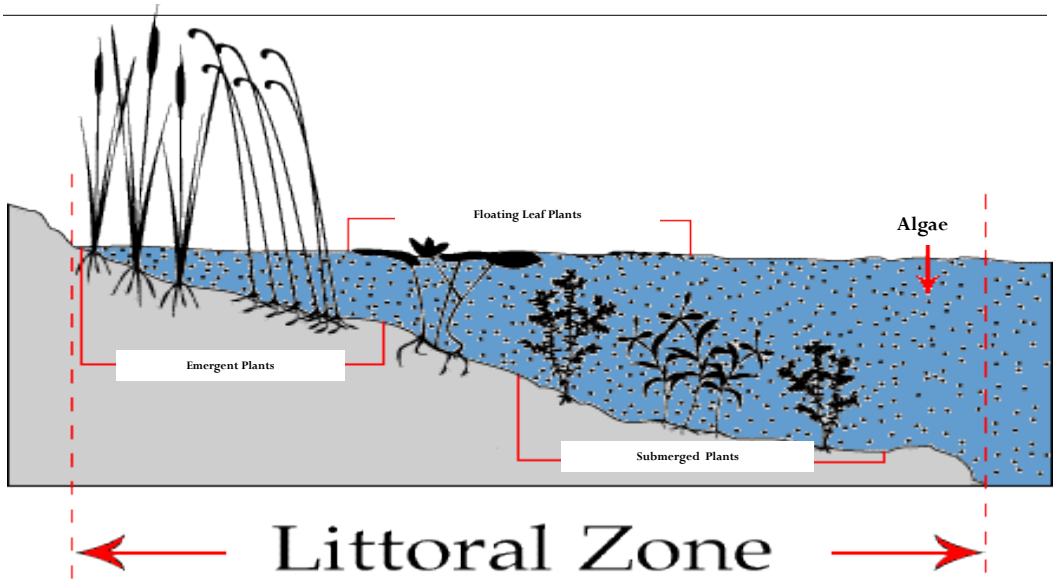
Submerged Plants– have stems and leaves that grow entirely underwater, although some may also have floating leaves.

Floating-leaf Plants– are often rooted in the lake bottom, but their leaves and flowers flat on the water surface.

Emergent Plants– are rooted in the lake bottom, but their leaves and stems extend out of



Litoral Zone



Source: Minnesota Department of Natural Resources

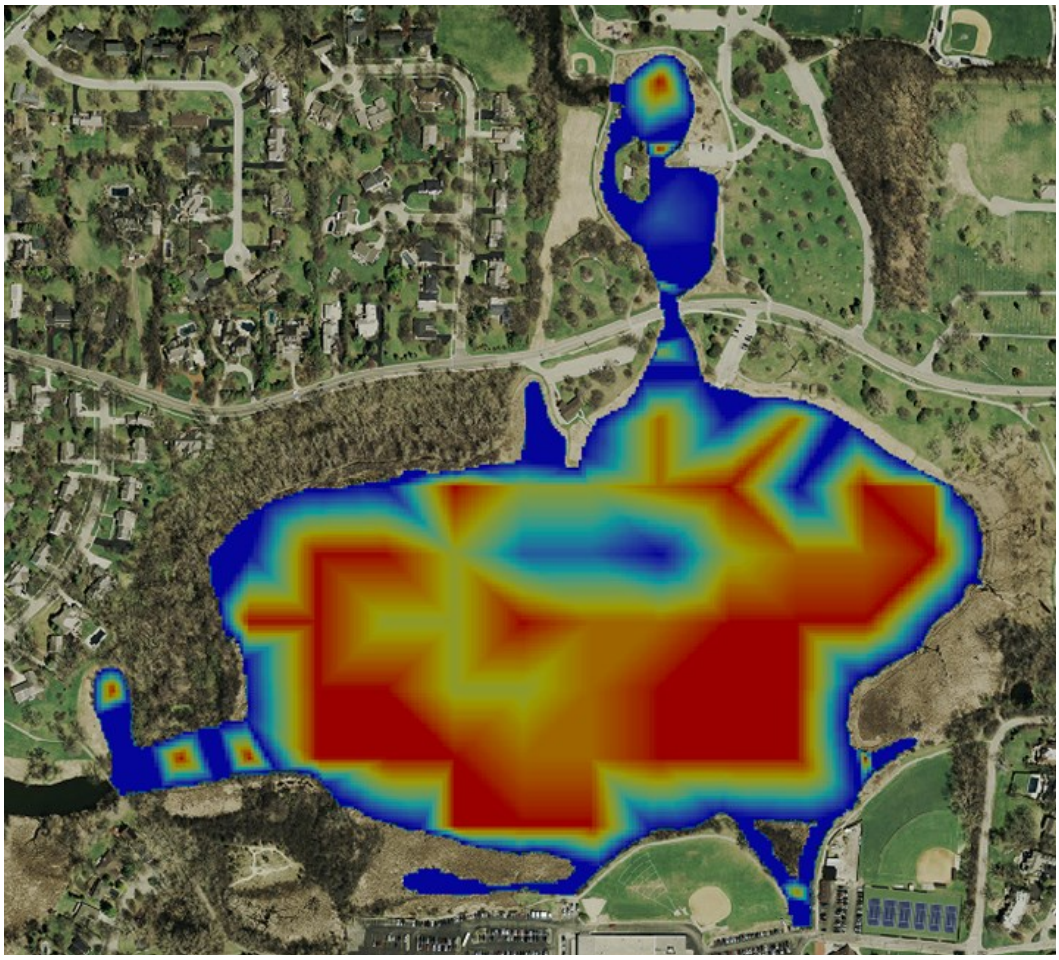
Aquatic Plants

Aquatic plant mapping survey provides information based on the species, density and distribution of plant communities in a particular lake. An aquatic plant sampling was conducted on Butler Lake on July 2015 when most plants are present. There were 64 points generated based on a computer grid system with points 60 meters apart. Aquatic plants occurred at 57 of the sites (89% total lake coverage) that included 10 aquatic plant species, including 2 exotic invasive species: Curlyleaf Pondweed and Eurasian water milfoil. The macro algae Chara, was also found during the plant survey. The most commonly occurring species were Coontail and White Water Lily at 79.7%, and 57.8% respectively, while Eurasian watermilfoil (31.3%), Giant duckweed (21.9%), and Chara (20.3%) were the next abundant species. Glacial lakes, like Butler Lake, typically have a very good plant diversity and density. The extent of plant populations can be influenced by a variety of factors. Water clarity and depth are the major limiting factors in determining the maximum depth at which aquatic plants will grow. When light level in the water column falls below 1% of the surface light level, plants can no longer grow. The extent of the 1% light can be obtained by doubling the Secchi disk reading. The average Secchi disk reading for 2015 was 6.49 feet. The deepest aquatic plant, Coontail, was found in 8.8 feet of water. Aquatic plants play an important role in the lakes ecosystem by providing habitat for fish and shelter for aquatic organism. Aquatic plants provide oxygen, reduce nutrients such as phosphorus to prevent algae bloom, and help stabilize sediment.

LCHD Staff identifying plants during sampling.

Rake Density (coverage)	# of Sites	% of Sites
No Plants	7	11
>0-10%	3	5
10-40%	0	0
40-60%	10	16
60-90%	12	19
>90%	32	50
Total Sites with Plants	57	89
Total # of Sites	64	100

Aquatic Plant map for July 2015



Key Features

LEAF:
ROUND, LEAF SLIT ON ONE SIDE ATTACHES TO ROUND STEM WHICH CONTAINS AIR PASSAGEWAYS (PARENCHYMA)

PLANT:
FLOATING FROM FLESHY RHIZOMES
FLOWER:

WHITE, 7 OR MORE PARTED, FLOATING ON WATER SURFACE

LOOK ALIKES:
SPATTERDOCK, AMERICAN LOTUS

Chara is an advance form of algae which resemble higher plants. Its easily identified by its musky odor and gritty surface due to mineral deposits on its surface. It filters nutrients out of the water and stabilizes the lake bottom.

Aquatic plants

Aquatic plants provide many water quality benefits and play an important role in the lakes ecosystem by providing habitat for fish and shelter for aquatic organism. Plants provide oxygen, reduce nutrients such as phosphorus to prevent algae bloom, and help stabilize sediment. A native plant community tends to be diverse and usually does not impede lake activities such as boating, swimming and fishing.

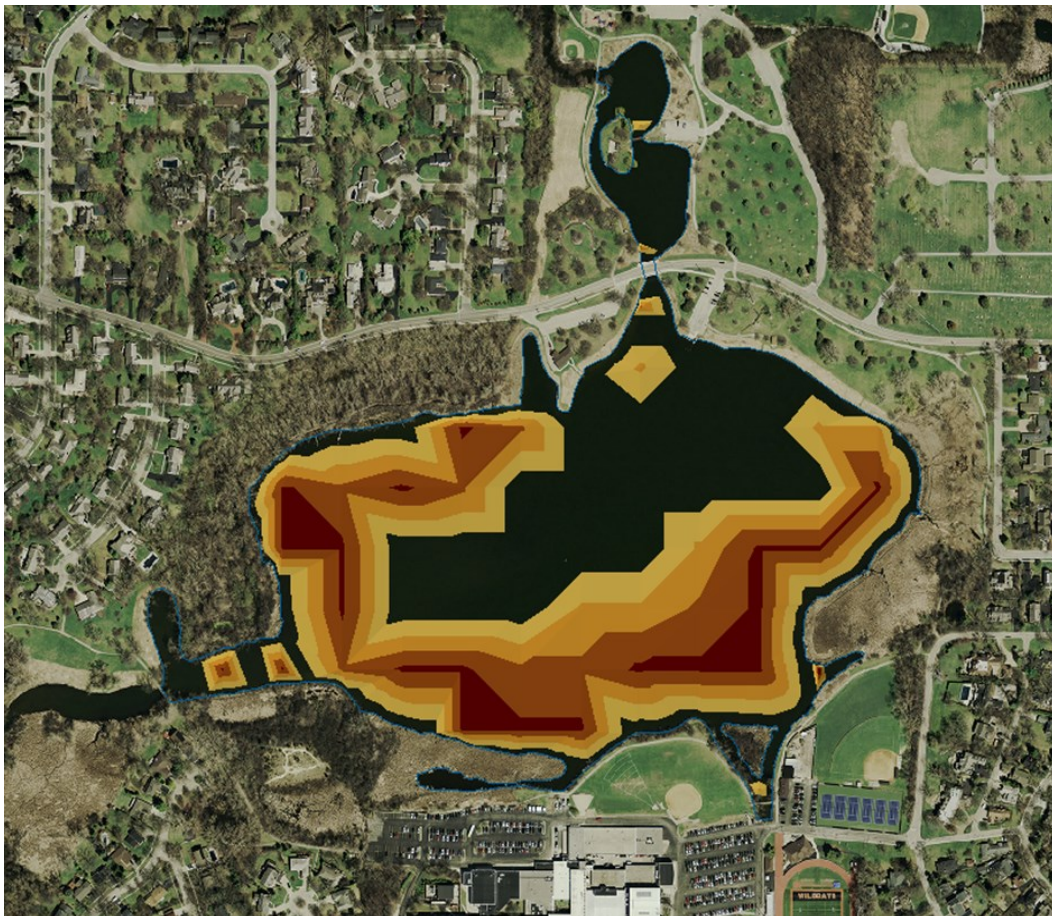
Common Plants Found in Butler Lake in 2015

White Water Lily

Nymphaea Tuberosa

A perennial plant that can grow in waters to 8' deep. The leaves develop directly from the rootstock on long petioles. They are 4-12" across, orbicular in shape, cleft toward the middle on one side, and smooth along the outer margins. The upper surface of the leaf is medium green, while the lower surface is often purplish; its texture is rather leathery and thick. Fine veins radiate outward from the center of the leaf.

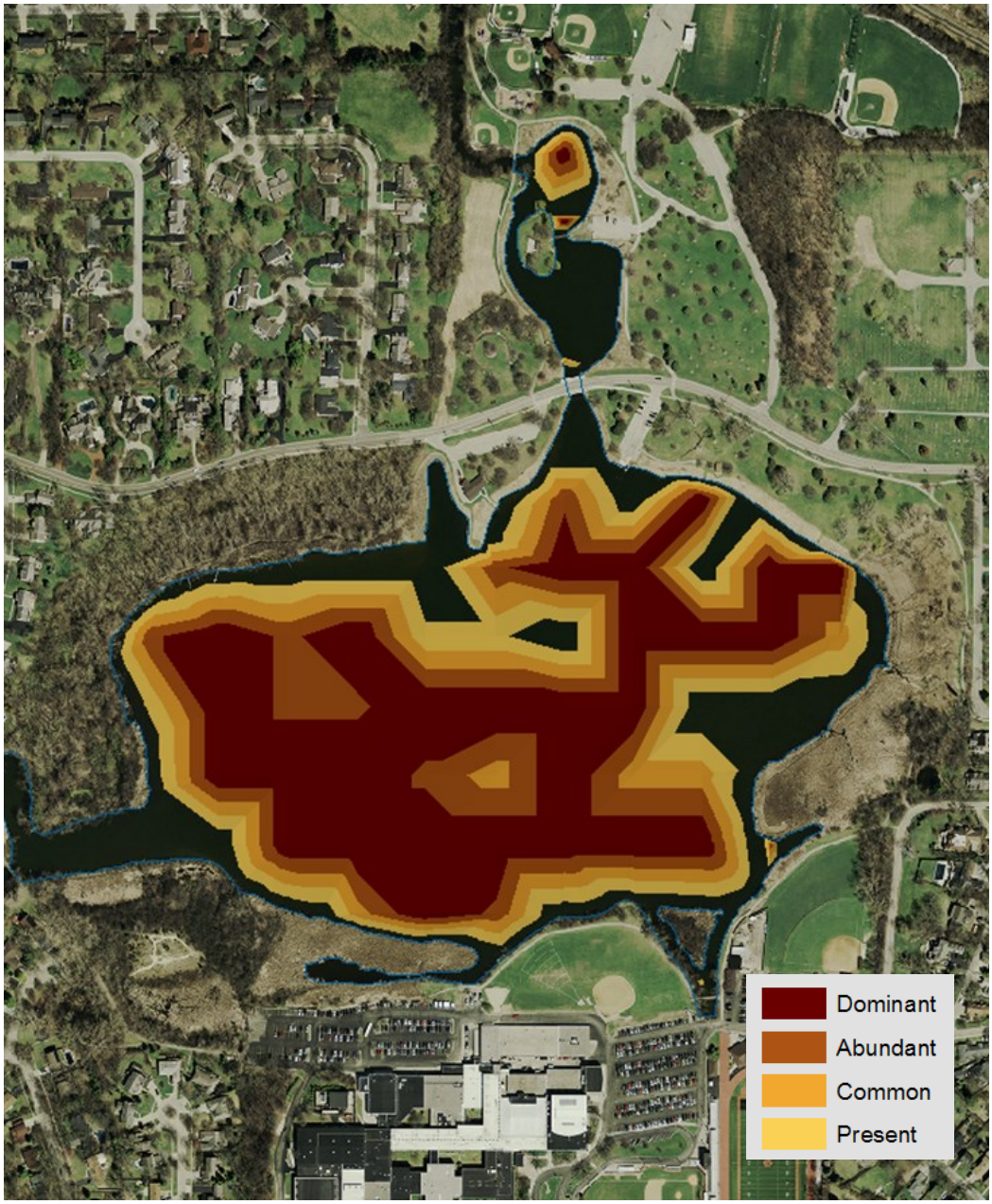
July 2015 White Water Lily Density at Butler Lake



COONTAIL (*Ceratophyllum demersum*)

This perennial plant is a submerged aquatic about 1-3' long. There is more branching of the stems above than below, creating fan-like aggregations of leaves. The stems are up to 1.0 mm. across, light green to nearly white, terete to slightly compressed (flattened), and hairless; they are slender and flexible. The leaves are highly flexible and readily bend. The preference is full sun, shallow water up to 4' deep, and a mucky bottom.

JULY 2015 COONTAIL DENSITY AT BUTLER LAKE



Giant Duckweed

Star Duckweed

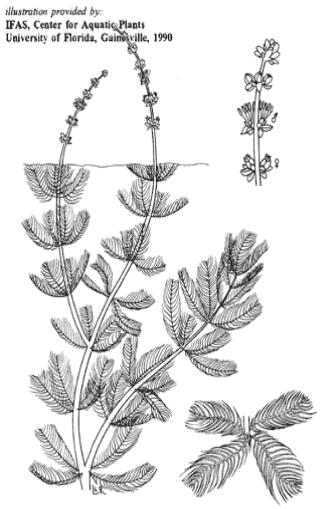
Watermeal

Flatstem Pondweed

Sago Pondweed

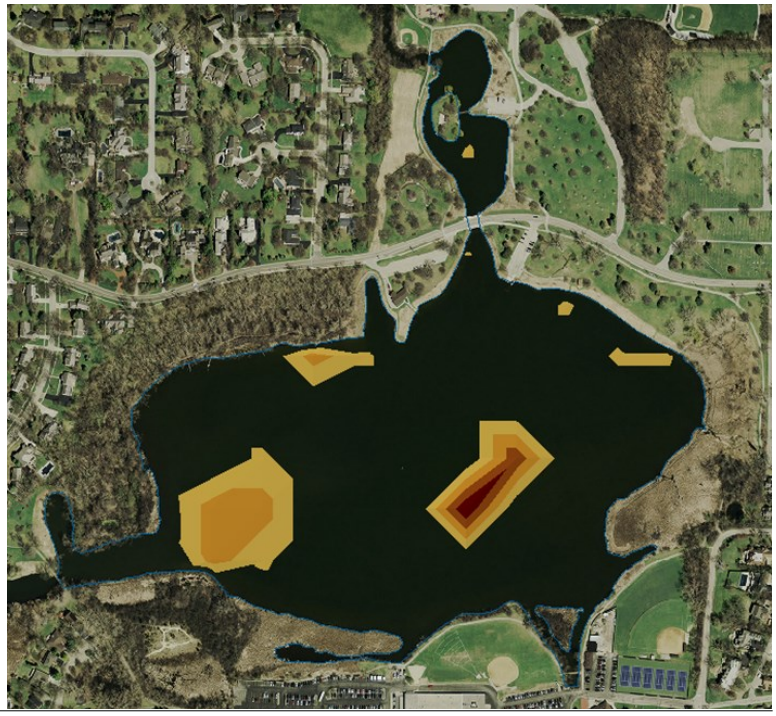
Eurasian Watermilfoil

Illustration of Eurasian Watermilfoil

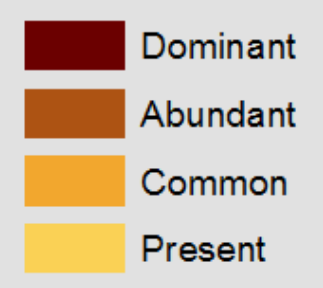


Eurasian Watermilfoil (EWM) is a feathery submerged aquatic plant that can quickly form thick mats in shallow areas of lakes and rivers in North America. These mats can interfere with swimming and entangle propellers, which hinders boating fishing, and waterfowl hunting. Matted milfoil can displace native aquatic plants, impacting fish and wildlife. Since it was discovered in North America in the 1940's, EWM has invaded nearly every US state and at least three Canadian Provinces. Milfoil spreads when plant pieces break off and float on water currents. It can cross land to new waters by clinging to sailboats, personal watercraft, powerboats, motors, trailers, and fishing gear.

The abundance of EWM in Butler Lake has increased from 2005 (15%) to 2015 (31.1%) of the sample sites. An aquatic plant management plan is critical to maintaining the health of the lake and a balanced aquatic plant community. The plan should be based on the management goals of the lake and involve usage issues, habitat maintenance/restoration, and limitations of the lake. The primary focus of the plan must include the control of exotic aquatic species including EWM and Curlyleaf Pondweed. Follow up is critical to achieve long-term success. A good aquatic plant management plan considers both the short and long-term needs of the lake. At this time there is a healthy population of native aquatic plants to keep the Eurasian water milfoil from becoming the dominant plant in the lake. Hand raking areas may help reduce the EWM population.



Erasian watermilfoil density at 20 sites on Butler Lake in July, 2015,



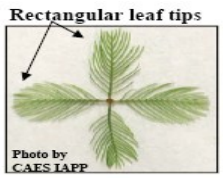
Myriophyllum spicatum Exotic*

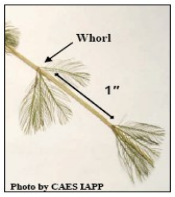
Common Names:
Eurasian watermilfoil

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 Features:

Stem: Long, often abundantly branced stems form a reddish or olive-green surface mat in summer.

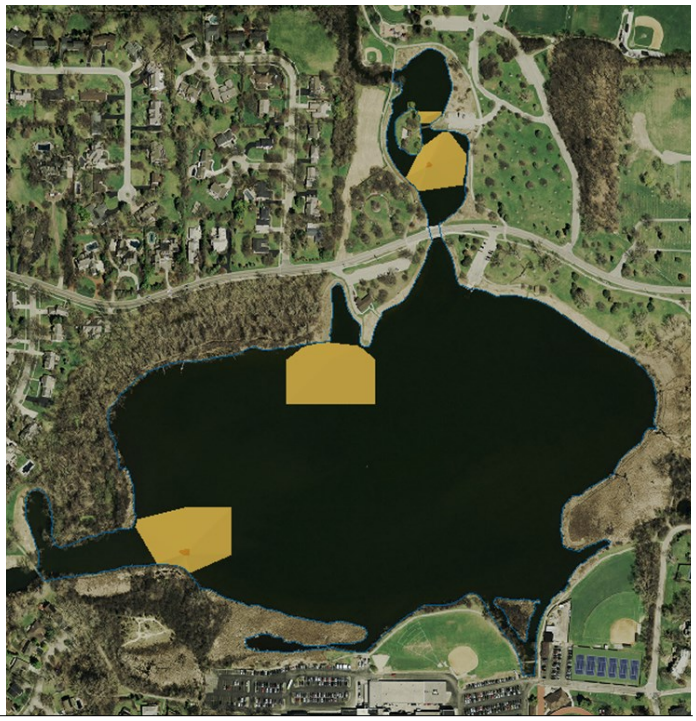
Leaf: Leaves are rectangular with ≥12 pairs of leaflets per leaf and are dissected giving a feathery appearance, arranged in a whorl, whorls are 1 inch apart.

Flower: Small pinkish male flowers that occur on reddish spikes, female flowers lack petals and sepals and 4 lobed pistil.

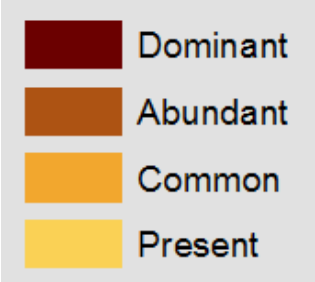
Curlyleaf Pondweed

Curlyleaf Pondweed (CLP) is an invasive aquatic perennial that is native to Eurasia, Africa, and Australia. It was accidentally introduced to United States waters in the mid-1880s by hobbyists who used it as an aquarium plant. The leaves are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. This aquatic plant has an unusual life history. Unlike our native pondweeds it begins growing in the early spring. CLP has even been documented growing under the ice in lakes! The plant then reaches maturity in mid summer typically June in Lake County when our natives are starting to emerge. CLP becomes invasive in some areas because of its adaptations for low light tolerance and low water temperatures which allow the plant to get a head start and outcompete native plants in the spring. In mid-summer, when most aquatic plants are growing, CLP plants are dying off. Plant die-offs may result in a critical loss of dissolved oxygen. Large populations of CLP also can cause changes in nutrient availability. In midsummer, CLP plants usually die back which is typically followed by an increase in phosphorus availability that may fuel nuisance algal blooms. CLP can form dense mats that may interfere with boating and other recreational uses. In July 2015, Butler Lake CLP were present, plants being found at 4.7% of the sampled sites. This is a decrease from 2005 when CLP was found at 13% of the sampled sites. At this time the density of CLP is not causing fluctuations in nutrient availability. The Butler Lake aquatic plant management plan should manually hand rake to CLP in an effort to keep the population from expanding.

Illustration of Curlyleaf Pondweed

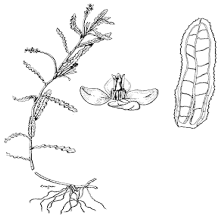


Curlyleaf Pondweed density at 3 sites on Butler lake in July 2015,



Potamogeton crispus *Exotic**

Turion



Key Features:

Stem: are flattened, branched, can form dense stands in water up to 15 feet deep.

Leaf: alternate all submersed, oblong, stiff, translucent leaves have distinctly wavy edges with fine teeth and 3 main veins.

Flower: tiny, with 4 petal-like lobes. In spikes 1-3cm long on stalks up to 7cm long. (May see turions which over winters as a hard, brown, bur-like bud with crowded, small holly-like leaves).

Common Names:
Curly leaf pondweed

Origin: EOXTIC*
Asia, Africa, and Europe Found throughout lake county and illinois

Importance:
Invasive: has a tolerance for low light and water temperatures that allow the plant to get a head start on native plants. By mid summer when most aquatic plants are growing, curlyleaf plants are dying off. Which may result in a critical loss of dissolved oxygen and an increase in nutrients.

Look alikes:
none

PESTICIDE PERMIT REQUIREMENTS FOR PESTICIDE APPLICATION

A National Pesticide Elimination System (NPDES) permit is required when pesticides are applied to, over or near the waters of the State. This permit applies to all public waters that have an outflow to the State waters. A Notice of Intent (NOI) must be filled and submitted electronically to the Illinois Environmental Protection Agency (IEPA) at least 14 days prior to any application of pesticides.

In order to obtain the permit an application needs to be filed with the IDNR requesting a permit for pesticide application, the application can be filled out by the applicant or their representative (which is usually the pesticide consultant).

- When is a NPDES permit needed?

Prior to any pesticide application made directly to, over or near waters of the state.

- Who should obtain NPDES permit coverage?

The individual pond owner who will apply the herbicide. If the pond owner hires a contract applicator either the contract applicator or the pond owner could apply for NPDES coverage.

- How do I apply for NPDES permit coverage?

File a Notice of Intent (NOI) with the IEPA. The form can be printed from the site listed above. Don't forget the 14 day public notice period and the information regarding the approval and notification process listed above, so plan ahead

- What does the permit cost?

Currently there is no fee however fees may be introduced at a later date.

- How long is the permit good for?

Five years from the date of issuance but not from the date of coverage.

- Is anything else needed besides the permit?

An Adverse Incident Report is needed if there are any adverse impacts related to the application such as spills or accidental overdosing. The incident must be reported to the Illinois Emergency Management Agency immediately and the report must follow within 15 days.

A Pesticide Discharge Management Plan (PDMP) is required if the annual threshold of 80 acres is past and if you do not meet any of the additional exemptions within the permit. The threshold is determined not only by the size of the pond or lake but by the number of treatments. For example, if a 10 acre pond is treated 9 times with different herbicides within a one-year period, it would be counted as 90 treatment acres and the 80 acre threshold limit would have been passed. This would trigger the need for a PDMP. If treated with the same herbicide 9 times, the additional treatments would not count toward the threshold.

- Additional things to remember

You are allowed to apply only a pesticide that is labeled for aquatic use. The General NPDES permit only applies to pesticide applications that will be made directly to or over waters of the State or at water's edge. Pesticide applications to dry ditches which discharge into waters of the State may also require General NPDES permit coverage.

You must file an updated NOI to modify your NPDES permit coverage to add additional use patterns or treatment areas at least 14 days prior to beginning the pesticide applications. The General NPDES permit coverage is good for 5 years from the issuance date on the permit.

Excerpt : Illinois Department of Natural Resources

FOR FULL DETAILS OF THE RULE SEE:

HTTP: / / WWW.EPA.STATE.IL.US/WATER/PERMITS/PESTICIDE/INDEX.HTML

AND

HTTP:// WWW.FOXWATERWAY.COM/PDFATTACHMENTS/HERBICIDE.PDF

Manual removal of aquatic plants

Controlling exotic aquatic plants by hand removal is effective on small areas and if done prior to heavy infestation. Eurasian watermilfoil can be controlled to some degree by hand pulling or raking of entire plants including the roots. Just before the peak growth is the best time for removal to prevent re-growth and plant seed dispersal. Working in windblown areas will help contain fragments near shore which makes cleanup easier. All fragments of EWM plants must be removed to achieve adequate control. Most regeneration are from fragmented stems that drift into different areas of the lake and form new colonies. Small populations of Curlyleaf can be manually removed with a rake or by hand pulling. All plant materials should be carefully removed as floating pieces of Curlyleaf that may contain turions can float away and colonize a different part of the lake so removal of this plant should be done no later that the end of May.

Removal by hand is labor intensive but it can be effective in targeting small patches of invasive plants. This method also eliminates or reduces the need for chemicals treatments that can impact native vegetation and fish. There are different types of rakes. First is a bladed rake that can be used to cut the stems of plants. Secondly, a throw able double sided rake that can be used to pull plants from deeper water or further distances and lastly a long handled rake for working the shoreline and the boat dock area. Its important to remove the entire plant including the roots to prevent regeneration.

Aquatic Rake with Blade

Protect your waters

Helping to prevent the introduction and spread of invasive aquatic plants and animals are the most effective way of protecting healthy, non-infested ecosystems. Listed below are some of the simple steps you can take to prevent invasion.

- Remove all plants, mud, fish, or animals before transporting equipment.
- Eliminate all water from equipment before transporting equipment.
- Dry anything that comes in contact with water (boat, trailers, equipment, clothing, etc.).
- Remove all mud and dirt since it might contain aquatic hitchhikers.
- Never release plants, fish or animals into a body of water unless they came out of that body of water.
- Do not release bait into the waters you are fishing.
- Do not release aquarium fish or aquatic pets in to the lake.

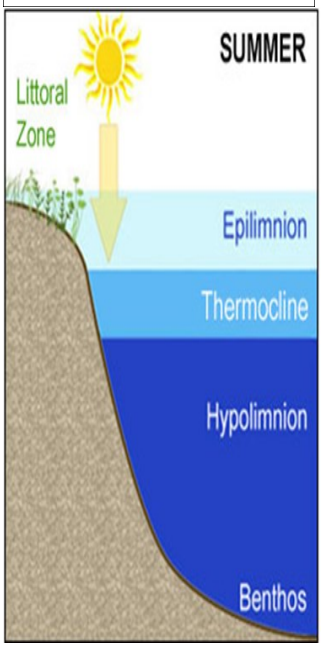
Double-sided Throwable Rake

Aquatic Plant Rake

Dissolved Oxygen

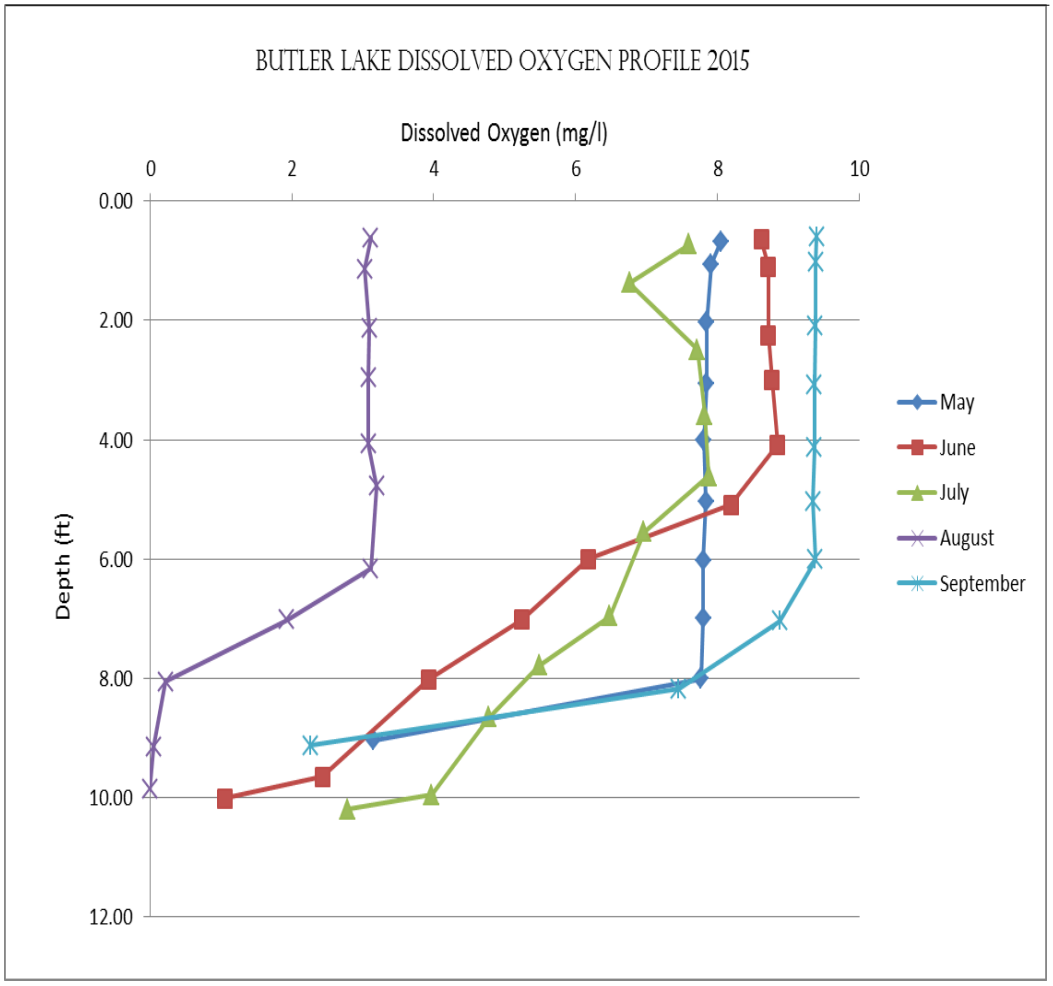
RANGE OF TOLERANCE FOR DISSOLVED OXYGEN IN FISH PARTS PER MILLION (PPM) DISSOLVED OXYGEN	
1	<3.0 PPM too low for fish populaitons
2	
3	
4	3.0-5.0 PPM 12-24 Hour range of tolerance /stressful conditions
5	
6	>6.0 PPM Supports Spawning
7	>7.0 PPM Supports Growth and Activity
8	
9	>9.0 PPM Supports abundant fish populations
10	

OXYGEN IS VITAL TO THE HEALTH OF AQUATIC HABITATS. PLANTS AND ANIMALS NEED OXYGEN TO SURVIVE. A LOW LEVEL OF OXYGEN IN THE WATER IS A SIGN THAT THE HABITAT IS STRESSED OR POLLUTED.



Dissolved oxygen (DO) is a major indicator of water quality and is important for aquatic organisms, algae, macrophytes, and for many chemical reactions to occur that are crucial for lake functions. Dissolved oxygen concentrations can have large variations occurring and are affected by diffusion, aeration, photosynthesis, respiration, and decomposition. Temperature, salinity and pressure changes will also cause DO to fluctuate. Dissolved oxygen will vary both seasonally and by depth throughout the water column in lakes. If dissolved oxygen concentrations drop below levels necessary for sustaining aquatic life (below 5.0 mg/L at 1 foot depth below the lake surface) it becomes a water quality impairment. Low dissolved oxygen primarily is a result of excessive nutrients that stimulate growth of organic matter, such as algae, or the increase of pollutants such as sewage, lawn clippings, and soils that are considered to be "oxygen-demanding". Low dissolved oxygen levels is also often a factor for fish kills. When many of the plants or algae die at the end of the growing season, their decomposition can significantly reduce DO concentrations. In deeper, thermally stratified lakes, oxygen production is greatest in the upper water layer (epilimnion) where sunlight drives photosynthesis and oxygen consumption is greatest near the bottom of the lake (hypoliminion) where organic matter accumulates and decomposes.

Butler Lake's dissolved oxygen concentrations remained good all year and did not drop below 5.0 mg/L at 1 foot below the lakes surface, which would qualify it as a DO impairment. The lake averaged 7.38 mg/L at 3 feet below the surface.



AQUATIC PLANTS AND FISH

Fish depend on aquatic plants to provide habitat and forage for food and most freshwater fish rely on aquatic plants at some point during their life stage. The plant composition and density can play an important role in the nesting, growth, and foraging success of these fish. While many fish require some aquatic vegetation for growth, excessive amounts of aquatic vegetation can negatively impact growth by reducing foraging success. The parameters of an ideal fish habitat change base on the size and species of fish, the type of lake, structures present in the lake and man other factors.

How do plants impact fish?

- *Plants provide critical structure to aquatic habitats.*
- *Plants influence growth of fish by enhancing fish diversity, feeding, growth, and reproduction.*
- *Plants influence spawning. The structure provided by plant beds is important to fish reproduction.*
- *Plants influence the physical environment. Aquatic plants can change water temperatures and available oxygen in habitats.*

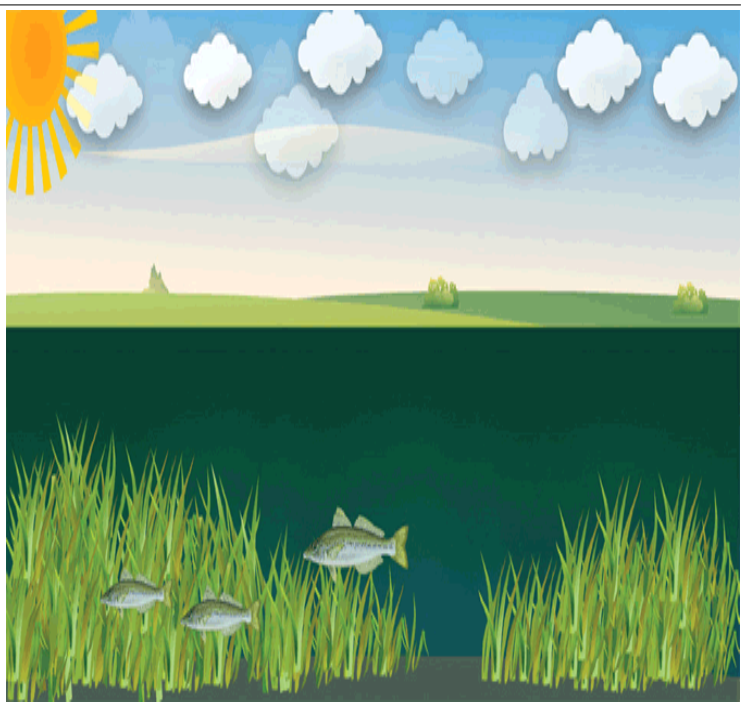


Image http://agriculture.vic.gov.au/

Table 1. Common fish and their plant affinity during various life stages and their relationship with plants

		Life Stage				Relationship	
Fish	**Plant Affinity**	**Larvae**	**Juvenile**	**Adult**	**Spawn**	**Forage**	**Predator avoidance**
Bluegill sunfish	High	X	X	X	X	X	X
Common carp	High	X	X	X	X	X	X
Largemouth bass	High	X	X	X	X	X	X
Musky	High	X	X	X	X	X	X
Northern Pike	High	X	X	X	X	X	X
Black crappie	Moderate		X	X	X	X	X
Smallmouth bass	Moderate		X	X		X	X
Yellow perch	Moderate	X	X			X	X
White crappie	Low		X			X	
Salmon, trout	Low		X				X
Shad	Low	X					
Walleye	Low			X		X	

Table adapted from Gettys, Lynn, William T. Haller and Marc Bellaud. "Biology and Control of Aquatic Plants: A Best Management Practices Handbook". 2009

Shoreline erosion

"Vegetative buffer zones can play a key role in limiting negative water quality impacts from developed shoreland property"

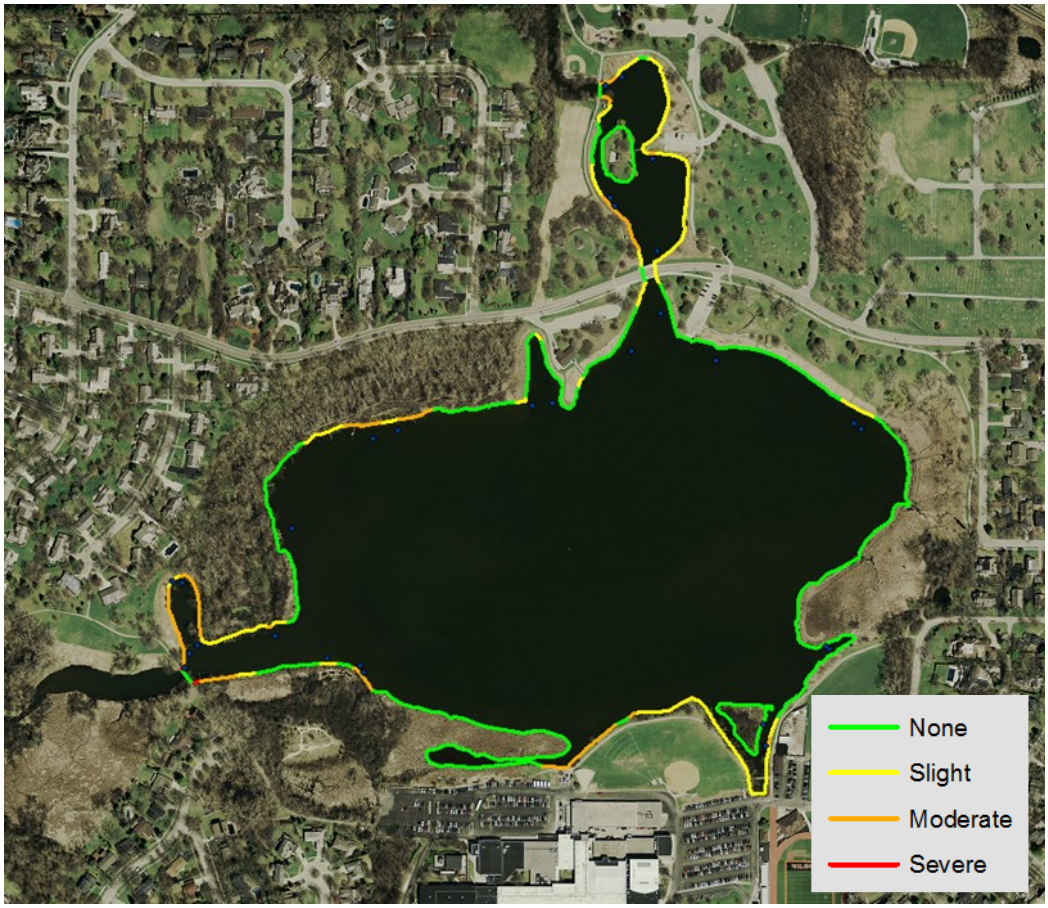
Butler Lake Shoreline Restoration Project

Information on shoreline regulation and permits can be found on the Illinois Department of Natural Resources' website.

http://www.dnr.illinois.gov/waterresources/documents/3704.pdf

Erosion is a natural process primarily caused by water which results in the loss of material from the shoreline. Disturbed shorelines caused by human activity such as clearing of vegetation and beach rocks, and increasing runoff will accelerate erosion. Rain and melting snow and wave action are the main causes of erosion. Rain can loosen soil and wash it down gradient towards the lake. Creating a native plant buffer helps prevent soil erosion as well as filter out pollutants and unwanted nutrients from entering the lake. Native plants can be planted along the shoreline since plant roots hold the soil particles in place so they are not easily washed away during a rain event, melting snow or wave action. Loose rocks and gravel placed on top of a filter fabric prevents soil from washing away before newly planted seed and vegetation has a chance to grow. Eroded materials cause turbidity, sedimentation, nutrients, and pollutants to enter a lake. Shore line buffer zone planted with native vegetation not only reduces runoff by increasing water infiltration into the ground, it also offers food and habitat for wildlife. Less runoff means less nutrients, sediments and other pollutants entering the lakes and streams. Excess nutrients are the primary cause of algal blooms and increased aquatic plant growth. Once in the lake, sediments, nutrients and pollutants are harder and more expensive to remove.

A shoreline erosion study was assessed for Butler Lake in 2015. The lake was divided into reaches, and the shoreline evaluated for none, slight, moderate and severe erosion based on exposed soil and tree/plant roots, failing infrastructure, undercut banks, and other signs of erosion. Based on the 2015 data, 39.2% of Butler Lake's shoreline has some erosion; 25.2% slight erosion, 13.7% moderate erosion, and 0.4% severe erosion.



ZEBRA MUSSELS *DREISSENA POLYMORPHA*

In the late 1990's, the presence of zebra mussels (*Dreissena polymorpha*) was confirmed in the Fox Chain O Lakes. These mussels are believed to have been spread to this country in the mid 1980's by cargo ships from Europe that discharged their ballast water into the Great Lakes. The mussels spread throughout the Great Lakes and by 1991 had made their way into the Illinois and Mississippi Rivers. The first sighting of the mussel in Lake County (besides Lake Michigan and the Chain of Lakes) occurred in 1999. Currently, 33 inland lakes in the county are known to be infested with the zebra mussel, but this number could be much higher, since the zebra mussel has probably gone unnoticed in many lakes. Zebra mussels were first discovered in St. Mary's Lake after 2005 and has now spread through out the entire lake. Zebra mussels was discovered below the spillway, in Bull Creek, in November 2015 by the LCHD staff. There were no zebra mussels in observed in Butler Lake in 2015.

ZEBRA MUSSEL

For more information:

http://www.seagrant.wisc.edu/zebramussels/faqs.html

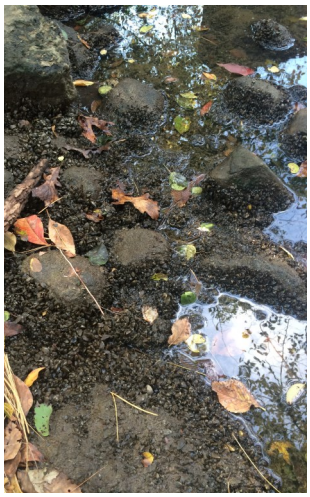
The zebra mussel's reproductive cycle allows for rapid expansion of the population. A mature female can produce up to 40,000 eggs in a cycle and up to one million in a season. Zebra mussels can live as long as five years and have an average life span of about 3.5 years. The adults are typically about the size of a thumbnail but can grow as large as 2 inches in diameter. Colonies can reach densities of 30,000 - 70,000 mussels per square meter. Due to their quick life cycle and explosive growth rate, zebra mussels can quickly edge out native mussel species. Negative impacts on native bivalve populations include interference with feeding, habitat, growth, movement and reproduction. The impact that mussels have on fish populations is not fully understood. However, zebra mussels feed on phytoplankton (algae), which is also a major food source for planktivorous fish, such as minnows and shad and young of the year bluegill. These fish, in turn, are a food source for piscivorus fish (fish eating fish), such as largemouth bass and northern pike.

ZEBRA MUSSEL FORM A COLONY CALLED "DRUSES"

Zebra mussels have also caused economic problems for large power plants, public water supplies, and industrial facilities, where they clog water intake pipes. Boats stored on the water offer suitable areas for zebra mussels to start a colony. Researchers found that many of the mussel larvae were being transported via aquatic plants that were taken from one lake to another on boats and trailers. It is important that all boats and trailers entering or leaving St. Mary's Lake are inspected for aquatic plants, zebra mussels and all water from the bilge and motors are drained.

Below are some tips from the Great Lakes Sea Grant Network that can help prevent the spread of zebra mussels:

- Always inspect your boat and boat trailer carefully before transporting. Studies have shown that transport via aquatic plant fragments is one of the major contributors to the spread of zebra mussels.
- Drain all bilge waters, live wells, bait buckets and engine compartments before entering another lake. Make sure water is not trapped in your trailer. Never transport water from one lake to another.
- Flush clean water (tap) through the cooling system of your motor to rinse out any larvae. Full grown zebra mussels can be easily seen but cling stubbornly to surfaces. Boats that have been in the water for long periods of time should be carefully inspected. Carefully scrape the hull (or trailer), or use a high pressure spray (250 psi) to dislodge them. Or leave your boat out of the water for at least 5 days, preferably up to two weeks. The mussels will die and drop off.
- In their earlier stages, attached zebra mussels may not be easily seen. Pass your hand across the boat's bottom - if it feels grainy, it's probably covered with mussels. Don't take a chance; clean them off by scraping or blasting.
- Dispose of the mussels in a trash barrel or other garbage container. Don't leave them on the shore where they could be swept back into the lake or foul the area.



ZEBRA MUSSELS IN BULL CREEK BELOW ST. MARY'S LAKE

CARP (CYPRINUS CARPIO)

Family:

Cyprinidae (Minnows or carps)

Order:

Cypriniformes (carps)

Class: Actinopterygii (ray-finned fishes)

Carp are considered to be one of the most damaging invasive fish species. Originally introduced to the Midwest waters in the 1800's as a food fish, carp can now be found in 48 States. In the U.S., the common carp is more abundant in manmade impoundments, lakes, and turbid sluggish streams and less abundant in clear waters or streams with a high gradient (Pflieger 1975; Trautman 1981; Ross 2001; Boschung and Mayden 2004). They are also highly tolerant of poor water quality. Participation in the Clean Waters Clean Boats program will help prevent other invasive species from entering the lake. Never release plants, fish or animals into a body of water unless they came out of that body of water.

The common carp has a dark copper-gold back with sides that are lighter, a yellowish belly and olive fins. They have 2 pairs of short barbells on their upper lip and their dorsal and anal fins have a leading spine that are serrated. They spawn from early spring to late summer in water ranging from 15 – 28 C and prefer freshly flooded vegetation as spawning substrate. They prefer to spawn in shallow weedy areas in groups consisting of one female and several males. A single female can produce up to 100,000-500,000 which hatch in 5-8 days. The spawning ritual involves a lot of thrashing in shallow water contributing to turbidity problems. Carp are omnivorous and feed over soft bottom substrate where they suck up silt and filter out crustaceans, insect larvae and other desirable food items. Carp are very active when feeding and can be observed around shallow areas where they uproot plants which increases turbidity and nutrient concentrations. Increase in nutrients causes algal blooms and reduction in light penetration that impacts aquatic plants.

There are several ways to control the carp population in a lake. Rotenone (piscicide) may be used to eradicate carp from a lake. However, it may be expensive because the entire lake and feeder creek needs to be treated to prevent carp from repopulating the lake. Rotenone is approved for use as a piscicide by the USEPA and has been used in the U.S. since the 1930's. This piscicide can only be applied by an IDNR fisheries biologist. It is also biodegradable and there is no bioaccumulation. Treating the entire system would eradicate carp and allow aquatic plants to become established.

Assess current fish population to ensure that there are enough native predator fish such as bass, catfish and northern pike to help control the carp population. The removal of carp would certainly increase the water clarity in the shallower sections of Butler Lake where most of the carp activity was observed. The dense aquatic plants in the main lake helps filter out the sediments kicked up by the carp's spawning and feeding activity.

The spawning ritual involves a lot of thrashing in shallow water contributing to turbidity problems.

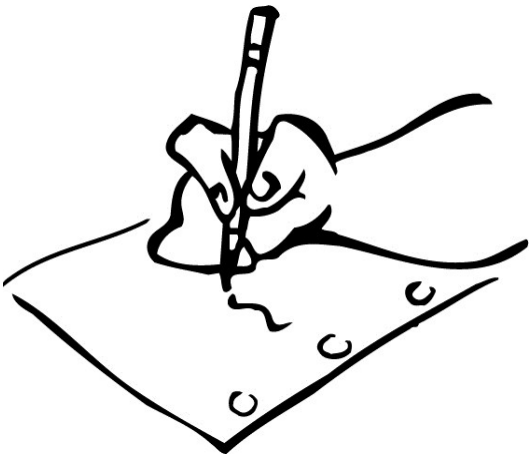
Lake management plans

It is recommended that a long term Lake Management Plans be developed to effectively manage lake issues. All stakeholders should participate in the development of the plan and include homeowners, recreational users, lake management associations, park districts, townships or any other entity involved in managing Butler Lake. Lake Management plans should educate the public about specific lake issues, provide a concise assessment of the problem, outline methods and techniques that will be employed to control the problems and clearly define the goals of the program. Mechanisms for monitoring and evaluation should be developed as well and information gathered during these efforts should be used to implement management efforts (Biology and Control of Aquatic Plants, Gettys et al., 2009)

What are the steps in creating a Lake Management Plan?

1. **Getting Started**: Identify lake stakeholders and communication pathways
2. **Setting Goals:** Getting the effort organized, identifying problems to be addressed, and agreeing on the goals
3. **Problem Assessment & Analysis**: collecting baseline information to define the past and existing conditions. Synthesize the information, quantifying and comparing the current conditions to desired conditions, researching opportunities and constraints and setting direction to achieve goals.
4. **Alternatives:** List all possible management alternatives and evaluate their strengths, weakness, and general feasibility.
5. **Recommendations:** Prioritize management options, setting objectives and drafting the plan
6. **Project Management:** Management of assets, detailed records of expenses and time
7. **Implementation:** adopting the plan, lining up funding, and scheduling activities for taking action to achieve goals.
8. **Monitor & Modify:** Develop a mechanism for tracking activities and adjusting the plan as it evolves.

Follow these steps when getting started with writing Lake Management Plans. While each step is necessary, the level of effort and detail for each step will vary depending on the project's goals, size of the lake, and number of stakeholders.



LakeCounty
Health Department and
Community Health Center

ECOLOGICAL SERVICES

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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.

Ecological 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.

LAKE RECOMMENDATIONS

Butler Lake's water quality has improved since 2005 with a reduction in phosphorus (39%) and total suspended solids (63%) which led to an increase in Secchi depth (88%). Chloride has declined by 16% since 2005. The aquatic plant density remains good, but diversity remains has gone down in 2015. Butler Lake has successfully demonstrated shoreline restoration at the Butler along Lake Street. Butler Lake's management is administered by the Village of Libertyville.

To improve the overall quality of Butler Lake, ES (Ecological Services) has the following recommendations:

- **Continue participation in Volunteer Lake Monitoring Program**
- **Install a sign to educate on ways to reduce the spread of Aquatic Invasive Species and participate in the Clean Waters Clean Boats Program**
- **Help reduce Cl^- by supporting wise use of road salt in the watershed**
- **Install a permanent staff gage to monitor lake level fluctuations**
- **Become familiar with the appearance of harmful algal blooms and report any blooms to the LCHD-ES by calling 847-837-8030.**
- **Develop an Aquatic Plant Management Plan (APMP) that targets the reduction of invasive species and promotes native plant diversity. Aquatic plant management plans should consider type, timing of pesticide applications and quantity of pesticide used.**
- **Monitor Eurasian watermilfoil and curly leaf population. Hand rake or manually remove Eurasian Watermilfoil and curly leaf to keep population from expanding**
- **Reduce carp population**
- **Assess current fish population**