Illinois Department of Natural Resources
CONSERVATION PLAN
(Application for an Incidental Take Authorization)
Per 520 ILCS 10/5.5 and 17 Ill. Adm. Code 1080

150-day minimum required for public review, biological and legal analysis, and permitting

PROJECT APPLICANT: *Friends of Catherine and Channel Lakes (FCCL)*
3216 N. Hoyne Ave, Chicago, IL 60618

PROJECT NAME: *Lake Catherine and Channel Lake aquatic weed management.*

COUNTY: *Lake*

AREA OF IMPACT: *An area where the water depth is between 3 feet and 12 feet* in *both Lake Catherine and Channel Lake where aquatic vegetation is densest and where the harvester can reasonably reach. This area is estimated at approximately 200 acres. No more than approximately 70 acres would be harvested in any given year. This would be done on a rotational basis for 10 years, thus the desired term of the ITA is 10 years.*

The incidental taking of endangered and threatened species shall be authorized by the Illinois Department of Natural Resources (IDNR) only if an applicant submits a conservation plan to the IDNR Incidental Take Coordinator that meets the following criteria:

In each section, text in italics represents the applicant's response to the IDNR requirements shown verbatim in plain or bold text.

1. A description of the impact likely to result from the proposed taking of the species that would be covered by the authorization, including but not limited to -

A) Identification of the **area to be affected** by the proposed action, include a legal description and a detailed description including street address, map(s), and GIS shapefile. Include an indication of ownership or control of affected property. Attach photos of the project area.

The project site is Lake Catherine and Channel Lake located in Antioch Township, Lake County, Illinois (Sections 1, 2, 11, and 12, T46N, R9E). Both lakes are a part of the larger Fox River Chain O'Lakes system. Channel Lake is a glacial lake whose maximum depth is 36 feet and has a surface area of 371 acres. Lake Catherine is hydrologically connected to Channel Lake, though they were once separated by a gravel bar. Lake Catherine has a maximum depth of 39 feet and a surface area of 164 acres. Lake Catherine receives water directly from Trevor Creek which flows from Wisconsin and is part of the Fox River watershed. Exhibit 1 provides a map of the location of the lakes, and the contributing watershed to these two lakes. Exhibit 2 provides a bathymetric map of the lakes (bathymetry provided by others).

The shorelines are owned by a host of property owners. The Lake Catherine lake bottom encompasses 10 parcels with most owned by 6 private parties as shown on Exhibit 3. Some *parcels are shown as PIN 7777777, which is explained below. Letters of authorization for this work from each private owner are provided in Appendix A.*

The bottom of Channel Lake is identified principally as one parcel with unknown ownership with a PIN of 77-77-7777-77, which is a default number assigned to lake bottom parcels with unknown ownership (see Lake County Assessor's letter in Appendix A). Research on the issue of ownership of this lake bottom completed by Don Moles, IDNR Professional Land Surveyor, incorrectly refers to Lake Catherine, but was in fact in reference to Channel Lake since the ownership of Lake Catherine is mostly known to be private and his comments were clearly directed at the more undefined ownership of Channel Lake. His analysis is summarized below.

Both Lake Catherine and Channel Lake are a part of Pistakee Lake as far as the Federal Government Plans and is a part of what we today call the Fox Chain O'Lakes. The original survey of Township 46 North, Range 9 East was approved in December 1839. Those original surveys said that Pistakee Lake was navigable. Complaint was made to the land office that the surveys were erroneous. The lands were subsequently resurveyed, and the determination was that the lands were not navigable, but rather swamp, marsh, and overflow lands. An amended plat was registered on March 25, 1876.

According to Mr. Moles, after this it gets complicated. More complaints prompted further review by the land office which said the resurvey was correct. The government sold the land and then retracted the sales because it was determined that the land belonged to the State or its grantees. The landmark court case of Peoples vs Hatch stated that the State was vested title to all swamp lands not patented prior to the Swamp Lands Act of 1850. In 1852 the State granted those lands to the Counties. In summary, the federal government granted this lake bottom to the State in 1850 and the State granted it to the County in 1852.

Lake County records assign this parcel a default PIN in accordance with the information in their letter included in Appendix A. The Fox Waterway Agency (FWA) has authority over maintaining the lakes of the Fox Chain O'Lakes in accordance with their establishing ordinance (615 ILCS 90/), which specifically states:

> *The Agency shall implement reasonable programs and adopt necessary and reasonable ordinances and rules to improve and maintain the Chain O Lakes - Fox River recreational waterway from the Wisconsin State line to the Algonquin Dam for the purposes of boating, sailing, canoeing, swimming, water skiing, rowing, iceboating, fishing, hunting and other recreational uses, to help prevent or control flooding of the waterway, to improve recreational uses of the waterway, to prevent pollution and otherwise improve the quality of the waterway, to promote tourism, and to create and administer a procedure for establishing restricted areas.*

FWA has provided a letter of support in accordance with their authorities (see Appendix A).

The applicant believes that every known lake bottom owner has been contacted and that no objections to the proposed project have been raised (see Appendix A). One parcel on the channel in the southeast corner of Channel Lake is owned by an out-of-state party who did not respond to *attempts to reach them on this issue. This parcel (PIN 0111201023 Christoph Gnilka) will therefore not be included in any harvesting. The question of ownership of parcels with the default PIN 7777777777 cannot be resolved within the scope or timeframe of this project, though it is most likely the ownership lies with the County of Lake.*

Recent photographs of the lakes are included in Exhibit 4.

GIS shapefiles are provided in a separate zip file.

B) **Biological data** on the affected species including life history needs and habitat characteristics. Attach all biological survey reports.

The IDNR has identified the Illinois threatened blackchin shiner (Notropis heterodon), Iowa darter (Etheostoma exile), and starhead topminnow (Fundulus dispar) as occurring in Lake Catherine/Channel Lake (LC/CL). The IDNR EcoCAT response letter and recent IDNR fish survey data sheets are provided in Appendix B.

Blackchin Shiner (*Notropis heterodon*)

The blackchin shiner is about two to two and three-fourths inches in length. It is yellow-brown on the back and upper sides and silver below. There is a black band from the tail fin to the tip of the snout on each side. The tip of the lower jaw has dark pigment. The anal fin has eight rays. Teeth are present in the throat. This minnow has large eyes. The front edge of the dorsal fin is slightly in front of the front edge of the pelvic fins. It lives in glacial lakes that have many aquatic plants and in the streams that enter and leave these lakes. It swims in schools. Spawning occurs from June through August. This fish eats tiny crustaceans and immature aquatic insects. It has a life span of about two years.

Iowa Darter (Etheostoma exile)

Used with permission.

The Iowa darter averages about two and three-fourths inches in length. It is a brown or green-brown fish with eight to 10 dark marks on the back and 10 to 14 dark blotches on the side separated by red spaces. There is a dark, teardrop mark under the eye and a dark bar in front of the eye, as well as bars on the fins. The lateral line is short, extending to about the second dorsal fin. There are two spines in the anal fin. The cheeks have scales. The breeding male has a blue tint to the back, green side blotches separated by rust-red spaces, wide bands of blue and orange in the first dorsal fin and orange along the lower sides.

The Iowa darter is found in glacial lakes in northeastern Illinois, a few streams in northern Illinois and a few limestone quarries in Vermilion County, Illinois. It lives in clear lakes, sloughs and creeks that have many aquatic plants. In streams it can be found in quiet pools over a mud or clay bottom with dead material and brush. Spawning occurs in April in shallow water over roots, vegetation or debris. The immature Iowa darter eats plankton, while the adult feeds on immature insects and small crustaceans.

Starhead Topminnow (Fundulus dispar)

The starhead topminnow is a deep-bodied killifish with olive coloration on its back upper sides and yellow coloration on its flanks with small flecks of red, blue, or green. It has a prominent blur-black notch or tear drop beneath the eye. The males have 10 to 14 thin dark vertical bars on its flanks while females have numerous longitudinal bars. Its adult length is approximately 1.8-2.2 inches. They occur singly or in pairs just below the water's surface. The starhead topminnow rarely dives deeply to avoid predators. The typical habitat for the starhead topminnow is glacial lakes and clear, well-vegetated floodplain lakes, swamps, and marshes. Spawning occurs in late spring and early summer among dense beds of vegetation. Its diet includes snails, crustaceans, aquatic insects, and algae. The distribution of the starhead topminnow is sporadic in the state of Illinois, hence its threatened status. There is a historic record from Lake Catherine, and it is known to occur in the Fox River/Chain O Lakes system.

C) **Description of project activities** that will result in taking of an endangered or threatened species, including practices to be used, a timeline of proposed activities, and any permitting reviews, such as a USFWS biological opinion or USACE wetland review. Please consider all potential impacts such as noise, vibration, light, predator/prey alterations, habitat alterations, increased traffic, etc.

The project is the management and control of invasive aquatic plans in LC/CL. Specifically, a 2017 Management Plan (see Appendix D) prepared by ILM (ILM is the name of a consulting firm, not an acronym, please see www.ilmenvironments.com) indicates a need to control growth of Eurasian water milfoil (Myriophyllum spicatum)(EWM). A 2014 Lake County Health Department (LCHD) assessment of Channel Lake found the aquatic vegetation was dominated by EWM, coontail (Ceratophyllum demersum), white water lily (Nymphaea tuberosa), and star duckweed (Lemna trisulca). Lake Catherine was also assessed by LCHD in 2014 and had a similar composition.

The LCHD recommended development of a more comprehensive aquatic vegetation management plan for both lakes. The IDNR (Frank Jakubicek) has also indicated support for a program to reduce the occurrence and growth of EWM in these lakes. In the past, chemical control efforts were on an ad hoc basis by individual shoreline owners using contact herbicides covering an unknown portion of the shoreline area. This scattered approach by different parties makes it more difficult to maintain the needed concentrations and contact time required for control of the target species. The herbicide can dissipate to adjacent untreated shoreline areas leaving low concentration areas with less effectiveness.

It is the desire of this project to target control efforts to EWM and coontail and allow establishment of more desirable native species while reducing conflicts with lake usage. The current proposal is to augment limited chemical control by others with targeted mechanical vegetation harvesting by FCCL.

EWM and coontail have similar characteristics and are the most problematic for lake usage and water quality in these lakes. While EWM can spread by fragmentation, coontail is not known to. ILM has noted that in many areas the EWM growth is dense enough that it is beyond being affected by fragments. In high boat traffic or swimming areas, harvesting can have a more immediate effect. Targeted harvesting will allow a more immediate effect in areas of heavy growth by these two species, while avoiding areas with desirable native vegetation. In addition, mechanical harvesting has the advantage of removing the biomass from the lake system which in turn reduces the nutrients released back into the lakes as would happen with chemical control through natural decomposition of the dead plant material.

Current practices for controlling vegetation in nearshore areas have included only early season herbiciding. Since there are "blackout dates" for herbiciding due to the presence of listed fishes, the practice by others has been to apply chemicals in late April near private piers. However, this practice is conducted early in the growing season while the vegetation has just begun to grow. Anecdotally, it is understood that the herbiciding contractors use the highest legal concentrations of active ingredients to control the submergent vegetation. This practice then tends to cause "drift" to adjacent areas of vegetation and causes complete die-off of any extant vegetation. This ITA is intended to give another technique for vegetation management that does not require chemicals, is not restricted by the "black-out" time periods and can be more targeted to avoid desirable native plant species. See Exhibit 5 for proposed harvesting areas and black-out time periods for herbicide application.

The general areas for proposed harvesting are shown on Exhibit 5. The general target area is a management corridor from a water depth of 3 feet and just beyond all residential piers out to a water depth of 12 feet. This area encompasses approximately 200± acres. However, it is intended that no more than 70 acres of the aquatic vegetation in any given year would be mechanically cleared. This harvesting would be focused on areas of EWM and coontail and leave considerable area as refugia for the listed fish species. The harvesting would be timed later in the season to achieve maximum effectiveness in reducing cover by these undesirable plants during the lake usage season, since this would not be under the same timing restrictions as herbicide application. It is also noted that these two targeted species tend to have tall and dense enough growth to inhibit other desirable aquatic plant species.

Each year the area to be harvested would be prioritized using observations of the densest growth of coontail and EWM and plotting them on a map, along with areas receiving the most complaints about plant growth. It is estimated that approximately 5-6 acres per day could be mechanically harvested by the contractor depending on conditions and the distance to off-loading areas. All material will be hauled offsite for disposal to reduce nutrient inputs into the lakes. FCCL will maintain a database on *the amount of material (by weight) hauled off each season, and the areas covered by the harvester.*

Each year the area identified by FCCL as the priority will be harvested by a contractor under FCCL's supervision, or by FCCL directly. The FCCL or the contractor will be given an aerial-based map showing the target areas and will be required to track their progress using GPS (global positioning systems). The harvested material will be offloaded at the end of each work day and placed into trucks once it has sufficiently dewatered. The harvester will be put in to the lakes and taken out at any number of boat launches located nearest the targeted harvesting areas. The machine will be taken out of the water and stored between work days. Harvested plant material will be disposed of offsite on upland farm fields with owner permission or at a composting facility such as Thelen Materials in Antioch, Illinois.

Limited chemical control of aquatic vegetation will occur along shoreline areas as carried out by individual shoreline owners not FCCL. FCCL will ensure that chemicals are not applied to areas scheduled for harvesting. Chemical application requires a permit from the IDNR and this permit process will be used to control any legal applications of herbicide such that they are complimentary to this harvesting program. No herbicide application will occur from May 1 through July 31 of each year. Any unpermitted herbicide application will be reported to the IDNR and addressed by the IDNR under their normal enforcement procedures.

D) Explanation of the anticipated **adverse effects on listed species**; how will the applicant's proposed actions impact each of the species' life cycle stages.

Blackchin shiners generally inhabit clear, shallow sections of lakes, while Iowa darters may use shallows and go deeper where there's adequate vegetation. Starhead topminnows swim at the surface, eating insects, snails, small crustaceans and algae. Mechanical harvesting of aquatic vegetation has the potential to "take" mature, juvenile, and fry/eggs of each of the 3 state-threatened species of fish in these lakes as these species tend to dwell in vegetation at/or near the surface, with the possible exception of the Iowa darters which tend to go deeper.

Since these species have not been detected in recent years, other than one starhead topminnow, they are likely present in very low numbers if at all within these two lakes. Therefore, by selectively focusing on areas of dense undesirable vegetation (EWM and coontail) in areas of boat piers and traffic, while leaving a large area of refugia each year, we would anticipate low potential for take of up to 2 individuals of each species per year in their immature or adult form, should they be foraging in these densely vegetated areas during harvesting activities. The remaining vegetated portions of the lakes would serve as refugia for the fish.

2) Measures the applicant will take to minimize and mitigate that impact and the funding that will be available to undertake those measures, including, but not limited to -

A) Plans to **minimize the area affected** by the proposed action, the estimated **number of individuals** of each endangered or threatened species that will be taken, and the **amount of habitat** affected (please provide an estimate of area by habitat type for each species).

The significant stands of submerged vegetation make lake use very difficult without some control of the density of plants. In addition, the dense beds of EWM, a non-native invasive species along with the aggressive coontail reduce the area with desirable native aquatic plants and may reduce suitable habitat for these aquatic vegetation dwelling fish species. Therefore controls, both by mechanical and chemical means (done by others in the past), are desired. Lengthy shorelines on both lakes contain dense stands of plants until water depth suppresses the plant growth. The water clarity is fairly good on the lakes which contributes to the growth of the vegetation.

The mechanical harvesting each year will prioritize areas that provide relatively clear lanes for navigation from the private piers, and areas with dense EWM and coontail, and not wholesale clearing of all vegetation in the near pier and shallow near-shore areas. Each year the area to be harvested will be determined by examination of vegetation density and composition in near shore areas.

No more than approximately 70 acres will be harvested each year on a rotating basis. We estimate a low potential for take of not more than 2 individuals of each of the 3 species in their immature or adult form.

B) **Plans for management of the area** affected by the proposed action that will enable continued use of the area by endangered or threatened species by maintaining/re-establishing suitable habitat (for example, native species planting, invasive species control, use of other best management practices, restored hydrology, etc.).

This project to reduce and control EWM and coontail is intended to reduce vegetative coverage by these aggressive species and allow for an increase in native vegetation and maintain clear boating lanes. The LCHD assessments of each lake indicated the following desireable species are present and could benefit from the reduction in EWM and coontail cover: white water lily (Nyphaea odorata), common duckweed (Lemna minor), star duckweed (L. trisulca), giant duckweed (Spirodela polyrhiza), water meal (Wolffia columbiana), flat-stemmed pondweed (Potamogeton zosteriformis), sago pondweed (Stuckenia pectinata), common bladderwort (Utricularia vulgaris), eel grass (Vallisneria americana), slender naiad (Najas flexilis), and water stargrass (Heteranthera dubia). While the 3 threatened fish species will be less likely to use the floating leaved plants such as the duckweeds, the other species will provide submergent growth that these fish can utilize. Floating leaved plants (water lilies) can provide cover and predator protection, and may reduce the opportunity for EWM growth.

In turn, this will improve the overall habitat for these 3 threatened fish species, and potentially improve water quality through the use of less chemical herbicides. In addition, by mechanical harvesting to remove the biomass, this will reduce the nutrient input into the lakes that fuels further growth by invasive species (EWM) and algae.

A selected area approximately 6.5 acres in size, as shown on Exhibit 5, will be enhanced with native aquatic vegetation plantings after appropriate control and reduction of the EWM growth. This area will be cordoned off to protect the young plantings, though it is typically too shallow for power boat access. The species proposed for planting are listed in Table 1 below.

Table 1. Planting List for Mitigation Area on Channel Lake.

Species	**common name**	**Unit**		**Quantity for 5 acres**	**Cost**
Nelumbo lutea	lotus	seed	$20/oz	8 oz	$160.00
Nymphaea odorata	fragrant water lily	bareroot	$1.50/ea	350	$525.00
Nuphar advena	yellow water lily	bareroot	$6.25/ea	300	$1,875.00
Potamogeton natans	common pondweed	bareroot	$2/ea	350	$700.00
Potamogeton nodosus	long-leaved pondweed	bareroot	$2/ea	300	$600.00
Stuckenia pectinata	sago pondweed	bareroot	$2/ea	350	$700.00
Vallisneria americana	eel grass	bareroot	$2/ea	350	$700.00
				2000	**$5,260.00**

Education and outreach efforts by the FCCL will inform shoreline landowners of the program and reduce the ad-hoc application of chemical controls. An emphasis will be placed on improving the water and habitat quality in the lakes, while allowing other recreational uses. It is estimated that FCCL will allocate $3000 for this education/outreach program. Specifically, the education and outreach program by FCCL will include:

- *Using the **Clean Boats Clean Waters** or **Transport Zero** programs to educate boat owners and users on the spread of invasive species and how they can help.*
- *Educating shoreline owners about the restrictions on herbicide use (May 1 – July 31 blackout) to protect the fish species.*
- *Educating shoreline owners and lake users about ”good” aquatic vegetation versus invasive species.*
- *Educating shoreline and watershed owners about septic system maintenance and design considerations to reduce nutrient inputs into the lakes.*
- *Educating shoreline owners and lake users about this Conservation Plan and the measures FCCL is taking to provide benefit to these listed fish species.*
- *Promoting appropriate and judicious use of aquatic herbicides by shoreline owners that compliments the harvesting program. This will include education on dosing, timing and other aspects of most effective herbicide application, as well as, potential impacts from herbicide usage (e.g. drift to other desireable plants). Chemical application should be outside of the protective ”black-out” period, when plants are actively growing, and not in areas where the harvester will be operating.*
- *Promoting measures shoreland owners can take to help improve water quality and reduce shoreline erosion with their own lawn care and shoreline treatments.*

- *Training volunteers to gather aquatic plant cover data to inform the adaptive management and harvesting program.*

Examples of related outreach materials that will be used by FCCL as design templates and inspiration are provided in Appendix C.

C) Description of **all measures to be implemented to avoid, minimize, and mitigate** the effects of the proposed action on endangered or threatened species.

- Avoidance measures include working outside the species' habitat.
- Minimization measures include timing work when species are less sensitive or reducing the project footprint.
- Mitigation is additional beneficial actions that will be taken for the species such as needed research, conservation easements, propagation, habitat work, or recovery planning.
- It is the applicant's responsibility to propose mitigation measures. IDNR expects applicants to provide species conservation benefits 5.5 times larger than their adverse impact.

The following measures will be implemented to avoid, minimize and mitigate any potential effects on the threatened blackchin shiner, Iowa darter, and starhead topminnow.

- *Harvesting will specifically target areas with dense EWM or coontail growth, invasive species that typically support less fish and invertebrate numbers compared to native species.*
- *An area near the inlet channel at the northwestern end of Channel Lake will be planted with floating leaved vegetation and native submergent plants after EWM growth is controlled/reduced. This area would be outside of normal recreational uses and provide additional in-lake habitat.*
- *The removal of the harvested biomass will serve to reduce nutrient inputs to the lake from decomposing vegetation that occurs when only chemical control is used.*
- *FCCL will conduct an education/outreach program on invasive species and best practices at all boat launches on the two lakes. This program will be modeled after the IL-IN SeaGrant and other states' Clean Boats Clean Waters or Be a Hero Transport Zero programs.*
- *FCCL will also conduct education/outreach programs on chemical use on their lawns and in the lake, and on septic systems and their influence on the health of the lake.*

D) Plans for **monitoring** the effects of the proposed actions on endangered or threatened species, such as species and habitat monitoring before and after construction, include a plan for follow-up reporting to IDNR.

Pre-project data on LC/CL is provided in the form of the most recent IDNR fish surveys (Appendix A), the 2014 LCHD reports for both lakes, and the ILM management plan (Appendix D). Post-project monitoring of the listed fish species will be via the biennial fish surveys by the IDNR and augmented by FCCL working in cooperation with IDNR to seine in shallow areas typically used by these species. The effectiveness of the aquatic plant management will be assessed by conducting an in-lake vegetation survey every three (3) years by trained volunteers or a qualified lake mangement firm and comparing vegetative cover and composition with previous years. FCCL will also monitor shoreline landowner compliance with the overall program, and the amount of complaints received concerning aquatic plant growth. A report summarizing the results of any fish surveys, aquatic vegetation surveys, and the harvesting and herbiciding activity for each year will be prepared by FCCL and submitted to IDNR.

E) **Adaptive management practices** that will be used to deal with changed or unforeseen circumstances that effect on endangered or threatened species. Consider environmental variables such as flooding, drought, and species dynamics as well as other catastrophes. Management practices should include contingencies and specific triggers. Note: Not foreseeing any changes does not quality as an adaptive management plan.

Adaptive management is essentially responding to monitoring data and changing conditions with appropriate changes in management. If field conditions are such that mechanical harvesting is not safely possible or effective (such as high-water levels), operations will be suspended until suitable conditions return. If early harvesting shows that it is ineffective or makes EWM growth worse due to fragments becoming established, harvesting will be modified or suspended.

The effectiveness of this project will be determined in part by the FCCL being able to coordinate all aquatic vegetation control efforts across both lakes. The harvesting approach may need to be adapted as these challenges are addressed. IDNR fish data and FCCL vegetation monitoring data will also be used to inform future management and measure the efficacy of the program. Combinations of chemical control and mechanical harvesting are likely to be used to adapt the management regime to changing conditions. Any changes will be coordinated with the Fox Waterway Agency and the IDNR.

F) Verification that **adequate funding** exists to support and implement all mitigation activities described in the conservation plan. This may be in the form of bonds, certificates of insurance, escrow accounts or other financial instruments adequate to carry out all aspects of the conservation plan.

The funding for the mitigation and lake management work will be provided by FCCL through their annual budget which is largely funded by donations. As with many public agencies, a non-profit like FCCL cannot predict its annual budget beyond the current year, however, the FCCL Board and members are committed to the implementation of this Conservation Plan and the other elements of their lake management program as embodied by their mission and goal statements below.

> *The mission of FCCL is "to maintain the sanctity of Lake Catherine and Channel Lakes, to continuously improve and maintain the lakes' ecosystem, and to establish and implement value-enriched programs to enhance the overall quality of lake life."*
>
> *"Their goal is to return Lake Catherine and Channel Lake to pristine condition by eradicating invasive plant species, reducing pollution and increasing awareness about how to care for the lakes. We are doing this through the implementation of a detailed Lake Management Plan."*

3) A description of alternative actions the applicant considered that would reduce take, and the reasons that each of those alternatives was not selected. A "no-action" alternative" shall be included in this description of alternatives. Please, describe the economic, social, and ecological tradeoffs of each action.

The no-action alternative would leave the existing dense EWM and other aquatic vegetative growth. This would reduce the quality of fish habitat due to the dense growth of the non-native EWM and continue ongoing conflicts with lake users (boating, swimming, etc.). This would not make any progress toward the goals of improving lake conditions for users, improving fish habitat, and improving water quality and the overall health of the lakes.

Chemical control is an alternative method of EWM and aquatic vegetation control. It has been used in an ad hoc manner by others for the past several years with limited success. The time restrictions when chemicals can be applied in waters with these listed species limits the effectiveness of the applications. However, the use of the chemicals may also cause take of these listed species, though it would be minimal.

4) Data and information to indicate that the proposed taking will not reduce the likelihood of the survival of the endangered or threatened species in the wild within the State of Illinois, the biotic community of which the species is a part, or the habitat essential to the species existence in Illinois.

These species are known from several glacial lakes in northeastern Illinois. The IDNR collected a starhead topminnow a couple years ago (probably 2016 or 2017) while seining at the mouth of Trevor Creek but have not detected a blackchin shiner in either lake for probably 10 years (pers. comm. Jakubicek 2019). Also, from Jakubicek, blackchin shiners are likely present but not common, Starhead topminnows are probably more common than we know of.

Iowa darters seem to be more ubiquitous than thought 20 years ago. Iowa darters are present in the Chain and are occasionally collected when dip-netting in the right habitat. But in the Chain, the nearshore habitat is usually too shallow to drive IDNR boats for electroshocking (or there are too many piers) so the IDNR surveys tend to miss them. It should be noted that the Iowa darter is likely to be delisted in Illinois before the 2020 harvesting season.

The starhead topminnow may be found in the Mississippi, Illinois and Wabash Rivers and in the northern one-fourth of Illinois. So, while it is listed as threatened, it is fairly widespread. Whereas the Iowa darter is thought to be largely restricted to glacial lakes and small streams in northeastern Illinois, blackchin shiners are known only from glacial lakes in Lake County within Illinois.

Blackchin shiners generally inhabit clear, shallow sections of lakes, while Iowa darters may use shallows and go deeper where there's adequate vegetation. Starhead topminnows swim at the surface, eating insects, snails, small crustaceans and algae.

Since these species have not been detected recently, other than one starhead topminnow, they are likely present in very low numbers if at all within these two lakes. Any fish present in LC/CL would be connected to a larger population in other portions of the Chain. Moreover, this project is intended to improve the habitat for these species by reducing the aggressive growth of EWM and coontail, a recommendation by IDNR (Jakubicek).

Therefore, we would not anticipate that this project would reduce the likelihood of the survival of these species in the wild within Illinois.

5) An implementing agreement, which shall include, but not be limited to (on a separate piece of paper containing signatures):

A) The names and signatures of all participants in the execution of the conservation plan;

B) The obligations and responsibilities of each of the identified participants with schedules and deadlines for completion of activities included in the conservation plan and a schedule for preparation of progress reports to be provided to the IDNR;

C) Certification that each participant in the execution of the conservation plan has the legal authority to carry out their respective obligations and responsibilities under the conservation plan;

D) Assurance of compliance with all other federal, State and local regulations pertinent to the proposed action and to execution of the conservation plan;

E) **Copies of any final federal authorizations for a taking already issued to the applicant**, if any.

See attached Implementing Agreement.

PLEASE SUBMIT TO: Incidental Take Authorization Coordinator, Illinois Department of Natural Resources, Division of Natural Heritage, One Natural Resources Way, Springfield, IL, 62702 OR DNR.ITAcoordinator@illinois.gov

References

Illinois Department of Natural Resources. 2019. Species fact sheets from web site https://www.dnr.illinois.gov/education/Pages/ accessed January and February 2019.

ILM. 2017. Lake Catherine/Channel Lake Lake Management Plan. Prepared for Friends of Lake Catherine and Channel Lakes. 31pp.

ILM. May 2014. Conservation Plan for Bang’s Lake, Wauconda, IL.

Lake County Health Department, Ecological Services. 2014. 2014 Summary Report Lake Catherine. 21pp + tables and figures.

Lake County Health Department, Ecological Services. 2014. 2014 Summary Report Channel Lake. 24pp + tables and figures.

Smith, P.W. 2002. The Fishes of Illinois. University of Illinois Press.

Implementation Agreement

Mechanical Harvesting of Aquatic Vegetation, Lake Catherine and Channel Lake

Lake County, Illinois.

A) The <u>names and signatures</u> of all participants in the execution of the conservation plan;

Robert Mazzeffi, Secretary
Amy Littleton, President
Friends of Catherine and Channel Lakes

B) The <u>obligations and responsibilities</u> of each of the identified participants with schedules and deadlines for completion of activities included in the conservation plan and <u>a schedule for preparation of progress reports</u> to be provided to the IDNR;

Ongoing Starting in 2019 – Coordination by FCCL leadership with Fox Waterway Agency, IDNR, and lake bottom and shoreline owners as appropriate.

April & September Each Year Beginning in 2020 – Chemical treatment of invasive/aggressive plants in native planting/mitigation area carried out by a properly licensed and permitted contractor or volunteer working for private shore owners (not FCCL).

May-September Each Year Beginning in 2020, – Mechanical harvesting in selected areas totaling not more than 70 acres. Anticipated rate is 5-6 acres of harvesting per day depending on conditions and distance to off-loading area carried out by a contractor retained and supervised by FCCL. Contractor will dispose of all harvested plant biomass at an approved offsite location.

September 2019-April 2020 – Design of education and outreach program about invasive aquatic plants, appropriate control measures, impacts of lawn chemicals and fertilizers on the lakes, and proper use of aquatic herbicides.

Throughout Ten Year Period of Permit (2020-2030) – Implementation of education and outreach program at all boat launches on both lakes aimed at best practices for reducing invasive species transport by boats, bait buckets, etc.

October-December Each Year Beginning in 2020 – Develop report on activities completed and recommended actions for following year.

C) **Certification that each participant in the execution of the conservation plan has the legal authority to carry out their respective obligations and responsibilities under the conservation plan;**

See certification clause below.

D) Assurance of compliance with all other federal, State and local regulations pertinent to the proposed action and to execution of the conservation plan;

See certification clause below.

E) Copies of any final federal authorizations for a taking already issued to the applicant, if any.

No federal permits for Take have been requested or issued.

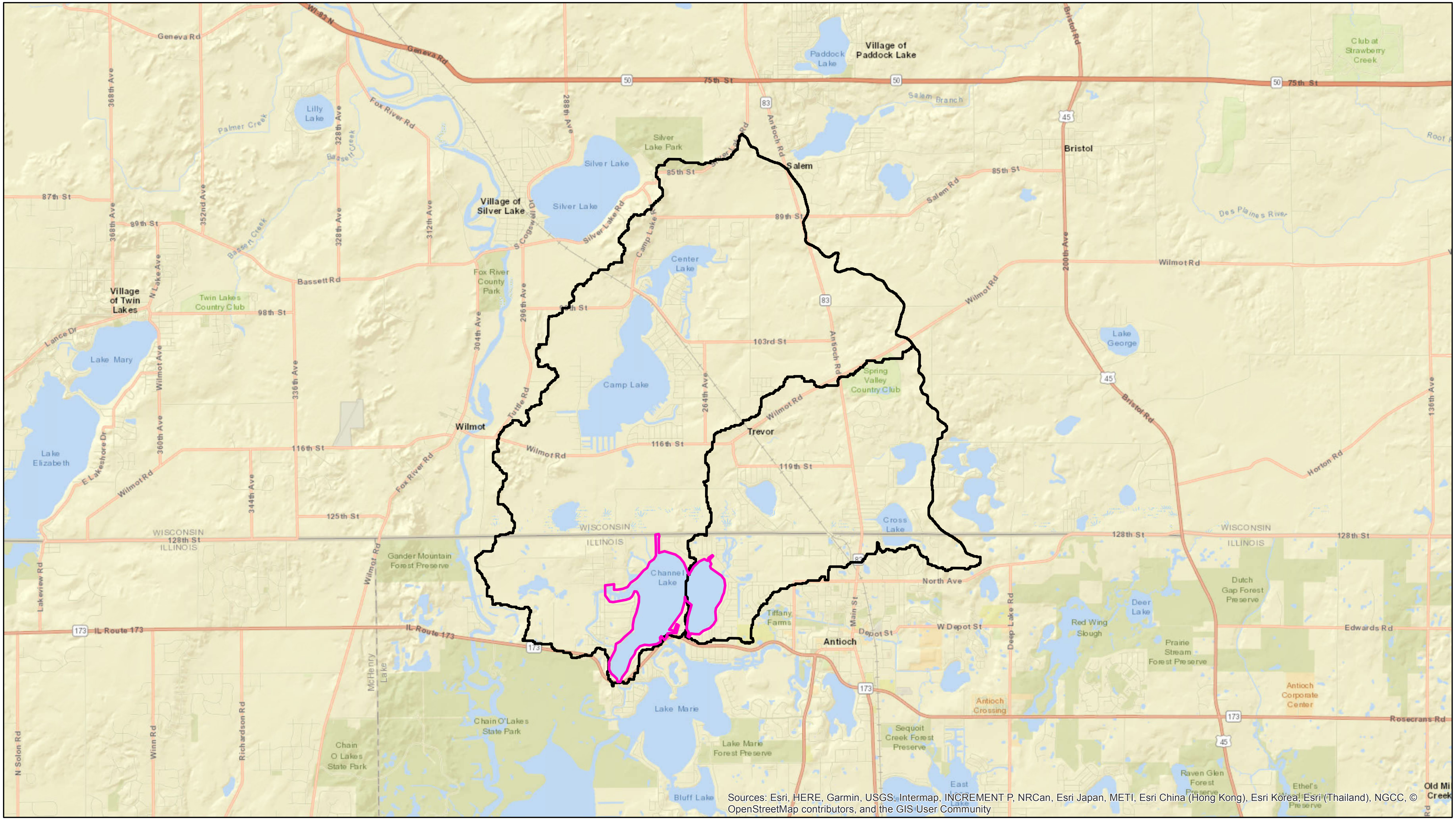
CERTIFICATION: The Friends of Catherine and Channel Lakes hereby certifies that it has the authority and funding to complete the project and to address the issues proposed in this Incidental Take Conservation Plan for the state-listed blackchin shiner, Iowa darter, and starhead topminnow. The Friends of Catherine and Channel Lakes is in charge of the project and will assure that all applicable state, federal, and local laws will be adhered to during the completion of the project.

Amy Li DATE: 9/11/2019

Amy Littleton
president
Friends of Catherine & Channel lakes

Amy Li 11/4/2019

Amy Littleton
president
Friends of Catherine & Channel Lakes



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Scale:

0 1 Miles

Project Number: 18-0315

Orientation:

Date: 2/28/2019

Legend:

- ☐ Subwatershed Boundaries
- ☐ Project Boundary

Project Name:

Lake Catherine and Channel Lake

Prepared For:

Friends of Lake Catherine & Channel Lake

Location Information:

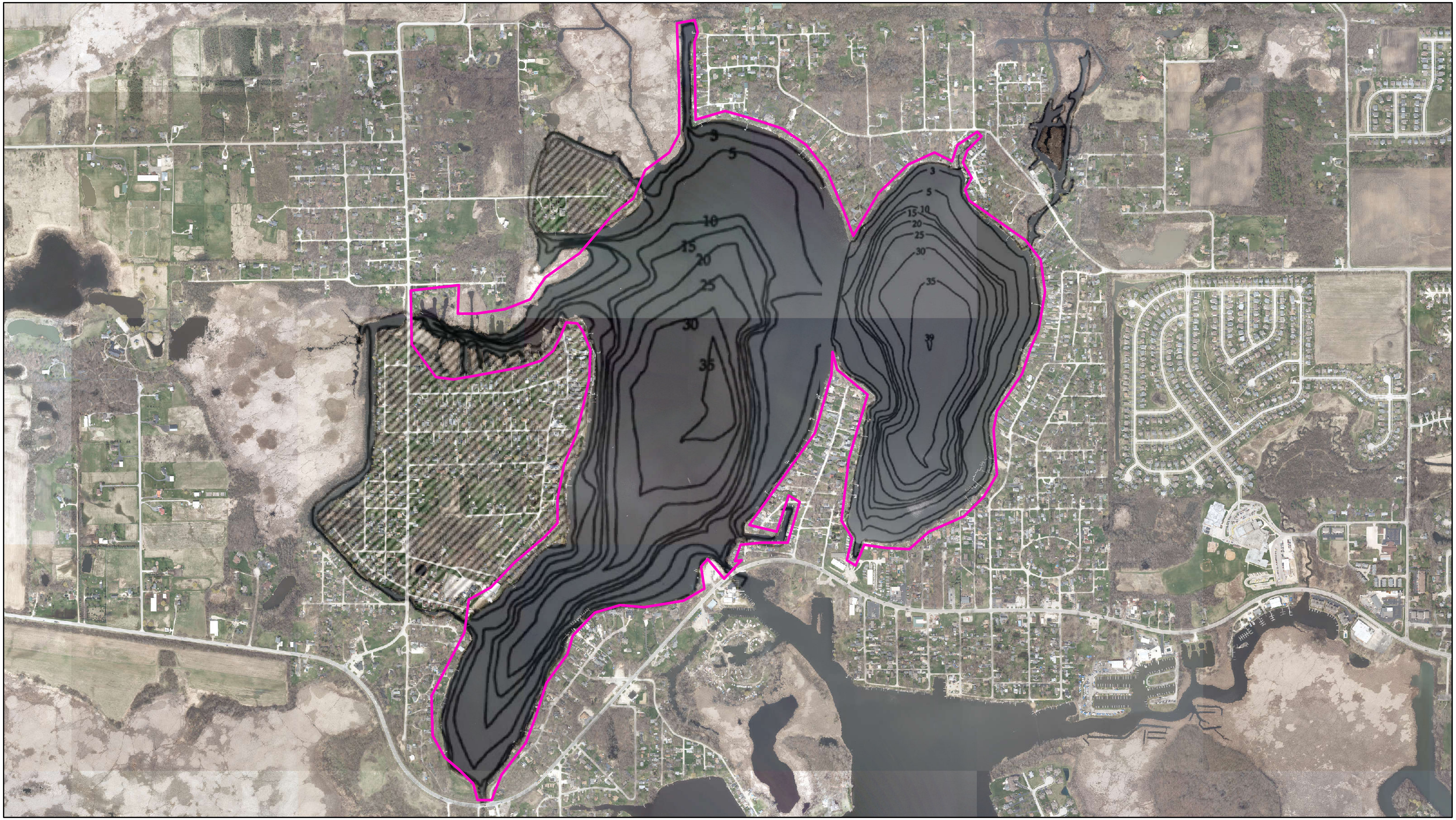
T.46N.-R.9E., Sections 1, 2, 11 & 12

Exhibit Title:

Project Loacation and Watershed Map

Exhibit:

1



Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Scale:

0 1,000 Feet

Project Number: 18-0315

Orientation:

Date: 2/28/2019

Legend:

▭ Project Boundary

Project Name:

Lake Catherine and Channel Lake

Prepared For:

Friends of Lake Catherine & Channel Lake

Exhibit Information:

LCHD 1989 geo-referenced bathymetric contours

Exhibit Title:

Bathymetric Map

Exhibit:

2

Prepared by:

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Scale:

0 1,000 Feet

Project Number: 18-0315

Orientation:

Date: 7/31/2019

Legend:

▭ Lake Bottom Parcels

Project Name:

Lake Catherine and Channel Lake

Aerial Date:

2017

Prepared For:

Friends of Catherine and Channel Lakes

Exhibit Title:

Lake Ownership

Exhibit:

3

Photograph 1:

Channel Lake, southwestern shore March 2019.

Photograph 2:

Lake Catherine showing aquatic plant growth March 2019.

Project Number: 18-0315

Project Name:

Lake Catherine & Channel Lake

Hey and Associates, Inc.

Engineering, Ecology and Landscape Architecture

Exhibit Title:

Representative Photographs

(All Photos Provided by FCCL)

Exhibit:

4

Photograph 3:

South side of Lake Catherine March 2019.

Photograph 4:

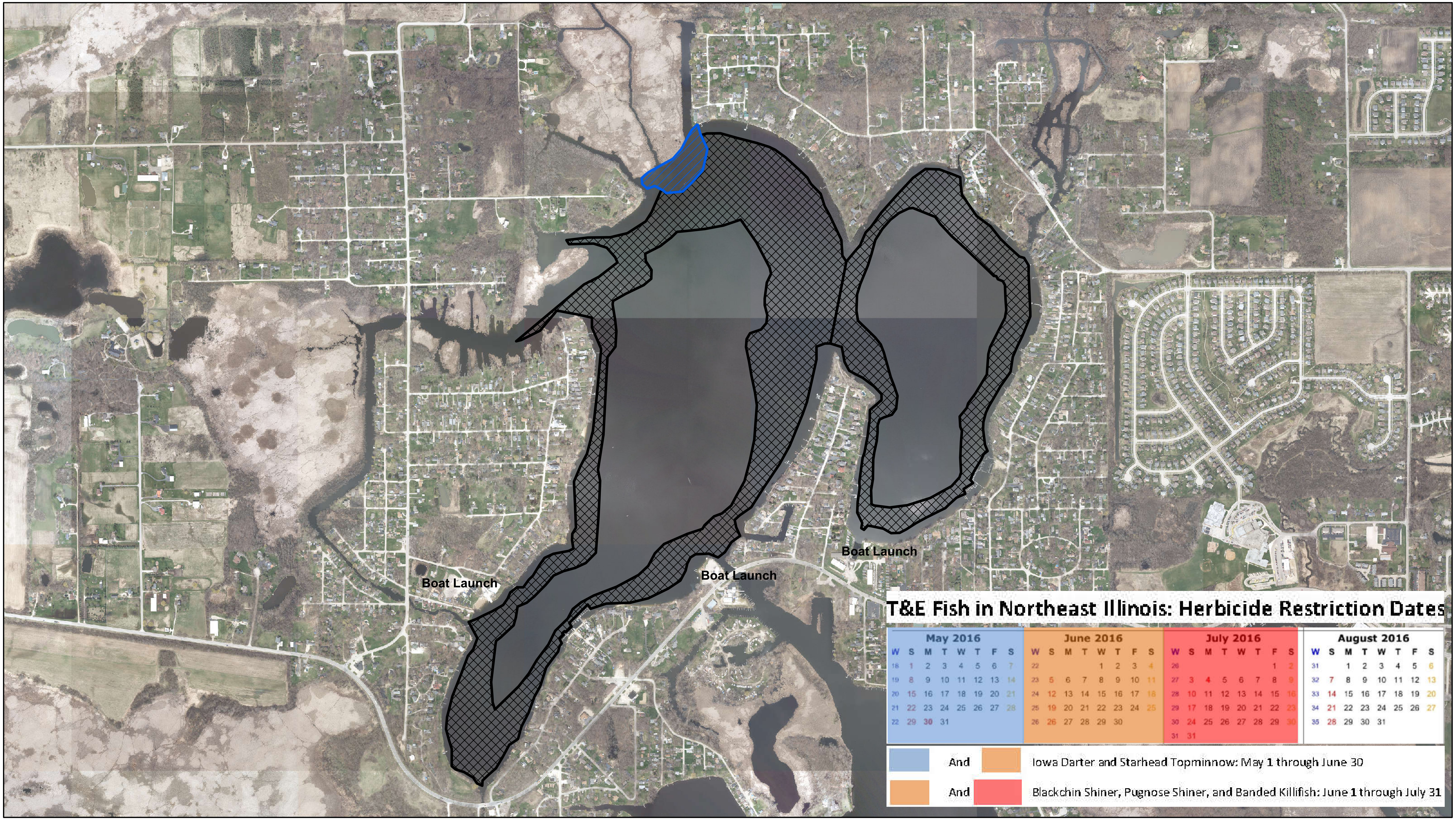
Increased aquatic vegetation growth on Lake Catherine July 2019.

Photograph 5:

Increased aquatic vegetation growth by July 2019.

Photograph 6:

Increased aquatic vegetation growth by July 2019.



T&E Fish in Northeast Illinois: Herbicide Restriction Dates

May 2016

W	S	M	T	W	T	F	S
18	1	2	3	4	5	6	7
19	8	9	10	11	12	13	14
20	15	16	17	18	19	20	21
21	22	23	24	25	26	27	28
22	29	30	31				

June 2016

W	S	M	T	W	T	F	S
22				1	2	3	4
23	5	6	7	8	9	10	11
24	12	13	14	15	16	17	18
25	19	20	21	22	23	24	25
26	26	27	28	29	30		

July 2016

W	S	M	T	W	T	F	S
26						1	2
27	3	4	5	6	7	8	9
28	10	11	12	13	14	15	16
29	17	18	19	20	21	22	23
30	24	25	26	27	28	29	30
31	31						

August 2016

W	S	M	T	W	T	F	S
31		1	2	3	4	5	6
32	7	8	9	10	11	12	13
33	14	15	16	17	18	19	20
34	21	22	23	24	25	26	27
35	28	29	30	31			

🟦	And	🟧	Iowa Darter and Starhead Topminnow: May 1 through June 30
🟧	And	🟥	Blackchin Shiner, Pugnose Shiner, and Banded Killifish: June 1 through July 31

Prepared by:

Hey and Associates, Inc.
Engineering, Ecology and Landscape Architecture

Scale:
0 1,000
Feet
Project Number: 18-0315

Orientation:

Date: 9/6/2019

Legend:
▭ Native Planting Zone
▨ Harvest_Zone

Project Name:
Lake Catherine and Channel Lake

Aerial Date:
2017

Prepared For:
Friends of Catherine and Channel Lakes

Exhibit Title:
Harvesting Zone Map

Exhibit:
5

APPENDIX A

Lake Bottom Ownership Documents

CATHERINE CHANNEL

RIPARIAN OWNER – REQUEST FOR YOUR CONSENT

Date: 6/25/2019

Dear Riparian Property Owner:

The Friends of Lake Catherine and Channel Lakes ("FOCCL") has identified you through publically available records as a riparian owner of a portion of the lake-bottom within waters of Lake Catherine in Lake County, Illinois. We are writing you to request your permission to conduct harvesting and removal of nuisance aquatic plants within the waters on or above said riparian land.

The FOCCL is a 503(c) charity formed by a group of residents of Lake Catherine and Channel Lake. FOCCL's mission is to maintain and improve the water quality of the lakes. In furtherance of these goals, the FOCCL commissioned ILM Environments (ILM), an environmental consulting firm based in Waukegan, IL, to prepare a Lake Management Plan (LMP). The LMP is meant to guide and coordinate efforts on the lakes to achieve a common goal around improved water quality and aesthetics. A copy of the LMP can be found on our website at https://catherineandchannellakes.org/ and can be provided to you upon request. Two key aesthetic issues addressed within the LMP are the control the abundant growth of nuisance aquatic plants and an overall reduction in excessive nutrient levels. The predominant species of nuisance plants in Lake Catherine and Channel Lake include Eurasian Watermilfoil and Coontail.

For background, both Channel Lake and Lake Catherine were identified by the Illinois Environmental Protection Agency (IL EPA) as waters within the State of Illinois that fail to meet water quality standards for its designated ("aesthetic") use category. Specifically, the concentration of Total Phosphorous within these lakes exceeds the applicable water quality standard for a recreational water body[2]. The presence of abundant Phosphorous, a common nutrient and source of food for plant life, leads to the proliferation of aquatic plants which impair many lake activities such as boating and swimming. Additionally, the overabundance of nutrients and resultant densely populated aquatic plants can lead to reduced oxygen levels available to fish and other living organisms thereby upsetting the overall fish population, in particular species that are larger and more desired by recreational fisherman.

As a short-to-intermediate range measure to reduce the present of nuisance aquatic plants, the LMP recommends "targeted" aquatic plant harvesting. Harvesting is the removal of the non-desirable weeds and plants from the lake, typically using machinery or equipment. Removal of these plants from the lake not only provides quick relief from the presence of nuisance plants, it also acts to reduce overall nutrient levels within the lakes by removing both the plant and the nutrients contained therein from the waterbody. This helps lower nutrient concentrations within the lake over time which is considered desirable. As such, harvesting is highly preferred over other methods of nuisance aquatic plant control such as the use of aquatic herbicides which kill the plants but cause the dead plant fibers to sink to the lake bottom where they decay and recycle the nutrients back into the water ecosystem.

In order to conduct harvesting, the FOCCL has applied for a permit from the Illinois Department of Natural Resources (IL DNR). As part of that application process, FOCCL hired Hey & Associates, Inc., a professional environmental engineering firm based in Volo, Illinois, to assist with the permit process. This process includes working with the IL DNR to ensure that the proposed harvesting won't unduly impact any endangered or threatened species within the lakes. A copy of the harvesting application documents, including an Incidental Take Authorization (ITA) and associated Conservation Plan can be made available to you upon request.

One of the key provisions of the proposed harvesting plan is to limit the total area of the lakes that can be harvested in any one calendar year to a certain percentage of the combined lake area. This helps ensure that sufficient habitat is available for any fish or wildlife, including any endangered or threaten species present within the lakes, even after harvesting takes place. Through a search of available public records, you have been identified as an owner of a portion of the lake bottom where mechanical harvesting could take place. As such, the FOCCL is writing to request your permission to conduct harvesting within the waters above the lake bottom to which you are designated below as the owner.

RIPARIAN ZONE / LAKE-BOTTOM DESIGNATION:

Parcel # ~~**0112200004**~~ located within Lake Catherine, part of the Upper Fox Upper Fox River/Chain O' Lakes Watershed, in Antioch Township, Lake County, Illinois, which is also designated on the attached map (hereinafter referred to as the "designated riparian waters" and/or "waters above said designated lake-bottom").

President Felters Association

I, Richard Doty **(print name of lake-bottom owner) hereby represent and certify that I am the legal owner of the riparian land / lake-bottom designated above. Furthermore, as the rightful owner, I hereby authorize the FOCCL to conduct periodic harvesting and removal of aquatic weeds within the designated riparian zone and waters above the designated lake-bottom for the duration of my ownership of property. This authorization shall continue in full force and effect until such time as it is revoked in a written request made by me to the FOCCL to cease such harvesting on said designated riparian zone and said writing is duly delivered to the FOCCL at the address stated below, or until I transfer my ownership in said property to another party. Nothing in this letter shall be construed so as to create any other legal right or interest for FOCCL in the riparian land / lake-bottom designated above.**

PIN #
0112200017

The permission to harvest mechanically on or within the designated riparian zone is effective as of the date shown immediately below.

Riparian Landowner's Signature: ____________ Date: 6-26-2019

Print Name: Richard Doty
Current Primary Address: 42523 N Addison Ln Antioch IL 60002
Cell Phone: ____________
Home Phone: 847-838-6737
Email: rdoty@wakitowood.com

If you have any questions either before or after granting permission to the FOCCL to conduct the harvesting activities outlined herein, please feel free to contact Amy Littleton, President of the FOCCL, using the information below.

Sincerely,

Amy Littleton, President of FOCCL
Address: 3216 N Hoyne Ave Chicago IL 60618
Tel.: 773-569-0469
Email: amylitt@msn.com

FOCCL Board Members:
John Vrchota – johneyv@aol.com
Robert Mazzeffi – antiochbuzz@att.net
Adrien Robinson – ARobinson@navg.com

CATHERINE
CHANNEL
LAKES

RIPARIAN OWNER – REQUEST FOR YOUR CONSENT

Date: 6/25/2019

Dear Riparian Property Owner:

The Friends of Lake Catherine and Channel Lakes ("FOCCL") has identified you through publically available records as a riparian owner of a portion of the lake-bottom within waters of Lake Catherine in Lake County, Illinois. We are writing you to request your permission to conduct harvesting and removal of nuisance aquatic plants within the waters on or above said riparian land.

The FOCCL is a 503(c) charity formed by a group of residents of Lake Catherine and Channel Lake. FOCCL's mission is to maintain and improve the water quality of the lakes. In furtherance of these goals, the FOCCL commissioned ILM Environments (ILM), an environmental consulting firm based in Waukegan, IL, to prepare a Lake Management Plan (LMP). The LMP is meant to guide and coordinate efforts on the lakes to achieve a common goal around improved water quality and aesthetics. A copy of the LMP can be found on our website at https://catherineandchannellakes.org/ and can be provided to you upon request. Two key aesthetic issues addressed within the LMP are the control the abundant growth of nuisance aquatic plants and an overall reduction in excessive nutrient levels. The predominant species of nuisance plants in Lake Catherine and Channel Lake include Eurasian Watermilfoil and Coontail.

For background, both Channel Lake and Lake Catherine were identified by the Illinois Environmental Protection Agency (IL EPA) as waters within the State of Illinois that fail to meet water quality standards for its designated ("aesthetic") use category[1]. Specifically, the concentration of Total Phosphorous within these lakes exceeds the applicable water quality standard for a recreational water body[2]. The presence of abundant Phosphorous, a common nutrient and source of food for plant life, leads to the proliferation of aquatic plants which impair many lake activities such as boating and swimming. Additionally, the overabundance of nutrients and resultant densely populated aquatic plants can lead to reduced oxygen levels available to fish and other living organisms thereby upsetting the overall fish population, in particular species that are larger and more desired by recreational fisherman.

As a short-to-intermediate range measure to reduce the present of nuisance aquatic plants, the LMP recommends "targeted" aquatic plant harvesting. Harvesting is the removal of the non-desirable weeds and plants from the lake, typically using machinery or equipment. Removal of these plants from the lake not only provides quick relief from the presence of nuisance plants, it also acts to reduce overall nutrient levels within the lakes by removing both the plant and the nutrients contained therein from the

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[1, 2] See generally the Upper Fox River/Chain O' Lake Watershed TMDL Final Stage 1 Report, March 2010, prepared for the IL EPA by AECOM, Inc.; and the Draft Report on the Upper Fox River - Chain O' Lakes Watershed Stage 3 TMDL, For Public Notice Review, March 2019, Prepared for Illinois EPA by CDM Smith.

waterbody. This helps lower nutrient concentrations within the lake over time which is considered desirable. As such, harvesting is highly preferred over other methods of nuisance aquatic plant control such as the use of aquatic herbicides which kill the plants but cause the dead plant fibers to sink to the lake bottom where they decay and recycle the nutrients back into the water ecosystem.

In order to conduct harvesting, the FOCCL has applied for a permit from the Illinois Department of Natural Resources (IL DNR). As part of that application process, FOCCL hired Hey & Associates, Inc., a professional environmental engineering firm based in Volo, Illinois, to assist with the permit process. This process includes working with the IL DNR to ensure that the proposed harvesting won't unduly impact any endangered or threatened species within the lakes. A copy of the harvesting application documents, including an Incidental Take Authorization (ITA) and associated Conservation Plan can be made available to you upon request.

One of the key provisions of the proposed harvesting plan is to limit the total area of the lakes that can be harvested in any one calendar year to a certain percentage of the combined lake area. This helps ensure that sufficient habitat is available for any fish or wildlife, including any endangered or threaten species present within the lakes, even after harvesting takes place. Through a search of available public records, you have been identified as an owner of a portion of the lake bottom where mechanical harvesting could take place. As such, the FOCCL is writing to request your permission to conduct harvesting within the waters above the lake bottom to which you are designated below as the owner.

RIPARIAN ZONE / LAKE-BOTTOM DESIGNATION:

Parcel # 0101400009 located within Lake Catherine, part of the Upper Fox Upper Fox River/Chain O' Lakes Watershed, in Antioch Township, Lake County, Illinois, which is also designated on the attached map (hereinafter referred to as the "designated riparian waters" and/or "waters above said designated lake-bottom").

I, SUSAN GUSTAFSON (print name of lake-bottom owner) hereby represent and certify that I am the legal owner of the riparian land / lake-bottom designated above. Furthermore, as the rightful owner, I hereby authorize the FOCCL to conduct periodic harvesting and removal of aquatic weeds within the designated riparian zone and waters above the designated lake-bottom for the duration of my ownership of property. This authorization shall continue in full force and effect until such time as it is revoked in a written request made by me to the FOCCL to cease such harvesting on said designated riparian zone and said writing is duly delivered to the FOCCL at the address stated below, or until I transfer my ownership in said property to another party. Nothing in this letter shall be construed so as to create any other legal right or interest for FOCCL in the riparian land / lake-bottom designated above.

The permission to harvest mechanically on or within the designated riparian zone is effective as of the date shown immediately below.

Riparian Landowner's Signature: __________ Date: 6-27-19

Print Name: SUSAN M GUSTAFSON

Current Primary Address: 25101 W North Ave. Antioch IL 60002

Cell Phone: __________

Home Phone: 847 6031813

Email: BESKOWGUST @ AOL.COM

If you have any questions either before or after granting permission to the FOCCL to conduct the harvesting activities outlined herein, please feel free to contact Amy Littleton, President of the FOCCL, using the information below.

Sincerely,

Amy Littleton, President of FOCCL

Address: 3216 N Hoyne Ave Chicago IL 60618

Tel.: 773-569-0469

Email: amylitt@msn.com

FOCCL Board Members:

John Vrchota – johneyv@aol.com

Robert Mazzeffi – antiochbuzz@att.net

Adrien Robinson – ARobinson@navg.com

CATHERINE
& CHANNEL

RIPARIAN OWNER – REQUEST FOR YOUR CONSENT

Date: 6/25/2019

Dear Riparian Property Owner:

The Friends of Lake Catherine and Channel Lakes ("FOCCL") has identified you through publically available records as a riparian owner of a portion of the lake-bottom within waters of Lake Catherine in Lake County, Illinois. We are writing you to request your permission to conduct harvesting and removal of nuisance aquatic plants within the waters on or above said riparian land.

The FOCCL is a 503(c) charity formed by a group of residents of Lake Catherine and Channel Lake. FOCCL's mission is to maintain and improve the water quality of the lakes. In furtherance of these goals, the FOCCL commissioned ILM Environments (ILM), an environmental consulting firm based in Waukegan, IL, to prepare a Lake Management Plan (LMP). The LMP is meant to guide and coordinate efforts on the lakes to achieve a common goal around improved water quality and aesthetics. A copy of the LMP can be found on our website at https://catherineandchannellakes.org/ and can be provided to you upon request. Two key aesthetic issues addressed within the LMP are the control the abundant growth of nuisance aquatic plants and an overall reduction in excessive nutrient levels. The predominant species of nuisance plants in Lake Catherine and Channel Lake include Eurasian Watermilfoil and Coontail.

For background, both Channel Lake and Lake Catherine were identified by the Illinois Environmental Protection Agency (IL EPA) as waters within the State of Illinois that fail to meet water quality standards for its designated ("aesthetic") use category. Specifically, the concentration of Total Phosphorous within these lakes exceeds the applicable water quality standard for a recreational water body[2]. The presence of abundant Phosphorous, a common nutrient and source of food for plant life, leads to the proliferation of aquatic plants which impair many lake activities such as boating and swimming. Additionally, the overabundance of nutrients and resultant densely populated aquatic plants can lead to reduced oxygen levels available to fish and other living organisms thereby upsetting the overall fish population, in particular species that are larger and more desired by recreational fisherman.

As a short-to-intermediate range measure to reduce the present of nuisance aquatic plants, the LMP recommends "targeted" aquatic plant harvesting. Harvesting is the removal of the non-desirable weeds and plants from the lake, typically using machinery or equipment. Removal of these plants from the lake not only provides quick relief from the presence of nuisance plants, it also acts to reduce overall nutrient levels within the lakes by removing both the plant and the nutrients contained therein from the waterbody. This helps lower nutrient concentrations within the lake over time which is considered desirable. As such, harvesting is highly preferred over other methods of nuisance aquatic plant control such as the use of aquatic herbicides which kill the plants but cause the dead plant fibers to sink to the lake bottom where they decay and recycle the nutrients back into the water ecosystem.

In order to conduct harvesting, the FOCCL has applied for a permit from the Illinois Department of Natural Resources (IL DNR). As part of that application process, FOCCL hired Hey & Associates, Inc., a professional environmental engineering firm based in Volo, Illinois, to assist with the permit process. This process includes working with the IL DNR to ensure that the proposed harvesting won't unduly impact any endangered or threatened species within the lakes. A copy of the harvesting application documents, including an Incidental Take Authorization (ITA) and associated Conservation Plan can be made available to you upon request.

One of the key provisions of the proposed harvesting plan is to limit the total area of the lakes that can be harvested in any one calendar year to a certain percentage of the combined lake area. This helps ensure that sufficient habitat is available for any fish or wildlife, including any endangered or threaten species present within the lakes, even after harvesting takes place. Through a search of available public records, you have been identified as an owner of a portion of the lake bottom where mechanical harvesting could take place. As such, the FOCCL is writing to request your permission to conduct harvesting within the waters above the lake bottom to which you are designated below as the owner.

RIPARIAN ZONE / LAKE-BOTTOM DESIGNATION:

Parcel # 0112400001 located within Lake Catherine, part of the Upper Fox Upper Fox River/Chain O' Lakes Watershed, in Antioch Township, Lake County, Illinois, which is also designated on the attached map (hereinafter referred to as the "designated riparian waters" and/or "waters above said designated lake-bottom").

I, MATT PALM (print name of lake-bottom owner) hereby represent and certify that I am the legal owner of the riparian land / lake-bottom designated above. Furthermore, as the rightful owner, I hereby authorize the FOCCL to conduct periodic harvesting and removal of aquatic weeds within the designated riparian zone and waters above the designated lake-bottom for the duration of my ownership of property. This authorization shall continue in full force and effect until such time as it is revoked in a written request made by me to the FOCCL to cease such harvesting on said designated riparian zone and said writing is duly delivered to the FOCCL at the address stated below, or until I transfer my ownership in said property to another party. Nothing in this letter shall be construed so as to create any other legal right or interest for FOCCL in the riparian land / lake-bottom designated above.

The permission to harvest mechanically on or within the designated riparian zone is effective as of the date shown immediately below.

Riparian Landowner's Signature: Date: 6/28/19

Print Name: Matt Palm
Current Primary Address: 25584 W Rt 173 Antioch, IL 60002
Cell Phone:
Home Phone: 847-345-1173
Email: Bobsmarina@gmail.com

If you have any questions either before or after granting permission to the FOCCL to conduct the harvesting activities outlined herein, please feel free to contact Amy Littleton, President of the FOCCL, using the information below.

Sincerely,

Amy Littleton, President of FOCCL
Address: 3216 N Hoyne Ave Chicago IL 60618
Tel.: 773-569-0469
Email: amylitt@msn.com

FOCCL Board Members:
John Vrchota – johneyv@aol.com
Robert Mazzeffi – antiochbuzz@att.net
Adrien Robinson – ARobinson@navg.com

CATHERINE
& CHANNEL

RIPARIAN OWNER – REQUEST FOR YOUR CONSENT

Date: 6/25/2019

Dear Riparian Property Owner:

The Friends of Lake Catherine and Channel Lakes ("FOCCL") has identified you through publically available records as a riparian owner of a portion of the lake-bottom within waters of Lake Catherine in Lake County, Illinois. We are writing you to request your permission to conduct harvesting and removal of nuisance aquatic plants within the waters on or above said riparian land.

The FOCCL is a 503(c) charity formed by a group of residents of Lake Catherine and Channel Lake. FOCCL's mission is to maintain and improve the water quality of the lakes. In furtherance of these goals, the FOCCL commissioned ILM Environments (ILM), an environmental consulting firm based in Waukegan, IL, to prepare a Lake Management Plan (LMP). The LMP is meant to guide and coordinate efforts on the lakes to achieve a common goal around improved water quality and aesthetics. A copy of the LMP can be found on our website at https://catherineandchannellakes.org/ and can be provided to you upon request. Two key aesthetic issues addressed within the LMP are the control the abundant growth of nuisance aquatic plants and an overall reduction in excessive nutrient levels. The predominant species of nuisance plants in Lake Catherine and Channel Lake include Eurasian Watermilfoil and Coontail.

For background, both Channel Lake and Lake Catherine were identified by the Illinois Environmental Protection Agency (IL EPA) as waters within the State of Illinois that fail to meet water quality standards for its designated ("aesthetic") use category. Specifically, the concentration of Total Phosphorous within these lakes exceeds the applicable water quality standard for a recreational water body[2]. The presence of abundant Phosphorous, a common nutrient and source of food for plant life, leads to the proliferation of aquatic plants which impair many lake activities such as boating and swimming. Additionally, the overabundance of nutrients and resultant densely populated aquatic plants can lead to reduced oxygen levels available to fish and other living organisms thereby upsetting the overall fish population, in particular species that are larger and more desired by recreational fisherman.

As a short-to-intermediate range measure to reduce the present of nuisance aquatic plants, the LMP recommends aquatic plant harvesting. Harvesting is the removal of the non-desirable weeds and plants from the lake, typically using machinery or equipment. Removal of these plants from the lake not only provides quick relief from the presence of nuisance plants, it also acts to reduce overall nutrient levels within the lakes by removing both the plant and the nutrients contained therein from the waterbody. This helps lower nutrient concentrations within the lake over time which is considered desirable. As such, harvesting is highly preferred over other methods of nuisance aquatic plant control such as the use of aquatic herbicides which kill the plants but cause the dead plant fibers to sink to the lake bottom where they decay and recycle the nutrients back into the water ecosystem.

In order to conduct harvesting, the FOCCL has applied for a permit from the Illinois Department of Natural Resources (IL DNR) and IL EPA. As part of that application process, FOCCL hired Hey & Associates, Inc., a professional environmental engineering firm based in Volo, Illinois, to assist with the permit process. This process includes working with the IL DNR and IL EPA to ensure that the proposed harvesting won't unduly impact any endangered or threatened species within the lakes. A copy of the harvesting application documents, including an Incidental Take Authorization (ITA) and associated Conservation Plan can be made available to you upon request.

One of the key provisions of the proposed harvesting plan is to limit the total area of the lakes that can be harvested in any one calendar year to 35 acres total, or roughly 7 percent of the combined lake area of both Channel Lake and Lake Catherine, or 23 percent of the surface area Lake Catherine alone. This helps ensure that sufficient habitat is available for any fish or wildlife, including any endangered or threaten species present within the lakes, even after harvesting takes place. Through a search of available public records, you have been identified as an owner of a portion of the lake bottom where mechanical harvesting could take place. As such, the FOCCL is writing to request your permission to conduct harvesting within the waters above the lake bottom to which you are designated below as the owner.

RIPARIAN ZONE / LAKE-BOTTOM DESIGNATION:

Parcel # [redacted], located within Lake Catherine, part of the Upper Fox Upper Fox River/Chain O' Lakes Watershed, in Antioch Township, Lake County, Illinois, which is also designated on the attached map (hereinafter referred to as the "designated riparian waters" and/or "waters above said designated lake-bottom").

I, Matt Palm **(print name of lake-bottom owner) hereby represent and certify that I am the legal owner of the riparian land / lake-bottom designated above. Furthermore, as the rightful owner, I hereby authorize the FOCCL to conduct periodic harvesting and removal of aquatic weeds within the designated riparian zone and waters above the designated lake-bottom for the duration of my ownership of property. This authorization shall continue in full force and effect until such time as it is revoked in a written request made by me to the FOCCL to cease such harvesting on said designated riparian zone and said writing is duly delivered to the FOCCL at the address stated below, or until I transfer my ownership in said property to another party. Nothing in this letter shall be construed so as to create any other legal right or interest for FOCCL in the riparian land / lake-bottom designated above.**

The permission to harvest mechanically on or within the designated riparian zone is effective as of the date shown immediately below.

PIN # 0112300004

6/28/19

Riparian Landowner's Signature

Date

Print Name: Matt Palm
Current Primary Address: 25584 W Rt 173 Antioch IL 60002
Cell Phone:
Home Phone: 847 395 1173
Email: bobsmarina@gmail.com

If you have any questions either before or after granting permission to the FOCCL to conduct the harvesting activities outlined herein, please feel free to contact Amy Littleton, President of the FOCCL, using the information below.

Sincerely,

Amy Littleton, President of FOCCL
Address: 3216 N Hoyne Ave Chicago, IL 60618-6306
Tel.: 773-569-0469
Email: amylitt@msn.com

FOCCL Board Members:
John Vrchota – johneyv@aol.com
Robert Mazzeffi – antiochbuzz@att.net
Adrien Robinson – ARobinson@navg.com

CATHERINE & CHANNEL LAKES

RIPARIAN OWNER – REQUEST FOR YOUR CONSENT

Date: 6/25/2019

Dear Riparian Property Owner:

The Friends of Lake Catherine and Channel Lakes ("FOCCL") has identified you through publically available records as a riparian owner of a portion of the lake-bottom within waters of Lake Catherine in Lake County, Illinois. We are writing you to request your permission to conduct harvesting and removal of nuisance aquatic plants within the waters on or above said riparian land.

The FOCCL is a 503(c) charity formed by a group of residents of Lake Catherine and Channel Lake. FOCCL's mission is to maintain and improve the water quality of the lakes. In furtherance of these goals, the FOCCL commissioned ILM Environments (ILM), an environmental consulting firm based in Waukegan, IL, to prepare a Lake Management Plan (LMP). The LMP is meant to guide and coordinate efforts on the lakes to achieve a common goal around improved water quality and aesthetics. A copy of the LMP can be found on our website at https://catherineandchannellakes.org/ and can be provided to you upon request. Two key aesthetic issues addressed within the LMP are the control the abundant growth of nuisance aquatic plants and an overall reduction in excessive nutrient levels. The predominant species of nuisance plants in Lake Catherine and Channel Lake include Eurasian Watermilfoil and Coontail.

For background, both Channel Lake and Lake Catherine were identified by the Illinois Environmental Protection Agency (IL EPA) as waters within the State of Illinois that fail to meet water quality standards for its designated ("aesthetic") use category. Specifically, the concentration of Total Phosphorous within these lakes exceeds the applicable water quality standard for a recreational water body[2]. The presence of abundant Phosphorous, a common nutrient and source of food for plant life, leads to the proliferation of aquatic plants which impair many lake activities such as boating and swimming. Additionally, the overabundance of nutrients and resultant densely populated aquatic plants can lead to reduced oxygen levels available to fish and other living organisms thereby upsetting the overall fish population, in particular species that are larger and more desired by recreational fisherman.

As a short-to-intermediate range measure to reduce the present of nuisance aquatic plants, the LMP recommends aquatic plant harvesting. Harvesting is the removal of the non-desirable weeds and plants from the lake, typically using machinery or equipment. Removal of these plants from the lake not only provides quick relief from the presence of nuisance plants, it also acts to reduce overall nutrient levels within the lakes by removing both the plant and the nutrients contained therein from the waterbody. This helps lower nutrient concentrations within the lake over time which is considered desirable. As such, harvesting is highly preferred over other methods of nuisance aquatic plant control such as the use of aquatic herbicides which kill the plants but cause the dead plant fibers to sink to the lake bottom where they decay and recycle the nutrients back into the water ecosystem.

In order to conduct harvesting, the FOCCL has applied for a permit from the Illinois Department of Natural Resources (IL DNR) and IL EPA. As part of that application process, FOCCL hired Hey & Associates, Inc., a professional environmental engineering firm based in Volo, Illinois, to assist with the permit process. This process includes working with the IL DNR and IL EPA to ensure that the proposed harvesting won't unduly impact any endangered or threatened species within the lakes. A copy of the harvesting application documents, including an Incidental Take Authorization (ITA) and associated Conservation Plan can be made available to you upon request.

One of the key provisions of the proposed harvesting plan is to limit the total area of the lakes that can be harvested in any one calendar year to 35 acres total, or roughly 7 percent of the combined lake area of both Channel Lake and Lake Catherine, or 23 percent of the surface area Lake Catherine alone. This helps ensure that sufficient habitat is available for any fish or wildlife, including any endangered or threaten species present within the lakes, even after harvesting takes place. Through a search of available public records, you have been identified as an owner of a portion of the lake bottom where mechanical harvesting could take place. As such, the FOCCL is writing to request your permission to conduct harvesting within the waters above the lake bottom to which you are designated below as the owner.

LAKE-BOTTOM DESIGNATION:

Parcel #0112200[redacted], located within Lake Catherine, part of the Upper Fox Upper Fox River/Chain O' Lakes Watershed, in Antioch Township, Lake County, Illinois, which is also designated on the attached map (hereinafter referred to as the "designated riparian waters" and/or "waters above said designated lake-bottom").

PIN # 0112200001

I, Robert Joseph (print name of lake-bottom owner) hereby represent and certify that I am the legal owner of the riparian land / lake-bottom designated above. Furthermore, as the rightful owner, I hereby authorize the FOCCL to conduct periodic harvesting and removal of aquatic weeds within the designated riparian zone and waters above the designated lake-bottom for the duration of my ownership of property. This authorization shall continue in full force and effect until such time as it is revoked in a written request made by me to the FOCCL to cease such harvesting on said designated riparian zone and said writing is duly delivered to the FOCCL at the address stated below, or until I transfer my ownership in said property to another party. Nothing in this letter shall be construed so as to create any other legal right or interest for FOCCL in the riparian land / lake-bottom designated above.

The permission to harvest mechanically on or within the designated riparian zone is effective as of the date shown immediately below.

Robert E Joseph 6/26/19

Riparian Landowner's Signature Date

Print Name: Robert Joseph
Current Primary Address: 42879 N. Nanette St, Antioch, IL 60002
Cell Phone: 630 854 2884
Home Phone:
Email:

If you have any questions either before or after granting permission to the FOCCL to conduct the harvesting activities outlined herein, please feel free to contact Amy Littleton, President of the FOCCL, using the information below.

Sincerely,

Amy Littleton, President of FOCCL
Address: 3216 N Hoyne Ave Chicago, IL 60618-6306
Tel.: 773-569-0469
Email: amylitt@msn.com

FOCCL Board Members:
John Vrchota – johneyv@aol.com
Robert Mazzeffi – antiochbuzz@att.net
Adrien Robinson – ARobinson@navg.com

Alvera MORGAN
Alvera Morgan
CLARA SVOBODA
Clara Svoboda
Gordon A. Nelson
Jeff Vitt
JOHN VRCHOTA

RIPARIAN OWNER – REQUEST FOR YOUR CONSENT

Date: 6/25/2019

Dear Riparian Property Owner:

The Friends of Lake Catherine and Channel Lakes ("FOCCL") has identified you through publically available records as a riparian owner of a portion of the lake-bottom within waters of Lake Catherine in Lake County, Illinois. We are writing you to request your permission to conduct harvesting and removal of nuisance aquatic plants within the waters on or above said riparian land.

The FOCCL is a 503(c) charity formed by a group of residents of Lake Catherine and Channel Lake. FOCCL's mission is to maintain and improve the water quality of the lakes. In furtherance of these goals, the FOCCL commissioned ILM Environments (ILM), an environmental consulting firm based in Waukegan, IL, to prepare a Lake Management Plan (LMP). The LMP is meant to guide and coordinate efforts on the lakes to achieve a common goal around improved water quality and aesthetics. A copy of the LMP can be found on our website at https://catherineandchannellakes.org/ and can be provided to you upon request. Two key aesthetic issues addressed within the LMP are the control the abundant growth of nuisance aquatic plants and an overall reduction in excessive nutrient levels. The predominant species of nuisance plants in Lake Catherine and Channel Lake include Eurasian Watermilfoil and Coontail.

For background, both Channel Lake and Lake Catherine were identified by the Illinois Environmental Protection Agency (IL EPA) as waters within the State of Illinois that fail to meet water quality standards for its designated ("aesthetic") use category. Specifically, the concentration of Total Phosphorous within these lakes exceeds the applicable water quality standard for a recreational water body[2]. The presence of abundant Phosphorous, a common nutrient and source of food for plant life, leads to the proliferation of aquatic plants which impair many lake activities such as boating and swimming. Additionally, the overabundance of nutrients and resultant densely populated aquatic plants can lead to reduced oxygen levels available to fish and other living organisms thereby upsetting the overall fish population, in particular species that are larger and more desired by recreational fisherman.

As a short-to-intermediate range measure to reduce the present of nuisance aquatic plants, the LMP recommends "targeted" aquatic plant harvesting. Harvesting is the removal of the non-desirable weeds and plants from the lake, typically using machinery or equipment. Removal of these plants from the lake not only provides quick relief from the presence of nuisance plants, it also acts to reduce overall nutrient levels within the lakes by removing both the plant and the nutrients contained therein from the waterbody. This helps lower nutrient concentrations within the lake over time which is considered desirable. As such, harvesting is highly preferred over other methods of nuisance aquatic plant control such as the use of aquatic herbicides which kill the plants but cause the dead plant fibers to sink to the lake bottom where they decay and recycle the nutrients back into the water ecosystem.

In order to conduct harvesting, the FOCCL has applied for a permit from the Illinois Department of Natural Resources (IL DNR). As part of that application process, FOCCL hired Hey & Associates, Inc., a professional environmental engineering firm based in Volo, Illinois, to assist with the permit process. This process includes working with the IL DNR to ensure that the proposed harvesting won't unduly impact any endangered or threatened species within the lakes. A copy of the harvesting application documents, including an Incidental Take Authorization (ITA) and associated Conservation Plan can be made available to you upon request.

One of the key provisions of the proposed harvesting plan is to limit the total area of the lakes that can be harvested in any one calendar year to a certain percentage of the combined lake area. This helps ensure that sufficient habitat is available for any fish or wildlife, including any endangered or threaten species present within the lakes, even after harvesting takes place. Through a search of available public records, you have been identified as an owner of a portion of the lake bottom where mechanical harvesting could take place. As such, the FOCCL is writing to request your permission to conduct harvesting within the waters above the lake bottom to which you are designated below as the owner.

RIPARIAN ZONE / LAKE-BOTTOM DESIGNATION:

Parcel # 0[redacted] located within Lake Catherine, part of the Upper Fox Upper Fox River/Chain O' Lakes Watershed, in Antioch Township, Lake County, Illinois, which is also designated on the attached map (hereinafter referred to as the "designated riparian waters" and/or "waters above said designated lake-bottom").

I, JAMIE POLEC (print name of lake-bottom owner) hereby represent and certify that I am the legal owner of the riparian land / lake-bottom designated above. Furthermore, as the rightful owner, I hereby authorize the FOCCL to conduct periodic harvesting and removal of aquatic weeds within the designated riparian zone and waters above the designated lake-bottom for the duration of my ownership of property. This authorization shall continue in full force and effect until such time as it is revoked in a written request made by me to the FOCCL to cease such harvesting on said designated riparian zone and said writing is duly delivered to the FOCCL at the address stated below, or until I transfer my ownership in said property to another party. Nothing in this letter shall be construed so as to create any other legal right or interest for FOCCL in the riparian land / lake-bottom designated above.

The permission to harvest mechanically on or within the designated riparian zone is effective as of the date shown immediately below.

Riparian Landowner's Signature:

Date: 6/28/2019

PIN # 011220016

Print Name: JAMIE POLEC
Current Primary Address: 42610 N ADDISON LN
Cell Phone: 847-749-7445
Home Phone:
Email: JGPtherock@hotmail.com

If you have any questions either before or after granting permission to the FOCCL to conduct the harvesting activities outlined herein, please feel free to contact Amy Littleton, President of the FOCCL, using the information below.

Sincerely,

Amy Littleton, President of FOCCL
Address: 3216 N Hoyne Ave Chicago IL 60618
Tel.: 773-569-0469
Email: amylitt@msn.com

FOCCL Board Members:
John Vrchota – johneyv@aol.com
Robert Mazzeffi – antiochbuzz@att.net
Adrien Robinson – ARobinson@navg.com

RIPARIAN OWNER – REQUEST FOR YOUR CONSENT

Date: 6/25/2019

Dear Riparian Property Owner:

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RIPARIAN ZONE / LAKE-BOTTOM DESIGNATION:

Parcel # 0101400012 located within Lake Catherine, part of the Upper Fox Upper Fox River/Chain O' Lakes Watershed, in Antioch Township, Lake County, Illinois, which is also designated on the attached map (hereinafter referred to as the "designated riparian waters" and/or "waters above said designated lake-bottom").

I, IRVIN NEMECEK (print name of lake-bottom owner) hereby represent and certify that I am the legal owner of the riparian land / lake-bottom designated above. Furthermore, as the rightful owner, I hereby authorize the FOCCL to conduct periodic harvesting and removal of aquatic weeds within the designated riparian zone and waters above the designated lake-bottom for the duration of my ownership of property. This authorization shall continue in full force and effect until such time as it is revoked in a written request made by me to the FOCCL to cease such harvesting on said designated riparian zone and said writing is duly delivered to the FOCCL at the address stated below, or until I transfer my ownership in said property to another party. Nothing in this letter shall be construed so as to create any other legal right or interest for FOCCL in the riparian land / lake-bottom designated above.

The permission to harvest mechanically on or within the designated riparian zone is effective as of the date shown immediately below.

Riparian Landowner's Signature: Date: 6/27/15

Print Name: IRVIN NEMECEK
Current Primary Address: 815 S. SPRING LA GRANGE, IL 60525
Cell Phone: 708 337 9735
Home Phone:
Email: opiks@mac.com

If you have any questions either before or after granting permission to the FOCCL to conduct the harvesting activities outlined herein, please feel free to contact Amy Littleton, President of the FOCCL, using the information below.

Sincerely,

Amy Littleton, President of FOCCL
Address: 3216 N Hoyne Ave Chicago IL 60618
Tel.: 773-569-0469
Email: amylitt@msn.com

FOCCL Board Members:
John Vrchota – johneyv@aol.com
Robert Mazzeffi – antiochbuzz@att.net
Adrien Robinson – ARobinson@navg.com

FOX WATERWAY AGENCY
45 S. Pistakee Lake Road ◆ Fox Lake, Illinois 60020
(847)587-8540

July 12, 2019

Friends of Lake Catherine and Channel Lakes

RE: ITA/ Governing authority

Dear Bob Mazzeffi,

The Fox Waterway Agency- (FWA) is the local government authority on Channel and Catherine Lakes pursuant to the (615 ILCS 90/) Fox Waterway Agency Act.

We understand the Friends of Lake Catherine and Channel Lakes have applied for permission to weed harvest on the above-mentioned lakes from the IDNR.

The FWA has no objection to the FOLCCL performing these tasks providing the proper permission is granted from the IDNR, and the work is completed within the conditions of their permit.

Sincerely,

Joseph S. Keller
Executive Director

LakeCounty

Chief County Assessment Office
18 North County Street
Waukegan, IL 60085-4335
Phone (847) 377-2050

July 26, 2019

RE: PINs known as “77-77-777-777”

Due to the nature of the mapping software utilized by Lake County, it was necessary to have a complete, countywide coverage of tax parcels, to allow our data checks to run properly and to minimize errors in parcel geometry.

To this end, tax parcels were generated where they did not exist, or where ownership was not known. Following the conventional ten-digit PIN system, this saw the creation of tax parcels with “dummy PINs” in Public Rights-of-Way (4444444444), in Condominium Common Elements (8888888888), and on Lake Bottoms (7777777777); areas that had earlier been simply designated “for Public Use.”

These “dummy PINs” exist in the earliest digital mapping product the CCAO has on file, representing Tax Year 1996.

The transition to an updated mapping system in 2015 has allowed the CCAO to eradicate nearly all 444s and 888s parcels, however, the majority of the 777s still exist, as nothing has facilitated change.

Chain of title research must be done to find the last record owner, who is likely long deceased. Once the last owner is determined, a legitimate PIN can be generated, which in turn would go tax delinquent and become a County of Lake Trustee parcel.

With a count of over 600 distinct 777s parcels, the CCAO has no timeline for performing the research necessary to generate new PINs for these areas. For now, they will remain 777s with ownership “Unknown.”

Please contact the CCAO if we can provide any additional information in this matter.

Matthew Hellyer
Sr. GIS Analyst
Chief County Assessment Office

18 N County St – 7th Floor
Waukegan, IL 60085
847-377-2557
mhellyer@lakecountyil.gov

APPENDIX B

IDNR Correspondence and Fish Survey Data

Fish Species Abbreviations in IDNR Datasheets for Lake Catherine and Channel Lake

BLB = black bullhead
BLC = black crappie
BLG = bluegill
BLGL = bluegill
BLS = blunt nose minnow
BOW = bowfin
BRB = brown bullhead
BRS = brook silverside
BWFN = bowfin
CAP = common carp
CCF = channel catfish
EMS = emerald shiner
FMS = fathead minnow
FRD = freshwater drum
GOS = golden shiner
GRP = grass pickerel
GSF = green sunfish
GSPK = grass pickerel
GZS = gizzard shad
LGPH = log perch
LMB = largemouth bass
LMBS = largemouth bass
LOP = log perch
MUE = muskellunge
NOP = northern pike
PNSO = pugnose shiner
PUD = pumpkinseed
RSF = red-ear sunfish
SMB = smallmouth bass
SPS = spottail shiner
ULL= quillback
WAE = walleye
WAM = warmouth
WHB = white bass
WHC = white crappie
WHS = white sucker
WRMH = warmouth
WTBS = white bass
WTCP = white crappie
YEP = yellow perch
YLB = yellow bass
YWPH = yellow perch

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE____OF____ ✓

BODY OF WATER Catherine STATION 1E1 SAMPLE 30min SPECIES ALL DATE 10-2-17

		LTH	WT		FREQUENCY
	00				
	10				
	20				
	30				
LMB	40				
	50				
	60	369	714		
	70				
	80				
	90				
	00				
	10				
	20				
	30				
	40	446	1655		
	50				
	60				
	70				
	80				
	90				
	00	202	103		
	10	215	122		
	20	225	145		
	30				
	40	240	180		|
	50				
	60	262	237		||
	70				
	80				
	90				
	00	112	—		|
	10	195	97		
	20				
	30	89			
	40	71			|
	50				
	60				
	70				
	80				
	90				
RUD	00	[illegible]			
	10	117	38		
	20	129	50		
	30	133	53		
	40				
	50				
	60				
	70				
	80				
	90				
	00				
	10	117	17		|
	20	126	20		|||
YEP	30	132	34		
	40	145	41		|||
	50	157	44		||||
	60	164	50		卌|
	70	172	58		|
	80	184	70		|
	90	199	—		

BLG

		LTH	WT		FREQUENCY
	00	100	11		|||
	10	112	22		||||
	20	125	35		||||
	30	135	48		卌 |||
	40	140	59		||
	50	154	75		||
	60	166	97		
	70	175	108		
	80				
	90				
	00	97	—		卌
	10	85	—		||
	20	70	—		卌 ||||
	30				
	40	40	—		|
	50	30	—		
	60	62	—		|
	70				
	80				
	90				
	00				
	10	195	112		BLC
	20				
	30				
	40				
	50				
	60				
	70				
	80				
	90				
	00	610	3234		CAP
	10	630	3449		
	20	449	1244		
	30	525	1874		
	40				
	50				
	60				
	70				
	80				
	90				
WAE	00	463	972		
	10				
	20				
	30				
	40				
	50				
	60				
	70				
	80				
	90				
BLS	00	82	—		
	10	62	—		YEB 284-405
	20	72	—		
	30	BLS			ULL 520-1779
	40				
	50				
	60				
	70				
	80				
	90				

EM3-55

6more carp

10min on CAT

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE____OF____ ✓

BODY OF WATER CHANNEL LAKE 10:00-1030 STATION 1E2 20 Amps 290 SAMPLE 30 MIN SPECIES ALL DATE 10/2/17

		LTH	WT		FREQUENCY
	00				WAM
	10				165/112
BLG	20				
	30	35	—		
	40				
	50				
	60				
	70				
	80	86	—		卌 |
	90	93	—		卌 ||||
1	00	101	38		|||| WHC
	10	110	42		72/—
	20	124	59		卌 ||
	30	133	77		卌
	40	146	75		卌 |||| BOS
	50	154	84		卌 ||| 178/76
	60	161	103		|
	70	179	132		|||
	80	189	156		|||
	90	192	155		
2	00				BLC
	10				321/561
	20				205/138
	30				
	40				
	50				
	60				
	70				
	80				
	90				
	00				WAE
YEP	10				395/497
	20				
	30				
	40				
	50				
	60				
	70				
	80	82	—		
	90				
1	00				BLB
	10	110	35		202/101
	20	123	42		|||
	30	132	48		||||
	40	146	52		BRB
	50	153	59		| 156/64
	60	164	65		||
	70	176	77		|||
	80	181	75		|
	90	197	100		||||
2	00	207	115		|| NOP
	10	214	132		|||| 721/1998
	20	222	106		
	30	235	156		
	40	241	176		
	50				
	60				
	70				
	80				
	90				

LMB

		LTH	WT		FREQUENCY
	00				
	10				MUE
	20				970/7020—m
	30				
	40				
	50				
	60				
	70				
	80	84	—		
	90				
1	00				CAP
	10	114	38		564/2155
	20				610/2953
	30				364/692
	40	143	55		卌
	50	152	64		
	60				
	70				
	80				
	90				
2	00	209	265	|	ERD
	10	210	132		416/831
	20	223	156		358/497
	30				
	40	244	219		
	50	255	245	||	
	60	262	221	|	
	70				
	80	286	360		
	90				
3	00				BOW
	10				532/1549
	20				513/1311
	30	339	620		675/3668
	40				735/4066
	50	350	653	|	465/1030
	60	360	717		393/605
	70				
	80				
	90				
4	00				SMB
	10				340/523
	20				
	30				
	40				WHS
	50	458	1360		105/—
	60				
	70				
	80				
	90				
5	00	503	2010		
	10				BLC
	20				160/75
	30				188/107
	40				
	50				
	60				
	70				
	80				
	90				

GRP 244/115
212/78
325/248
135/—
212/74

PUD 131/67
89/—
163/116
133/65

GZS 297/340
312/382

ULL 461/1224

GSF 99/—

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE____OF____ ✓

BODY OF WATER CHANNEL LAKE 1230- 1:00 STATION 1E3 SAMPLE 30 min SPECIES all DATE 10/2/17

		LTH	WT		FREQUENCY
	00				
	10				
	20				
	30				
BLG	40				
	50				
	60				
	70	70	–		
	80	88	–		
	90	94	–		|
1	00	108	22		|
	10	112	25		|
	20	127	40		|||
	30	131	41		||
	40	142	55		~~||||~~
	50	152	60		~~||||~~ ||
	60	167	91		|
	70	174	108		|
	80				
	90	190	135		
4 WAE	00	407	635		
	10				
	20				
	30				
	40	445	655		
	50	459	1585		
	60				
	70				
	80				
	90	496	1113		
5	00	500	1233		
	10				
	20				
	30				
	40				
	50	552	1695		|
	60				
	70				
	80				
	90				
6	00				
	10	612	2160		
	20				
	30				
	40				
	50				
	60				
	70	672	2725		
	80				
	90				
	00				CCF,
	10				577/1740
	20				
	30				
	40				
	50				
	60				
	70				
	80				
	90				

LMB

		LTH	WT		FREQUENCY	
	00				CAP.	
	10				575/2660	
	20				606/2851	
	30				~~||||~~ ~~||||~~	
	40					
	50					
	60					
	70					
	80					
	90					
1	00				MUE	
	10				975/7360	F
	20				932/7260	M
	30				1085/9660	F
	40				358/—	
	50					
	60					
	70	173	66		|	
	80	182	85			
	90	193	191			
2	00	200	93		FMS.	
	10	211	128		72/—	
	20				94/—	
	30	238	111		| 99/—	
	40	246	194			
	50	253	206		||	
	60	260	222			
	70	274	271			
	80					
	90					
3	00	302	412		GZS	
	10				175/63	1
	20				180/45	
	30				302/304	L
	40				387/823	|
	50				168/56	|
	60				151/41	
	70					
	80					
	90					
4	00				PUD	
	10				105/21	
	20	426	1243		| 135/58	
	30				105/24	
	40				151/89	
	50					
	60					
	70					
	80					
	90	490	2010			
	00				YEP	
	10				163/47	
	20				166/41	
	30				141/32	1
	40				193/78	
	50				131/27	
	60				126/26	
	70				108/25	
	80				137/30	
	90					

SMB
215/138
227/152
243/185
298/346
202/106

WHB
244/184

ULL 527/1932
485/1572

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

00080-2015311

PAGE 1 OF 2

BODY OF WATER Lake Catherine STATION 1E1 SAMPLE ______ SPECIES ✓ DATE 09/28/15

		LTH	WT		FREQUENCY			LTH	WT		FREQUENCY
RSF	00					LMB	00				
	10						10				
	20						20				
	30						30				
	40						40				
	50						50				
	60						60				
	70						70	77	11		1
	80						80	81	11		1
	90						90				
	00						100	102	14		
	10	119	42				10				
	20						20				
	30						30				
	40						40				
	50						50				
	60						60				
	70						70				
	80						80				
	90						90				
BLC	00						200				
	10						10				
	20						20				
	30						30				
	40						40				
	50						50				
	60						60				
	70						70				
	80						80				
	90	95	17				90				
	100						300				
	10						10				
	20	[illegible]	[illegible]				20				
	30						30				
	40						40				
	50						50				
	60						60				
	70						70				
	80						80				
	90						90				
	200						400				
	10						10				
	20	265	295		1		20				
	30						30				
	40						40				
	50						50				
	60						60				
	70						70				
	80						80				
	90						90				
	00						500				
	10						10				
	20						20				
	30						30				
	40						40				
	50						50	550	253		
	60						60				
	70						70				
	80						80				
	90						90				

WAE	564	1808
	388	479
FRD -	354	422
	360	508
	364	598
SMB	87	10

Minnow - ?

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE 2 OF 2

BODY OF WATER Lake Catherine STATION 1E1 SAMPLE ____ SPECIES __________ DATE 09/28/15

		LTH	WT		FREQUENCY
	00				
BLG	10				
	20				
	30	35	—		
	40	45	—		
	50				
	60	67	2		
	70				|
	80				
	90	94	18		|
	1 00				
	10				
	20	121	37		
	30				
	40				
	50				
	60	168	109		
	70				
	80	181	115		
	90				
	00				
YEP	10				
	20				
	30				
	40				
	50				
	60				
	70				
	80	87	21		𝍸 |||
	90	95	7		|||
	1 00				
	10				
	20				
	30	137	31		|
	40				
	50				
	60				
	70				
	80				
	90				
	200	200	98		
	10				
	20				
	30				
	40				
	50				
	60				
	70				
	80				
	90				
	00				
	10				
	20				
	30				
	40				
	50				
	60				
	70				
	80				
	90				

	LTH	WT		FREQUENCY
JUV 00				
10				
20				
30				
40				
50	51			𝍸 |
60	62			𝍸
70	72			||
80	81			||
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				

LENGTH/WEIGHT - LENGTH FREQUENCY DATA 00080-2015312 PAGE 1 OF 6

BODY OF WATER Channel STATION IE2 SAMPLE ____ SPECIES ✓ DATE 9/28

WTBS

White BASS

	LTH	WT		FREQUENCY
100				
10				
20				
30				
40				
50				
60				
70				
80				
90				
200				
10				
20				
30				
40				
50				
60				
70				
80				
90				
300				
10				
20				
30				
40				
50				
60	307	630		
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				

WTCP

White Crappie

	LTH	WT		FREQUENCY
00	100	15		I
10	112	30		
20	128	25		
30				
40				
50	55			
60				
70	75			II
80	87			IIII
90				
200				
10				
20				
30	237	220		
40				
50				
60	266	300		II
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				
000				
010				
020				
030				
040				
050				
060	68			
070	71			
080	85			I
090	95			
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE 2 OF 6

BODY OF WATER Channel STATION IE2 SAMPLE ____ SPECIES ____ DATE 9/28

BIGL   LMBS

	LTH	WT		FREQUENCY		LTH	WT		FREQUENCY
00					00				
10					10				
20					20				
30	36			𝍸𝍸||||	30				
40	42			𝍸𝍸𝍸𝍸|	40				
50	55			𝍸𝍸𝍸𝍸	50				
60	63			𝍸||	60				
70	77			|	70	78			𝍸
80	85			|	80	88			𝍸
90	96			||	90	94			||
00	108			||||	00	102	20		|
10	117	25		|	10	114	15		|
20	125	40		|	20	128	25		
30	132	45		|||	30				
40					40				
50	158	85			50				
60	164	85		𝍸||	60				
70	174	100		|||	70				
80	188	140		𝍸	80	187			
90	190	165		|	90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE 3 OF 6

BODY OF WATER Channel WRMH STATION ____ SAMPLE ____ SPECIES B~~[illegible]~~W DATE ____

[illegible] GOS

	LTH	WT		FREQUENCY		LTH	WT		FREQUENCY
00					00				
10					10				
20					20				
30					30				
40					40				BLS
50	50			11	50				
60				Warmouth	60	104			1111 Bluntnose
70					70	73			1 minnow
80					80	82			1
90					90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60	105				60				
70	76			1	70				
80					80				
90					90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE 4 OF 6

BODY OF WATER Channel STATION ____ SAMPLE ____ SPECIES ____ DATE ____

BWFN

CARP

Bowfin

	LTH	WT		FREQUENCY
100				
10				
20				
30				
40				
50				
60				
70				
80				
90				
200				
10				
20				
30				
40				
50				
60				
70				
80				
90				
300				
10				
20				
30				
40	348	400		
50				
60				
70				
80				
90				
400				
10				
20				
30				
40				
50				
60				
70				
80	485	1025		
90	498	1140		
500	503	1165	1	
10				
20	524	1445		
30	538	1385		
40				
50				
60				
70				
80				
90				
600	607	2125		
10				
20				
30				
40				
50				
60	661	2635		
70				
80				
90				

	LTH	WT		FREQUENCY
300				
10				
20				
30				
40				
50				
60				
70				
80				
90				
400				
10				
20				
30				
40				
50				
60				
70				
80				
90				
500				
10				
20				
30				
40				
50				
60				
70				
80				
90				
600				
10				
20				
30	631	3000		
40				
50				
60				
70	671	4040		
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE 5 OF 6

BODY OF WATER Channel STATION ____ SAMPLE ____ SPECIES ____ DATE ____

GSPK

YWPH

	LTH	WT		FREQUENCY		LTH	WT		FREQUENCY
00					00				
10					10				
20					20				
30				Grass pickerel	30				
40					40				Yellow perch
50					50				
60					60				
70					70				
80					80				
90					90				
100					100				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70	172	45		
80	188	6.0			80				
90					90	195	95		
00					00	200	155		
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				
LGPH 00					00				
10					10				
20					20				
30					30				
40				[illegible]	40				
50					50				
60					60				
70					70				
80					80				
90	96				90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE 6 OF 6

BODY OF WATER Channel Mudminnow STATION ______ SAMPLE ______ SPECIES PNSD DATE ______

	LTH	WT		FREQUENCY		LTH	WT		FREQUENCY
00					00				
10					10				
20					20				
30					30				
40					40				
50	58			1	50				
60					60				
70					70				
80	80				80	88			
90					90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90	197			
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				
00					00				
BKSD 10					10				
20					20				
30					30				
40	42				40				
50					50				
60					60				
70					70				
80					80				
90					90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				
00					00				
10					10				
20					20				
30					30				
40					40				
50					50				
60					60				
70					70				
80					80				
90					90				

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

10:30 - 11:00

PAGE____OF____

00080-2015313

BODY OF WATER Channel Lake STATION 1E3 SAMPLE_____ SPECIES ✓ DATE 9/28/15

		LTH	WT		FREQUENCY
	00				
	10				
	20				
	30				
	40				
	50	52			111
BLG	60	62			
	70				
	80	87			
	90	92			1
	00	102	14		~~1111~~
	10	112	27		
	20	124	39		
	30	138	55		
	40	144	49		
BLG	50				
	60	164	107		111
	70	172	100		11
	80	186	148		11
	90	197	152		1
	00				
	10	267	142		GSP
	20				114 43
WAE	30				
	40	344	300		
	50				
	60				
	70	372			
	80				
	90				
	00				
	10				
	20				
	30				
	40				
	50				
	60	468	1323		
ULL	70				
	80				
	90				
	00	502	208		
	10				
	20	522	101		
	30				
	40				
ULL	50				
	60	560	276		1
	70				
	80				
	90				
	00	822	6720		
	10	630	3620		
	20	150	52		
CAP	30	145	49		
	40				
	50				
	60				
	70				
	80				
	90				

	LTH	WT		FREQUENCY	
00					
10					
20					
30					
40	442	813			
50	451	833			WAE
60					
70					
80					
90					
00					WA
10					
20					
30	535	1317			
40					
50					
60					
70					
80	585	1979			
90					
00				85	
10					
20	126	21			
30	136	33			
40					
50					
60					LM
70	174	59			
80					
90	194	95			
00					
10					
20					
30					
40					
50					
60					
70					
80	288	320			
90	295	386			
00	306	363			
10	318	456			
20	320	514			LM
30					
40					
50					
60					
70					
80	455	1140			
90					
00					
10					
20					LM
30					
40					
50					
60					
70	77			1	
80	80	—		1	
90	91				

F 402 NW
FRD 441-1068 352-438
366-591

PUD 112-29 102-20 11
126-48 87

SMB 85
210-133 1
186-97 1

YEP 202 97
102 101
96 11
88
112-19

BLC 242-245

BLS 57, 62, 62

LOP 89

SPS
112-40

OBSERVED: 2 MUB, 30" 14-04

1200-1230
CAP/FULL-5MIN

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE 1 OF 1

BODY OF WATER CATHERINE STATION I SAMPLE E1 SPECIES ______ DATE 9/26/2011

~~LMB~~

		LTH	WT		FREQUENCY
BOW FIN	00	502	1190		
	10	407	604		
	20	478	866		
	30				
	40				
	50				
	60				
	70	74	—		
	80				
	90				
LMB	00	105	15		
	10				
	20				
	30	133	31		
	40				
	50				
	60				
	70				
	80	186	78		
	90				
	00	204	101		
	10	211	126		
	20	220	136		
	30				
	40				
	50				
	60				
	70				
	80				
	90				
	00				
	10				
	20				
	30	338	485		
	40				
	50	358	610		
	60	366	709		/
	70				
	80				
	90	408	992		
WAE	00	~~188~~	~~63~~		
	10	253	140		
	20	273	179		/
	30				
	40	302	235		
	50	357	344		
	60	393	445		
	70	443	832		
	80				
	90				
ILL	00	548	2239		
	10	509	1772		
	20	484	1568		
	30				
	40				
	50				
	60				
CAP	70	652	3328		
	80	640	3122		
	90				

~~BLG~~ FRD

		LTH	WT		FREQUENCY
	00	369	546		
	10				
	20				
	30				
	40				
	50				
	60				BMS-91
	70				
	80	82	—		//
	90	97	—		//// BBS-78
BLG	00	100	16		𝍸 / 87
	10	118	31		/// 67
	20	123	29		//
	30	136	26		//
	40	142	51		/
	50	150	58		
	60	162	80		
	70	172	89		
	80				
	90				
	00	102	12		/
	10	113	19		//
	20	123	17		//
	30	134	16		///
	40	148	30		
	50				
	60	168	40		//
	70	174	61		//
	80	183	64		
YEP	90	192	71		
	00	208	112		/
	10				
	20				
	30				
	40				
	50				
	60				
	70				
	80	54	—		
	90	97	—		
YLB	00	106	16		
	10				
	20				
	30				
	40	142	34		
	50	151	43		251-230
BLG	60	168	54		/ 269-307
	70	173	69		
	80				
	90				
	00	102	21		
	10	112	26		
	20				
PUD	30	134	56		/
	40				
	50				
GOS	60	83			
	70				
	80				
	90				

PUDXBLG-172/99

1029—1059 H2O temp 65°

– Very Choppy –

√19

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE 1 OF 2

BODY OF WATER Channel Lakes STATION I SAMPLE E2 SPECIES ______ DATE 9/26/2011

— CAPFULL - 10 MIN ONLY —

	LTH	WT		FREQUENCY
00				
10				
20				
30				
40				
50				
60				
70				
80	88	—		
90	96	—		||
00				
10	112	16		
20				
30				
40				
50	152	47		
60				
LMB 70				
80				
90				
00	203	104		|
10				
20	228	163		
30	237	165		
40	244	213		
50	251	196		
60				
70				
80				
90				
00				
10				
20	324	571		
30				
40	348	562		
50	358	638		||
60				
70	376	761		|
80				
90				
00				
10				
20				
30				
40				
50				
60	78	—		
BRS 70	48	—		
80	82	—		
90				
BLC 00	234	185		
10				
20				
30				
40	63	—		𝍸 𝍸 ||
EMS 50	57	—		𝍸 64mm, 81mm, 88mm, 60mm, 70, 70, 70
60	73	—		|||
GOS 70	133	19		|, 85mm, 78, 64,
80	164	39		|
BHB 90	62	—		

	LTH	WT		FREQUENCY
00				
10				
20				
30	37	—		|
40	48	—		
50	51	—		
60				
70	74	—		
80	82	—		|||
90	96	—		𝍸 |
00	108	30		||
10	113	31		||
BLG 20	123	33		||
30	138	52		||||
40	147	62		|
50	151	72		𝍸
60	163	56		|
70	178	116		|
80	184	109		|
90				
00				
WAM 10	173	122		
20				
30				
40				
50	268	223		
WHB 60	298	250		|
70				
80				
90				
00				206-91-1
10				
YEP 20	129	24		||
30	133	27		|
40				
50	157	42		
60	164	52		
70	178	65		
80				
90				
00	274	150		
10	342	357		
20	327	257		
30	366	377		
40	403	515		
WAE 50	458	890		
60	335	286		
70	573	1616		
80	370	371		
90				
00				
CCF 10				
20	522	1144		
30				
40	587	1678		
50				
60				
70	702	3054		
80				
90				

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE 2 OF 2

BODY OF WATER CHANNEL STATION F SAMPLE E2 SPECIES ____ DATE ____

FWD

BOW FIN

	LTH	WT		FREQUENCY
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				
00				
10				
20	324	425		
30	339	441		
40				
50	354	476		
60	364	757		
70				
80	383	629		
90				
00				
10	418	933		
20				
30				
40				
50				
60				
70				
80	388	539		
90				
00				
10				
20				
30				
40	443	845		
50	452	843		
60	460	842		
70	472	938		
80				
90				
00				
10				
20				
30				
40				
50	558	1742		1
60				
70				
80				
90				

CAP

CHEL

	LTH	WT		FREQUENCY
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				
00				
10				
20				
30	430	1098		
40				
50				
60	462	1273		
70				
80				
90				
00	603	3088		
10				
20				
30				
40				
50				
60				
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90	499	1088		
00	509	1550		1
10				
20	524	1868		1
30				
40				
50	557	2624		1
60				
70				
80				
90				
00				
10				
20				
30				
40				
50				
60				
70				
80				
90				

Observed 1 MLB ~ 35" 1322 - 1352

1/9/20

LENGTH/WEIGHT - LENGTH FREQUENCY DATA

PAGE____OF____

BODY OF WATER Channel STATION 1 SAMPLE E3 SPECIES__________ DATE_______

capd ULL - 5min

	LTH	WT		FREQUENCY
00				
10	112	13		
20				
30				
40				
50				
60	165	61		
70	78	–		/
80				
90				
00	203	98		/
10				
20	223	144		
30				
40				
50				
60				
70				
80				
90				

LMB

	LTH	WT		FREQUENCY
00				
10				
20				
30				
40				
50	355	630		/
60				
70				
80	380	727		
90				
00	270	170		
10	412	569		
20	328	445		
30	315	215		
40	349	361		
50	158	23		
60	403	572		
70	268	148		322/263
80	563	1321		240/106
90	138	20		

WAE

	LTH	WT		FREQUENCY
00	936	324		
10	503	1396		
20	398	407		
30	602	2043		
40	293	170		
50	432	717		
60	229	93		
70	324	272		
80	440	763		
90	631	2015		

WHB, WAM, YEE, SMB

	LTH	WT		FREQUENCY
00	212	347		
10	247	181		
20	291	227		/
30	283	219		
40	267	214		
50	142	55	)	
60				
70	250	200		
80				
90	409	909		

CAP

	LTH	WT		FREQUENCY
00	834	5890		
10	620	3268		
20				
30				
40				
50				
60				
70				
80	81	–		
90	96	–		/

BLG

	LTH	WT		FREQUENCY
00	102	21		//
10	116	29		////
20	121	33		//
30	134	50		//
40	142	51		////
50	158	77		//
60	168	96		
70				
80				
90				

ULL

	LTH	WT		FREQUENCY
00				
10				
20				
30	489	1280		
40	529	1312		
50	505	1958		
60	554	2337		
70				
80				
90				

YEP

	LTH	WT		FREQUENCY
00				
10				
20	123	19		
30	136	29		////
40	149	37		/
50	150	27		/
60	163	62		/
70	172	67		/
80	187	73		//
90	193	82		///

BLG, DUD

	LTH	WT		FREQUENCY
00				
10	219	135		
20	229	191		/
30	157	56		
40				
50				
60				
70	142	31		
80				
90				

FRD

	LTH	WT		FREQUENCY
00	361	518		
10	407	992		
20	379	690		
30	334	425		//
40	348	523		/
50	444	1187		
60	462	1340		/
70	395	814		
80	494	1708		
90	532	2424		

BLS - 42 mm
BAS - 62 mm Bam
EAS - 59 mm, 72 mm

Illinois Department of
Natural Resources
One Natural Resources Way Springfield, Illinois 62702-1271
www.dnr.illinois.gov

Bruce Rauner, Governor
Wayne A. Rosenthal, Director

June 26, 2018

Frank Jakubicek
IDNR-Fisheries
One Natural Resources Way
Springfield, IL 62702-1271

RE Friends of Lake Catherine & Channel Lake, Mechanical Harvesting
Project Number(s): 1808131
County: Lake

Dear Mr. Jakubicek:

This letter is in reference to the above project submitted for consultation involving targeted mechanical harvesting of Eurasian water milfoil, coontail and other invasive plants in Lake Catherine and Channel Lake. The natural resource review provided by EcoCAT identified protected resources in the vicinity of the proposed action. The Department has evaluated this information and makes the following recommendations:

Records of the state-listed threatened blackchin shiner (*Notropis heterodon*), Iowa darter (*Etheostoma exile*) and starhead topminnow (*Fundulus dispar*) occur in the project area. Additionally, Channel Lake is designated as an Illinois Natural Heritage Inventory Site. Mechanical harvesting has potential to “take” state-listed fish species including mature, juvenile and fry/eggs of each of the listed species known to occur in these lakes. The Department recommends a condition be included that the applicant execute an Incidental Take Authorization for blackchin shiner, Iowa darter and starhead topminnow. Further questions regarding the ITA process should be directed to Jenny Skufca, IDNR ITA Coordinator.

Consultation under 17 Ill. Adm. Code Part 1075 is terminated. This consultation is valid for two years unless new information becomes available that was not previously considered; the proposed action is modified; or additional species, essential habitat, or Natural Areas are identified in the vicinity. If the project has not been implemented within two years of the date of this letter, or any of the above listed conditions develop, a new consultation is necessary.

The natural resource review reflects the information existing in the Illinois Natural Heritage Database at the time of the project submittal, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project’s implementation, you must comply with the applicable statutes and regulations. Also, note that termination does not imply IDNR's authorization or endorsement of the proposed action.

Please contact me if you have questions regarding this review.

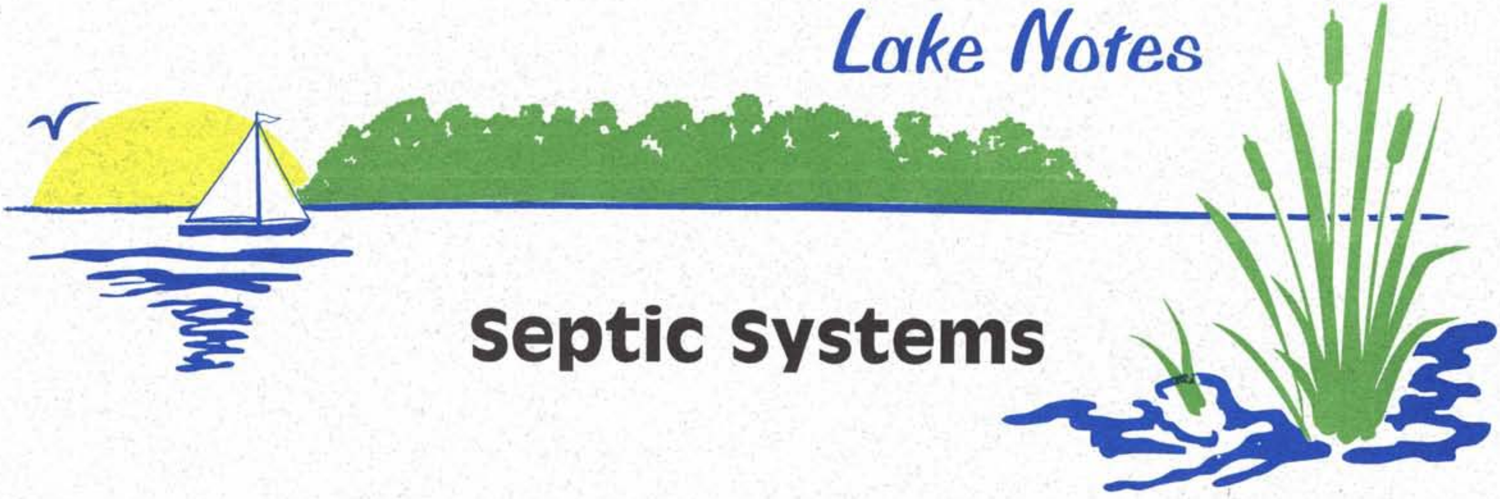
Adam Rawe
Division of Ecosystems and Environment
217-785-4991

Cc Jenny Skufca

APPENDIX C

Example Education and Outreach Materials

Lake Notes



Septic Systems

Those living in a home served by a sanitary sewer system may seldom ponder the fate of waste once it goes down the drain—they trust that the sewer system is well-designed and that the professionals monitoring and maintaining it are doing their jobs. But for those who must utilize an on-site wastewater treatment system, commonly called a septic system, the proper use and maintenance of the system is the responsibility of each homeowner.

Septic systems originally were used to serve individual homes in rural areas where population densities were too low to economically justify sanitary sewers. Septic systems also have been used to serve more densely settled areas where, at least originally, occupancy was seasonal.

A properly-functioning septic system will remove most disease-causing organisms and some nutrients and chemicals from wastewater. However, it will not remove or treat many water-soluble pollutants such as solvents, drain cleaners, and many household chemicals. Consequently, the proper location, design, construction, operation, and maintenance of septic systems are critical in areas close to lakes and streams as well as in shallow groundwater zones. Lake community homeowners have a special responsibility to ensure that their septic systems are not polluting the lake. Septic systems can be safe and effective so long as installers design, locate, and construct systems correctly, ***and*** homeowners actively monitor and maintain them. This publication is intended to help you understand, operate, and maintain your septic system.

Septic systems that are not functioning properly can pose a health threat by allowing sewage to contaminate drinking water. The ecology of nearby lakes can be harmed as well. Sewage is high in phosphorus, which usually is the nutrient limiting algae and rooted aquatic plant growth in Illinois lakes.

Discharge of septic tank effluent to a lake or tributary stream, either through overland flow or groundwater seepage, can contribute to localized increases in algae or aquatic plant growth. In extreme cases, the oxygen depletion associated with untreated sewage can even kill fish. Widespread discharge to a lake over a period of time can significantly accelerate the lake's eutrophication ("aging") rate. Because phosphorus is very slow to leave a lake system, sewage inputs often have lingering effects long after they have been discontinued. Bacterial contamination can be a concern if the lake is used as a source of drinking water or for body contact recreation such as swimming.

Signs of a problem

- Slow draining toilets, showers, or sinks.
- Sewage backing up in the basement or drains.
- Ponded water or wet areas over the absorption field in your lawn.
- Bright green grass over the absorption field may indicate that effluent is coming to the surface.
- A dense stand of aquatic plants or algae along only your shoreline.
- Sewage odors.
- Bacteria or nitrates show up in tests of a nearby drinking water well.
- Biodegradable dye flushed through your system is detectable in the lake.

The most common type of septic system consists of two primary components: 1) a septic tank for collecting waste and settling out solids, and 2) a soil absorption field for filtering the liquid waste. Older—and much less efficient—septic systems often utilize drywells instead of an absorption field or combine the functions of both the septic tank and absorption field into a cesspool.

Where soil composition or depth is not suitable for a conventional septic tank/absorption field, alternative systems may be used. Mound systems create a suitable area for an absorption field by piling up "good" soils to an approved depth and placing the absorption field within the resulting mound. Often this requires pumping the liquid waste up to the elevation of the new field, adding additional mechanical complexities. Other more intricate and expensive designs can be used if conditions dictate. These include aerobic treatment units, sand filters, lagoons, electro-osmosis systems, leeching chambers, and holding tank/truck collection systems.

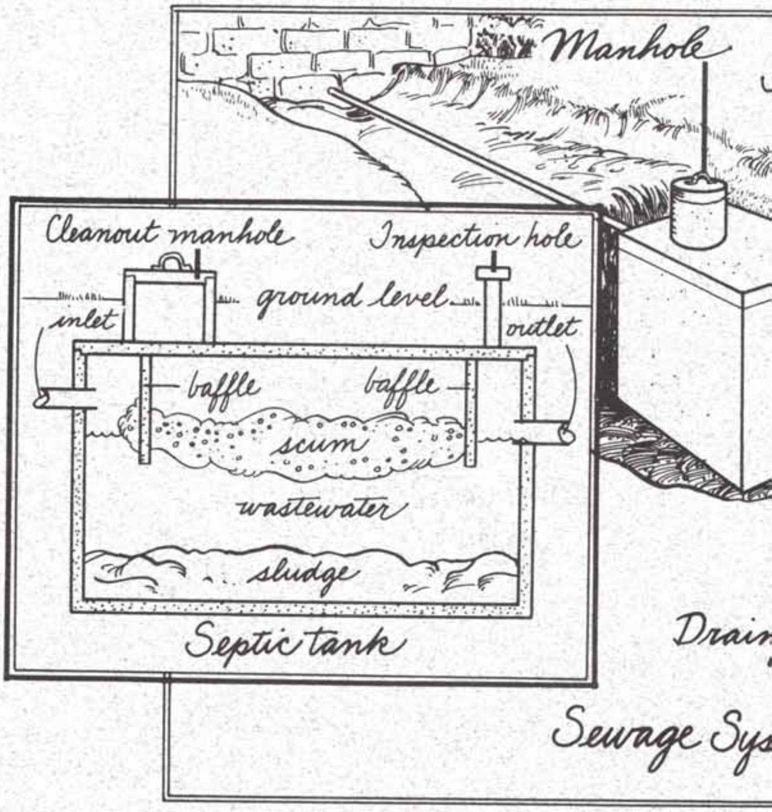
The Septic Tank

The septic tank serves three functions: storage, settling, and digestion. The tank must be able to store waste from high flow periods (e.g., the morning round of showers) until it can pass through the absorption field. Hence, the size of the septic tank is determined by the size of the household it is intended to serve, and it incorporates a formula that accounts for the number of bedrooms and bathrooms in the house. The size and location of a septic tank and its absorption field are regulated by your county health department, with minimum standards set by the State.

Sewage flow coming from the house is separated into three fractions after it enters the tank. Grease, oils, and other light materials accumulate at the top of the tank in a layer of scum. The heavier solids settle into a sludge layer at the bottom of the tank. The intermediate layer is the wastewater—primarily liquids with some suspended solids. It is this wastewater that is passed on to the absorption field. The scum and sludge are held in the tank by a set of baffles. This settling process requires time, so tanks are designed to hold the liquid for 24 hours under normal flow conditions before discharging to the absorption field. A community of anaerobic bacteria in the bottom sludge layer digests the organic sludge portion, slowly transforming part of it into a form that can later be passed to the absorption field.

The septic tank requires regular maintenance to operate efficiently. Annual inspections of the baffles are necessary to ensure that scum is not leaving the tank and entering the absorption field. Similarly, accumulated sludge must be removed on a regular basis to prevent it from backing up into the absorption field or reducing the tank capacity to the point that solids are not able to settle out before the sewage slurry leaves the tank.

The frequency of sludge removal ("pumping") varies with the amount of use your system receives. For an average family of four, a septic tank needs to be pumped out every two to three years. If you are only using the system on a seasonal basis (e.g., summer cottages), the tank may need to be pumped less often. If you are placing heavy demands on the system, such as a large family or a garbage disposal, the tank may need to be pumped every year. Tank pumping must be done by a licensed contractor, but sludge level determinations and tank inspections can be done by you. Contact your County Extension Service office for further guidance. *Never enter the tank or breathe the gases inside the tank. The gases produced in a septic tank are dangerous and can kill!*

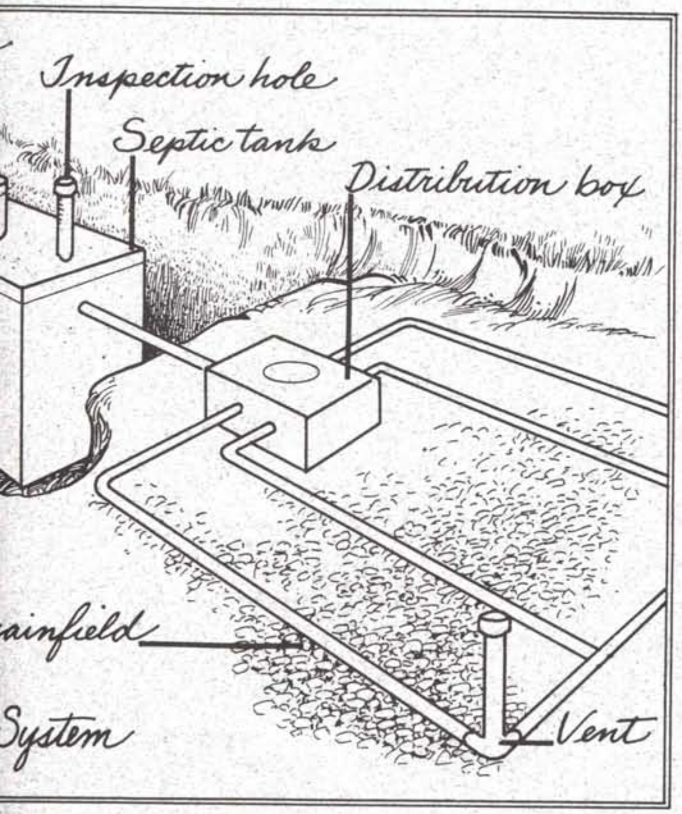


The Soil Filter

When the liquid fraction of the sewage leaves the septic tank it flows on to the absorption field. The absorption field consists of a network of perforated pipes (often plastic) laid out in a bed of trenches lined with gravel. The pipes are connected to the septic tank through a small chamber known as a distribution box. The distribution box is designed to distribute liquids equally among the absorption field pipes. Septic liquid then flows through the gravel and into the surrounding soil.

Together, the gravel and soil act as a filter and remove any solids still found in the liquid. Microorganisms in the soil decompose many of the remaining contaminants. However, the soil cannot remove dissolved solvents, drain cleaners, and other household chemicals that can easily percolate into groundwater.

If the absorption field is properly designed and installed it will accept septic tank discharge for 20-25 years with no maintenance, provided that: 1) the field is not overloaded with liquid, and 2) the septic tank is properly maintained and does not allow sludge or scum to escape and clog the field. Minimizing household water usage and waste output will extend the life of the absorption field and help keep it in good operating condition.



The size and placement of the absorption field is determined by the type and depth of soils on the site, as well as the sewage load it is expected to handle. Some soils are better than others for placement of an absorption field. For example, sandy soils allow water to pass through too quickly to be treated efficiently, while heavy clay soils do not allow enough flow. In addition, there must be sufficient soil above the water table or bedrock for complete treatment (generally about six feet).

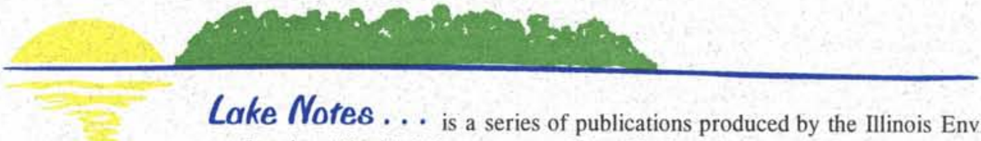
Many lake homes have septic systems that do not have sufficient capacity for the type of use they receive, are located too close to the water table, and/or are in poor soils. Your county Soil and Water Conservation District can help you determine the type, depth, and location of the various soils on your property and their suitability for septic systems.

The absorption field ceases to function when the soils surrounding it become saturated. This can happen when the system is overloaded or when the water table rises to the level of the absorption field. When the soil surrounding the field is saturated, septic effluent flows untreated into the saturated soils and may rise to the surface over the field or seep to the surface down gradient from the field. This untreated septic effluent may also migrate below ground with the prevailing groundwater flow and towards the nearest surface water—quite possibly your lake or a stream tributary to your lake! Whenever your absorption field becomes saturated, the sewage you flush flows essentially untreated into the surrounding environment.

Septic System Tips

The following list of tips will help keep your septic system operating properly while reducing adverse impacts to the environment.

- Limit the water entering your septic tank, and give your system time to rest after heavy use. Use water-saving fixtures; repair leaky toilets and dripping faucets.
- Do not connect foundation sump pumps or other "clean water" discharges to your septic system.
- Inspect your tank every year. Measure the level of sludge build-up and inspect the baffles for scum. Pump your septic tank when necessary (as indicated by your annual inspection of the tank). Save money—organize neighborhood tank pumping!
- Get complete design and maintenance records from the previous owner when you buy a house with a septic system. Know the location of the system's components. Make a sketch showing locations and distances, and keep it in a safe place.
- Driveways, patios, aboveground pools, and other structures should never be built over the absorption field. As much as one third of the water in septic effluent evaporates up through the ground over the absorption field.
- Avoid using a garbage disposal. Garbage disposals add tremendously to the amount of solids entering your septic tank.
- Discard grease in the garbage instead of the drain. Grease can clog the septic tank or the soils surrounding the absorption field. Also, use of liquid fabric softeners can contribute to excessive scum in the septic tank.
- Use toilet paper that decomposes easily. Purchase brands labeled "safe" for septic systems.
- Install a lint trap on your washing machine. Lint will clog the pipes in the absorption field.
- Keep water softener discharges out of your septic system. Sodium in water softener water reacts with soil and reduce's the absorption field's efficiency.
- Read product labels! Use low phosphorus detergents and cleaning products whenever possible. Phosphorus is the nutrient most likely to cause damage to a lake after leaving your septic system.
- Perform routine maintenance on any lift or distribution pumps associated with your system. Systems that utilize pumps will quickly back-up if a pump fails.
- Do not pour strong cleaning agents, chemicals, or old medicines down the drain. These kill beneficial bacteria that break down waste in your septic system.
- Keep all non-biodegradable items such as sanitary napkins, disposable diapers, paper towels, and plastic out of your septic tank. They can block the tank's outlet and necessitate expensive repairs.
- Do not drive or park vehicles on your absorption field. Vehicles can compact soils and break pipes.
- Keep trees and shrubs at least 35 feet away from your field to prevent roots from plugging or breaking pipes.
- Avoid chemical additives. No additive can alleviate the need to regularly pump your septic tank; some may actually promote clogging of your absorption field or contaminate groundwater.
- Route surface water drainage away from your absorption field. Snowmelt, rain, and other surface runoff can temporarily inundate your field.
- Do not inhale gas emitted from an open septic tank. Gas produced in your septic tank is toxic.
- Locate your absorption field as far away as possible from surface water to reduce its potential of becoming a source of contamination.



Lake Notes . . . is a series of publications produced by the Illinois Environmental Protection Agency about issues confronting Illinois' lake resources. The objective of these publications is to provide lake and watershed residents with a greater understanding of environmental cause-and-effect relationships, and actions we all can take to protect our lakes.

Appreciation is extended to the Univ. of Wisconsin-Extension and the Wisconsin Dept. of Natural Resources for permission to excerpt and adapt information and illustrations from "Life on the Edge—Owning Waterfront Property" and "Maintaining Your Septic System."

This *Lake Notes* publication was prepared by Michael Murphy, Holly Hudson, and Bob Kirschner of the Northeastern Illinois Planning Commission, Chicago, Illinois.

For more information about other publications in this series and to request copies, please contact: Illinois Environmental Protection Agency, DWPC-Lake and Watershed Unit, P.O. Box 19276, Springfield, Illinois, 62794-9276; 217/782-3362.

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Your opinion matters! Please take this brief survey to help us improve this website. Thank you!

BE A HERO TRANSPORT ZERO™

FIGHT THE SPREAD OF AQUATIC INVADERS

Aquatic invaders like zebra mussels, Eurasian watermilfoil, and the fish disease viral hemorrhagic septicemia (VHS) are non-native species that cause damage to watercraft and equipment, and can interfere with our enjoyment of water recreation. These organisms also harm native plants and animals, reduce habitat for wildlife, change natural ecosystems, create health risks for humans, and result in negative economic impacts.

Easily overlooked, the main way that these aquatic invaders spread is by hitching rides on boats, trailers, and gear used by anglers, boaters, and other recreationists. If you leave a water access site without taking precautions, you may be transporting these harmful organisms from one body of water to another.

Recreational activities that can spread invaders include:

- Canoeing
- Jet-skiing
- Kayaking
- Paddleboarding
- Power Boating
- Sailing

- Scuba Diving
- Shore and Fly Fishing
- Surfing
- Waterfowl Hunting
- Windsurfing

YOU CAN HELP

Simple steps can be taken to prevent the spread of aquatic invaders in Illinois.

BE A HERO TRANSPORT ZERO™

FIGHT THE SPREAD OF AQUATIC INVADERS

REMOVE PLANTS, ANIMALS AND MUD FROM ALL EQUIPMENT.

DRAIN ALL WATER FROM YOUR BOAT AND GEAR.

DRY EVERYTHING THOROUGHLY WITH A TOWEL.

TRANSPORTZERO.ORG

REMOVE

plants, animals, and mud from all equipment.

Many aquatic invaders spread by attaching to boats, trailers, and other equipment.

Pull drain plugs and remove water from all equipment, such as portable bait containers, ballast tanks, motors, bilge tanks, livewells, and baitwells.

DRY

everything thoroughly with a towel.
Wiping down your boat, trailer, and other equipment not only leaves you with clean gear, but also removes any aquatic invaders. If possible, let your gear remain dry for at least five days.

NEW **BE A HERO** ZONES

This summer, Lake Michigan's Waukegan Harbor and North Point Marina set aside areas now dedicated to giving you the time and space to Remove, Drain and Dry. After time on the water, look for signs directing you to a zone. There, you will find detailed information to help you Transport Zero.

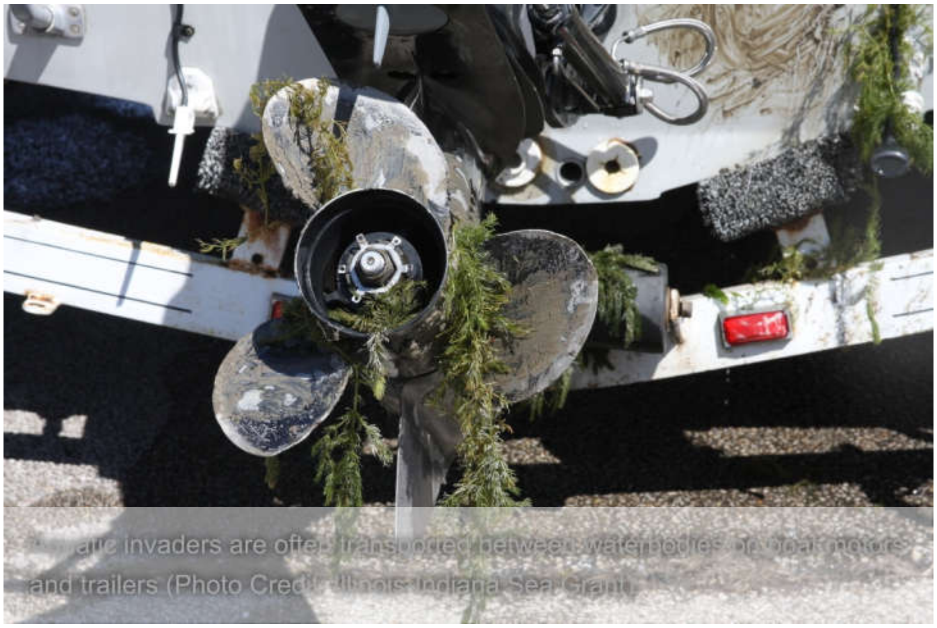
Have you used one of the Be A Hero zones and have comments or questions? Contact us here.

REPORT NEW SIGHTINGS

IT'S THE LAW

Effective January 1, 2013, Illinois' Boat Registration and Safety Act (625 ILCS 45/5-23) has been amended to prevent the spread of invasive aquatic plants and animals by boats, trailers, and vehicles.

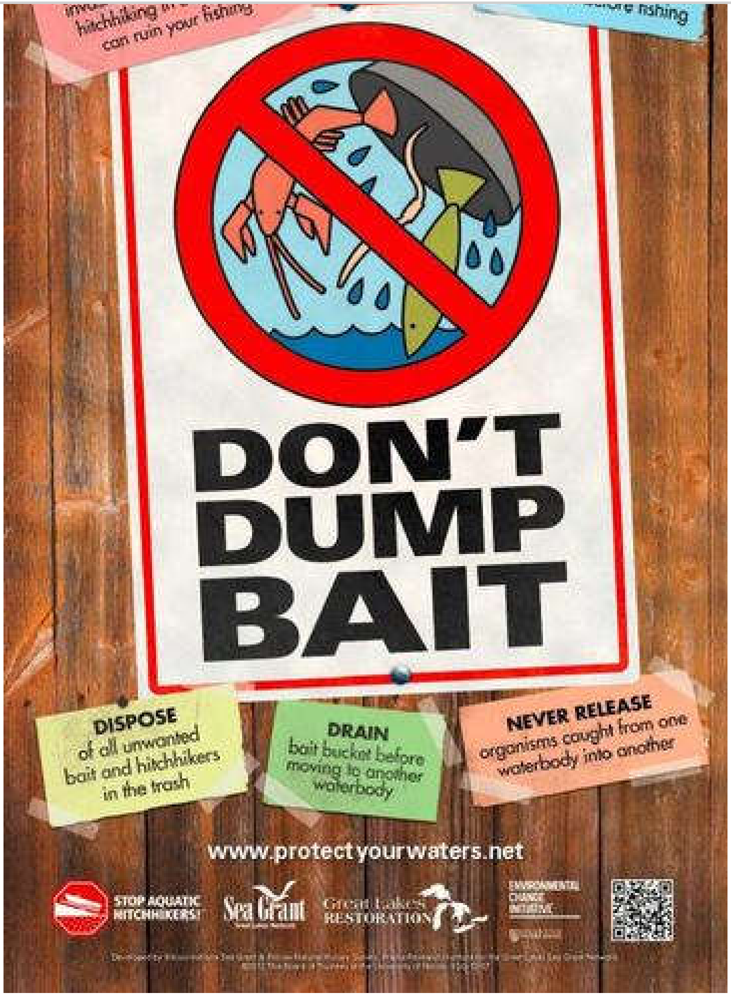
It is illegal to enter OR leave a waterbody with aquatic plants or animals attached to your boat or trailer, and travel on Illinois highways with aquatic plants or animals attached is prohibited.



Aquatic invaders are often transported between waterbodies on boat motors and trailers (Photo Credit: Illinois-Indiana Sea Grant)

BAIT

Aquatic invaders can be spread through the use of live bait. Juvenile silver carp, goldfish, and sticklebacks are sometimes unintentionally mixed in with bait species, depending on where the bait was sourced. To prevent the spread of invaders, anglers can take these simple actions:



REMOVE

non-bait fish, plants and other hitchhikers from your bait bucket before fishing.

DISPOSE

of all unwanted bait and hitchhikers in the trash.

DRAIN

bait bucket before moving to another waterbody.

NEVER

TAKE THE PLEDGE

Join the fight! 95% of Illinois anglers are already fighting the spread of aquatic invaders. Check the boxes in the form below and press submit to take the pledge.

Edit Form Builder

- Only you can see this (https://www.powr.io/knowledge-base/139)
- Edit on Live Site
- Edit in Draft Mode
- View Form Submissions

Your submission has been received, but we're still awaiting payment.

Click to reopen payment window

Your submission has been received, but we're still awaiting payment.

Done with Payment

Click to reopen payment window

Thank you for taking the pledge! If you'd like more information about fighting the spread of aquatic invaders, please contact us at TransportZero@gmail.com.

Loading form responses...

View Results

JOIN OUR MAILING LIST

Email

SUBSCRIBE

RESOURCES

Handouts, flyers, and other outreach tools for recreational water users are available here.

TRANSPORT ZERO–AQUATIC

TRANSPORT ZERO–TERRESTRIAL

RELEASE ZERO

BECOME A PARTNER

Sea Grant
ILLINOIS-INDIANA

ILLINOIS
Illinois Natural History Survey
PRAIRIE RESEARCH INSTITUTE

ILLINOIS
DEPARTMENT OF
NATURAL
RESOURCES

APPENDIX D

ILM and LCHD Reports

FINAL 11.12.17

LAKE CATHERINE / CHANNEL LAKE

LAKE MANAGEMENT PLAN

2017

Prepared For:	Friends of Lake Catherine & Channel Lakes 3216 N. Hoyne Avenue Chicago, IL 60618
Prepared By:	Keith Gray/Sandy Kubillus ILM 110 Le Baron St. Waukegan, IL 60085 (847) 244-6662

Contents

Lake Catherine / Channel Lake
Lake Management Plan
2017

Introduction

Lake Catherine and Channel Lake (LC/CL) are centerpieces of the surrounding community. Maintaining and improving the health and function of the lakes enhances the quality of life not only for those using the lakes, but for everyone who is touched by the economic benefits of these resources.

Over the last 20 years there has been a noticeable degradation in the water quality of the lakes defined by nuisance aquatic plant growth, specifically Eurasian Water Milfoil (EWM) (see Appendix 1) with dense coontail stands, increased algae growth (see Appendix 1), and sediment build-up. Lake conditions continue to quantitatively deteriorate as well. (See data from the Lake County Health Department and the IEPA presented in graphs that substantiate this claim in Appendix 2). A variety of concerned citizens have made efforts to improve conditions either individually or as part of their community. Predictably, the well-intended efforts of various groups with different needs or priorities have resulted in a disjointed array of activities that have made only incremental or temporary improvements. These activities have not been coordinated and, at best, do not take advantage of scale, and, at worst, are counterproductive or even damaging to the environment.

While the Fox Waterway Agency (FWA) was created to maintain the Chain of Lakes (Chain), funding has not kept pace with the eutrophication (the accumulation of nutrients and sediment that shifts the plant and animal population to less desirable – and often non-native – species) of the system. Limited resources necessitates that the FWA focus predominantly on maintaining the safety and navigability of the Chain, primarily through dredging; maintenance of navigational aids; debris removal; and related activities. Consequently, the high demand for FWA services leaves Chain communities uncertain about assistance from that agency – particularly with respect to restoring the environmental health of the lakes – all while water quality and aesthetics continue to decline. Although FWA has a history of work on the lake, some resources, and an existing system of generating funding to maintain Chain waters including LC/CL, a better understanding of current and future FWA funding strategies and how projects are prioritized can be important in making localized decisions regarding LC/CL. This plan assumes lake improvement efforts independent of FWA.

Unfortunately, there is often no simple "silver bullet" solution for improving or restoring the water quality in aquatic ecosystems of the size and complexity of LC/CL. **The goal of this plan is to provide a pragmatic road-map leading to improved water quality for Lake Catherine/Channel Lake.**

To accomplish this, it provides stakeholders:

- Context (including historical data)
- Lake management options and recommendations (including cost estimates)
- List of stakeholders
- Regulatory considerations
- Implementation plan
- Monitoring program to measure progress

Like many excellent plans, this one will be worthless unless it is implemented. There is not an unlimited budget, and, as data shows, the likelihood of being able to affect lake inflow water quality from far up the watershed is very small and consequently not a focal point of the plan. Therefore, this plan is deliberately concise as to be user friendly and not overwhelm readers. Also, it is important to remember that it took decades of human influence for the lakes to reach their current state, and positive changes in conditions and water quality will be incremental and will take time.

Lastly, this plan must be a living document. What will be known in 10 years from advances in monitoring and in management/treatment technologies will likely dwarf what is currently known and what is available today. Future challenges, like the introduction of invasive species not currently seen in LC/CL, as well as new solutions, must be considered with adjustments made to the management approach of these valuable natural resources. In this spirit and as part of the creation of this plan, ILM will be assisting your organization with incrementally advancing this initiative over the next 12 months.

A. Relevant Historical Information

LC/CL are at the headwaters of the 'Chain of Lakes' and benefit from the vast wetland to the north that traps sediment and nutrients of incoming water before entering the lake. A 1999 USGS study shows more sediment leaving the lake, flowing south under Rt. 173, than is entering the lake. An evaluation of current watershed land use (see charts in Appendix 3) show little difference since the 1999 report. Additionally, changes to the flood gates in the last 10 years downstream within the Fox River (i.e., at the Stratton Lock and Dam located near McHenry, IL) allows for greater flow which will move more sediment with it. The general conclusion that the net loss of sediment from these lakes is still occurring remains, but there are identifiable areas within the lakes where sediment is accumulating. This means that in-lake efforts to improve conditions have a better chance at succeeding in LC/LC than in other lakes along the chain that are influenced greatly by flow from LC/CL and developed areas.

Phosphorus is a key nutrient in the growth of algae and aquatic weeds and therefore an important water quality indicator. Total phosphorus concentration, as listed by the IEPA, is shown to be a problem in both lakes, particularly in the deeper samples collected near the lake bottom (Appendix 2). Data and modeling based on watershed land use show the annual proportion of phosphorus compounds coming into the lakes from major sources should be relatively constant as follows:

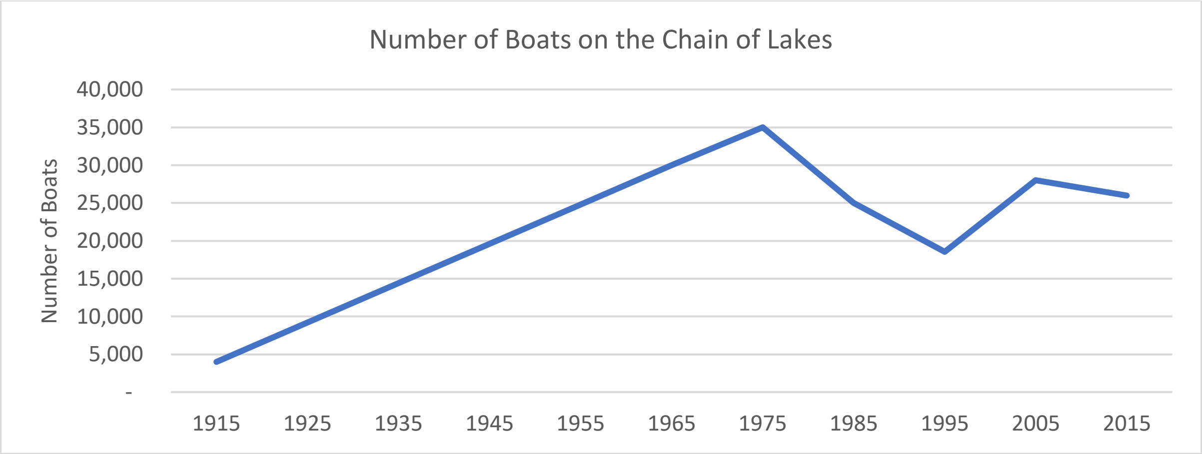
− Precipitation	< 5%
− Decomposing matter (organic debris)	< 5%
− Waterfowl	< 1%

− Internal regeneration (release of phosphorus from anoxic conditions; also known as internal “loading”)	40%
− Watershed inflows	30%
− Direct storm drain connections	15%
− Inflow through Rt. 173 bridge	10%

Water quality parameters have been collected on LC/CL for decades (Appendix 2). This data, along with qualitative input from lake users, indicate a degradation of water quality which is inherent in the eutrophication process. This process is accelerated proportional to: land disturbance/development in the watershed (specifically around the lake), the effects of accumulation (available nutrients), newly introduced aquatic species (such as zebra mussels), and lake use.

Lake water quality was of concern in the 1990’s which prompted a very significant study and report completed by Cochran and Wilken in 2000. This report took over two years to complete and is very comprehensive (137 pages). It is an excellent source of information regarding all aspects of LC/CL and much of the data presented gave direction for the current data collected resulting in our conclusions and recommendations. (Note: Funding for this report was through the IEPA and Fox Waterway Agency, with assistance from the IDNR, USGS, and USDA. It is important to note that since the time of this report, funding from these agencies to maintain or improve LC/CL have not kept pace with need or have disappeared altogether). While it is reasonable to expect that historical data offers a good baseline for which to compare current data, what we find is that between 1979 and 2014 traditional water quality parameters (clarity, chlorophyll, dissolved oxygen, phosphorus) have either not improved or are trending negatively further evidencing deteriorating conditions of the lakes (Appendix 2).

The loss of water clarity and increased algae growth are mostly a function of re-suspension and reintroduction of solids and nutrients that currently exist in the organic-rich sediments that accumulated on the lake bottom over decades. Motorboat traffic is one of the principle drivers of such solid and nutrient re-suspension. Although the graphic below shows that the density of boats is down from historic highs, boat use frequency and factors like hull design (with the growing popularity of wakeboarding on vessels designed to produce large wakes) and marine engine horsepower are such that turbulence and wave energy in shallower areas and along shorelines is a significant contributing factor in the re-suspension of solids.



*Data based on number of boating permits registered. Data for 1915 and 1977 are estimates from 1977 Fox Chain of Lakes Investigation and Water Quality Management Plan.

Limited sampling and analysis of primary inlet waters in 2017 (Appendix 4) support the claim in the 2000 report that internal nutrient loading (i.e., from existing bottom lake sediments) is the primary cause of water degradation.

It should be noted that all data referred to previously is a result of grab samples collected that are highly susceptible to variability for different, but valid reasons. As such, installation of a continuous water quality monitor(s) to accurately monitor trends in water quality will be amongst our recommendations.

Another indicator of lake health has been the biennial fish surveys conducted by the Illinois Department of Natural Resources (IDNR). These studies use fish population, species, and size primarily for making stocking decisions, but are also an imperfect but useful indicator of lake health. According to IDNR staff, as of 2017 these studies are expected to continue. One of the negative impacts of dense beds of EWM is that it creates more hiding spaces for small fish making them harder for larger fish to catch. The result generally is a population of shrinking fish, and without adequate food sources, these fish typically stay small – a phenomena referred to as stunting.

A source of nutrients into the lake system that does not seem to get much attention are the known antiquated septic connections feeding into the two lakes. The map in Appendix 5 shows these locations. The Lake County Health Department requires new septic systems to meet certain capacity and performance criteria, but once a system is approved and put into service, its function is not checked or validated by any regulatory body or agency. One of the effects of untreated waste into the lakes is the constant addition of nutrients that will support added algae growth and reduce water clarity. These antiquated septic systems will also be addressed within our recommended actions.

B. Recommendations

The components of an effective lake management plan are inter-related, with one challenge being prioritization of implementation. Further, the intensity with which high priority recommendations are pursued can affect the validity of lower priority recommendations. With an unlimited budget and no regulation, much could be done. Neither is the case here, and the focus of this report is on the lakes, and not necessarily the channels which have different influences and behave very differently than the main lakes. The implementation of this report's recommendations need to be part of a process that is fluid relative to stakeholder needs as well as conditions that may be outside of control of the stakeholders. Therefore, these recommendations are listed separately for clarity and it is not intended to imply exclusivity between them.

Tier I Recommendations

(action items that should be initiated immediately)

a. **Reduce the occurrence of and control the growth of EWM:** *This recommendation is supported by Frank Jakubicek (IDNR) and Mike Adam (Lake County Health Department-Lake Management Unit).*

   Healthy water impoundments have 1/4 to 1/3 aquatic vegetative growth on the lake bottom. However, non-native/invasive plants impede healthy lake environments in several ways:

  - They outcompete and displace native plants, reducing plant, insect, and fish diversity that are hallmarks of a healthy and sustainable ecosystem. (Since the current practice of consistent limited/targeted chemical management of non-native/invasive plant species has started in some areas within the lakes, IDNR has observed increases in native plant populations.)
  - Dense aquatic plant growth hinders mixing and oxygenation of the lake bottom in shallow areas. When the water at the sediment level in a lake becomes stagnant and void of oxygen, the microorganisms in the sediment release phosphorus back into the water column that then fuels algae growth (nutrient regeneration/internal loading accounts for approximately 40% of the nutrient compounds available in the water for algal growth).

Reducing the coverage and density of EWM and replacing this growth with more desirable growth (chara or native plants) is expected to lead to fewer occurrences of blue-green algae by allowing for better oxygenation (in this case through natural diffusion) of the lake bottom that in turn is expected to keep algae-growing nutrients sequestered in the bottom sediment. Care must be taken to discourage establishment of other undesirable species in place of controlled EWM.

Biological control of EWM is not considered since this approach is no longer available commercially. Implementation of a chemical EWM control program and plant harvesting will be described later.

b. **Create a monitoring program that will document improvement to the lakes:** There are several monitoring programs currently practiced. To monitor progress/results of efforts to improve conditions and water quality, a reliable monitoring program must be established and maintained. *(Two different methods are discussed later in this report.)*

c. **Identify and investigate known discharges to the lakes that carry contributing excess nutrients to the lakes:** Internal regeneration of nutrients, failing septic systems, and surface runoff all contribute to phosphorus levels (and therefore algal growth) in the lakes. Further investigation can help determine the relative contributions from each and allow stakeholders to make sound management decisions based on that data. Failing septic systems, nutrient rich sediment in anoxic conditions, and residential practices can all be evaluated and actions implemented to curtail added phosphorus to the lakes.

d. **Implement nutrient deactivation and mixing/oxygenation techniques potentially coupled with the use of approved algaecides <u>if algae growth persists after significant reduction of EWM</u>:** Dissolved nutrient levels in the water may be such that even with improved mixing after the significant reduction of EWM, algae growth continues to be at an unacceptable level. Mixing (oxygenation) can be accomplished via different means with varying costs, zones of influence, and that have different compatibilities with lake use.

Historical Note: An aeration system was installed in the southern end of Lake Catherine in 1978 at a depth of 26 feet. Water quality was monitored that season with the documented conclusion being: 'Aeration had no effect on the concentration of nutrients and other chemical parameters in Lake Catherine.' The following year, the aeration system was operated in conjunction with *copper sulfate applications to address the formation of blue-green algae. While the blue-green algae issue was successfully addressed and water clarity improved, there was no effect on nutrient concentration leading to the conclusion that this management option addressed undesirable symptoms, but did nothing to address the causes of poor water quality. This experience – while dated – suggests that consideration of scaled-up aeration and/or mixing coupled with chemical control may be prudent if after other less intense and less costly methods of management are not effective.*

Tier II Recommendations

(action items that should be planned for)

a. **Sediment probing and sampling in high vegetation production areas:** It may benefit water quality to identify and remove sediment to reduce the nutrient bank in strategic areas of the lakes and to create more depth. This allows for better mixing and cooler water (improved oxygenation), resulting in less algae production and fewer aquatic plants. As a first step, targeted sampling of areas with high vegetation is recommended to assess the potential for excessive nutrient concentrations.

b. **Removal of sediment (if warranted from findings in 'a'):** Removal of sediment from targeted areas where the high nutrient content is fueling algae growth, and/or where added water depth will improve mixing, can reduce rooted aquatic plant growth. Removal of sediment in areas where algae and nuisance aquatic plants appear are prime targets for limited dredging programs that may, in turn, benefit the entire lake. Planning these projects generally takes 9 to 18 months and is historically performed by FWA. Early determination of whether dredging is a good investment allows for planning and permitting that can require long lead times.

c. **Creation, appointment, or hiring of a Lake Manager (volunteer or professional):** Implementation of activities to improve water quality requires coordination of several components (funding, communication, contractor performance, etc.) and should be sustainable past the efforts of the current leadership. This allows time for improvement to occur and to protect the lakes for future generations. A recognized or designated 'manager' to maintain focus and ensure stability through changes in board or committee make-up, and to implement programs, monitor success, and make recommendations for adjustments as needed, is recommended to give water quality improvement initiatives on LC/CL the best chance of success.

Not Recommended

a. **Large Scale Harvesting:** Since the target plant in LC/CL (EWM) spreads fairly easily by fragmentation, large scale harvesting is not recommended. Further, naturally occurring weevils that can help control growth of the plant incrementally, and allow for native plants to fill the void left, inhabit the upper portions of the EWM plant that is cut off during harvesting. Cutting is non-selective and the native/beneficial plants capable of replacing the EWM may also be adversely affected. Lack of rooted plants in the lakes will lead to an alga dominated ecosystem that is highly undesirable. Vacuum methods claiming to be able to economically pull the target plants selectively have been on the market for some time. Our experience is that this approach is very labor intensive and likely not a viable method for vegetated areas the size found in LC/CL. If this technique can be automated to recover the root while minimizing fragmentation, and invasive plants are replaced with native species to avoid re-infestation, it should be considered. *(Note: while large scale or mass harvesting is not recommended, targeted harvesting using certain tactful techniques can be a beneficial strategy and is addressed later in this Plan.)*

b. **Enzymes and Bacteria:** There are many products on the market that claim to reduce sludge or to reduce phosphorus in the water (with the implication being that because of this it will control algae growth). The effect on sludge reduction has been qualified independently and found to be useful for lakes with *a minimal organic layer on the lake bottom*, but for thick accumulations as occurs in key areas of LC/CL, the data suggests that this approach is less cost effective than dredging. Independent research showing that these products inhibit algae growth without proper mixing and aeration cannot be found.

C. Stakeholders

This list is compiled to give Friends of LC/CL a starting point for engaging members and partners. Experience from dozens of lake communities show that the importance of this activity cannot be overstated. Awareness is vital to gaining support for fundraising, supporting the management activities, implementing recommendations, and to help carry the initiative forward. Creation and distribution of a simple guide for lake front property owners on what they can do individually to help control EWM or other invasive species, stabilize shorelines, and manage septic systems is an excellent first step towards achieving the water quality goals of your community.

Organized Homeowner's Associations (HOAs)
See map and table in Appendix 6

Non-HOA Resident Groups
See map and table in Appendix 6 and list of local businesses who may receive benefit from the lake use in Appendix 7.

All Waterfront and Water-view Properties
A graphic of properties surrounding the lakes is in Appendix 8.

Villages
The lakes occur in unincorporated areas near the Villages of Antioch, Fox Lake, Spring Grove, and Richmond. Village of Antioch officials indicated that all land touching the lakes are unincorporated. The unit of local government with boundary jurisdiction containing the lakes is Antioch Township.

Elected Officials
Mayors, Trustees, State office holders, Township officials, County Board Representatives.

D. Regulatory Considerations

Consideration must be given to regulatory constraints and costs when considering lake management activities. This list is provided as comprehensive reference for future use.

Illinois Department of Natural Resources (IDNR)
Concerned with state Threatened and Endangered Species (T&E). Must be consulted and permit obtained for chemical treatments, pier installation, dredging, and shoreline stabilization. Has ability to assess fees. According to Frank Jakubicek of IDNR: *If a person, other than the State, owns property, the property owners may need to give permission to treat over their property even though the State has Jurisdictional Management Authority. Several avenues of State Law may be involved and "someone" may have to decipher the interpretations between Dept. of Agriculture and Jurisdictional Management.*

Illinois Dept. of Public Health (IDPH) (for beaches)
While they have some jurisdiction on the Chain, they defer to Lake County Health Dept. for issues on the Fox Chain.

Fox Waterway Agency (FWA)
Charged with delineating buoy zones, creating safe boating ordinances, and keeping main navigational channels open. Administers user fee program. Requirements to gain approval from FWA for lake management practices such as chemical treatments, aeration, installation of continuous monitors, etc. cannot be found. Sharing this information with FWA is a courtesy and is recommended.

US Army Corp of Engineers (USACOE)
Regulates waterway construction and concerned with wetlands and dredging. USACOE will not issue permits for work until IEPA approval for a project is obtained.

Illinois Environmental Protection Agency (water quality)
Authority over water quality, specifically relating to water treatment having to do with dredging. Has ability to assess fees.

Lake County Health Department
Tasked with monitoring public swimming areas (pools and lakes). This department includes the Lakes Management Unit (LMU).

Lake County Stormwater Management Commission (SMC)
Issues permits for work affecting stormwater management in Lake County. Tasked with policing erosion control as required by Watershed Development Ordinance (WDO) and USACOE. Assesses fees.

Lake County Planning and Development
Responsible for regulating construction (including seawalls) in floodways. Assesses fees.

US Fish and Wildlife Service
For work where there are Federally Threatened or Endangered species (this is the case for LC/CL), this organization must review any plans and may issue permits with limitations to activities.

E. Implementation Plan

Governance

This plan was commissioned by the Friends of Lake Catherine/Channel Lake with the understanding that it has authority to implement the recommendations. As noted previously, FWA is the recognized regulatory authority for the Chain of Lakes, including LC/CL. Communicating any funding or lake management intentions with FWA representatives can help to avoid conflicting or duplicative efforts and may facilitate opportunities for funding and implementation that may not otherwise occur.

An IDNR permit is required for some of the recommendations made below. Either Friends of LC/CL or FWA should consider applying for and owning these permits so that adjustments to the service providers used can be made, if necessary.

Control of EWM

(two recommended control options)

1. **Targeted Chemical control of EWM:** This approach is currently administered on an adhoc, property-by-property basis using a contact herbicide covering approximately 20% of the LC/CL shoreline (mostly on Lake Catherine). By treating only 20% of the shoreline area, it's difficult to maintain the requisite concentration/contact time needed to control growth of the target species given that the herbicide can dissipate amongst surrounding, non-treated waters quite easily. It is important to note that IDNR permitting and the limitations embedded in the permits are out of concern for the effects of product 'drift' that can cause inadvertent damage to sensitive areas. 'Partial' treatments leave a low concentration of the active ingredient in a wider area, thereby making treatment less effective than if permitted treatments of larger areas were performed. Dosing below effective rates potentially encourages the growth of herbicide resistant plant strains and should be administered by licensed and experienced applicators. ILM has been treating EWM along limited shorelines on LC/CL for seven years and IDNR officials have noted incremental improvement (less EWM and establishment of desirable native aquatic plants) over this time. Complete eradication of EWM by any means should not be expected. Of further note, chemical control of EWM is akin to treating the symptoms of an unbalanced lake, but not the underlying root cause of poor water quality (i.e., elevated nutrients and phosphorous). However, a significant reduction in the EWM population can be achieved by scaling this approach up and would require years to realize noticeable benefits to the water quality as a result. While this time frame may not be desirable, one positive is that a slower transition away from EWM gives native plants an opportunity to fill the voids naturally.

   COST: *The current cost of limited EWM control under standard IDNR limitations (which offers some progress towards aquatic plant diversification) is $7,300. The extrapolated cost for this treatment covering the entire LC/CL shoreline (75ft or to the end of a pier, whichever is greater) would be $35,000 annually. Attention should be paid to the application areas, products used, and dosages as to not inadvertently encourage herbicide resistant strains of plants by under-treating. The decision to continue (or expand) the approach to EWM management with individual property owners (or HOA's) engaging qualified services to apply the herbicide should be made by January 2018 so that requisite permits can be issued by spring.*

2. **Targeted Harvesting**: EWM and coontail have similar characteristics and effects on lake use and water quality, and targeted harvesting of these plants can have an immediate impact. While EWM can spread by fragmentation, coontail is not known to. For areas with high boat traffic or in popular swimming areas, harvesting is a viable option. It is important to know that harvesting aquatic plants is like mowing a lawn: the plants grow back. The cost to harvest (machinery, labor, transport of material, disposal) versus the benefits should be considered.

   The *presence* of aquatic plants (native or non-native) stabilize the sediment with roots and sequester nutrients in the plant structure, both leading to the conclusion that algae is less likely to grow. Conversely, the *absence* of aquatic plants allows for greater mixing which would limit the reintroduction of nutrients (specifically phosphorus) back into the water. This also allows for less algal growth. Localized lake conditions (depth, mixing, sediment quality,) play a role in whether a reduction in aquatic plants results in a reduction of the formation and accumulation of blue-green algae. Close observation of treated or harvested areas will help guide future activities.

   Chemical management methods to specifically control blue-green algae should be considered if this type of algae is persistent. It should be noted that early detection and early treatment of blue-green algae are critical.

   COST: *The cost associated with harvesting (including machinery, labor, transport to and disposal of the harvested material in an environmental waste facility) is approximately $1,800/acre. It is highly dependent on the location of the material being harvested and its proximity to the shoreline/temporary disposal site. If chemical management of blue-green algae is needed, the cost to treat is approximately $250/acre. The number of acres and frequency that blooms will occur is unknown.*

Water Quality Monitoring
(several options can be considered as reliable measurements of water quality improvement)

1. **Continuous dissolved oxygen (DO) monitoring**: Dissolved oxygen is an important water quality parameter that is *highly variable* by time of day, temperature, season, location within the lake, weather conditions, algae or aquatic plant growth, and depth. Newer technology allows for the monitoring and recording of DO through the water column at key points continuously and can produce reliable data that can be used to assess lake improvement initiatives and quantify improvement. In-Situ and other manufacturers of monitoring and data logging instrumentation have equipment that can measure dissolved oxygen and log data continuously. There are telemetry options available that allow access to data remotely. This data would be a very reliable indicator of water quality changes over time. After review of bathymetric maps of the lakes, data from various monitoring points, and in consideration of discretion when deploying continuous monitors of any kind, two recommended monitoring sites on LC/CL are highlighted in Appendix 10.

   COST: *The cost to obtain and set-up/install eight units (four in each of two locations) that measure DO at 1ft, 6ft, 11ft, and 16ft water depths would not exceed $30,000. Once installed,* *the only cost would be the annual cellular connection (less than $500/year) and batteries for the units (less than $100/year). Some amount of labor to install in the spring and remove before the formation of ice can be accomplished with volunteers. Specifications for the instrumentation described above is in Appendix 10. Vandalism to the buoys or monitors should be considered before making this investment.*

2. **Lake vegetation mapping**: This can be employed to measure and chart the occurrence of EWM as well as desirable aquatic plants in the lakes so that shifts in these populations can be monitored. Since the current concern is EWM and potentially coontail, mapping total vegetative cover does not differentiate between plant species (recall that it is desirable to have EWM replaced by lower growing native plants) and is useless for your purpose. To avoid creating an alga dominated lake, 25-33% of the lake bottom should support vegetative growth. Gathering data that can be used as a reliable indicator for progress in the reduction of EWM requires trained personnel to gather aquatic plant samples on a grid, identify the percentage of the target plant, and record the results. A program takes this data and maps the plant location and density in the lake. Consistency in how the data is collected is important since the samples represent larger areas and any inaccuracies can have magnified effects.

   COST: *A certain amount of plant identification expertise is required to execute this task and, to gain accurate information, two studies per season should be done so that plants appearing at different times during the growing season can be included. If contracted professionally, the cost to sample, identify and catalog plant species, and map the vegetation of each lake (up to approximately 10ft in depth) will cost an estimated $5,000-$7,000/season depending on the density of the sampling points. A modified program that looks only at EWM may be completed within a budget of $4,000, and a condensed version that looks at representative areas of the lakes as opposed to the whole lake can have lower costs proportionally.*

3. **Chemical and biological indicators (secchi readings, phosphorus, chlorophyll, dissolved oxygen):** These are traditional methods to determine lake health for short-term monitoring by the IDNR and separately by the Lake County Health Department's Lake Management Unit on a five-year cycle. There is value in comparing historical data to current data. However, these indicators are highly susceptible to variation due to influences that are outside the control of the community (weather, upstream watershed, time of day, seasonal variability) and small degrees of improvement can easily be overshadowed by the lack of consistency in these data summaries. Further, the cost for consistent and reliable labor to collect samples and monitor and lab fees can be quite high and worse, may not represent the condition of the lake as a whole.

   COST: *These services come at no cost to the community and have a place regarding long-term trends in the condition of the lakes, and should continue with new data evaluated for meaning as part of a more comprehensive monitoring program.*

Improved water quality can be expected as a result of a combination of several factors and actions:

- Continuation of negative sediment load coming into the lake
- Tracking and mitigating known sources of nutrients into the lake

- Shifting the aquatic plant population from EWM to native plants like eel grass and chara (a bottom anchored form of algae)
- Identification and addressing of ‘hot spots’ where sediment is nutrient rich and likely a source of nutrient regeneration into the water column will all contribute to improved water quality

Nutrient Deactivation / Aeration

In LC/CL, nuisance algae growth is fueled by ortho phosphorus in the water. Compounds such as bulk aluminum sulfate, or trade products with a functionally similar molecular structure, can be applied to the water to combine with the phosphorus in the water and sink to the lake bottom making that nutrient unavailable for algae growth. This has been effective in many lakes, but would likely not be a realistic approach as a whole-lake treatment. It can be considered in areas where nutrients are cycling back into the water and dredging is not a viable option. If the lake bottom is allowed to become void of oxygen (anoxic), the bacteria that flourish in that environment release the phosphorus back into the water as part of the decomposition process. To minimize this effect, aeration of the treated areas of the lake is required.

Oxygenation of lakes is accomplished naturally with waterfalls/streams (turbulence), at the air-to-water interface, and through the respiration of oxygen from subsurface plants. In many instances, and especially in lakes with a significant nutrient bank, the oxygen content of the water can be increased using equipment in several ways depending on water depth, cost of and availability of electrical power sources, desired areas of influence, and lake uses. Since this plan prioritizes actions that encourages natural oxygenation first, it cannot be known before control of EWM occurs:

- If mechanical aeration will be beneficial (or cost effective)
- The location(s) where the air introduction or mixing will occur
- How much aeration may be required
- The best/most cost effecting methods to accomplish the introduction of added oxygen into the water

The broad categories of lake aeration methods are fountains, mixers and air diffusion. Because of the size and the potential for interference with lake use, fountains and mixers are not appropriate options for LC/CL. Air diffusion could be a viable option.

Air diffusion systems are the most unobtrusive aerators and are most effective in deeper lakes. Air diffusion is commonly accomplished through land based air pumps pushing air through weighted lines to diffusers beneath the water surface. The more horsepower of the motor, and the deeper the diffuser, the greater the zone of influence. The diffuser emits the air in the form of bubbles that capture and entrain the bottom water and lift it to the surface. The rise of air bubbles pulls the cool bottom water to the surface where the atmospheric oxygen exchange occurs. In the presence of a now oxygen-rich environment, nutrients (i.e. phosphorus) stay locked in the sediment at the bottom of the lake – unavailable to weeds and algae. This reduction of nutrient cycling will slowly break up the stagnant zones, raise the DO, decompose the organic materials and improve water quality overall. There are several approaches to air diffusion, and understanding where in the lake to best position the diffusers helps to ensure proper system sizing.

***COST:** The purchase cost for these systems are as follows:*

- *Lake Catherine: Equipment $80,000 plus building cost ($15,000) and electrical cost per month*
- *Channel: Equipment $148,000 plus building cost ($15,000) and electrical costs*

Increase the percentage of native plants

Increasing the native plant population is best achieved by decreasing the populations of non-native/invasive plants to reduce competition and encourage the native growth. Consistent, targeted chemical management has accomplished this in areas of the lakes where this approach has been utilized.

COST: *Treatment costs for the primary target, EWM, are outlined in the 'Control of EWM' section above. The extrapolated cost covering the entire LC/CL shoreline (75ft or to the end of a pier, whichever is greater) would be $35,000 annually. Please see additional notes under 'Control of EWM'.*

Dredging / Sediment Removal

Dredging (sediment removal) could be considered for targeted locations within the lake area (i.e., Trevor Creek and/or the southwest side of Channel Lake). Any recommendations to dredge must be based on an evaluation of which combination of sediment richness (i.e. phosphorus concentration) and anoxic conditions make any area the highest priority. A sediment investigation study would help to identify areas that could most benefit from dredging and provide the greatest impact to the lakes overall. A sediment study would provide critical information such as sediment volumes, locations, DO in each area, and nutrient level of the sediment.

COST: *To execute a sediment investigation study (a necessary step prior to dredging) the cost is $12,000. Average costs for sediment removal are $35-$65/yard, depending on location, material, and disposal options. It is likely that even a 'small' job will include 1,000 yards for removal, meaning the cost for just that much is $35,000 to $65,000.*

Awareness Program

Creating awareness among community members and visitors is a key step to achieving incremental improvements to the lakes. A common theme among many of the recommendations contained in this plan is the need for excellent communication to lake stakeholders so that engagement and support and maintained. Lake community members, municipal leaders, local businesses, neighboring communities, county officials, state level officials, regulators, and others within the Fox River watershed should be considered partners so that educational resources can be shared where applicable.

COST: *This could be a low cost or free option, depending on the types of communication that are deemed to be most appropriate. Utilizing existing communication channels, and partnering with the FWA and other established stakeholders will help to reach a large percentage of the target audience.*

Summary (Steps stated generally to improve water quality in LC/CL);

1. Identify and engage immediate participants. *Reversing eutrophication will take time and maintaining a lake has no end. Ensuring longevity of the initiative requires broad participation.*

Formation of the 'Friends of Lake Catherine/Channel Lake' is complete. Creating a plan to expose, educate, and engage stakeholders should be an ongoing task.

2. Determine short and mid-term direction (what action items will be implemented, budget). *Many management strategies have long lead times, and positive changes to the lakes can occur by implementing recommendations while other activities are being planned. -Investigation into potentially leaking septic systems has been started. -There are ongoing treatments of EWM by various lake front associations. -A method to measure improvement should begin. Purchase and installation of continuous DO monitors/data loggers is recommended as this is immediate and sustainable at a relatively low cost. Based on DO readings, aeration system types and their locations can be investigated, with an implementation plan ready if needed.*
3. Identify targets (partners, funders, agencies, other stakeholders). *In the same spirit, as #1 above, useful partnerships will be identified through this process and should be cultivated.*
4. Implement action items as time and funding allows.
5. Establish measures for success and milestones for evaluation and management plan adjustment.

As discussed, the reversal natural lake eutrophication is a process that takes an ongoing commitment of time, planning, organizing, educating and resources. ILM stands ready to help the 'Friends of Lake Catherine/Channel Lake' as a professional and technical resource through July 2018 as part of this plan.

Appendices

Appendix 1

Invasive/Non-native Aquatic Plants Eurasian water milfoil (EWM) is a highly aggressive/non-native aquatic plant that disrupts lake use because of its growth near and at the surface. It also displaces beneficial/native aquatic plants. The population of EWM has stabilized in LC/CL at an 80% occurrence rate and is by far the dominant plant species in the lake and because of its density inhibits mixing (oxygenation) of the deep water, leaving less habitat to support a healthy fishery.

Algae Phosphorus in the water column is the primary driver of algae growth. There are reports of nuisance blue-green algae blooms as early as 1979. Algae can develop in isolated areas (bays, shallows, channels) and often grows near the surface throughout the lake and can accumulate in more stagnated areas. While filamentous (floating/horse hair algae) is a nuisance, blue-green algae can emit microsysten that can be toxic to wildlife, pets, and humans.

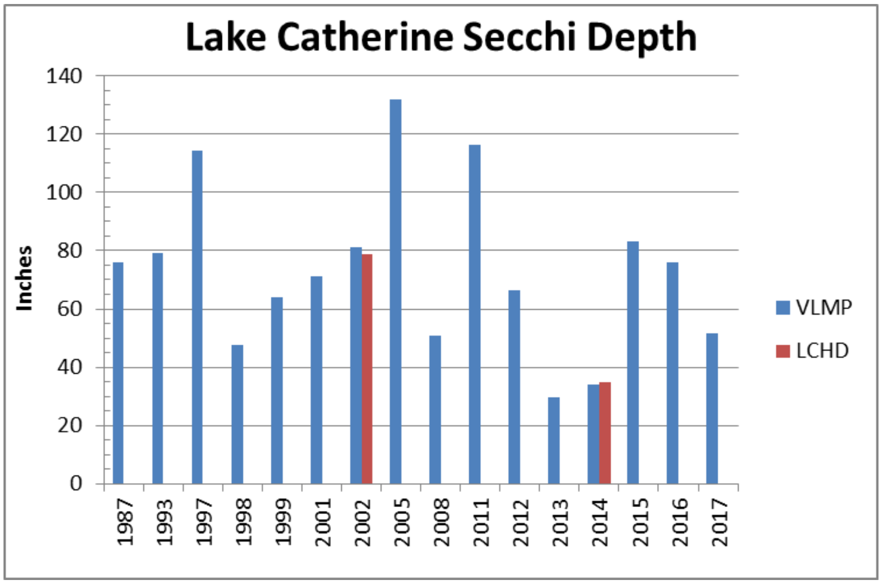
Appendix 2

Degraded Water Quality

(Data from Lake County Health Department, IEPA and Volunteer Lake Monitoring Program).

Figure 1: Average annual secchi depth measured by the Volunteer Lake Monitoring Program. Multiple sites are used within the lake and multiple dates.

The average secchi reading has decreased, indicating that water quality is degrading.



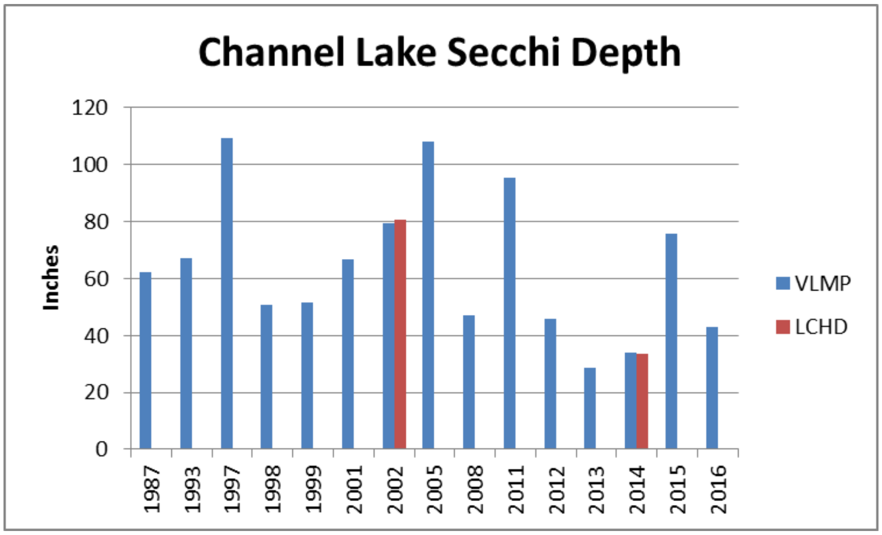
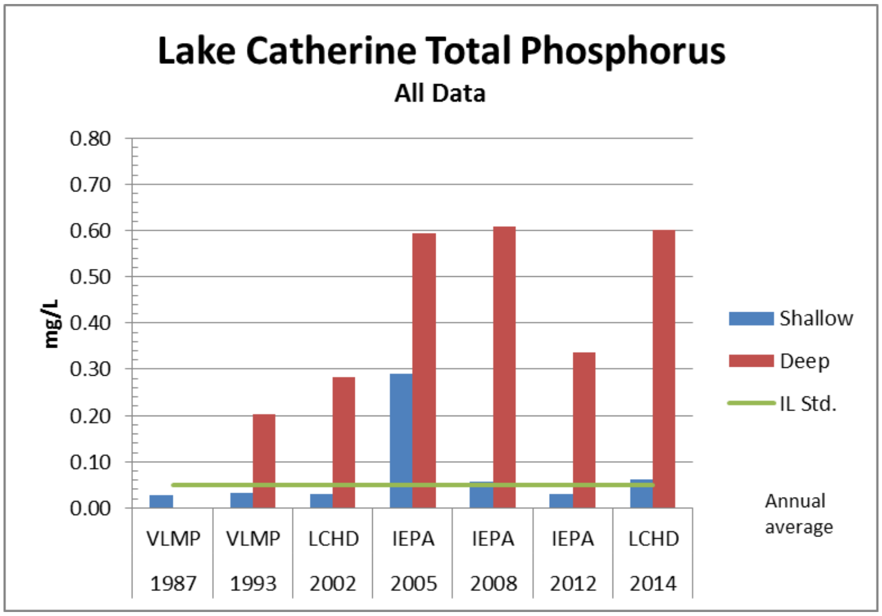


Figure 2: Total phosphorus measured by IEPA and the Volunteer Lake Monitoring Program.



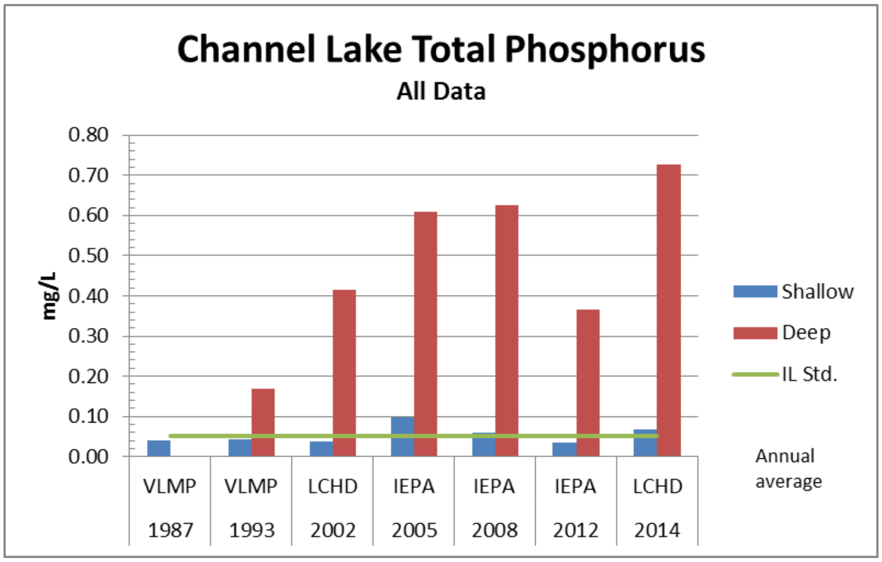


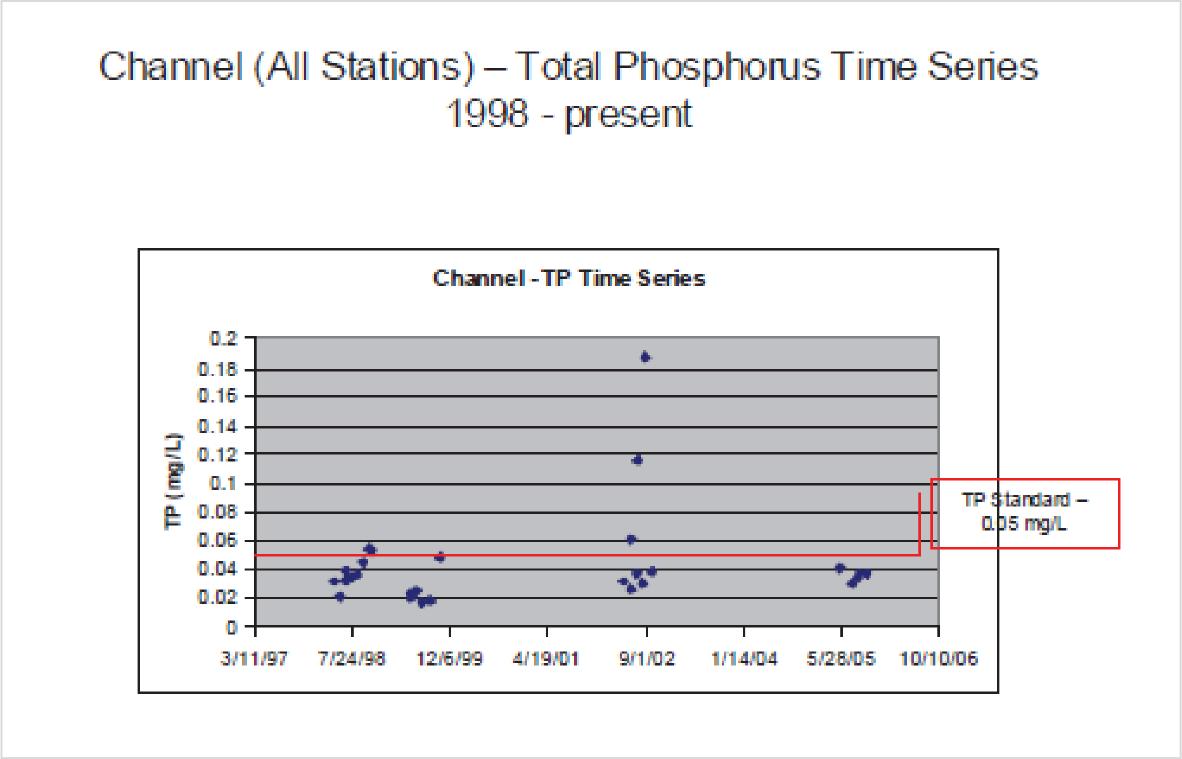
Figure 3: Total phosphorus data measured by Lake County Health Department. Data outliers are noted.

Deep samples for phosphorus are increasing (while surface samples are improving). The deeper samples are part of the anoxic layer, and where nutrients are recycled from. Phosphors leaving the sediment and going into the water supports algae growth. Mixing and aeration could help mitigate this effect.

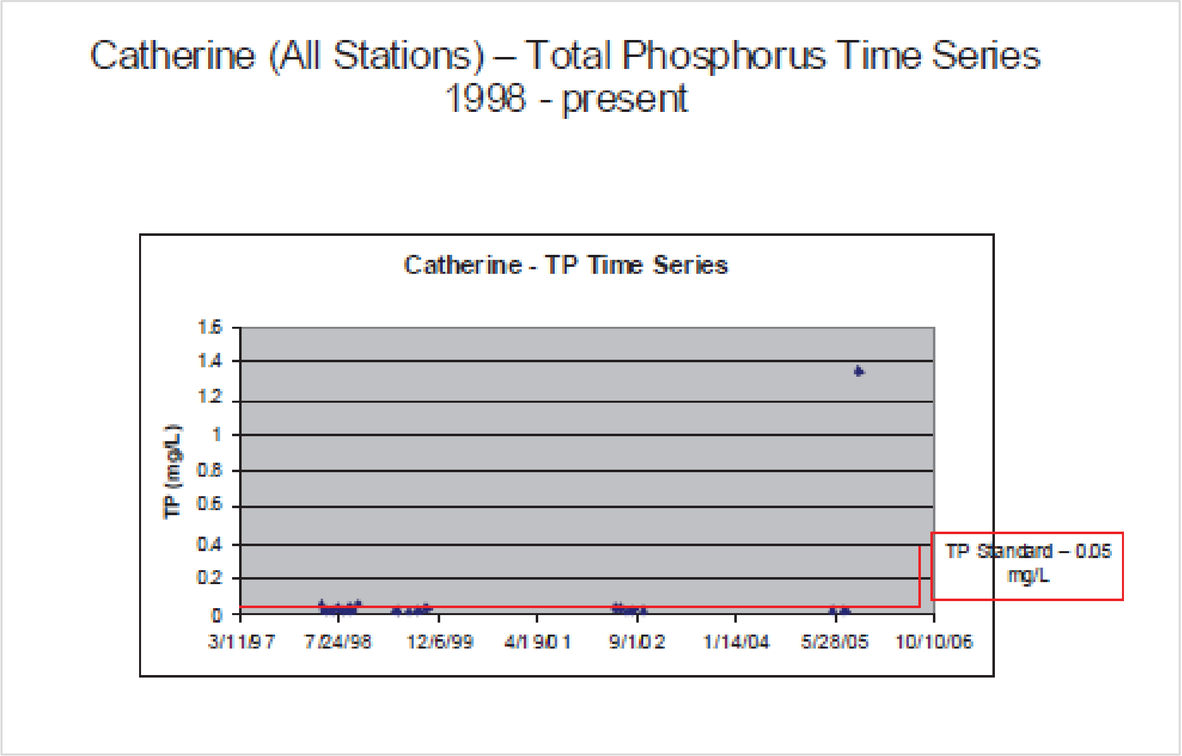
Historical WQ data - Catherine.pdf

Historical WQ data - Channel Lake.pdf

Figure 4: Historical total phosphorus from the 2009 Upper Fox River/Chain O' Lakes Watershed TMDL Stage 1 Report.



Channel (All Stations) – Total Phosphorus Time Series 1998 - present



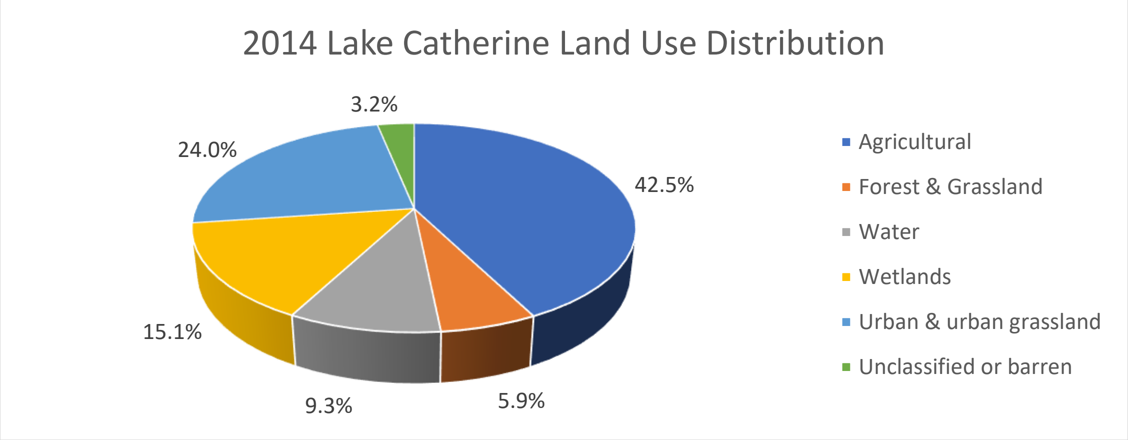
Catherine (All Stations) – Total Phosphorus Time Series 1998 - present

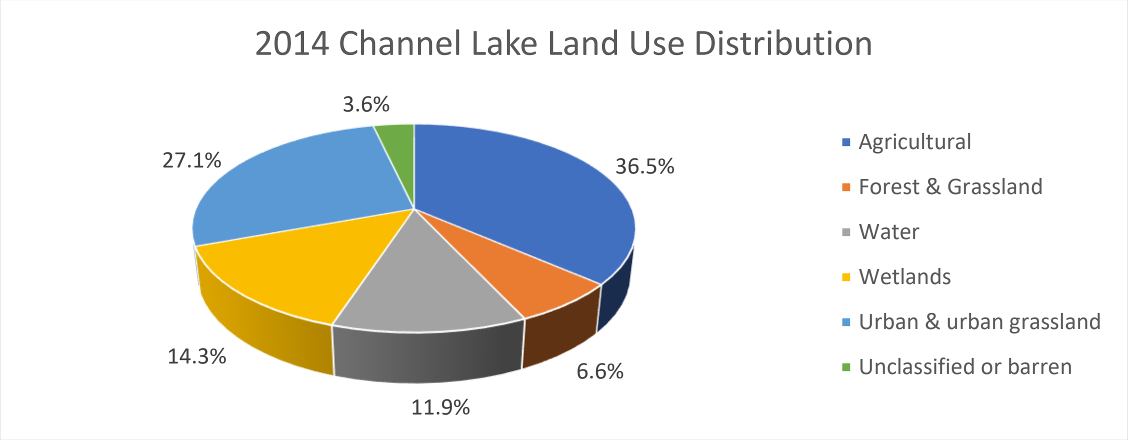
Appendix 3

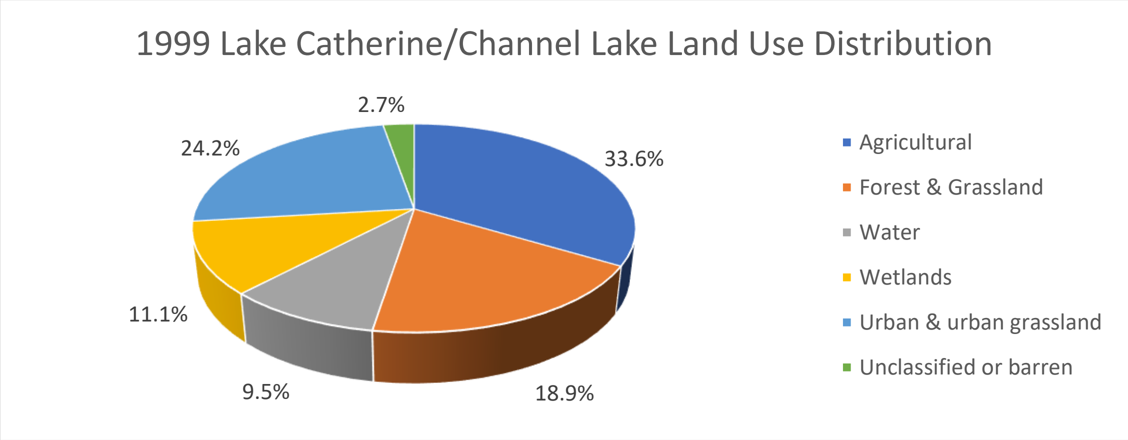
Watershed Land Use Distribution

(Data from 2014 Summary Report Channel Lake/Lake Catherine and 1999 USGS Study).

Although there are differences in how land use is categorized, the uses and relative percentages are fairly constant. Since regulations and enforcement of erosion control measures have been strengthened since 1999, it is logical that external influences on the lakes are steady and more likely improving.







Appendix 4

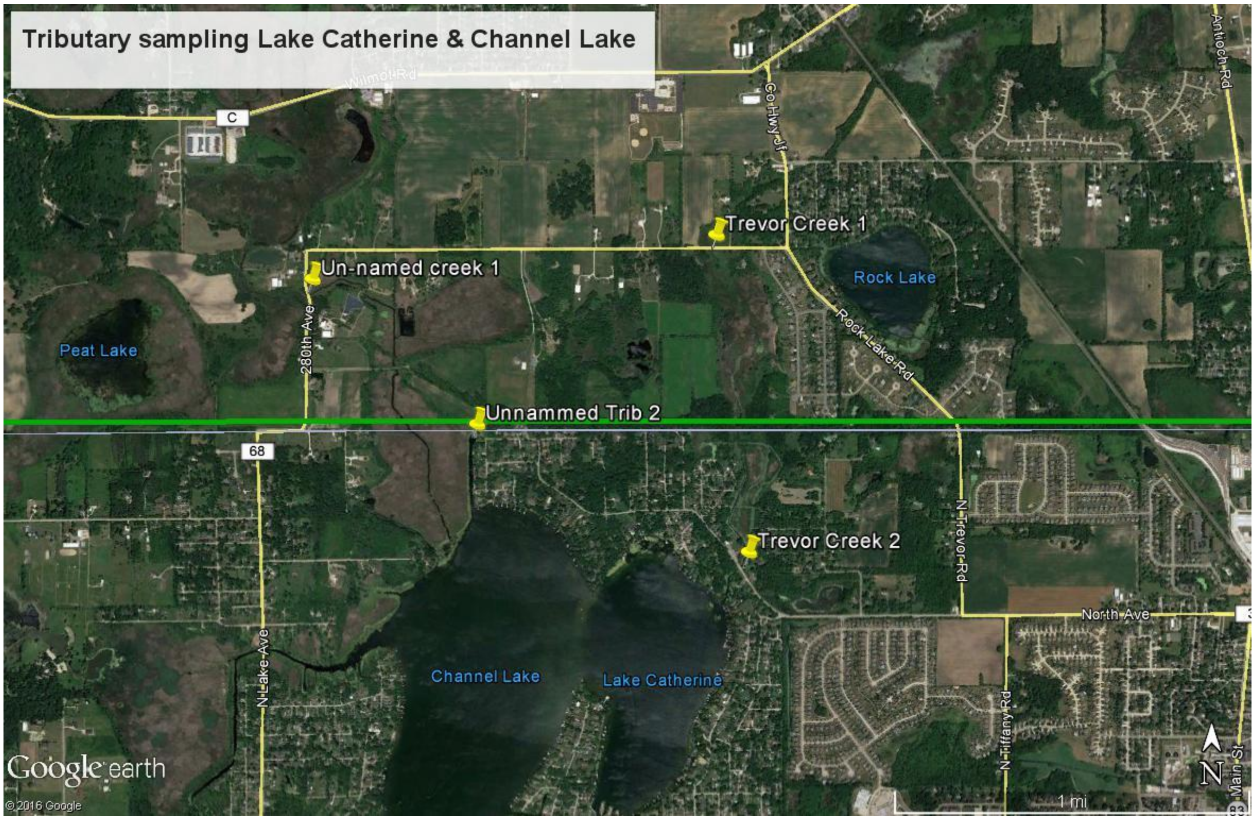
Sampling and analysis of primary inlet waters

	DRY WEATHER SAMPLE (7/7/17)		WET WEATHER SAMPLE (6/16/17)	
Site	T-Phos. (mg/l)	o-Phos (mg/l)	T-Phos. (mg/l)	o-Phos. (mg/l)
Trevor Creek #1	0.15	0.21*	0.13	0.08
Trevor Creek #2	0.08	0.08	0.18	0.16
Tributary #1	0.06	0.06	0.15	0.17
Tributary #2	0.03	0.04	0.18	0.11

**this data point is an outlier.*

The largest identifiable inlet to LC/CL is Trevor Creek. This limited grab sample data can only be confidently when compared internally. This indicates o-Phos. contribution between TC-1 and TC-2.

Comparison to historical external data does not indicate significant increases in phosphorus load from upstream sources.



Appendix 5

Septic Connections feeding into Lake Catherine/Channel Lake

(Map supplied by Lake County Health Department)

Contact Tom Copenhaver at Lake County Health Department for more information.

- *Phone: 847-377-8000*
- *Email: TCopenhaver@lakecountyil.gov*

Fecal coliform data from the 2000 report provided extensive review of 1998 and 1999 Lake County Health Department monitoring (page 85) that showed no exceedances of the state standard for primary contact (500 cfu's for swimming). There are sites where concentrations are elevated (up to 220 cfu's) but still considered safe.

As with other data, snap shots in time of water quality, especially a biological parameter like fecal coliform, can be unreliable or misleading.

Appendix 6

Known HOA and Resident Groups on Lake Catherine/Channel Lake and Water Treatment Areas

(Map and table supplied by ILM, based on client data)

Association/Group	Address	Treatment Type	Spend	Contact info
Channel Lake Residents 🟨	43220 Andyville Ln. Antioch, IL 60002	Herbicide and algaecide	$800 (since 2017)	Erika Frable 847-656-6395 efrable@yahoo.com
Club Zobak* 🟦	25135 W. North Ave Antioch, IL 60002	Herbicide	$2,700 (since 2012)	Paul Hruby 847-395-7569 opiks@msn.com
Crandall Subdivision* ⬜	42355 N Park Ln W Antioch, IL 60002	Herbicide and algaecide	$1,540 (since 2016)	Gregg Zink 847-343-3472 gzink@ilmenvironments.com
Lake Catherine Felters* 🟥	42500 N. Addison Ln. Antioch, IL 60002	Herbicide	$8,500 (since 2012)	Richard (Tommy) Doty 847-309-9663 wake2wood@ameritech.net
Linden Lane 🟩	42515 N. Linden Ln. Antioch, IL 60002	Herbicide	$2,300 (since 2017)	Barb Mazzeffi 815-923-0309 barb.maz@att.net
Oak Lane 🟪	42449 Oak Lane Antioch, IL 60002	Herbicide and algaecide	$2,700 (since 2015)	Mike Turner 847-239-4969 mrmike7351@gmail.com
Warriner's Shores* 🟦	42948 Janette Antioch, IL 60002	Herbicide	$15,400 (since 2012)	Gordon Nelson 847-603-1613

**Denotes associations. Other listings are groups of individual homeowners.*

Appendix 7

Local Businesses Benefiting from Lake Use

Marinas/Boating Services:

- Bob's Marina
- Webb's Boat Services & Marina
- Turtle Beach Marina
- Diebold Marina

Lodging:

- Norshore II
- Lake Marie Lodge

Restaurants/Bars:

- Steve's Sports Bar
- Thirsty Turtle Brew and View Pub
- Toppers
- Choppers Bar and Grill

Other Services:

- Lakeshore Builders
- Wake to Wood, Inc.
- VA Loans Midwest
- Roy's Auto Services
- Evante Purification Solutions

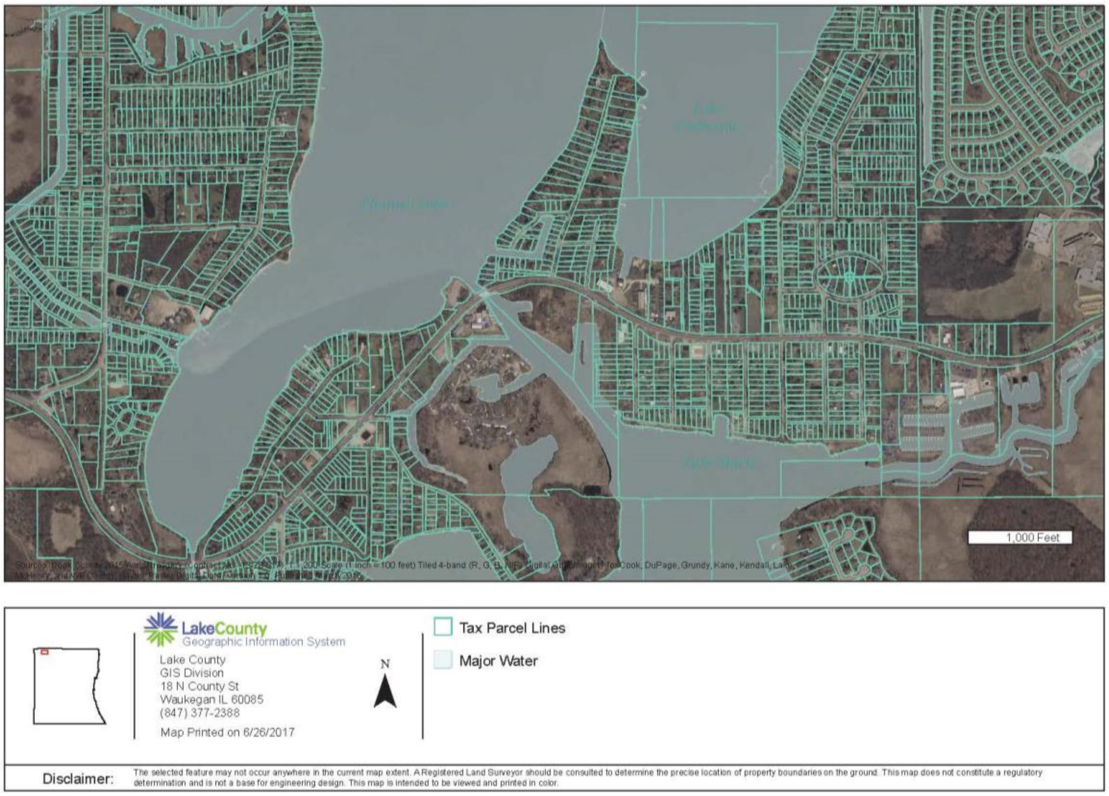
Appendix 8

Waterfront and Water-view Properties

(Maps from Lake County Maps Online)

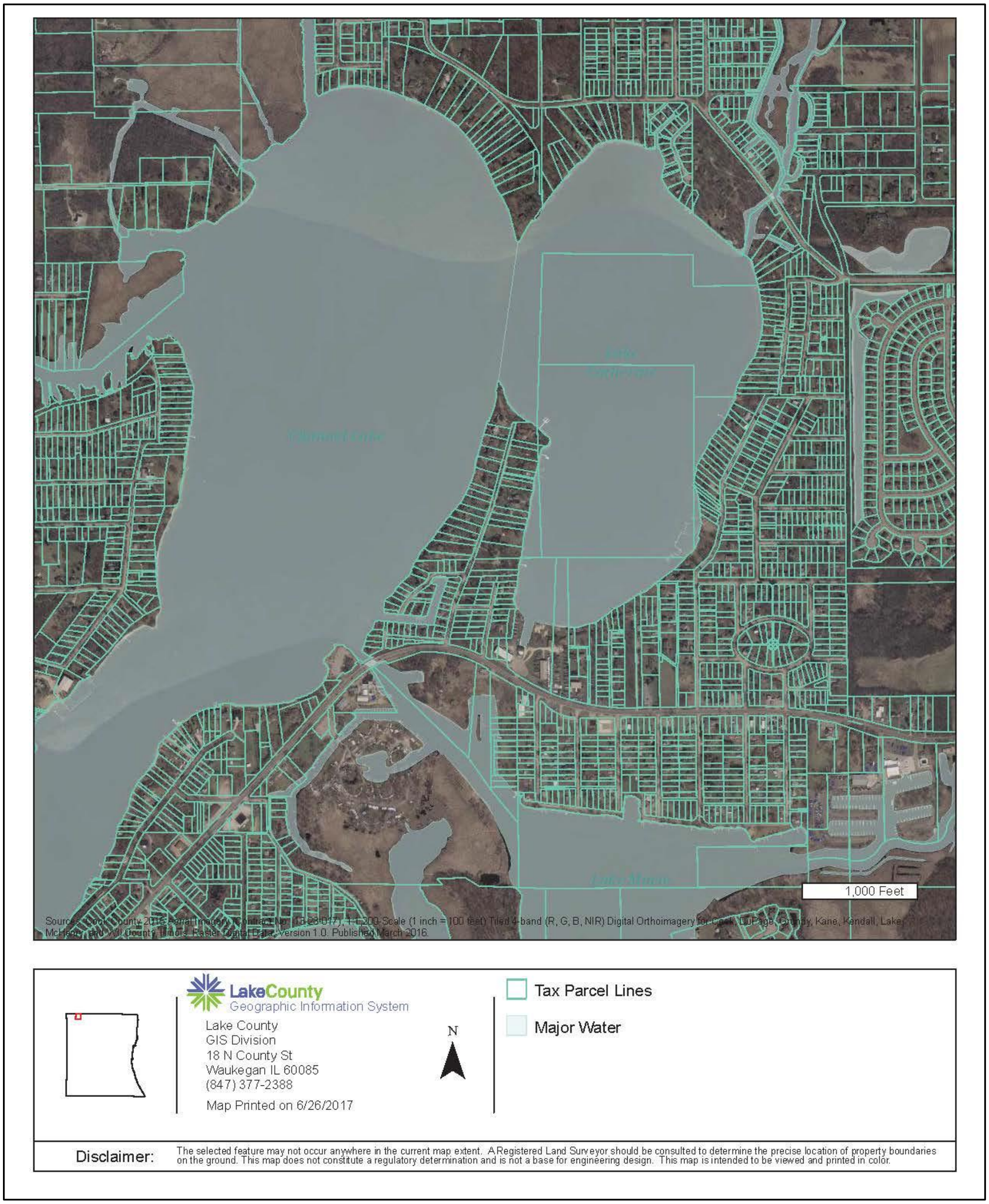
View 1:

View 2:



Disclaimer: The selected feature may not occur anywhere in the current map extent. A Registered Land Surveyor should be consulted to determine the precise location of property boundaries on the ground. This map does not constitute a regulatory determination and is not a base for engineering design. This map is intended to be viewed and printed in color.

View 3:



Sources: Cook County 2015 Aerial Imagery (Contract No. 13-28-017), 1:1,200-Scale (1 inch = 100 feet) Tiled 4-band (R, G, B, NIR) Digital Orthoimagery for Cook, DuPage, Grundy, Kane, Kendall, Lake, McHenry, and Will County, Illinois. Raster Digital Data, Version 1.0. Published March 2016.

Disclaimer: The selected feature may not occur anywhere in the current map extent. A Registered Land Surveyor should be consulted to determine the precise location of property boundaries on the ground. This map does not constitute a regulatory determination and is not a base for engineering design. This map is intended to be viewed and printed in color.

Appendix 9

2009 IEPA Phytoplankton Report for Lake Catherine

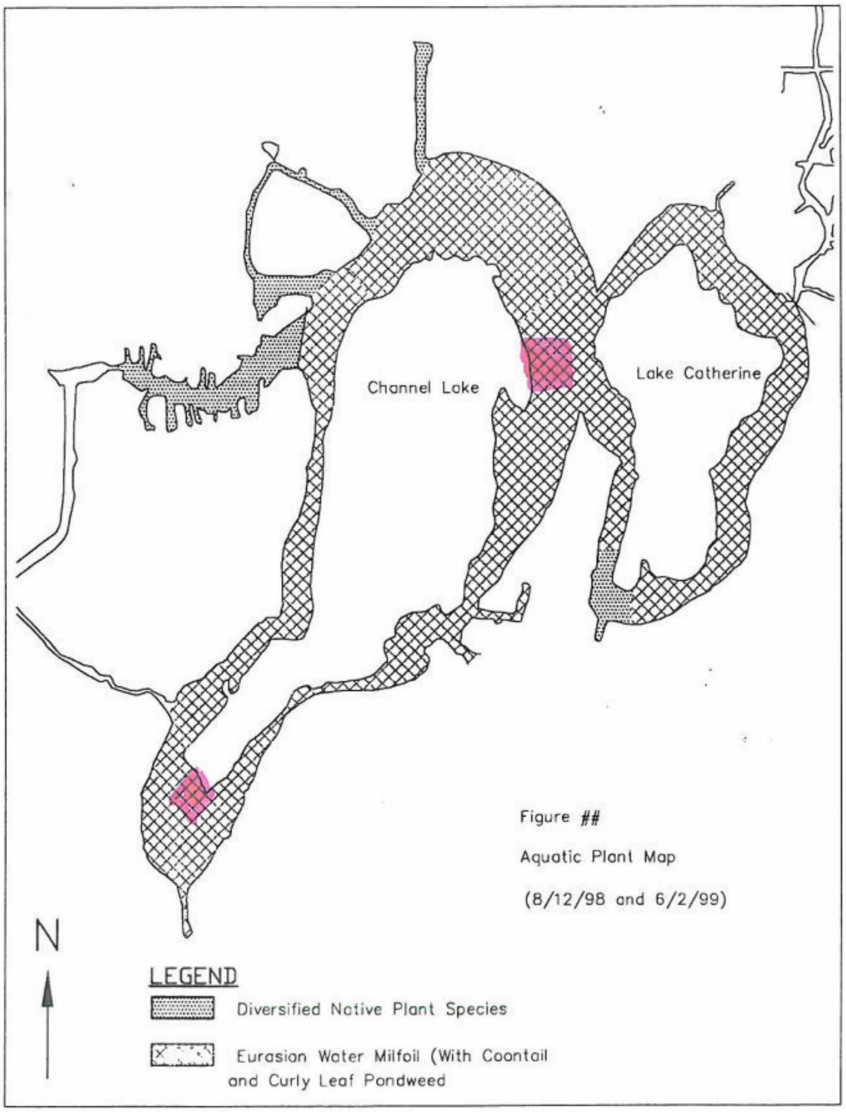
Catherine Report
(2009).pdf

Appendix 10

Dissolved Oxygen (DO) Monitoring

Figure 1: Dissolved Oxygen (DO) Recommended Monitoring Sites

Figure 51. Aquatic Plant Map for Channel Lake and Lake Catherine



Source: Lake County Health Department

Figure 2: Specifications for DO Monitoring Units

In-Situ DO
Monitoring Specs_Inte

Appendix 11

2014 Summary Report Channel Lake/Lake Catherine
http://www.lakecountyil.gov/DocumentCenter/Home/View/14187
http://www.lakecountyil.gov/DocumentCenter/Home/View/14191

Online IL Volunteer Lake Monitoring Program Database (provides historical data)
http://dataservices.epa.illinois.gov/waBowSurfaceWater/Default.aspx

LAKE COUNTY, ILLINOIS

2014 SUMMARY REPORT LAKE CATHERINE

PREPARED BY THE

LAKE COUNTY HEALTH DEPARTMENT

Population Health-Ecological Services

Figure 1. Lake Catherine (right) and Channel Lake (left) 2010 Aerial

Lake Catherine is one of the thirteen lakes within the Fox Chain 'O' Lakes monitored by the LCHD-ES in 2014. It is a glacial lake with a maximum depth of 39 feet and a surface area of 164.7 acres. Water elevations in Lake Catherine are influenced by the McHenry Dam which was built in 1939. Lake Catherine is hydrologicaly connected to Channel Lake, although this was not always the case, as there was once a gravel bar that separated the two, however, most of that bar has eroded away. Currently both lakes form one large footprint. Boaters are still observed anchored at the remaining sandbar on the northwestern edge of the lake; swimming and recreating. Lake Catherine and Channel Lake are both located near the bottom of the Trevor Creek watershed, and are the deepest of the lakes in the Fox Chain 'O' Lakes. Lake Catherine receives water directly from Trevor Creek which flows from Wisconsin and is part of the Fox River Watershed. Lakes feeding Trevor Creek include Cross, Voltz and Rock Lake in Kenosha County, Wisconsin. There are also several small tributaries and stormwater drainage outfalls entering into the lake. Data supplied by the Lake County Mapping Services Division and Southeastern Wisconsin Regional Planning Commission estimate the Trevor Creek watershed to be approximately 12,581.67 acres in

INSIDE THIS ISSUE:

ENVIRONMENTAL SERVICES WATER QUALITY SPECIALISTS

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Gerard Urbanozo gurbanozo@lakecountyil.gov

SUMMARY (CONTINUED)

size. Agriculture, single family and wetlands are the dominant land uses in the Trevor Creek watershed. However, single family and transportation contribute the greatest amount of runoff into Lake Catherine.

The lake is well known by anglers. There are two private boat launches on Lake Catherine; as well as other public launches on the Fox Chain 'O' Lakes. Fishing by shoreline is limited along the shoreline of Lake Catherine as most of it is under private ownership, therefore, fishermen usually access the lake from public launches on the Fox Chain 'O' Lakes.

In 2014, the LCHD-ES sampled the lakes for the water quality parameters discussed in this report. Once a month water chemistry samples were collected at the deep hole of the lake at 3 feet from the surface (epilimnion) and lake bottom (hypolimnion) by use of a Van Dorn sampler. A multi-parameter sonde was utilized to collect depth profile data. A Secchi disc was used to measure the water clarity of the lake. Other environmental data recorded included air temperature, water elevation and any observations of wildlife in the area.

The overall water quality of the Lake Catherine is fair. Like many of the lakes in our county, it is impaired for phosphorus based upon the Illinois Environmental Protection Agency's (IEPA) phosphorus standard for general use (≥ 0.05 mg/L TP). The standard applies to lakes with a surface area greater than 20 acres. It only takes one exceedance of the standard during a season to be considered impaired. The average TP concentration during 2014 was 0.062 mg/L. This is well below the median TP concentration of 0.126 for all of the lakes sampled on the Fox Chain in 2014 and is slightly below the county median TP concentration of 0.068 mg/L for lakes sampled for TP since 2000.

An aquatic vegetation survey was conducted on Lake Catherine in July using the point intercept method. In order to accomplish this a randomized grid was placed over the footprint of the lake using ARCGIS 10.2. In order to sample the aquatic vegetation, a rake was lowered at each point sampled and scored 0—5; "0" where plants were not detected. The data collected was entered into ARCGIS 10.2 and maps were created indicating cover and location of vegetation in the lake. Maps of the indicating abundance of invasive plants were also created to assist in aquatic plant management plans.

Thirteen plant species were detected in Lake Catherine in 2014; 44.9% of the points sampled were colonized with aquatic vegetation. The total average cover of vegetation in Lake Catherine was 14.6%, this was below the total average cover of vegetation estimated for the Fox Chain 'O' Lakes in 2014 of 27.3%. A floristic quality assessment was conducted on the species found in Lake Catherine resulting in a FQI score of 21.8. This is a pretty good score considering that floristic quality assessments are usually performed on terrestrial vegetation. An FQI score between 20 and 35 would indicate that the vegetation had some of the qualities of a natural area.

Lake Catherine has three licensed swim beaches monitored as part of our beach monitoring program. Warriners Subdivision was the only beach to have a swim ban issued since 2004, it occurred during July of 2012 and was likely caused by waterfowl. Bans occur at swim beaches due to the presence of elevated (>235 colonies/100 mL) E-coli found in the water sample collected at the beach. Licensed beaches in the Fox Chain 'O' Lakes are sampled bi-weekly on a rotation between north and south chain beaches. Since 2013, a subset of beaches are routinely sampled for the presence of harmful algal blooms (HABs), Felter's Subdivision beach was selected from Lake Catherine.

Lake Facts:

Major Watershed: Fox River

Sub-Watershed: Fox River

Location: T43N, R9E, Section 11

Surface Area: 164.7 acres

Shoreline Length: 6.24 miles

Maximum Depth: 39.00 ft.

Average Depth: 16.7 ft.

Lake Volume: 2881.90 acre-ft.

Watershed Area: 12,581.67 acres (WI and IL)

Lake Type: Glacial

Management Entity:

Fox Waterway Agency

State of Illinois

Homeowners Associations (various)

Current Uses: fishing, swimming, boating, aesthetics

Access: Private although there are public launches on other lakes of Fox Chain 'O' Lakes.

WATERSHED

A general definition of a watershed is an area of land defined by two or more high ridges. However, watersheds are usually much more complex than that due to the engineering of drainage areas designed to efficiently remove stormwater from the landscape. This can make boundaries hard to decipher at times.

Lake Catherine is located at the bottom of the approximately 12, 581.67 acres watershed of Trevor Creek (SEWRPC and Lake County Mapping Division). According to land use data, the watershed was dominated by agriculture (42.5%), single family (15.5%); and wetlands (15.1%). However, single family and transportation contributed the greatest total percent runoff entering into Lake Catherine, representing 36.5% and 26.7% respectively (Appendix A, Table 1). It is recommended that the stakeholders of the watershed work together to educate homeowners and municipalities of the important role that they play in the health of natural resources such as Lake Catherine. Stakeholders should incorporate management practices that reduce nutrients from entering our surface waters as most are impaired for phosphorus; these include, nutrient management plans for agriculture, and the remediation of eroding shorelines by other residents. This is an ideal time to initiate BMP's for the Fox River watershed as the IEPA is prioritizing the implementing of projects to address water quality issues in the Fox River in 2015. The deadline for application is August 1, 2015. For more information feel free to contact the LCHD-ES at 847-377-8030.

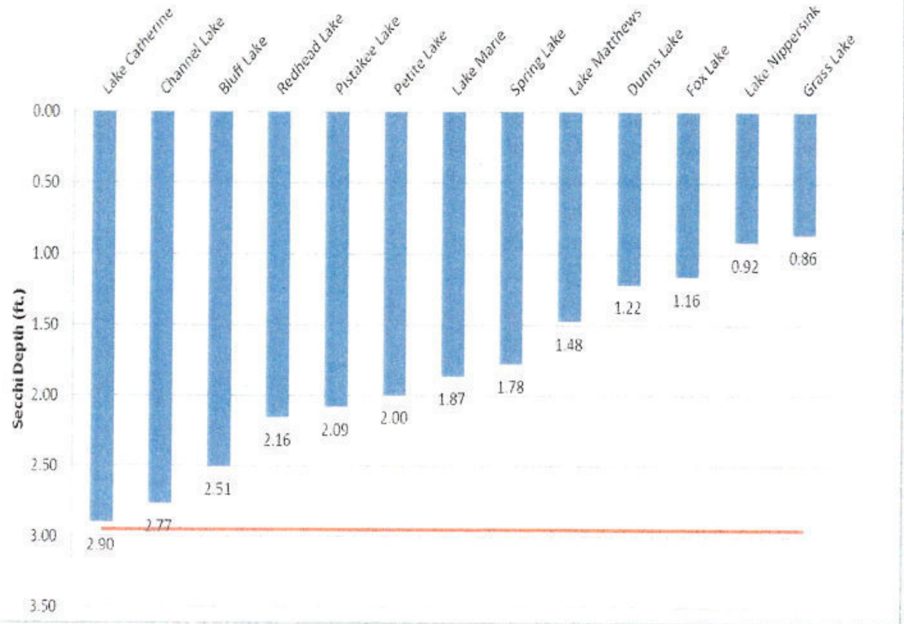
Produced by Lane Council of Governments

WATER CLARITY

Water clarity is important as it allows light to penetrate into the water column. This light is used by the primary producers (plants and phytoplankton) for their growth. Water clarity is measured by lowering a Secchi disk into the water until it can no longer be seen by the naked eye. The resulting depth is recorded.

In 2014, the water clarity in Lake Catherine ranged from 1.23 feet in September to 7.50 feet in June with an average Secchi depth of 2.90 feet. The county median Secchi depth for lakes whose Secchi depth has been recorded between 2000 and 2014 was 2.95 ft. (Appendix A, Table 2). Although the Secchi depth was slightly below the county median, the water clarity was better than the other

Figure 1. 2014 Secchi Depth: Fox Chain'O'Lakes.



WATER CLARITY (CONTINUED)

lakes monitored in the Fox Chain 'O' Lakes. This is likely due to its relatively small watershed in comparison to most of the other lakes.

However, water clarity has decreased significantly in Catherine since 2002; the average Secchi depth in 2002 was 6.58 mg/L compared to the 2014 average Secchi depth of 2.90 mg/L. This is a 127% decrease in water clarity within 12 years. VLMP data collected since 2011 suggests that a something occurred between 2011 and 2012; and again from 2012 to 2013, that accounts for the decline in water clarity of 75% and 123%, respectively.

Total suspended solids impact water clarity and sources are stormwater, plant and algal blooms, wastewater treatment plants, failing septic, recreational boating and invasive species.

In 2014, algal blooms were observed on Lake Catherine in May and August and during both of those months the Secchi depth was nearly equivalent at 1.61 mg/L and 1.58 mg/L, respectively. Spring rains and a storm event which occurred in August likely contributed nutrient rich sediments into the lake which promoted the blooms.

According to the Long Lake rain gauge (Lake County Stormwater Commission), May precipitation measurements captured at the station accumulated to a total of 3.77 inches of rainfall, which is comparable to average May precipitation (3.21 inches). In June, precipitation was well above the 12 year average of 4.64 in., with a total of 6.93 in. recorded at Long Lake. Two weeks prior to our June sampling event cumulatively only 1.01 inches of rain that fell in the region, the remaining 5.92 inches fell after that sampling . This explains the increase in Secchi depth observed in June (7.5 ft.) followed by the subsequent decrease in July (2.6 ft.). A large storm

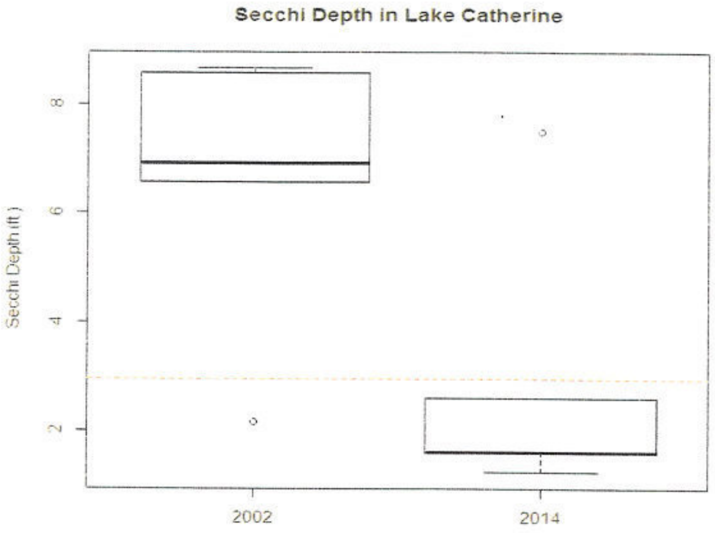


Figure 2. Box Plot showing decreased water clarity between 2002 and 2014.

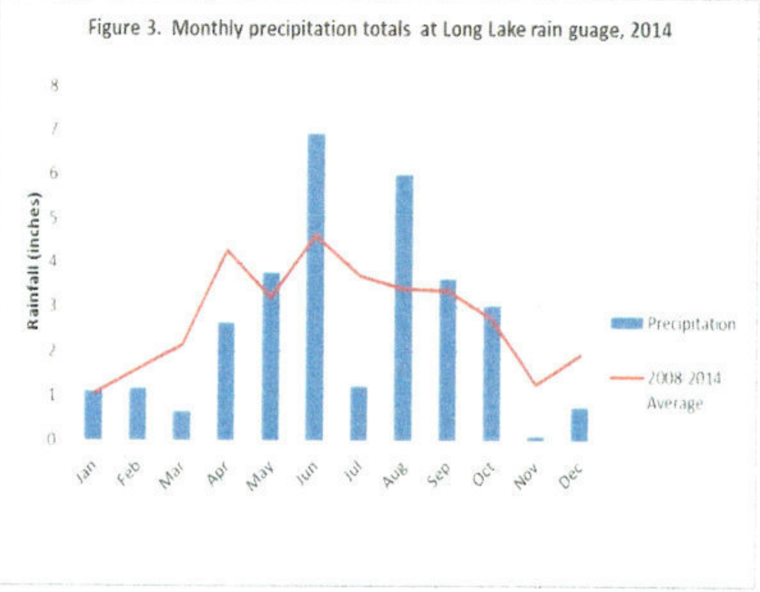


Figure 3. Monthly precipitation totals at Long Lake rain guage, 2014

WATER CLARITY (CONTINUED)

event in August introduced stormwater carrying nutrients and other pollutants into the lake. Nutrient demands by plants are reduced as they are no longer actively growing, algae are able to take advantage of the additional nutrients using them for their growth; therefore prolific algae blooms can occur for the remainder of the season.

Water clarity in Lake Catherine suffered in part due to a low abundance of vegetation, however, invasive species such as zebra mussels and gizzard shad can have profound effects on water clarity. Both feed off plankton and are known for their ability to clear water. Recreational boat propellers can increase turbidity, as well as can construction activities in the watershed. With all of the stressors impacting Lake Catherine water clarity it still ranked #87 out of the 158 lakes measured for water clarity based upon Secchi depth measurements taken in the County since 2000 (Appendix A, Table 4).

VOLUNTEER LAKE MONITORING PROGRAM

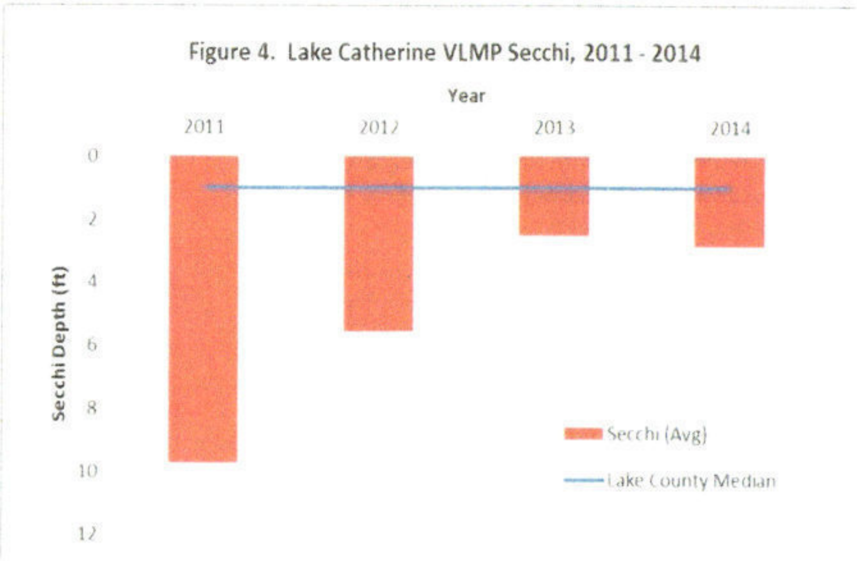


Figure 4. Lake Catherine VLMP Secchi, 2011 - 2014

The Volunteer Lake Monitoring Program was established in 1981 to assist in gathering water quality information on Illinois lakes and to provide an educational program for citizens interested in lake water quality. The primary measurement taken by all volunteers in the program is Secchi disk (water clarity). Other observations such as algal blooms, vegetation, water color, and wildlife, plus any observations that the VLMP feels noteworthy are recorded. The sampling season is May through October, two visits per month are required under the program.

VLMP data such as that presented in Figure 4 is just one example on how invaluable VLMP's are on a lake. They assist lake managers in identifying problems early so they can correct them, as well as provide agencies with a continuous dataset that allows them to track changes on the lakes at times when they are not actively monitoring them.

The VLMP Secchi disk data displayed in Figure 4 are of the average annual Secchi disk measurements across all VLMP sites for years 2011—2014. This data indicates that the water clarity in Lake Catherine decreased by 75% and 123% between 2011 through 2012; and 2012 through 2013, respectively. Water clarity started to show signs of improvement in 2014. This could be due to many of the factors discussed above under water clarity.

TOTAL SUSPENDED SOLIDS

Total suspended solids (TSS) are comprised of volatile (organic) materials and nonvolatile (inorganic) materials within the water column. Total suspended solids reduce water clarity and can impact both flora and fauna in a lake when prevalent. Examples of volatile solids are plankton and plant material as well as small macroinvertebrates. Non-volatile solids are sediments. TSS concentrations are inversely correlated to water clarity, hence when TSS concentrations are elevated, water clarity is diminished (Figure 5).

In 2014, TSS concentrations in Lake Catherine ranged from 13.0 mg/L in May to 7.6 mg/L in June and July (Appendix A, Table 3). The average TSS concentration of 9.6 mg/L was greater than the median TSS concentration of 8.2 mg/L for lakes in the county measured for TSS since 2000. TSS concentrations in 2002 averaged 6.6 mg/L, with concentrations ranging from 1.0 mg/L to 16.0 mg/L. TSS concentrations were not as variable in 2014 as they were in 2002 (Figure 6), this could be due to changes in abundance of aquatic vegetation or differences weather patterns between sampling years, 2002 and 2014.

In 2014, total volatile solids (TVS) ranged from 104 mg/L in May to 124 mg/L in June. The 2014 average TVS concentration was 112 mg/L, this is lower than the county median concentration of 121 mg/L for county lakes measured for TVS since 2000. In 2002, TVS concentrations ranged from 1 mg/L to 4 mg/L. The large difference between TVS concentrations between 2014 and 2002 is likely due to analytical differences caused by changes in laboratories used and are therefore not comparable.

In 2014, non-volatile suspended solids (NVSS) ranged from 1.87 mg/L in July to 6.32 mg/L in May, and was likely caused by activities in the watershed.

Algal blooms were noted in May and again in August. Sediments (NVSS) were elevated in May dropping during June and July and rebounding again in August and September. Sediments carry nutrients with them that fuel algal blooms, a combination of the two likely caused decreased water clarity during the season.

It is recommended to provide outreach to residents, businesses and the agriculture community on best management practices that they can incorporate into their daily lives that can reduce sediments from entering into waters that eventually discharge into Lake Catherine.

Figure 5. TSS vs. water clarity (Secchi depth) in Lake Catherine 2014

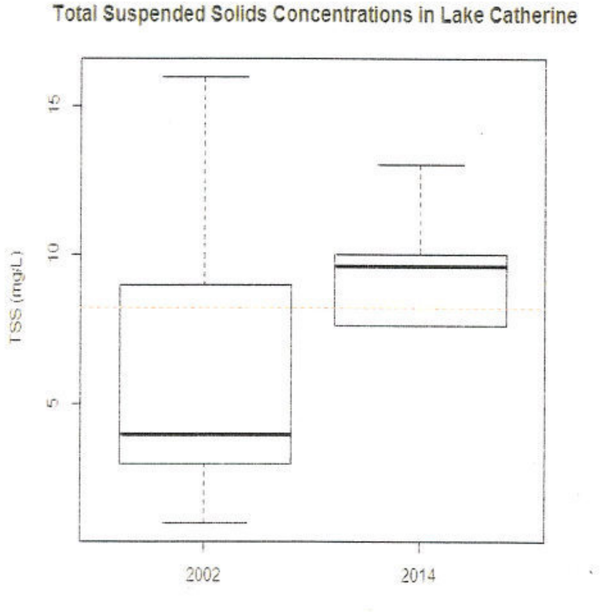


Figure 6. Boxplots illustrating TSS concentrations in Lake Catherine, 2002 and 2014. Red dashed line represents county median.

SEDIMENTS

Sedimentation naturally occurs in our environment, however, human activities can increase the amount of sediment that ends up in surface waters. Sediments are usually fine grained sands, silts and clays that can cover up the coarser bottom sediments and the spaces between rocks and cobbles that provide habitat for aquatic life.

In the Midwest region, sediments entering into surface water from erosion are laden with phosphorus and are a major source of eutrophication (nutrient enrichment). They reduce water clarity which reduces the amount of light penetrating into the water, subsequently impacting the ability of plants to photosynthesize and plant propagules (seeds) to reestablish. They impact fish and macro-invertebrate habitat by burying gravel nests and young vegetation, as well as suffocating fish eggs. Sediment particles in the water absorb warmth from the sun resulting in increased water temperatures. This can cause problems with dissolved oxygen and cause stress to fish.

The Fox Waterway Agency (FWA) provides the service of removing sediments deposited from the Fox River and other tributaries to the lakes within the Fox Chain 'O' Lakes. The sediment load coming from all tributaries has been calculated to be steady at approximately 100,000 yds^3/year. Of that sediment, 12%, or approximately 12,000 yds^3/year enter Lake Catherine from Trevor Creek.

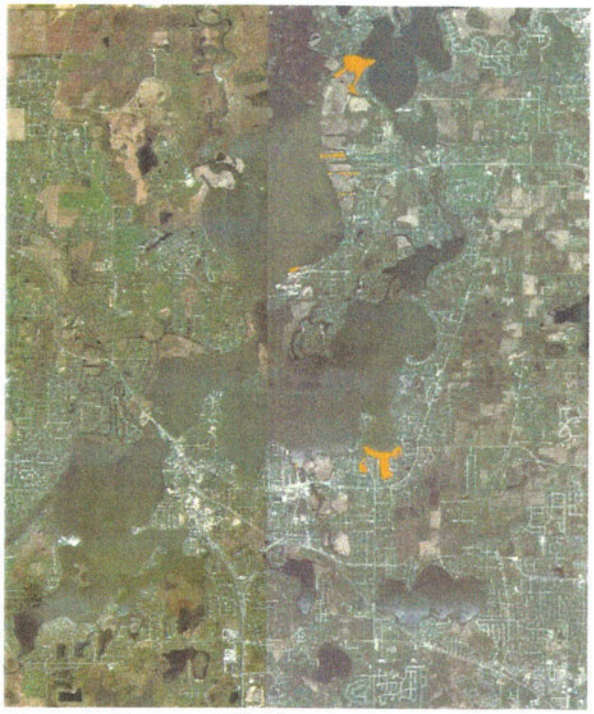


Figure 7. Location of dredging activities on the Fox Chain 'O' Lakes, 2014.

According to the FWA, Grass Lake is the main recipient of the sediment load of the Fox Chain 'O" Lakes, and is at or near capacity, therefore much of the 2014 dredging took place in Grass Lake and Lake Marie. The FWA is not supported through tax revenues but by annual sticker fees required by boaters using the lakes of the Fox Chain 'O' Lakes. Dredged sediments are used to construct islands that provide habitat for birds navigating and nesting in and among the Fox Chain 'O" Lakes. There are threatened and endangered bird species who utilize the islands and other areas of the Chain; however, recently we have observed increased gull activity on the islands as well. The sediments are frequently tested so that the spoils can be recycled as compost. Results from a study conducted by Hey and Associates in 2005 indicate that sediment concentrations for most parameters (total phosphorus as P, Arsenic, Cadmium, Chromium, copper, Lead, Manganese, Nickel, Zinc, and Mercury) were considered "Low" or "Normal" based on the IEPA's Illinois Lake Sediment Classification. The McDonald classification for these pollutants also indicate that adverse effects pollutants are either not expected or would be rarely observed in the majority of the sediment dwelling organisms. Table 1 provides the results of the sampling, the results indicate that the sediments were safe for recycling in that year.

Figure 8. Fox Waterway Agency dredging a channel in Lake Marie, 2014.

SEDIMENTS (CONTINUED)

Table 1. Most of the pollutants sampled in dredging sediments by Hey and Associates compared to IEPA and Macdonald Sediment Classifications

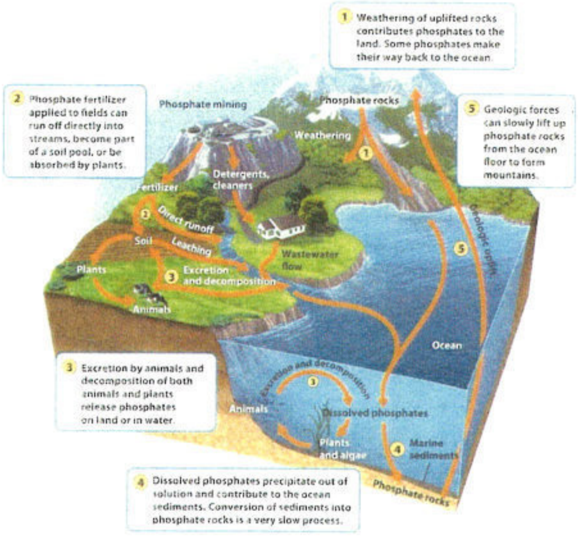
Metal	Value (Hey & Associates)	IEPA Illinois Lake Sediment Classification	MacDonald et al. Sediment Guidelines
Arsenic	12 mg/kg	Normal (4.1 to <14)	Below ERL
Cadmium	<0.5 mg/kg	Normal (<5)	Below LEL
Chromium	20 mg/kg	Normal (13 to <27)	Below LEL
Copper	14 mg/kg	Low (<16.7)	Below LEL
Lead	18 mg/kg	Normal (14 to <59)	Below LEL
Mercury	0.11 mg/kg	Normal (<0.15)	Below LEL
Nickel	14 mg/kg	Low (<14.3)	Below LEL
Zinc	51 mg/kg	Low (<59)	Below LEL

ERL: Effect range-low: represents the chemical concentration below which adverse effects would be rarely observed

LEL: Sediments are considered to be clean to marginally polluted. No effects on the majority of sediment dwelling organisms are expected below this concentration

NUTRIENTS

Phosphorus and nitrogen are essential, naturally occurring nutrients limiting plant growth, however when in excess they can impair water quality. Phosphorus is usually the nutrient responsible for water quality problems in lakes. It comes from both internal and external sources, and in general is the easiest of the limiting nutrients to manipulate due to the ability of some plant and algal species to fix nitrogen from the atmosphere. High phosphorus 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. External sources are those that occur in the watershed, such as from sept systems as they are still prevalent along properties throughout the Fox Chain 'O' Lakes as well as Lake Catherine. Septic systems can leach into the groundwater and then into the lake if they are not maintained. Lack of maintenance is responsible for overflows into the lakes' as well. Therefore it is important that septic systems are maintained by pumping them on a regular basis. When systems fail, they can cause problems in the lake such as elevated nutrients which can promote blue green algal blooms (HABSs). Therefore it is recom-



NUTRIENTS

mended that septic systems be maintained on Lake Catherine.

Internally, deep lakes such as Catherine, have conditions that cause bottom sediments to become anoxic creating the internal cycling of nutrients. This is prevalent especially in September when the lake begins to mix the phosphorus rich waters from the hypolimnion with waters of the epilimnion. The available phosphorus is quickly metabolized by algae for their growth and is likely responsible for the end of the season algal blooms that occur in Lake Catherine.

Like many of the lakes within Lake County, Lake Catherine is impaired for total phosphorus (TP) under the Illinois Environmental Protection Agency (IEPA) standard. The general use standard applies to lakes whose surface area is greater than 20 acres, and an impairment occurs when concentrations exceed 0.05 mg/L. TP concentrations in 2014 ranged from 0.044 mg/L in August to 0.110 mg/L in May (Appendix A, Table 3). The average TP concentration in Lake Catherine was 0.062 mg/L, and was comparable to the median TP concentration of lakes within the county during the period of 2000—2014 of 0.068 mg/L.

As indicated in Figure 9, the TP concentrations in 2002 were not considered impaired with a maximum concentration of 0.045 mg/L (Appendix A, Table 3) . In 2014, the minimum concentration of 0.044 mg/L equaled the maximum concentration measured in 2002.

A ratio between total nitrogen and total phosphorus (TN:TP) is a tool utilized to determine which nutrient is limiting plant or algal growth. Ratios of less than 10:1 indicate a system limited by nitrogen, while lakes with ratios greater than 20:1 are limited by phosphorus. The TN:TP ratio calculated for Lake Catherine in 2014 was 25, indicating that phosphorus was the limiting nutrient. Therefore any additional phosphorus into Lake Catherine could cause nuisance plant or algal growth. In 2014 the lake had sparse aquatic vegetation so it is likely that algal blooms will be prolific if aquatic vegetation remains at its current levels. The monthly TN:TP ratio in May was 15.5 indicates that both nutrients were plentiful. This further explains the algal blooms observed in Lake Catherine during that time.

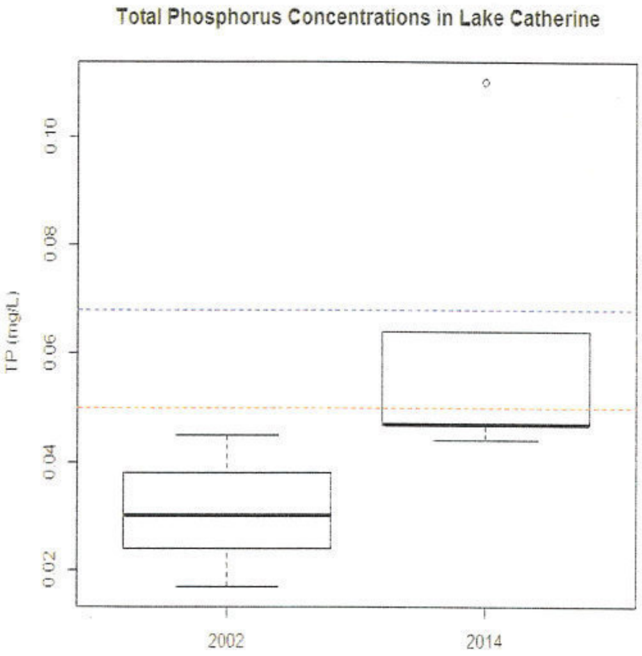
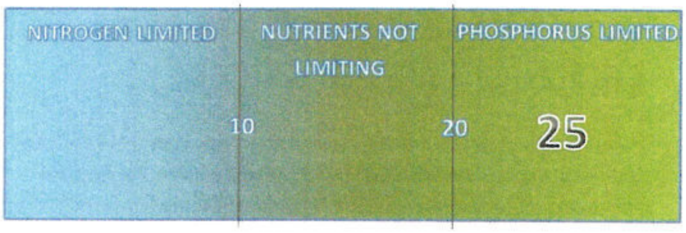


Figure 9. Comparison of TP concentrations in Lake Catherine from 2002 and 2014. Red dashed line is represented of IEPA standard (0.05 mg/L). Blue dashed line is county median (2000-2014) TP concentration of 0.068 mg/L.



TROPHIC STATE INDECES

OLIGOTROPHIC:

Lakes are generally clear, deep and free of weeds or large algae blooms. Though beautiful, they are low in nutrients and do not support large fish populations.

MESOTROPHIC:

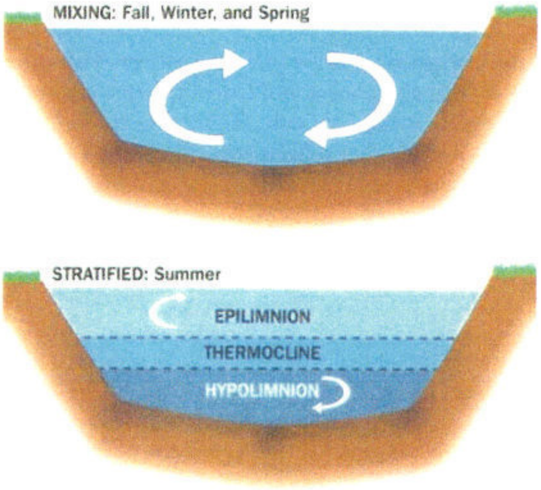
Lakes lie between the oligotrophic and eutrophic stages. Devoid of oxygen in late summer, their hypolimnion limit cold water fish and cause phosphorus cycling from sediments.

EUTROPHIC:

Lakes are high in nutrients, they are usually either weedy or subject to frequent algae blooms, or both. Eutrophic lakes often support large fish populations, but are also susceptible to oxygen depletion.

A Trophic State Index (TSI) based on phosphorus (TSIp) is commonly used to classify and compare lake productivity levels (trophic state). Excessive phosphorus can accelerate the rate of eutrophication. Eutrophication is a natural process of a lake aging where the lake is 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 normally takes thousands of years, however, human activities that supply lakes with additional phosphorus speeds up the eutrophication process significantly. The TSIp index classifies the lake into one of four categories: oligotrophic (nutrient-poor, biologically unproductive) mesotrophic (intermediate nutrient availability and biological productivity), eutrophic (nutrient-rich, highly productive), or hypereutrophic (extremely nutrient-rich, productive). In 2014 Lake Catherine was considered eutrophic with a TSIp score of 53.7. Lakes with scores between 50—70 are considered eutrophic, scores above 70 mean the lake is hypereutrophic. All of the lakes' of the Fox Chain 'O' Lakes were considered either eutrophic or hypereutrophic. TP concentrations measured in Lake Catherine ranked it #32 out of 165 lakes in the county whose TP concentrations have been measured since 2000 (appendix A, Table 5).

TROPHIC STATE INDECES



Thermal stratification occurs when water temperatures in a lake cause a change in density and cooler waters sink to the bottom (hypolimnion) and are separated by a thermocline from surface waters (epilimnion) Thermal stratification usually takes place in deep lakes where the wind and water currents are not strong enough to continually mix warmer waters with the cooler bottom waters. Eventually waters of the hypolimnion eventually experience anoxic conditions (where dissolved oxygen concentration fall <1 mg/L) as oxygen is consumed by benthic organisms.

In 2014 depth profiles were taken in Lake Catherine at the deep hole, using a multi-parameter sonde. Measurements were recorded at every foot from the surface to 4 ft. below the surface and every foot thereafter until the lake bottom was reached. The temperature and DO measurements are used to determine the depth of relative

STRATIFICATION

thermal resistance or where in the water column that lake stratification has set up (Appendix A, Table 6). DO and temperature profiles are a good visual of stratification taking place in a lake. Figure 8 and 9 present DO and temperature profiles from Lake Catherine for 2014.

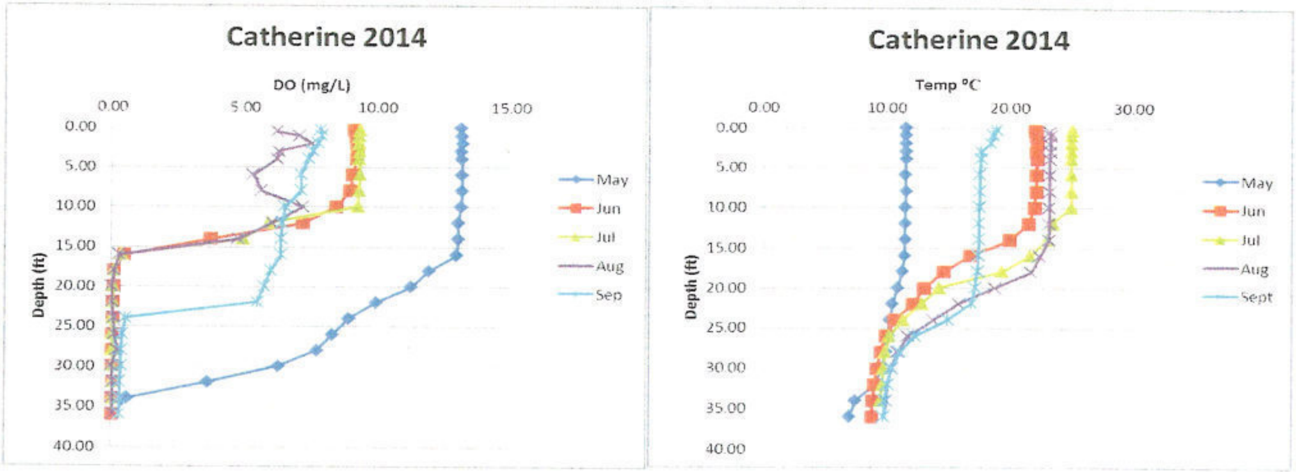


Figure 8 and 9. DO and Temperature profiles measured in Lake Catherine, 2014. Notice the lake becomes anoxic at approximately 15 feet below the surface.

DISSOLVED OXYGEN

Dissolved oxygen (DO) is essential for the survival of fish and invertebrates and influences many different biological and chemical processes (Indiana Department of Environmental Management, 2011). DO is affected by changes in temperature and temperature changes can effect the density of the water resulting in lake stratification. DO gets used up in the hypolimnion as the cooler, better oxygenated waters are not able to mix with those of the bottom, DO is metabolized by benthic (sediment dwelling) organisms and the waters of the hypolimnion eventually become anoxic (<1.0 mg/L DO).

Fish become stressed when DO concentrations are at or below 5 mg/L and avoid areas in the lake where anoxic conditions are present. The fisheries biologist from the IDNR suggests that as long as anoxic conditions do not expand above 14' depths, there will be a sufficient volume of oxygenated water for fish to utilize. The DO concentrations in Lake Catherine Lake did not fall below the 5 mg/L threshold until after 14 feet of the surface and therefore was not a concern in 2014. Lake volume can be calculated using bathymetric data in the form of a morphometric table. The morphometric table breaks the percentage of water volume down by depth The LCHD-ES recommends that bathymetric maps be updated every 10 years, Lake Catherine has a bathymetric map presented on the Interactive Map on the FWA website (http://www.foxwaterway.state.il.us/) however, the LCHD-ES has no record of a bathymetric survey taking place and whether or not a morphometric table accompanied that map.

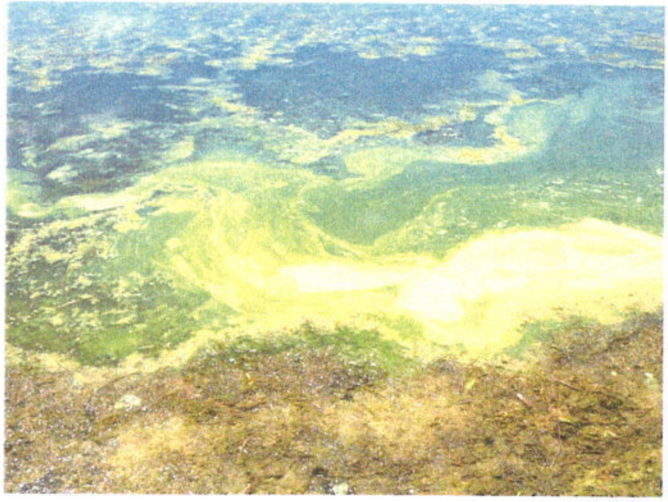
In Lake Catherine %DO was considered supersaturated (DO >100%) from May through July. %DO is considered saturated when the percent DO is 100%, or is equivalent to the ambient oxygen concentration and become supersaturated due to algae and plants producing oxygen more rapidly than it can escape into the atmosphere and %DO is greater than 100%. Although rare, supersaturated %DO can cause "gas bubble disease", this is where oxygen bubbles or emboli block the flow of blood in the blood vessels of fish. Lake Catherine exhibited supersaturated DO in waters of the epilimnion to 18' in May, and to 10 feet below the surface in July.

DISSOLVED OXYGEN (CONTINUED)

While most water quality parameter concentrations increase in the hypolimnion, DO decreases, as DO concentrations approach 2 mg/L near the lake bottom, bottom sediments become anoxic, this allows for phosphorus to release from sediments. As indicated in Figure 8 and 9 above, Lake Catherine was stratified from June through September. By September the average TP concentration in the hypolimnion of Lake Catherine was 0.6 mg/L setting up conditions conducive for fall algal blooms upon the lake mixing.

ALGAE

Historically, algal blooms have occurred on Lake Catherine during our monitoring years and planktonic blooms were again observed in 2014. Algae, like plants utilize dissolved phosphorus and nitrogen for their growth and like plants their populations can be balanced or become imbalanced and a bloom can occur usually because of excess nutrients. Although phosphorus has been identified as the source of algal blooms, it is important to pay attention to the amount of nitrogen present in the system as it has been linked to blue-green algal blooms, which have the potential to produce toxins (HABs). In May, a planktonic algal bloom was observed was supported by elevated TKN (1.70 mg/L) concentrations in the waters of the epilimnion and through the presence of supersaturated DO concentrations.



Recently, there has been an increased awareness of Harmful Algal Blooms (HABs) in Illinois. Blue green algal blooms are actually bacteria and as mentioned above can produce toxins. An initiative by the IEPA and LCHD was started in 2013 monitoring beaches for HAB's on a routine basis. In 2013, a subset of beaches were selected that would be routinely sampled as part of the program. Felter's North Beach on Lake Catherine was selected to participate in the program. The LCHD-ES sampled the water at the beach during sampling for E-coli. the sample taken was sent to an independent laboratory for enzyme-linked immunosorbent assay (ELISA). In 2013, Abraxis tests were not required on Felter's North Beach, and the results of ELISA were well below the recommended level by the World Health Organization for no contact (≥20 ug/L). If a blue-green algal bloom was present at the time of sampling, an Abraxis test was performed on a subsample to determine if toxins were present. If the results of the Abraxis test were positive for toxins, the beach manager would be advised of the results. In 2013 and 2014, none of the beaches in Lake Catherine had blue green algal blooms observed or reported. Septic system failure can contribute to HABs therefore it is important that septics are maintained on Lake Catherine.

CHLORIDES/CONDUCTIVITY

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

Conductivity measures the amount of ions in water, the more ions or salts in the water the higher its conductivity. It can be used to estimate both total dissolved solids ($R^2 = 0.96$) and chloride concentrations due to a strong correlation ($R^2 = 0.94$) between these parameters. Sources of chlorides are road salts (40% chloride) which are used in winter deicing programs by both public and private maintenance crews and water softener systems. The USEPA has determined that 230 mg/L of chloride is the critical concentration in which adverse impacts to aquatic ecosystems are possible if the critical concentration is maintained for prolonged periods. However, certain species can be impacted at much lower concentrations. It only takes 1 teaspoon of salt (chloride) to pollute 5 gallons of water (230 mg/L).

Recent trends show increasing chloride concentrations in surface and ground waters in the County. The chloride ion does not bind to soils or sediments so once in the water they remain there indefinitely, unless the water is diluted or treated by a reverse osmosis system, which is a very costly and not very practical for most surface water applications.

In 2014, the average chloride concentration in Lake Catherine was 91 mg/L with concentrations ranging from 87.0 mg/L to 94.0 mg/L. Chloride was not a parameter tested for in 2002, instead Conductivity was used to estimate chloride concentration in Lake Catherine. It is estimated that the average chloride concentration in 2002 was 86.9 resulting in a slight increase of 4.5% in chloride concentration between 2002 and 2014.

Although chloride concentrations were not highly elevated in 2014, single family and transportation were estimated to be the two highest contributors of total percent runoff, and therefore homeowners and those winter road maintenance crews should minimize their salt usage. Many residences in the Fox Chain 'O' Lakes remain on septic. If using a water softener, there is no removal of chloride from the waste water, as it percolates through our soils and eventually into the lake. Shifts in algal populations to blue green algae have been found and many invasive species are more tolerant of high chloride levels which can cause management issues. Saltwater is more dense than freshwater and therefore can get trapped in bottom waters eventually changing the volume of water mixed in the lake which can affect the entire ecosystem in the lake.

The LCHD-ES and Lake County Stormwater Management Commission (LCSMC) have been holding annual training sessions targeting deicing maintenance personnel for both public and private entities. Since 2010 we have provided training to approximately 468 winter maintenance personnel on the recommended application rates for applying deicers while still maintaining safe passageways. Almost all deicing products contain chloride so it is important to read and follow product labels for proper application. For instance, at a pavement temperature of 30° F, rock salt will efficiently melt ice; however at 10°F it is ineffective and therefore another product would be required to melt ice. Check with your HOA to see what is required of private companies hired to deice roads in your subdivisions. Support changes in deicing policies proposed by the local township in their attempts to incorporate best management practices into their routines.

Pavement Temp. °F	**One Pound of Salt (NaCl) melts**	**Melt Times**
30	46.3 lbs of ice	5 min.
25	14.4 lbs of ice	10 min.
20	8.6 lbs of ice	20 min.
15	6.3 lbs of ice	1 hour
10	Dry salt is ineffective and will blow away before it melts anything	

AQUATIC PLANTS

Figure 10. Status of vegetation in Lake Catherine, July, 2014.

Aquatic plants are a critical component in lakes as they uptake available nutrients such as phosphorus from the water column, making them unavailable for use by algae, filter sediments and other pollutants from the water, and stabilize bottom substrates. They also provide habitat for nesting and nursery for fish and other aquatic organisms. At times, nuisance growth has been encountered by lake managers due to invasive species and eutrophication. Aquatic vegetation surveys supply lake managers with valuable data allowing them to be more efficient and effective managers of the aquatic plant community .

In July 2014, an aquatic vegetation survey was conducted on Lake Catherine using a point intercept method. In order to accomplish this a randomized 60-meter grid was overlaid on an aerial photo of Lake Catherine using ARCGIS 10.2. A total of 178 points fell within the lake footprint. Above the 12 ft. depth, which is the average depth that plants are likely to be detected given a 3—5 ft. Secchi depth, every point was sampled regardless of whether plants were detected or not, if plants dropped out of the littoral zone after 12 ft. depth, points lying at greater depths were not sampled. To sample, a rake was lowered into the water and then scored on a scale from 1—5 (Appendix A, Table 7). These scores are associated with percent coverage and the midpoint of the percent range was used to estimate coverage. A total of 89 points were sampled and species cover, relative cover, frequency, relative frequency and relative importance were quantified using a modified Braun- Blanquet scale (Mueller-Dombois, Ellenberg, 2002). Relative importance is the sum of the relative cover and relative frequency for each species. Appendix A, Table 7 presents the estimated cover, frequency and relative importance for each species detected in the July, 2014 survey. A ranking of relative importance determined dominant species in the lake.

In 2014, vegetation was found at 22.5% of the points sampled with an estimated cover of 14.6%. Twelve plant species and Chara, a macro-algae were detected. Three floating plants were co-dominant; Coontail, Common Duckweed and Giant Duckweed. Coontail, is a native submerged aquatic species, and is tolerant of low light conditions. Figure 10 is a map delineating areas of vegetation in Lake Catherine based upon the July survey (Appendix A, Figure 6).

A floristic quality assessment was conducted on the plant species detected in our survey and resulted in an FQI score of 21.8. Floristic quality assessments are commonly used to identify natural areas, for site comparisons, and long term and habitat restoration monitoring. Since plant management occurs in areas of Lake Catherine, FQI can be used to determine the effectiveness of management practices and whether or not they are negatively affecting the quality of the native aquatic plant community. An FQI score of 21.8 indicates that the aquatic vegetation in Lake Catherine has some significance from a natural area perspective. Lake Catherine was ranked #34 out of 170 lakes that have had florist quality assessments conducted on them since 2000 (Appendix A, Table 8).

Eurasian Water milfoil, is a non-native aquatic invasive plant species was detected at 9.0% of the points assessed. The other

AQUATIC PLANTS (CONTINUED)

common invasive non-native aquatic plant found in lakes is Curly leaf Pondweed and although it was not detected by the LCHD at the time of the July survey, applications sent in by applicators on behalf of their clients on Lake Catherine have it listed as a targeted species. It was likely not detected either due to the application being successful, or the ephemeral nature of the plant, as it is capable overwintering, emerging early in spring before most other aquatic plants and completing its cycle before mid-July when our survey took place or a combination of both.

The LCHD-ES is recommending that Lake Catherine adopt a long term aquatic plant management plans that is developed by all stakeholders of the lake (lake associations, citizens, townships, park districts etc.). The plan would provide a template that describes the goals of aquatic plant management in Lake Catherine and defines objectives to help attain those goals. If a plan is not developed it is recommended that the native plant community be increased and therefore, if chemical treatments are used to control invasive species, they should occur in when water temperatures are not too warm as to accelerate breakdown of chemical through microbial processes as well as to ensure that chemicals have minimal, if any, impact to native plant populations and do not affect spawning fish.

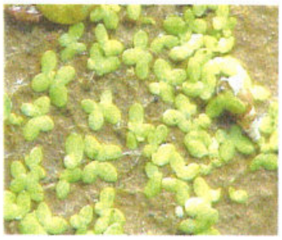
What type of plants are present in a lake becomes important if using chemicals to control invasive plants. Aquatic plants like terrestrial species are of two types; monocots and dicots. The monocots contain all the pondweeds, duckweeds, naiads, elodeas and others. Dicots include species such as the milfoils such as EWM, White Water Lily, Spatterdock, Coontail, White Water Crowfoot and Water Marigold. The dominant native plants found in Lake Catherine are showcased below.

COONTAIL (DICOT

Coontail (*Ceratophyllum 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.

DUCKWEEDS (MONOCOT)

Common duckweed (Lemna minor) and Giant Duckweed (Spirodela polyrhiza) are two widespread natives . Common duckweed has invasive tendencies and under eutrophic conditions has been found to cover entire water surfaces. Giant Duckweed has a red pigment on bottom with multiple roots coming from a cluster of leaves (pictured on bottom left).



AQUATIC PLANT MANAGEMENT

FOR FULL DETAILS OF PART 895 SEE:

HTTP://WWW.ILGA.GOV/COMMISSION/JCAR/ADMINCODE/017/01700895SECTIONS.HTML

Herbicide application is a tool utilized by home owner associations, individual residents and lake managers to control aquatic plants in Lake Catherine. Targeted species are usually non-native invasive species; however our records indicate that there has been some treatments over the years, targeting native species.

By Administrative Code, applying herbicides on Lake Catherine or any other lake in the Fox Chain 'O' Lakes requires a permit by the Illinois Department of Natural Resources (IDNR) 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). It should minimally document the location and area of treatment. The targeted species, pesticide and application rate as well as an estimated time when pesticide will be applied. The application can be obtained at the FWA or its website (http://www.foxwaterway.state.il.us/). The IDNR has 45 days to issue or deny the permit. The FWA has the right to review all applications and can recommend denial of a permit if it feels that it could cause harm to the environment. Chemicals should only be used if they are labelled and registered with the Illinois Environmental Protection Agency. More information is available at the link to Part 895 of the Administrative Code which covers management of aquatic plants on the Fox Chain 'O' Lakes.

A NPDES permit is required before applying pesticides over or near waters of the state. A notice of intent to apply pesticides needs to be filed with the state and can be found at the following website: http://www.epa.state.il.us/water/permits/pesticide/forms/noi.pdf. There is a 14 day public notice period and additional information may be requested so plan ahead. Either the homeowner or its representative can apply for the permit. Once issued the permit is good for 5 years. If your treatments exceed 80 acres annually additional reporting is required. Additional documentation is required in the cases where adverse affects due to a spill or overdosing occur.

The LCHD-ES recommends that a long-term (5 year) Aquatic Plant Management Plan (APMP) be developed for Lake Catherine, and followed by any entity or homeowner applying pesticides into the lake. Developing the plan should consider all stakeholders that utilize the lake. The plan should describe all methods of control and select the best management tool for the lake, explain why it was chosen. The plan should consider timing of pesticide application, targeted species, and pesticide selection. Distributing information on pesticides that are approved for aquatic use should be included so that the stakeholders are knowledgeable about the pesticides being applied to the lake and any risks associated with those chemicals. A well prepared APMP and a morphometric table constructed from bathymetry data allows for construction of a clear concise Request for Proposal (RFP) that addresses the key considerations, sets reasonable goals and the objectives for achieving those goals. The APMP should also require monitoring of the lake vegetation to ensure that the goals are being met. This would provide information to improve the APMP if they are not met.

INVASIVE SPECIES -EURASIAN WATERMILFOIL

ILLUSTRATION OF EURASIAN WATERMILFOIL

EURASIAN WATERMILFOIL WAS PRESENT AT 8 SITES ON LAKE CATHERINE IN JULY 2014.

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 (Couch & Nelson), 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.

EWM was found at 9% of the points sampled with an average density of 1.19%. In 2014 chemical applications were applied in May and June, targeting EWM populations. LCHD-ES did not conduct an early season sampling in 2014, however the results of the July sampling suggest that treatments were successful.

EWM rapidly grows as water temperatures approach 59°F. The water temperature at the deep hole in Lake Catherine on May 7th was 53.6°F. In 2014, treatments should have probably occurred by the end of May to have most efficient control of EWM and to have least amount of impact on native aquatic vegetation. Recently a hybrid milfoil (M. spicatum x M. sibiricum) has been encountered. The hybrid milfoil has proven to be less sensitive than either parental species to certain herbicides. Therefore, it is important to know whether the hybrid is present this can be positively identified through genetic testing. Switching chemicals used to treat invasive species reduce the chance of the plants developing a resistance to chemicals.

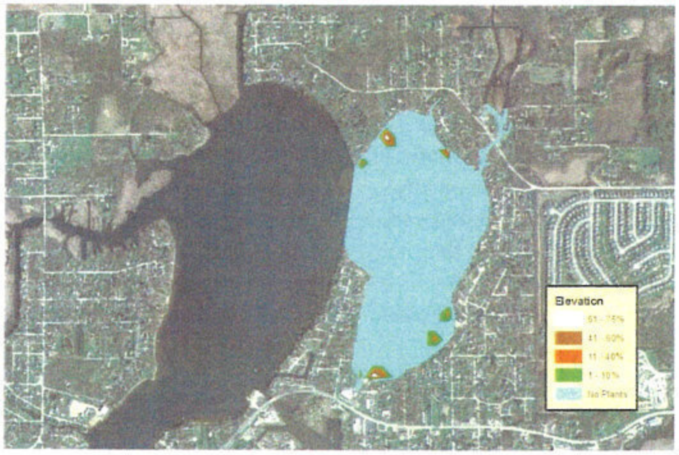


Figure 11. Status of EWM on Lake Catherine, July, 2014.

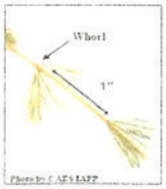
MYRIOPHYLLUM SPICATUM *EXOTIC**

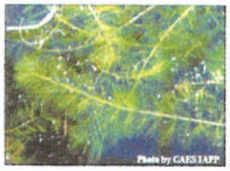
COMMON NAMES:
EURASIAN WATERMILFOIL

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; HYBRID MILFOILWHICH 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.

INVASIVE SPECIES—ZEBRA MUSSELS

ZEBRA MUSSEL

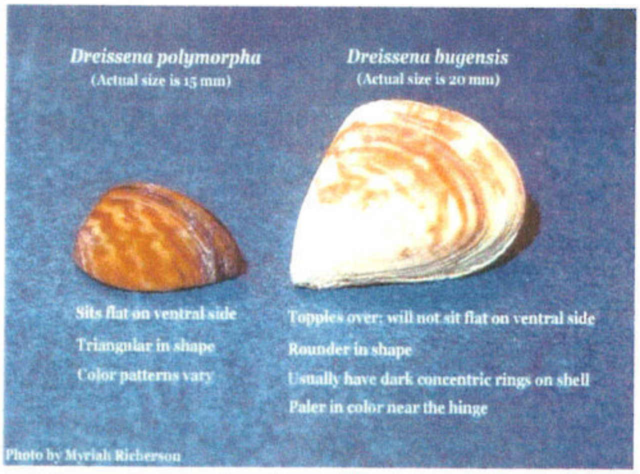
ZEBRA MUSSELS WERE NOT OBSERVED BY LCHD-ES IN LAKE CATHERINE DURING 2014.

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. In 1999, the first sighting of the mussel in Lake County (besides Lake Michigan and the Chain of Lakes) occurred. Currently, 32 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 can go unnoticed.

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. They can live as long as five years and have an average life span of about 3.5 years. 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 mussels clogging water intake pipes have caused economic hardships for power plants, public water supplies, and industrial facilities. Boats stored on the water offer suitable areas for zebra mussels to start a colony. They can eventually affect cooling and exhaust systems on boats and create



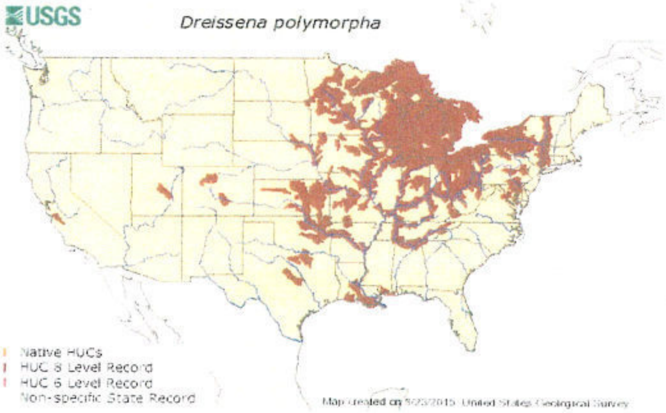


Figure 11. Status of Zebra Mussels in the US (USGS, 2015)

KEY FEATURES:

THE ZEBRA MUSSEL IS A SMALL SHELLFISH NAMED FOR THE STRIPED PATTERN OF ITS SHELL. COLOR PATTERNS CAN VARY TO THE POINT OF HAVING ONLY DARK OR LIGHT COLORED SHELLS AND NO STRIPES. IT IS TYPICALLY FOUND ATTACHED TO OBJECTS, SURFACES, OR OTHER MUSSELS BY THREADS EXTENDING FROM UNDERNEATH THE SHELLS. ALTHOUGH SIMILAR IN APPEARANCE TO THE QUAGGA MUSSEL (*DREISSENA BUGENSIS*), THE TWO SPECIES CAN BE EASILY DISTINGUISHED. WHEN PLACED ON A SURFACE ZEBRA MUSSELS ARE STABLE ON THEIR FLATTENED UNDERSIDE WHILE QUAGGA MUSSELS, LACKING A FLAT UNDERSIDE, WILL FALL OVER. SEE MACKIE AND CHLOSSER (1996) FOR A KEY TO ADULT DREISSENIDS

INVASIVE SPECIES -ZEBRA MUSSELS (CONTINUED)

extra drag causing lower fuel economy. Studies on the transport of the zebra mussel have shown that they can be found in any area of a boat that holds water, including the engine cooling system, bilge water, and bait buckets used in fishing. 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. Therefore, it is important that all boats and trailers entering or leaving the Fox Chain O' Lakes are inspected for aquatic plants and all water from the bilge and motors are drained.

Recently, an experimental biocide called Zequanox has shown to be effective against zebra mussels and it is not toxic to humans, native bivalves, and fish. In-lake tests show that it reached 97.1% mortality on zebra mussels within 14 days of treatment . Zequanox is a non-chemical solution made from dead cells of a naturally occurring microbe (Psuedomonas flourescens). It is highly selective to zebra and quagga mussels and has low toxicity (Marrone Bio Innovasions). Currently winter drawdowns have exposed the zebra mussels along the shorelines, however prevention is the best defense against any invasive species spread. The Great Lakes Sea Grant Network provides the following tips to 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.

BEACHES

Lake Catherine has 3 licensed beaches; Felter's North, Warriners Subdivision II, and Club Zobak. Licensed beaches are sampled bi-weekly for E-coli during the beach season, Memorial Day through Labor Day. If E-coli colonies are ≥ 235 colonies/100 mL, a swim ban is issued. Since 2004, there was only one swim ban at Warriners Subdivision, it occurred in July of 2012; E-coli colonies ranged from 290.9—325.5 colonies/100 mL. The elevated concentrations were likely caused by waterfowl and subsided by the next business day sampling, with E-coli colonies measured at 8.6 colonies/100 mL.

In 2013 and 2014, an additional sample collected at Felter's North Beach was routinely tested for the presence of toxins associated with blue-green algae (HABs). Felter's North was randomly selected as part of a pilot program initiated by LCHD and the IEPA. The sample was sent out to an independent laboratory for enzyme-linked immunosorbent assay (ELISA). In 2013, the results of ELISA were well below the recommended level by the World Health Organization for no contact (≥20 ug/L).

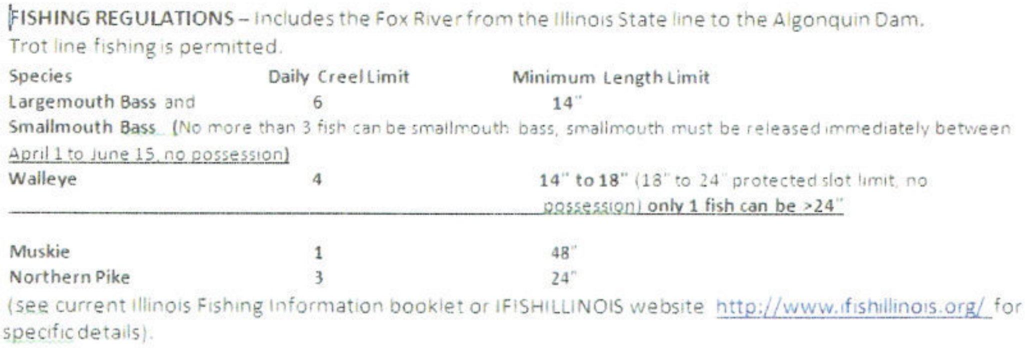
FISH

The Illinois Department of Natural Resources continuously monitors the fish populations in the Fox Chain 'O' Lakes through biennial fish surveys. They normally catch between 35—40 fish species during these surveys. In 2013, the IDNR conducted their biennial survey on the Fox Chain 'O' Lakes. During this survey they sampled Lake Catherine and Channel Lake and found 27 species of fish. Bluegill was the most abundant fish caught (354 individuals), however, Muskellunge (3) and Carp (7) were the fish having the greatest average weight, 8.4 lbs. and 7.6 lbs., respectively.

The Fox Chain 'O' Lakes is annually stocked with 243,000 2"walleye fingerlings, 2 million walleye fry, and at least 2000 muskie fingerlings. Sixty-five thousand 4" to 6" largemouth bass fingerlings are stocked every other year. Natural reproduction maintains all other species.

Fish Species in Lake Catherine and Channel Lake, 2013.

Black Crappie
Blue Gill
Blunt nose minnow
Bowfin
Brown Bullhead
Brook Silverside
Carp
Channel Catfish
Emerald Shiner
Fresh Water Drum
Golden Shiner
Green Sunfish
Gizzard Shad
Johnny Darter
Large Mouth Bass
Log Perch
Muskellunge
Northern Pike
Pumpkinseed
Spot tail Shiner
Quillback
Walleye
Warmouth
White Bass
Yellow Bullhead
Yellow Perch
Yellow Bass


FISHING REGULATIONS – Includes the Fox River from the Illinois State line to the Algonquin Dam. Trot line fishing is permitted.

Species	Daily Creel Limit	Minimum Length Limit
Largemouth Bass and	6	**14"**
Smallmouth Bass (No more than 3 fish can be smallmouth bass, smallmouth must be released immediately between April 1 to June 15, no possession)		
Walleye	4	**14" to 18"** (18" to 24" protected slot limit, no possession) **only 1 fish can be >24"**
Muskie	1	48"
Northern Pike	3	24"

(see current Illinois Fishing Information booklet or IFISHILLINOIS website http://www.ifishillinois.org/ for specific details).

LakeCounty
Health Department and
Community Health Center

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 Lake Catherine:

- Develop an aquatic plant management plan for Lake Catherine that can be used as a template for those interested in aquatic plant management on Lake Catherine.
- Encourage groups within the Trevor Creek watershed to incorporate best management practices to reduce the nutrient load (especially phosphorus) into Lake Catherine and the Fox Chain 'O' Lakes.
- Encourage municipalities within the watershed to use chloride products efficiently in their winter road maintenance programs while they still maintain safe passageways.
- Inspect and maintain septic systems as they can be a source for nutrients, E-coli contamination and chlorides in Lake Catherine and the Fox Chain 'O' Lakes.
- Organize a work group for working on an APMP, grants, and other items that can help improve the health of Lake Catherine and the Fox Chain 'O' Lakes. In 2015, the Fox River Watershed is prioritized for receiving 319 grant monies to implement projects that will improve the water quality of the Fox River. The grant application is due on August 1, 2015. The LCHD-ES can provide assistance to the group when formulating and implementing the grant.
- Update bathymetric map and create a morphometric table to assist lake managers in calculating volumes for in order to check for problems with DO or for aquatic plant management or many other lake management activities.

STOP AQUATIC HITCHHIKERS!™

Prevent the transport of nuisance species.
Clean all recreational equipment.
www.ProtectYourWaters.net

When you leave a body of water:

- Remove any visible mud, plants, fish or animals before transporting equipment.
- Eliminate water from equipment before transporting.
- Clean and dry anything that comes into contact with water (boats, trailers, equipment, clothing, dogs, etc.).
- Never release plants, fish or animals into a body of water unless they came out of that body of water.

APPENDIX A

FIGURES AND TABLES
LAKE CATHERINE
2014

Figure 1. LCHD water quality sampling points – Lake Catherine, 2014.

Table 1. Approximate land uses and retention time for Lake Catherine, 2014. (Lake County Mapping Services and SEWRPC data)

Land Use	Acreage	% of Total
Agricultural	4293.85	42.5%
Disturbed Land	9.38	0.1%
Forest and Grassland	599.96	5.9%
Government and Institutional	76.38	0.8%
Industrial	48.65	0.5%
Multi Family	26.87	0.3%
Office	0.00	0.0%
Public and Private Open Space	312.89	3.1%
Retail/Commercial	49.72	0.5%
Single Family	1565.75	15.5%
Transportation	660.98	6.5%
Utility and Waste Facilities	0.00	0.0%
Water	943.41	9.3%
Wetlands	1522.46	15.1%
Total Acres	**10110.30**	**100.0%**

Land Use	Acreage	Runoff Coeff.	Estimated Runoff, acft.	% Total of Estimated Runoff
Agricultural	4293.85	0.05	590.4	16.7%
Disturbed Land	9.38	0.05	1.3	0.0%
Forest and Grassland	599.96	0.05	82.5	2.3%
Government and Institutional	76.38	0.50	105.0	3.0%
Industrial	48.65	0.50	66.9	1.9%
Multi Family	26.87	0.50	36.9	1.0%
Office	0.00	0.85	0.0	0.0%
Public and Private Open Space	312.89	0.15	129.1	3.6%
Retail/Commercial	49.72	0.85	116.2	3.3%
Single Family	1565.75	0.30	1291.7	36.5%
Transportation	660.98	0.50	908.8	25.7%
Utility and Waste Facilities	0.00	0.30	0.0	0.0%
Water	943.41	0.00	0.0	0.0%
Wetlands	1522.46	0.05	209.3	5.9%
TOTAL	**10110.30**		**3538.3**	100.0%

Lake volume	**2188.90**	**acre-feet**
Retention Time (years)= lake volume/runoff	**0.62**	**years**
	225.80	**days**

Figure 2. Land Use and Watershed for Lake Catherine (Lake County Mapping Services and SEWRPC data).

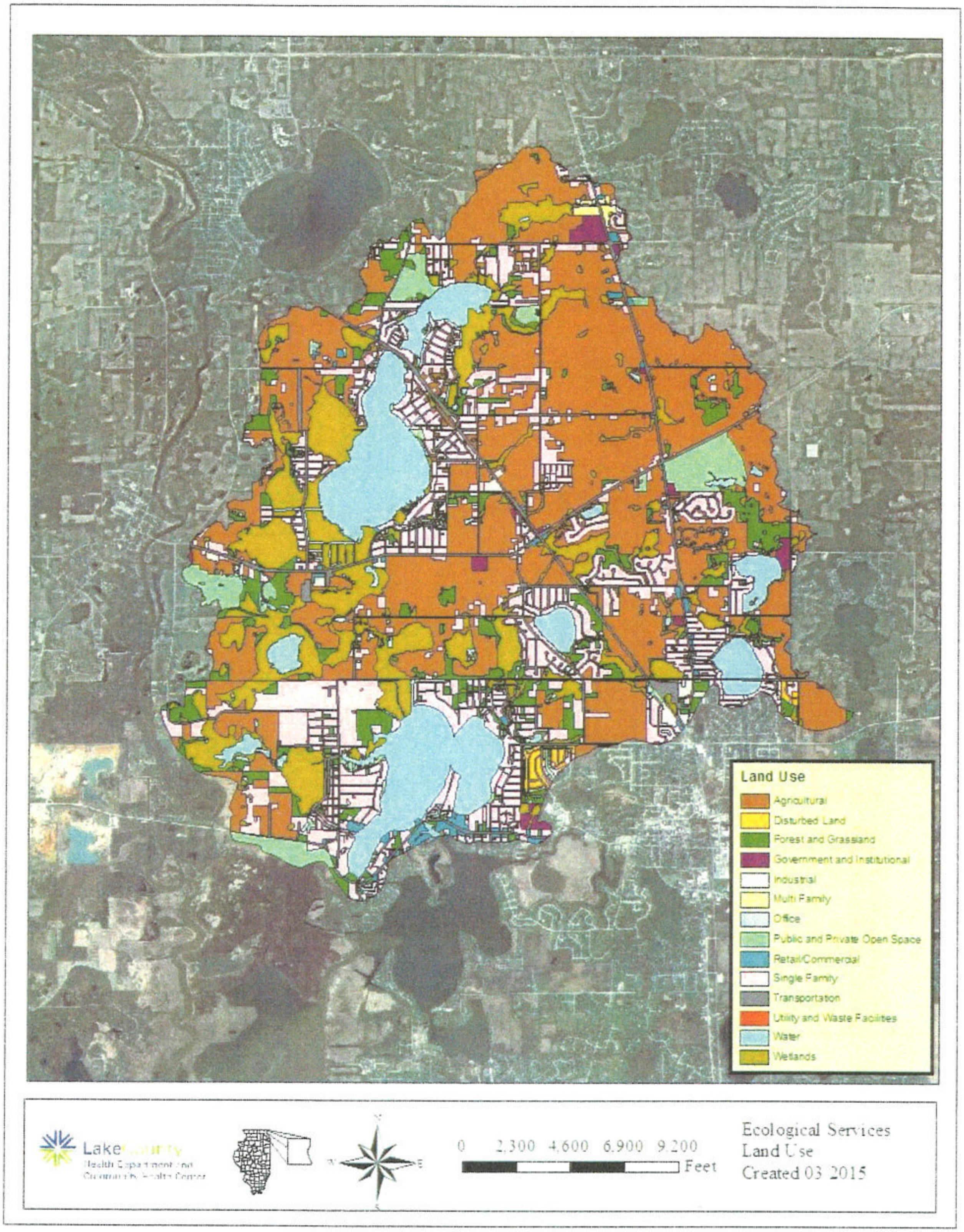


Table 3. Water Quality Data Summary for Lake Catherine, 2014.

Catherine	Epilimnion															
2014	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N*	TP	SRP	Cl-	TDS**	TSS	TS	TVS	SECCHI	COND	pH	DO
7-May	3.00	186	1.70	<0.10	<0.05	0.110	<0.005	94.0	375	13.0	426	104	1.61	0.6522	8.89	13.16
10-Jun	3.00	188	1.22	<0.10	<0.05	0.047	<0.005	93.0	384	7.6	429	124	7.50	0.6696	8.49	9.25
8-Jul	3.00	188	1.22	<0.10	<0.05	0.047	<0.005	87.0	387	7.6	417	122	2.60	0.6752	8.41	9.34
13-Aug	3.00	182	1.29	<0.10	<0.05	0.044	<0.005	90.2	365	9.6	396	106	1.58	0.6307	8.33	6.29
16-Sep	3.00	171	1.57	0.14	<0.05	0.064	<0.005	90.8	359	10.0	400	106	1.23	0.6190	8.03	7.59
	Average	183	1.40	0.11^k	<0.05	0.062	<0.005	91.0	374	9.6	414	112	2.90	0.6493	8.43	9.13

Catherine	Epilimnion															
2002	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N*	TP	SRP	Cl-**	TDS**	TSS	TS	TVS	SECCHI	COND	pH	DO
16-May	1.00	220	1.70	0.15	0.18	0.038	0.018	95.9	385	16.0	ND	4	8.67	0.6707	8.2	ND
12-Jun	3.00	195	1.35	0.01	0.03	0.045	0.006	85.5	368	9.0	ND	3	6.92	0.6367	8.34	ND
17-Jul	3.00	255	1.29	<0.10	<0.05	0.017	0.005	80.1	359	1.0	ND	1	8.58	0.6192	8.33	ND
14-Aug	3.00	195	<0.50	<0.10	<0.05	0.024	0.011	80.9	360	4.0	ND	4	2.17	0.6217	8.44	ND
2-Oct	3.00	255	<0.50	0.15	0.02	0.030	0.004	92.0	378	3.0	ND	3	6.58	0.6581	8.09	ND
	Average	224	1.45^k	0.10^k	0.07^k	0.031	0.009	86.9	370	6.6	ND	3	6.58	0.6413	8.28	ND

Glossary

ALK = Alkalinity, mg/L $CaCO_3$

TKN = Total Kjeldahl nitrogen, mg/L

NH_3-N = Ammonia nitrogen, mg/L

NO_2+NO_3-N = Nitrate + Nitrite nitrogen, mg/L

NO_3-N = Nitrate + Nitrite nitrogen, mg/L

TP = Total phosphorus, mg/L

SRP = Soluble reactive phosphorus, mg/L

Cl^- = Chloride, mg/L

TDS = Total dissolved solids, mg/L

TSS = Total suspended solids, mg/L

TS = Total solids, mg/L

TVS = Total volatile solids, mg/L

SECCHI = Secchi disk depth, ft

COND = Conductivity, milliSiemens/cm

DO = Dissolved oxygen, 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

**=Estimated based on Conductivity

ND = no data; data not available

Table 3. Water Quality Data Summary for Lake Catherine, 2014.

Catherine	**Hypolimnion**															
2014	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N*	TP	SRP	Cl-	TDS**	TSS	TS	TVS	SECCHI	COND	pH	DO
7-May	33	193	2.71	1.31	<0.05	0.248	0.052	94	386	12.0	442	116	NA	0.6741	7.80	2.13
10-Jun	33	220	5.32	3.89	<0.05	0.619	0.550	93	405	5.0	445	130	NA	0.7104	7.24	0.05
8-Jul	32	237	5.41	4.85	<0.05	0.624	0.618	99	432	4.0	453	126	NA	0.7657	7.22	0.04
13-Aug	33	250	6.62	5.49	<0.05	0.730	0.683	101	421	3.4	450	131	NA	0.7431	7.06	0.05
16-Sep	34	255	7.95	6.49	<0.05	0.783	0.747	100	441	3.2	439	87	NA	0.7820	6.60	0.32
	Average	231	5.60	4.41	<0.05	0.601	0.530	97.3	417	5.5	446	118	NA	0.7351	7.18	0.52

Catherine	**Hypolimnion**															
2002	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N*	TP	SRP	Cl-**	TDS**	TSS	TS	TVS	SECCHI	COND	pH	DO
16-May	33	285	1.27	0.46	0.07	0.085	0.061	97	386	16.0	ND	6	NA	0.6738	7.82	ND
12-Jun	33	220	2.24	1.1	<0.05	0.252	0.233	98	387	6.0	ND	2	NA	0.6760	7.45	ND
17-Jul	33	275	4.34	1.8	0.010	0.301	0.272	99	390	3.0	ND	3	NA	0.6810	7.29	ND
14-Aug	33	265	<0.5	1.8	<0.05	0.28	0.242	107	403	2.0	ND	2	NA	0.7067	7.15	ND
2-Oct	34	350	<0.5	3.8	<0.05	0.494	0.524	122	428	2.0	ND	2	NA	0.7573	6.94	ND
	Average	279	2.62	1.79	0.04	0.282	0.266	104.6	399	5.8	ND	3	NA	0.6990	7.33	ND

Glossary

ALK = Alkalinity, mg/L $CaCO_3$

TKN = Total Kjeldahl nitrogen, mg/L

NH_3-N = Ammonia nitrogen, mg/L

NO_2+NO_3-N = Nitrate + Nitrite nitrogen, mg/L

NO_3-N = Nitrate + Nitrite nitrogen, mg/L

TP = Total phosphorus, mg/L

SRP = Soluble reactive phosphorus, mg/L

Cl^- = Chloride, mg/L

TDS = Total dissolved solids, mg/L

TSS = Total suspended solids, mg/L

TS = Total solids, mg/L

TVS = Total volatile solids, mg/L

SECCHI = Secchi disk depth, ft

COND = Conductivity, milliSiemens/cm

DO = Dissolved oxygen, 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

**=Estimated based on Conductivity

ND = no data; data not available

Figure 3. 2002 and 2014 Secchi Depths compared to 2014 Lake County Median Secchi.

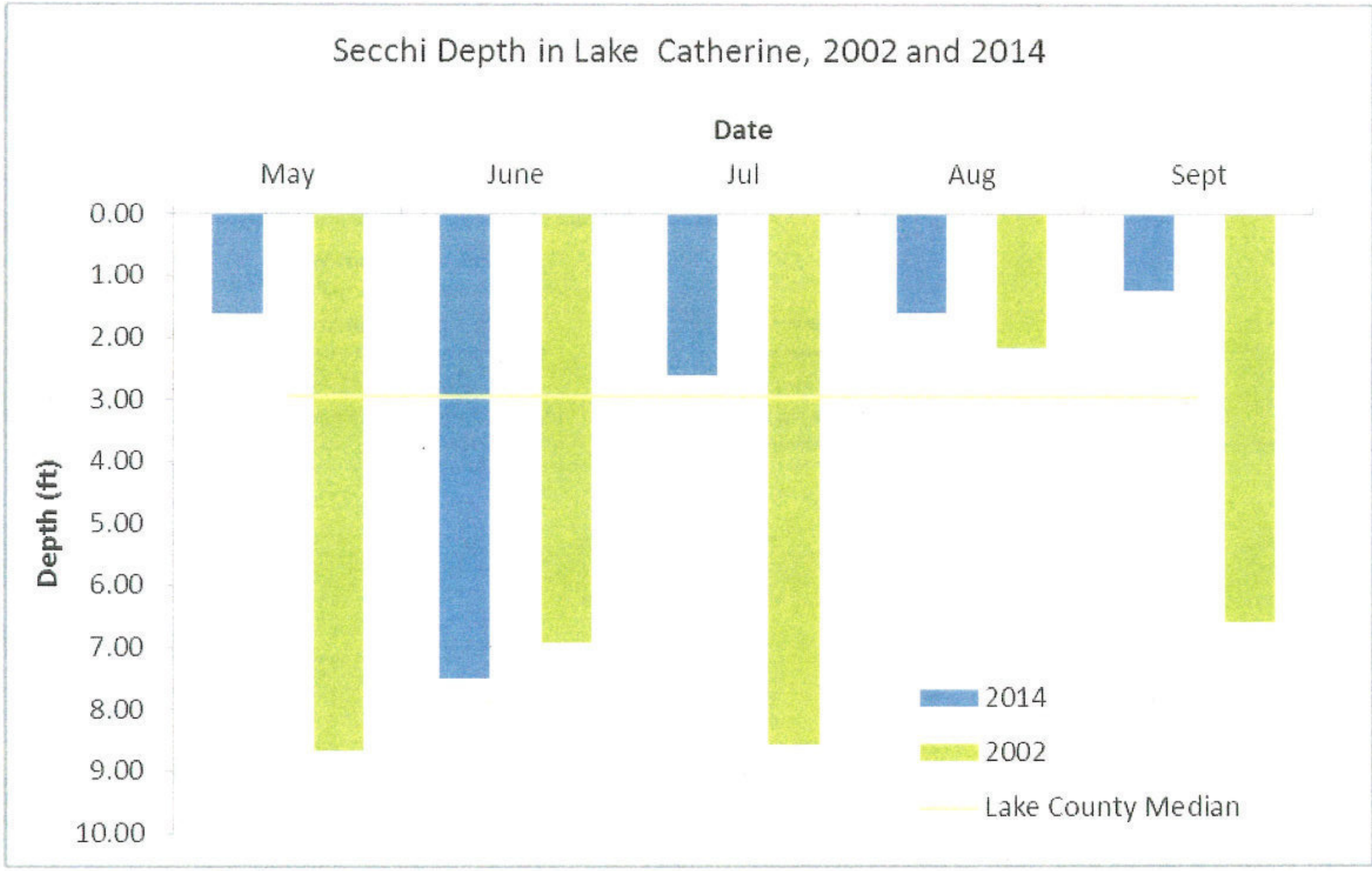


Figure 4. VLMP Secchi Data 2011 – 2014.

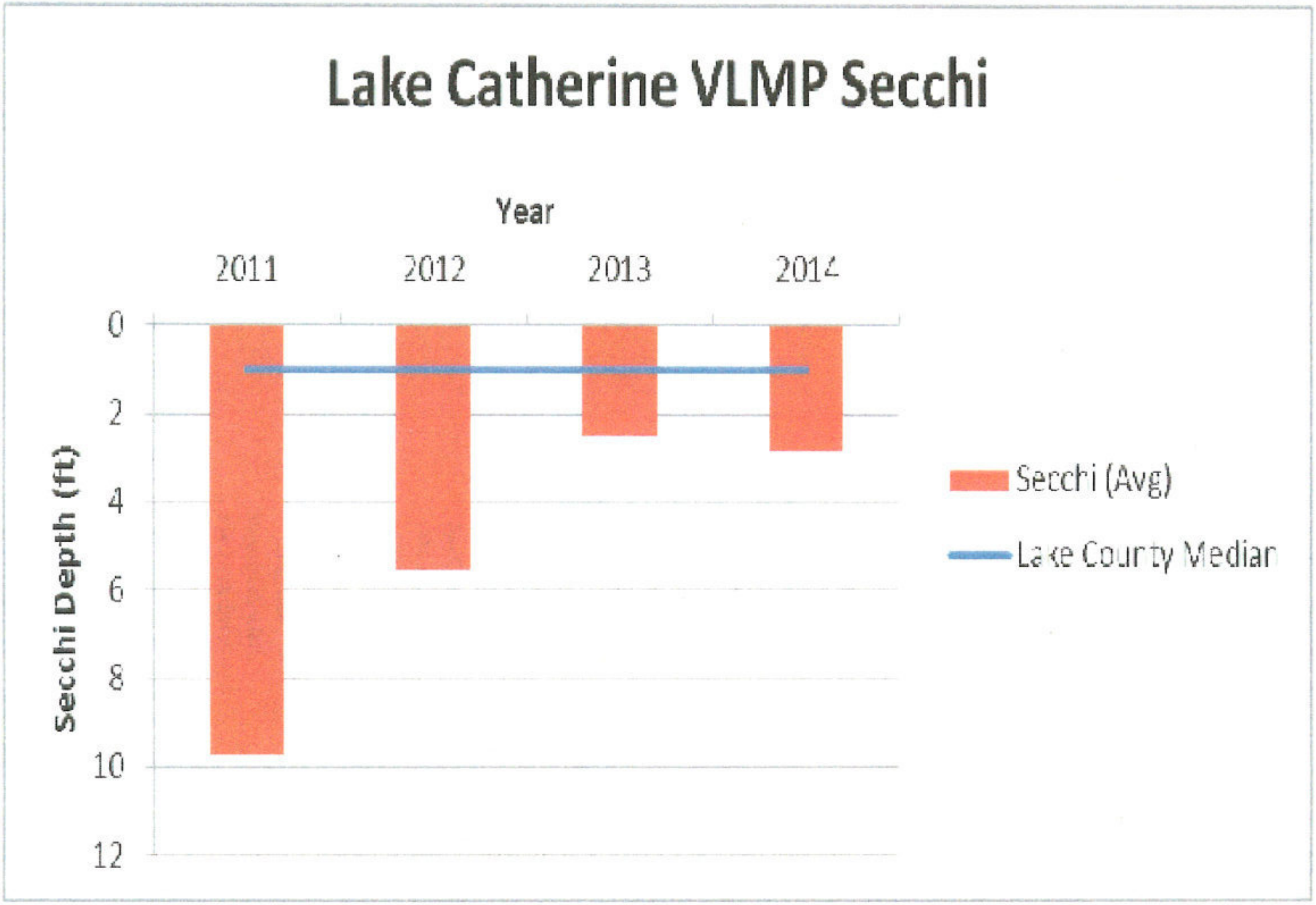


Table 4. Average Secchi depths measured from lakes in Lake County, 2000-2014.

RANK	LAKE NAME	SECCHI AVE	TSIsd
1	Windward Lake	14.28	38.79
2	Lake Carina	13.21	39.92
3	Cedar Lake	12.55	41.00
4	Druce Lake	12.25	41.00
5	Pulaski Pond	11.69	41.68
6	West Loon Lake	11.55	41.85
7	Indpendence Grove	11.50	41.92
8	Sterling Lake	11.35	42.10
9	Lake Zurich	10.40	43.37
10	Third Lake	9.76	44.00
11	Davis Lake	9.65	44.44
12	Harvey Lake	9.47	44.72
13	Little Silver Lake	9.42	44.79
14	Old School Lake	9.40	44.82
15	Lake Kathryn	9.39	44.84
16	Dugdale Lake	9.22	45.10
17	Dog Training Pond	9.04	45.39
18	Banana Pond	8.85	45.69
19	Deep Lake	8.83	45.72
20	Stone Quarry Lake	8.81	45.76
21	Lake of the Hollow	8.74	45.87
22	Cross Lake	8.18	46.83
23	Ames Pit	8.14	46.90
24	Bangs Lake	8.02	47.00
25	Briarcrest Pond	8.00	47.15
26	Sand Lake	7.48	48.12
27	Sand Pond (IDNR)	7.42	48.23
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	Lake Helen	6.43	50.30
38	Sun Lake	6.33	50.52
39	Lake Barrington	6.12	51.00
40	Cranberry Lake	5.94	51.00
41	Lake Fairfield	5.89	51.56
42	Gages Lake	5.45	52.68
43	Wooster Lake	5.33	47.00
44	Owens Lake	5.30	53.08
45	Valley Lake	5.05	53.78
46	McGreal Lake	5.04	53.81
47	Old Oak Lake	4.85	54.36
48	Waterford Lake	4.70	54.82
49	Lake Linden	4.60	55.13

Table 4. Average Secchi depths measured from lakes in Lake County, 2000-2014.

RANK	LAKE NAME	SECCHI AVE	TSIsd
50	Peterson Pond	4.51	55.41
51	Timber Lake (South)	4.46	56.00
52	Crooked Lake	4.39	55.79
53	Mary Lee Lake	4.35	55.93
54	Butler Lake	4.35	55.93
55	Crooked Lake	4.28	56.17
56	Deer Lake	4.20	56.45
57	Seven Acre Lake	4.18	56.51
58	Lambs Farm Lake	4.17	56.54
59	Grays Lake	4.08	56.86
60	Lake Naomi	4.05	56.96
61	White Lake	3.96	57.29
62	Hook Lake	3.95	57.32
63	Turner Lake	3.92	57.43
64	North Tower Lake	3.89	60.00
65	Leisure Lake	3.85	57.69
66	Salem Lake	3.77	58.00
67	Lake Fariview	3.75	58.00
68	Countryside Glen Lake	3.64	58.50
69	Taylor Lake	3.52	58.99
70	Hastings Lake	3.52	58.99
71	Duck Lake	3.49	59.11
72	Fish Lake	3.47	59.19
73	Bishop Lake	3.47	59.19
74	Lake Lakeland Estates	3.41	59.00
75	Lake Holloway	3.40	59.49
76	Stockholm Lake	3.38	59.57
77	East Loon Lake	3.30	59.92
78	Bresen Lake	3.28	60.00
79	Summerhill Estates Lake	3.27	60.05
80	Lucky Lake	3.22	60.27
81	Diamond Lake	3.17	60.50
82	Liberty Lake	3.16	60.54
83	International Mining and Chemical Lake	3.08	60.91
84	Long Lake	3.05	61.00
85	Lake Christa	3.01	61.24
86	Lucy Lake	2.99	61.34
87	Lake Catherine	2.90	62.00
88	St. Mary's Lake	2.79	62.34
89	Channel Lake	2.77	62.00
90	Werhane Lake	2.71	62.76
91	East Meadow Lake	2.61	63.30
92	Buffalo Creek Reservoir 1	2.60	64.00
93	Countryside Lake	2.58	63.00
94	Kemper Lake 1	2.56	63.58
95	Bluff Lake	2.51	64.00
96	Broberg Marsh	2.50	63.92
97	Antioch Lake	2.48	64.03
98	Little Bear Lake	2.38	64.63

Table 4. Average Secchi depths measured from lakes in Lake County, 2000-2014.

RANK	LAKE NAME	SECCHI AVE	TSIsd
99	Island Lake	2.32	65.00
100	Tower Lake	2.31	56.00
101	Buffalo Creek Reservoir 2	2.30	67.00
102	Woodland Lake	2.28	65.00
103	Rivershire Pond 2	2.23	65.57
104	Lake Charles	2.20	65.76
105	College Trail Lake	2.18	65.89
106	Loch Lomond	2.17	65.96
107	Redhead Lake	2.16	65.00
108	Pistakee Lake	2.15	66.00
109	Echo Lake	2.11	66.36
110	Eagle Lake (S1)	2.10	66.43
111	West Meadow Lake	2.07	66.64
112	Forest Lake	2.04	66.85
113	Grand Ave Marsh	2.03	66.92
114	Columbus Park Lake	2.03	66.92
115	Grassy Lake	2.00	67.14
116	Petite Lake	2.00	67.00
117	Sylvan Lake	1.98	67.28
118	Bittersweet Golf Course #13	1.98	67.28
119	Fischer Lake	1.96	67.43
120	Spring Lake	1.78	69.00
121	Kemper Lake 2	1.77	68.90
122	Fourth Lake	1.77	68.90
123	Nippersink Lake	1.73	69.23
124	Deer Lake Meadow Lake	1.73	69.23
125	Lake Louise	1.68	69.65
126	Willow Lake	1.63	70.09
127	Slough Lake	1.63	70.09
128	Rasmussen Lake	1.62	70.17
129	Lake Farmington	1.62	70.17
130	Half Day Pit	1.60	70.35
131	Lake Marie	1.56	68.00
132	Longview Meadow Lake	1.51	71.19
133	Lake Matthews	1.48	72.00
134	Big Bear Lake	1.32	73.13
135	Fox Lake	1.28	74.00
136	Dunn's Lake	1.22	74.00
137	Lake Eleanor	1.16	74.99
138	McDonald Lake 1	1.13	75.37
139	Lake Napa Suwe	1.06	105.00
140	Rollins Savannah 1	1.05	76.43
141	Osprey Lake	1.03	76.70
142	Manning's Slough	1.00	77.13
143	Rollins Savannah 2	0.95	77.87
144	Dog Bone Lake	0.94	78.02
145	Redwing Marsh	0.88	78.97
146	Flint Lake Oulet	0.83	79.82
147	Slocum Lake	0.81	80.00

Table 4. Average Secchi depths measured from lakes in Lake County, 2000-2014.

RANK	LAKE NAME	SECCHI AVE	TSIsd
148	Fairfield Marsh	0.81	80.17
149	Oak Hills Lake	0.79	80.53
150	Grass Lake	0.78	77.00
151	Lake Nippersink	0.77	81.00
152	South Churchill Lake	0.73	81.67
153	Lake Forest Pond	0.71	82.07
154	ADID 127	0.66	83.12
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	0.50	87.12

Table 5. Lake County Average TSI phosphorus (TSIp) Ranking 2000-2014.

RANK	LAKE NAME	TP AVE	TSIp
1	Lake Carina	0.0100	37.35
2	Sterling Lake	0.0100	37.35
3	Cedar Lake	0.0130	41.14
4	Indpendence Grove	0.0130	41.14
5	Lake Zurich	0.0135	41.68
6	Druce Lake	0.0140	42.00
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	Banana Pond	0.0200	47.35
12	Gages Lake	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	Cross Lake	0.0220	48.72
19	Dog Training Pond	0.0220	48.72
20	Sun Lake	0.0220	48.72
21	Deep Lake	0.0230	49.36
22	Lake of the Hollow	0.0230	49.36
23	Round Lake	0.0230	49.36
24	Stone Quarry Lake	0.0230	49.36
25	Little Silver Lake	0.0250	50.57
26	Bangs Lake	0.0260	51.13
27	Lake Leo	0.0260	51.13
28	Cranberry Lake	0.0270	51.68
29	Dugdale Lake	0.0270	51.68
30	Peterson Pond	0.0270	51.68
31	Fourth Lake	0.0360	53.00
32	Lambs Farm Lake	0.0310	53.67
33	Old School Lake	0.0310	53.67
34	Grays Lake	0.0310	54.00
35	Harvey Lake	0.0320	54.50
36	Hendrick Lake	0.0340	55.00
37	Honey Lake	0.0340	55.00
38	Sand Lake	0.0380	56.00
39	Third Lake	0.0384	56.00
40	Sullivan Lake	0.0370	56.22
41	Ames Pit	0.0390	56.98
42	Diamond Lake	0.0390	56.98
43	East Loon	0.0400	57.34
44	Schreiber Lake	0.0400	57.34
45	Waterford Lake	0.0400	57.34
46	Hook Lake	0.0410	57.70
47	Nielsen Pond	0.0450	59.04
48	Seven Acre Lake	0.0460	59.36
49	Turner Lake	0.0460	59.36
50	Willow Lake	0.0460	59.36
51	East Meadow Lake	0.0480	59.97
52	Lucky Lake	0.0480	59.97
53	Old Oak Lake	0.0490	60.27

Table 5. Lake County Average TSI phosphorus (TSIp) Ranking 2000-2014.

RANK	LAKE NAME	TP AVE	TSIp
54	College Trail Lake	0.0500	60.56
55	Hastings Lake	0.0520	61.13
56	Butler Lake	0.0530	61.40
57	West Meadow Lake	0.0530	61.40
58	Wooster Lake	0.0530	61.40
59	Lucy Lake	0.0550	61.94
60	Lake Linden	0.0570	62.45
61	Lake Christa	0.0580	62.70
62	Owens Lake	0.0580	62.70
63	Briarcrest Pond	0.0580	63.00
64	Lake Barrington	0.0600	63.10
65	Redhead Lake	0.0608	63.20
66	Lake Lakeland Estates	0.0620	63.66
67	Lake Naomi	0.0620	63.66
68	Lake Tranquility (S1)	0.0620	63.66
69	Lake Catherine	0.0620	63.76
70	Liberty Lake	0.0630	63.89
71	North Tower Lake	0.0630	63.89
72	Werhane Lake	0.0630	63.89
73	Countryside Glen Lake	0.0640	64.12
74	Davis Lake	0.0650	64.34
75	Leisure Lake	0.0650	64.34
76	St. Mary's Lake	0.0670	64.78
77	Channel Lake	0.0680	64.91
78	Buffalo Creek Reservoir 1	0.0680	65.00
79	Mary Lee Lake	0.0680	65.00
80	Little Bear Lake	0.0680	65.00
81	Timber Lake (South)	0.0720	65.82
82	Lake Helen	0.0720	65.82
83	Grandwood Park Lake	0.0720	65.82
84	Crooked Lake	0.0710	66.00
85	ADID 203	0.0730	66.02
86	Broberg Marsh	0.0780	66.97
87	Redwing Slough	0.0822	67.73
88	Tower Lake	0.0830	67.87
89	Countryside Lake	0.0800	68.00
90	Lake Nippersink	0.0800	68.00
91	Woodland Lake	0.0800	68.00
92	Lake Fairview	0.0890	68.00
93	Potomac Lake	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	Pistakee Lake	0.0880	68.71
99	Rivershire Pond 2	0.0900	69.04
100	South Churchill Lake	0.0900	69.04
101	McGreal Lake	0.0910	69.20
102	Lake Charles	0.0930	69.40
103	Deer Lake	0.0940	69.66
104	Eagle Lake (S1)	0.0950	69.82
105	International Mine and Chemical Lake	0.0950	69.82
106	Valley Lake	0.0950	69.82

Table 5. Lake County Average TSI phosphorus (TSIp) Ranking 2000-2014.

RANK	LAKE NAME	TP AVE	TSIp
107	Buffalo Creek Reservoir 2	0.0960	69.97
108	Fish Lake	0.0960	69.97
109	Lochanora Lake	0.0960	69.97
110	Big Bear Lake	0.0960	69.97
111	Fox Lake	0.1000	70.52
112	Nippersink Lake - LCFP	0.1000	70.56
113	Sylvan Lake	0.1000	70.56
114	Petite Lake	0.1020	70.84
115	Longview Meadow Lake	0.1020	70.84
116	Lake Marie	0.1030	71.00
117	Dunn's Lake	0.1070	71.53
118	Lake Forest Pond	0.1070	71.53
119	Long Lake	0.1070	71.53
120	Grass Lake	0.1090	71.77
121	Spring Lake	0.1100	71.93
122	Kemper 2	0.1100	71.93
123	Bittersweet Golf Course #13	0.1100	71.93
124	Bluff Lake	0.1120	72.00
125	Middlefork Savannah Outlet 1	0.1120	72.00
126	Osprey Lake	0.1110	72.06
127	Bresen Lake	0.1130	72.32
128	Round Lake Marsh North	0.1130	72.32
129	Deer Lake Meadow Lake	0.1160	72.70
130	Lake Matthews	0.1180	72.94
131	Taylor Lake	0.1180	72.94
132	Island Lake	0.1210	73.00
133	Columbus Park Lake	0.1230	73.54
134	Echo Lake	0.1250	73.77
135	Lake Holloway	0.1320	74.56
136	Antioch Lake	0.1450	75.91
137	Lakewood Marsh	0.1510	76.50
138	Pond-A-Rudy	0.1510	76.50
139	Forest Lake	0.1540	76.78
140	Slocum Lake	0.1500	77.00
141	Middlefork Savannah Outlet 2	0.1590	77.00
142	Grassy Lake	0.1610	77.42
143	Salem Lake	0.1650	77.78
144	Half Day Pit	0.1690	78.12
145	Lake Eleanor	0.1810	79.11
146	Lake Farmington	0.1850	79.43
147	Lake Louise	0.1850	79.43
148	ADID 127	0.1890	79.74
149	Lake Napa Suwe	0.1940	80.00
150	Patski Pond	0.1970	80.33
151	Dog Bone Lake	0.1990	80.48
152	Summerhill Estates Lake	0.1990	80.48
153	Redwing Marsh	0.2070	81.05
154	Stockholm Lake	0.2082	81.13
155	Bishop Lake	0.2160	81.66
156	Ozaukee Lake	0.2200	81.93
157	Kemper 1	0.2220	82.08
158	Hidden Lake	0.2240	82.19
159	McDonald Lake 2	0.2250	82.28

Table 5. Lake County Average TSI phosphorus (TSIp) Ranking 2000-2014.

RANK	LAKE NAME	TP AVE	TSIp
160	Fischer Lake	0.2280	82.44
161	Oak Hills Lake	0.2790	85.35
162	Loch Lomond	0.2950	86.16
163	Heron Pond	0.2990	86.35
164	Rollins Savannah 1	0.3070	87.00
165	Fairfield Marsh	0.3260	87.60
166	ADID 182	0.3280	87.69
167	Slough Lake	0.3860	90.03
168	Manning's Slough	0.3820	90.22
169	Rasmussen Lake	0.4860	93.36
170	Albert Lake, Site II, outflow	0.4950	93.67
171	Flint Lake Outlet	0.5000	93.76
172	Rollins Savannah 2	0.5870	96.00
173	Almond Marsh	1.9510	113.00

Table 6. Multiparameter data for Lake Catherine, 2014.

Lake Catherine Multi-parameter 2014

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	Extinction Coefficient
											0.735
5/7/2014	0.25	0.76	11.57	13.16	121.5	0.6523	8.86	1705	Surface	100%	
5/7/2014	1	1.02	11.60	13.18	121.7	0.6524	8.86	1568	Surface	100%	
5/7/2014	2	1.90	11.55	13.20	121.8	0.6523	8.86	296	0.15	19%	11.11
5/7/2014	3	2.79	11.57	13.16	121.5	0.6522	8.89	67	1.04	4%	1.43
5/7/2014	4	4.01	11.54	13.18	121.6	0.6521	8.87	57	2.26	4%	0.07
5/7/2014	6	7.09	11.53	13.18	121.6	0.6522	8.90	9	5.34	1%	0.35
5/7/2014	8	8.02	11.54	13.19	121.6	0.6522	8.88	6	6.27	0%	0.06
5/7/2014	10	10.13	11.52	13.15	121.3	0.6524	8.88	2	8.38	0%	0.13
5/7/2014	12	12.05	11.50	13.05	120.2	0.6526	8.89	1	10.3	0%	0.07
5/7/2014	14	14.11	11.49	13.06	120.3	0.6531	8.86	1	12.36	0%	0.00
5/7/2014	16	16.01	11.45	13.00	119.7	0.6543	8.85	1	14.26	0%	0.00
5/7/2014	18	18.20	11.29	11.95	109.6	0.6546	8.81	1	16.45	0%	0.00
5/7/2014	20	20.06	10.91	11.29	102.6	0.6566	8.68	1	18.31	0%	0.00
5/7/2014	22	22.02	10.47	9.98	89.8	0.6588	8.55	1	20.27	0%	0.00
5/7/2014	24	24.03	10.28	8.94	80.1	0.6607	8.46	1	22.28	0.1%	0.00
5/7/2014	26	26.76	10.11	8.34	74.4	0.6614	8.38	0	25.01	0.0%	0.00
5/7/2014	28	28.04	9.96	7.74	68.8	0.6624	8.34	0	26.29	0.0%	0.00
5/7/2014	30	30.50	9.59	6.29	55.4	0.6653	8.15	0	28.75	0.0%	0.00
5/7/2014	32	32.02	9.08	3.64	31.6	0.6697	7.93	0	30.27	0.0%	0.00
5/7/2014	34	33.97	7.43	0.61	5.1	0.6785	7.66	1	32.22	0.1%	0.00
5/7/2014	36	36.16	6.96	0.10	0.8	0.6843	7.51	1	34.41	0.1%	0.00

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	Extinction Coefficient
											0.344
6/10/2014	0.25	0.24	22.07	9.13	104.8	0.6699	8.50	1178	Surface	100%	
6/10/2014	1	1.01	22.14	9.20	105.7	0.6698	8.50	952	Surface	100%	
6/10/2014	2	2.00	22.15	9.23	106.1	0.6695	8.50	349	0.25	37%	4.01
6/10/2014	3	3.01	22.14	9.25	106.2	0.6696	8.49	159	1.26	17%	0.62
6/10/2014	4	3.97	22.15	9.21	105.9	0.6698	8.50	169	2.22	18%	-0.03
6/10/2014	6	6.00	22.13	9.08	104.3	0.6700	8.48	70	4.25	7%	0.21
6/10/2014	8	7.98	22.09	8.97	103.0	0.6719	8.45	45	6.23	5%	0.07
6/10/2014	10	9.96	21.94	8.44	96.6	0.6724	8.40	27	8.21	3%	0.06
6/10/2014	12	11.97	21.52	7.21	81.9	0.6724	8.28	18	10.22	2%	0.04
6/10/2014	14	14.03	19.99	3.72	41.0	0.6743	8.02	11	12.28	1%	0.04
6/10/2014	16	15.98	16.77	0.47	4.9	0.6714	7.78	8	14.23	1%	0.02
6/10/2014	18	18.00	14.62	0.11	1.1	0.6722	7.74	5	16.25	1%	0.03
6/10/2014	20	19.98	13.05	0.09	0.9	0.6738	7.71	3	18.23	0%	0.03
6/10/2014	22	21.99	12.16	0.05	0.5	0.6752	7.64	2	20.24	0%	0.02
6/10/2014	24	23.99	10.64	0.05	0.4	0.6865	7.50	2	22.24	0%	0.00
6/10/2014	26	26.01	9.97	0.04	0.4	0.6908	7.43	1	24.26	0%	0.03
6/10/2014	28	28.02	9.56	0.04	0.3	0.6963	7.36	1	26.27	0%	0.00
6/10/2014	30	29.96	9.23	0.03	0.3	0.7047	7.29	1	28.21	0%	0.00
6/10/2014	32	31.99	9.02	0.05	0.4	0.7083	7.25	1	30.24	0%	0.00
6/10/2014	34	34.02	8.89	0.04	0.3	0.7124	7.23	0	32.27	0%	0.00
6/10/2014	36	36.01	8.78	0.03	0.3	0.7191	7.17	1	34.26	0%	0.00!

Table 6. Multiparameter data for Lake Catherine, 2014.

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	Extinction Coefficient 0.429
7/8/2014	0.25	0.25	24.99	9.34	114.4	0.6747	8.40	4575	Surface	100%	
7/8/2014	1	1.08	24.98	9.33	114.6	0.6746	8.41	4406	Surface	100%	
7/8/2014	2	1.88	24.97	9.32	114.4	0.6744	8.41	2079	0.13	47%	5.78
7/8/2014	3	3.00	24.98	9.34	114.7	0.6752	8.41	279	1.25	6%	1.61
7/8/2014	4	3.92	24.96	9.33	114.5	0.6747	8.41	685	2.17	16%	-0.41
7/8/2014	6	5.91	24.95	9.36	114.8	0.6746	8.41	303	4.16	7%	0.20
7/8/2014	8	7.98	24.96	9.31	114.2	0.6747	8.41	104	6.23	2%	0.17
7/8/2014	10	9.94	24.95	9.28	113.8	0.6747	8.40	51	8.19	1%	0.09
7/8/2014	12	12.05	23.47	5.93	70.7	0.6823	8.01	19	10.3	0%	0.10
7/8/2014	14	13.82	22.98	4.94	58.4	0.6848	7.89	8	12.07	0%	0.07
7/8/2014	16	15.93	21.61	0.39	4.5	0.6929	7.63	3	14.18	0%	0.07
7/8/2014	18	17.98	19.37	0.08	0.9	0.7051	7.62	2	16.23	0%	0.02
7/8/2014	20	19.99	14.30	0.05	0.5	0.7296	7.54	1	18.24	0%	0.04
7/8/2014	22	21.94	12.87	0.05	0.5	0.7292	7.47	0	20.19	0%	0.00
7/8/2014	24	23.96	11.36	0.04	0.4	0.7425	7.40	0	22.21	0%	0.00
7/8/2014	26	26.04	10.29	0.04	0.4	0.7548	7.31	0	24.29	0%	0.00
7/8/2014	28	27.93	9.94	0.04	0.3	0.7596	7.26	0	26.18	0%	0.00
7/8/2014	30	29.84	9.80	0.04	0.4	0.7634	7.24	0	28.09	0%	0.00
7/8/2014	32	32.08	9.68	0.04	0.3	0.7657	7.22	0	30.33	0%	0.00
7/8/2014	34	34.11	9.53	0.04	0.3	0.7696	7.20	1	32.36	0%	0.00

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	Extinction Coefficient 0.288
8/13/2014	0.5	0.59	23.25	6.22	74.6	0.6306	8.21	3766	Surface	100%	
8/13/2014	1	1.50	23.27	7.06	84.6	0.6306	8.32	3628	Surface	100%	
8/13/2014	2	2.17	23.25	7.54	90.3	0.6308	8.31	1274	0.42	35%	2.49
8/13/2014	3	3.06	23.26	6.29	75.4	0.6307	8.33	313	1.31	9%	1.07
8/13/2014	4	3.97	23.22	6.23	74.6	0.6308	8.31	391	2.22	11%	-0.10
8/13/2014	6	6.08	23.19	5.31	63.6	0.6321	8.30	83	4.33	2%	0.36
8/13/2014	8	8.08	23.19	5.64	67.5	0.6313	8.28	19	6.33	1%	0.23
8/13/2014	10	10.06	23.18	7.21	86.3	0.6314	8.28	11	8.31	0%	0.07
8/13/2014	12	12.19	23.18	6.03	72.2	0.6314	8.28	4	10.44	0%	0.10
8/13/2014	14	14.05	23.12	4.77	57.0	0.6336	8.17	2	12.3	0%	0.06
8/13/2014	16	16.12	22.41	0.30	3.6	0.6465	7.82	1	14.37	0%	0.05
8/13/2014	18	18.00	21.72	0.10	1.1	0.6522	7.72	1	16.25	0%	0.00
8/13/2014	20	20.06	18.77	0.00	0.0	0.6722	7.49	1	18.31	0%	0.00
8/13/2014	22	22.00	15.85	0.03	0.3	0.6941	7.43	1	20.25	0%	0.00
8/13/2014	24	24.08	13.77	0.08	0.7	0.7017	7.31	1	22.33	0%	0.00
8/13/2014	26	26.07	11.74	0.12	1.2	0.7166	7.20	0	24.32	0%	0.00
8/13/2014	28	28.10	10.85	0.21	1.9	0.7278	7.14	1	26.35	0%	0.00
8/13/2014	30	30.09	10.45	0.00	0.0	0.7350	7.10	0	28.34	0%	0.00
8/13/2014	32	32.77	10.11	0.06	0.6	0.7424	7.06	1	31.02	0%	0.00
8/13/2014	34	34.00	10.00	0.04	0.3	0.7437	7.05	1	32.25	0%	0.00
8/13/2014	36	36.08	9.78	0.06	0.5	0.7514	7.03	0	34.33	0%	0.00

Table 6. Multiparameter data for Lake Catherine, 2014.

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	BGA-PC	PAR æE/s/mý	Depth of Light Meter feet
9/16/2014	0.25	0.25	18.89	7.88	84.8	0.6190	8.06	40392	NR	Surface
9/16/2014	1	1.00	18.67	7.92	83.8	0.6190	8.00	45000	NR	Surface
9/16/2014	2	2.00	18.43	7.79	83.0	0.6190	8.04	52087	NR	0.25
9/16/2014	3	3.00	17.71	7.59	77.7	0.6190	8.03	55632	NR	1.25
9/16/2014	4	4.00	17.65	7.41	77.7	0.6180	8.03	55713	NR	2.25
9/16/2014	6	6.00	17.56	7.13	74.8	0.6190	7.98	53786	NR	4.25
9/16/2014	8	8.00	17.54	7.14	70.4	0.6190	7.94	55973	NR	6.25
9/16/2014	10	10.00	17.51	6.54	68.4	0.6190	7.93	53307	NR	8.25
9/16/2014	12	12.00	17.47	6.43	66.3	0.6190	7.92	53287	NR	10.25
9/16/2014	14	14.00	17.47	6.39	66.9	0.6190	7.91	549618	NR	12.25
9/16/2014	16	16.00	17.46	6.39	66.9	0.6190	7.90	53670	NR	14.25
9/16/2014	18	18.00	17.37	6.01	62.6	0.6220	7.86	53490	NR	16.25
9/16/2014	20	20.00	17.16	5.75	59.7	0.6230	7.85	50634	NR	18.25
9/16/2014	22	22.00	16.90	5.49	56.7	0.6300	7.78	51318	NR	20.25
9/16/2014	24	24.00	14.95	0.56	5.5	0.7150	7.04	7419	NR	22.25
9/16/2014	26	26.00	12.28	0.42	3.9	0.7440	6.84	6299	NR	24.25
9/16/2014	28	28.00	11.11	0.38	3.4	0.7570	6.79	6260	NR	26.25
9/16/2014	30	30.00	10.43	0.38	3.4	0.7690	6.72	6704	NR	28.25
9/16/2014	32	32.00	10.09	0.33	3.0	0.7780	6.64	7451	NR	30.25
9/16/2014	34	34.00	9.89	0.32	2.8	0.7820	6.60	7376	NR	32.25
9/16/2014	36	36.00	9.78	0.31	2.7	0.7880	6.54	9941	NR	34.25

Figure 5. Monthly TP Concentrations measured in Lake Catherine in 2002 and 2014 compared to Illinois EPA General Use Standard.

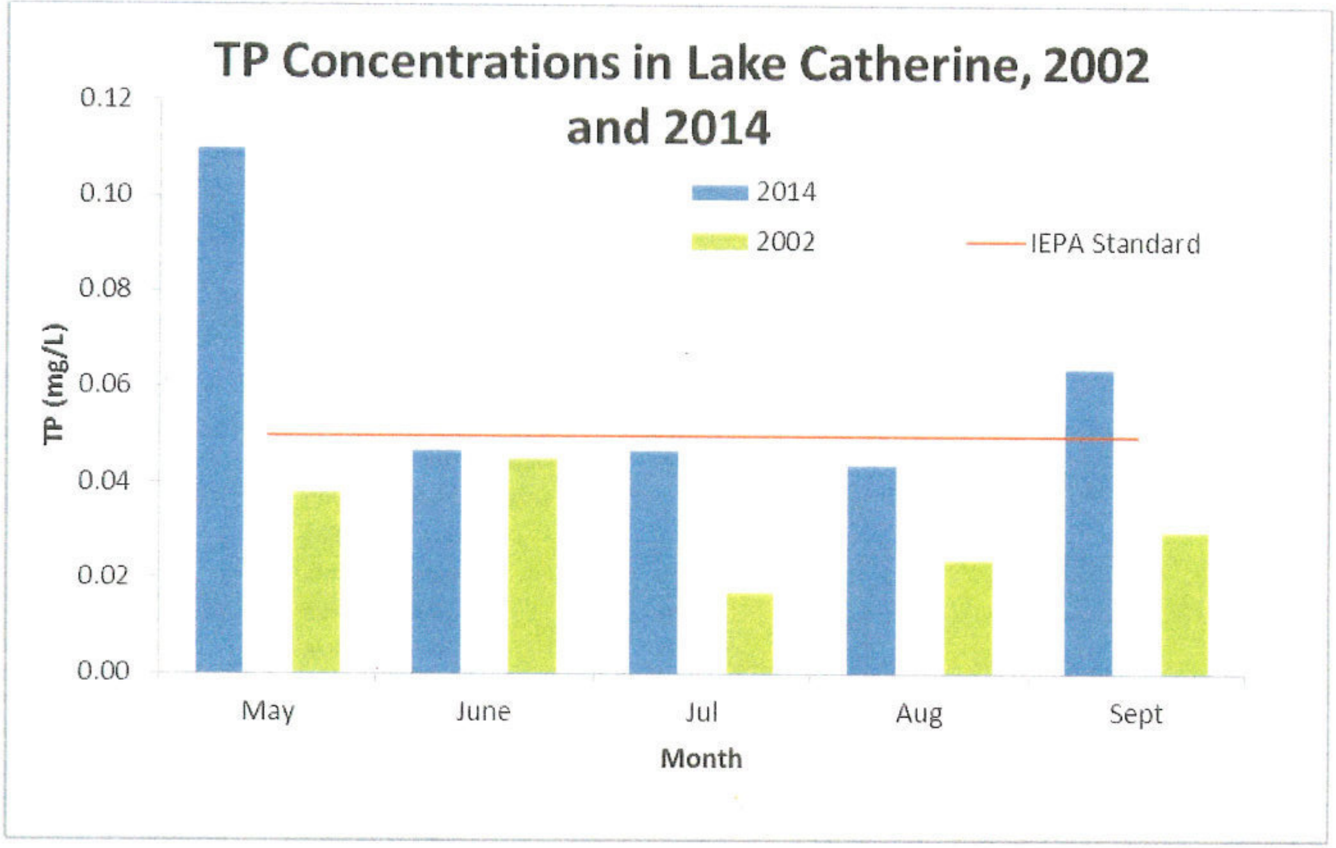


Table 7. Species Cover, Frequency, and Relative Importance per species for Lake Catherine, 2014.

Common Name	Average Cover	Frequency	Importance
Coontail	5.90	22.99	65.10
Common Duckweed	2.49	9.20	26.97
Giant Duckweed	1.79	5.75	18.46
Eurasian Watermilfoil	1.17	9.20	17.87
Vallisneria	0.93	9.20	16.26
Chara (macroalgae)	0.52	10.34	14.66
Slender naiad	0.40	8.05	11.40
White Water Lily	0.58	6.90	11.39
Watermeal	0.17	3.45	4.89
Water Stargrass	0.35	2.30	4.87
Sago Pondweed	0.11	2.30	3.26
Common Bladderwort	0.11	2.30	3.26
Flat-stemmed Pondweed	0.06	1.15	1.63
Total Average Density	**14.59**		

Cover Abundance Scale	
Scale	Estimated Cover
0	No Plants
1	1%-10%
2	11% - 40%
3	41% - 60%
4	61% - 90%
5	≥ 91%

Figure 6. Estimated abundance and location of submersed aquatic vegetatin found in Lake Catherine, 2014.

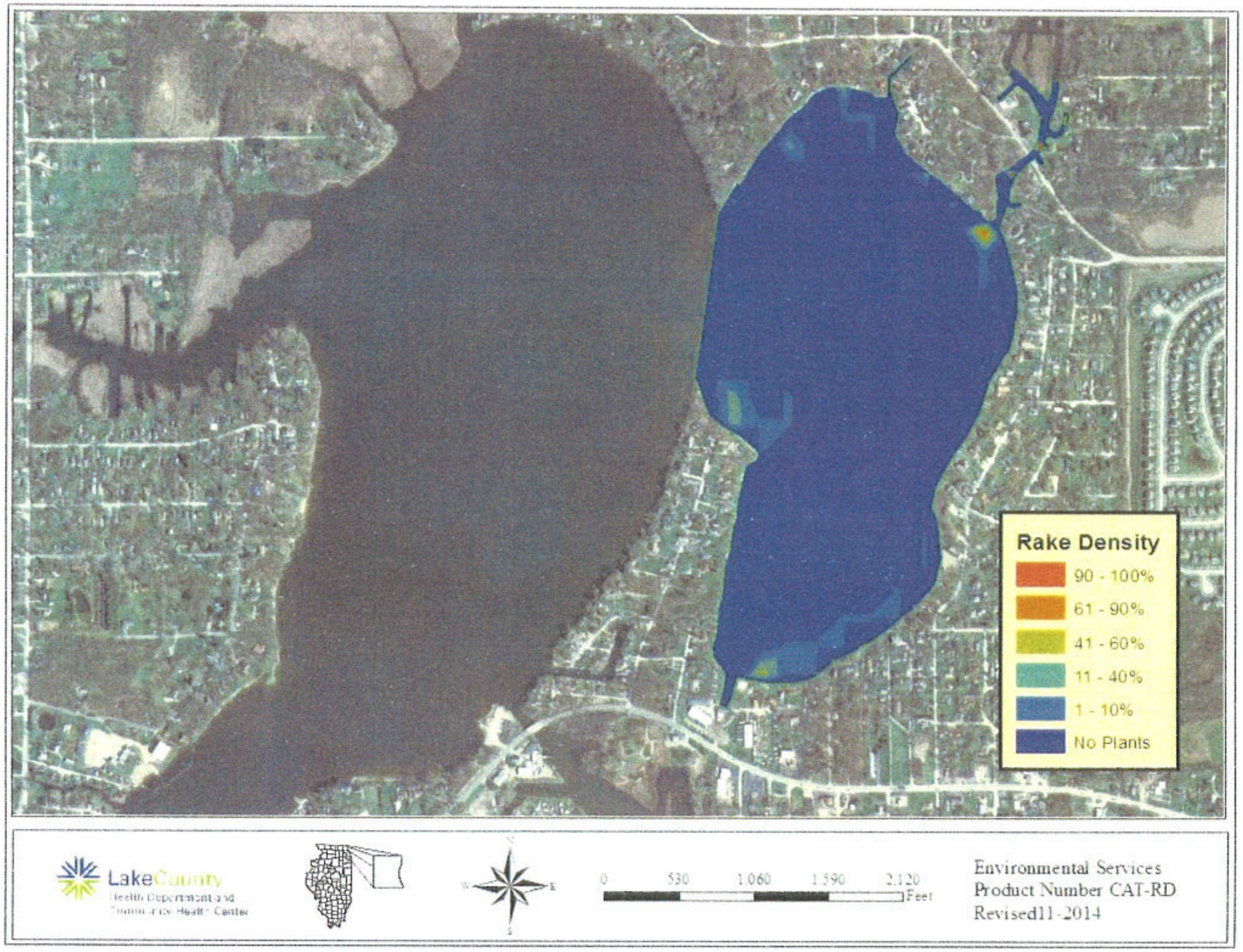


Figure 7. Estimated abundance and location of Eurasian Watermilfoil (EWM) found in Lake Catherine, 2014.

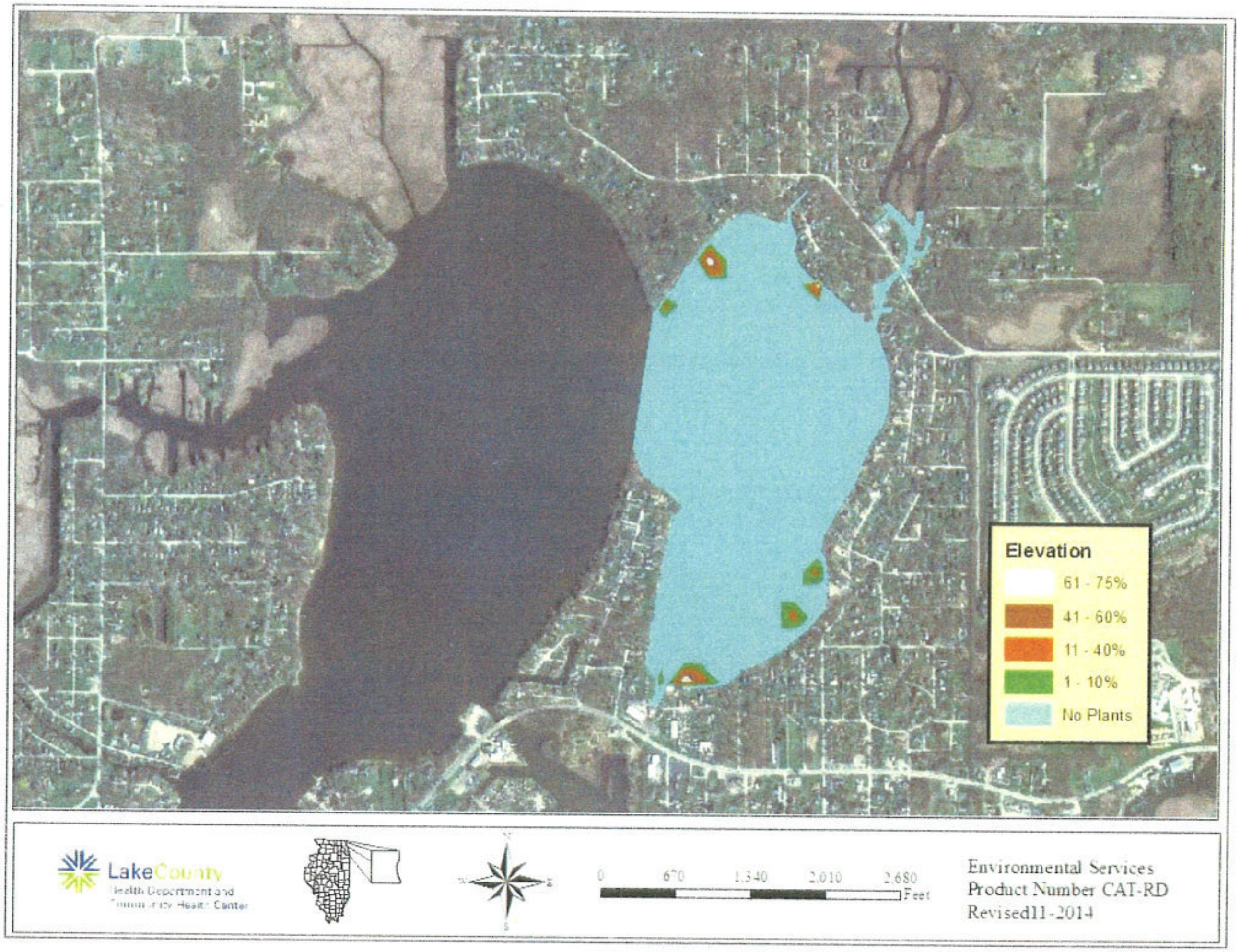


Table 8. Lake County average Floristic Quality Index ranking 2000 – 2014.

RANK	LAKE NAME	FQI (w/A)	FQI (native)
1	Cedar Lake	37.4	38.9
2	East Loon Lake	34.7	36.1
3	Cranberry Lake	29.7	29.7
4	Deep Lake	29.7	31.2
5	Little Silver Lake	29.6	31.6
6	Round Lake Marsh North	29.1	29.9
7	West Loon Lake	27.1	29.5
8	Sullivan Lake	26.9	28.5
9	Bangs Lake	26.2	27.8
10	Third Lake	25.1	22.5
11	Fourth Lake	24.7	27.1
12	Indpendence Grove	24.6	27.5
13	Sterling Lake	24.5	26.9
14	Sun Lake	24.3	26.1
15	Lake Zurich	24.3	27.1
16	Redwing Slough	24.0	25.8
17	Schreiber Lake	23.9	24.8
18	Lakewood Marsh	23.8	24.7
19	Deer Lake	23.5	24.4
20	Round Lake	23.5	25.9
21	Pistakee Lake	23.5	25.2
22	Lake Marie	23.5	25.2
23	Honey Lake	23.3	25.1
24	Lake of the Hollow	23.0	24.8
25	Cross Lake	22.4	24.2
26	Nippersink Lake (Fox Chain)	22.4	23.2
27	Countryside Glen Lake	21.9	22.8
28	Grass Lake	21.5	22.2
29	Davis Lake	21.4	21.4
30	Butler Lake	21.4	23.1
31	Lake Barrington	21.2	21.2
32	Duck Lake	21.1	22.9
33	Timber Lake (North)	20.9	23.4
34	Lake Catherine	20.8	21.8
35	ADID 203	20.5	20.5
36	Broberg Marsh	20.5	21.4
37	McGreal Lake	20.2	22.1
38	Fox Lake	20.2	21.2
39	Lake Kathryn	19.6	20.7
40	Fish Lake	19.3	21.2
41	Druce Lake	19.1	21.8
42	Turner Lake	18.6	21.2
43	Wooster Lake	18.5	20.2
44	Salem Lake	18.5	20.2
45	Lake Helen	18.0	18.0
46	Old Oak Lake	18.0	19.1
47	Potomac Lake	17.8	17.8
48	Redhead Lake	17.7	18.7
49	Long Lake	17.7	15.8
50	Hendrick Lake	17.7	17.7
51	Rollins Savannah 2	17.7	17.7
52	Grandwood Park Lake	17.2	19.0
53	Seven Acre Lake	17.0	15.5
54	Lake Miltmore	16.8	18.7
55	Petite Lake	16.8	18.7
56	Channel Lake	16.8	18.7
57	McDonald Lake 1	16.7	17.7
58	Highland Lake	16.7	18.9

Table 8. Lake County average Floristic Quality Index ranking 2000 – 2014.

RANK	LAKE NAME	FQI (w/A)	FQI (native)
59	Bresen Lake	16.6	17.8
60	Almond Marsh	16.3	17.3
61	Owens Lake	16.3	17.3
62	Windward Lake	16.3	17.6
63	Grays Lake	16.1	16.1
64	White Lake	16.0	17.0
65	Dunns Lake	15.9	17.0
66	Dog Bone Lake	15.7	15.7
67	Osprey Lake	15.5	17.3
68	Heron Pond	15.1	15.1
69	North Churchill Lake	15.0	15.0
70	Hastings Lake	15.0	17.0
71	Lake Tranquility (S1)	15.0	17.0
72	Forest Lake	14.8	15.9
73	Dog Training Pond	14.7	15.9
74	Grand Ave Marsh	14.3	16.3
75	Nippersink Lake	14.3	16.3
76	Taylor Lake	14.3	16.3
77	Manning's Slough	14.1	16.3
78	Tower Lake	14.0	14.0
79	Dugdale Lake	14.0	15.1
80	Eagle Lake (S1)	14.0	15.1
81	Crooked Lake	14.0	16.0
82	Spring Lake	14.0	15.2
83	Lake Matthews	13.9	15.5
84	Longview Meadow Lake	13.9	13.9
85	Bishop Lake	13.4	15.0
86	Ames Pit	13.4	15.5
87	Mary Lee Lake	13.1	15.1
88	Old School Lake	13.1	15.1
89	Summerhill Estates Lake	12.7	13.9
90	Buffalo Creek Reservoir 1	12.5	11.4
91	Buffalo Creek Reservoir 2	12.5	11.4
92	McDonald Lake 2	12.5	12.5
93	Rollins Savannah 1	12.5	12.5
94	Stone Quarry Lake	12.5	12.5
95	Kemper Lake 1	12.2	13.4
96	Pond-A-Rudy	12.1	12.1
97	Stockholm Lake	12.1	13.5
98	Lake Carina	12.1	14.3
99	Lake Leo	12.1	14.3
100	Lambs Farm Lake	12.1	14.3
101	Grassy Lake	12.0	12.0
102	Flint Lake Oulet	11.8	13.0
103	Albert Lake	11.5	10.3
104	Rivershire Pond 2	11.5	13.3
105	Antioch Lake	11.3	13.4
106	Hook Lake	11.3	13.4
107	Briarcrest Pond	11.2	12.5
108	Lake Naomi	11.2	12.5
109	Pulaski Pond	11.2	12.5
110	Lake Napa Suwe	11.0	11.0
111	Redwing Marsh	11.0	11.0
112	West Meadow Lake	11.0	11.0
113	Lake Minear	11.0	13.9
114	Nielsen Pond	10.7	12.0
116	Sylvan Lake	10.6	10.6
117	Gages Lake	10.2	12.5

Table 8. Lake County average Floristic Quality Index ranking 2000 – 2014.

RANK	LAKE NAME	FQI (w/A)	FQI (native)
118	College Trail Lake	10.0	10.0
119	Valley Lake	9.9	9.9
120	Werhane Lake	9.8	12.0
121	Loch Lomond	9.4	12.1
122	Columbus Park Lake	9.2	9.2
123	Lake Lakeland Estates	9.2	9.2
124	Waterford Lake	9.2	9.2
125	Bluff Lake	9.1	11.0
126	Lake Fairfield	9.0	10.4
127	Lake Louise	9.0	10.4
128	Fischer Lake	9.0	11.0
129	Lake Fairview	8.5	6.9
130	Timber Lake (South)	8.5	6.9
131	East Meadow Lake	8.5	8.5
132	South Churchill Lake	8.5	8.5
133	Kemper Lake 2	8.5	9.8
134	Lake Christa	8.5	9.8
135	Lake Farmington	8.5	9.8
136	Lucy Lake	8.5	9.8
137	Bittersweet Golf Course #13	8.1	8.1
138	Lake Linden	8.0	8.0
139	Sand Lake	8.0	10.4
140	Countryside Lake	7.7	11.5
141	Fairfield Marsh	7.5	8.7
142	Lake Eleanor	7.5	8.7
143	Banana Pond	7.5	9.2
144	Slocum Lake	7.1	5.8
145	Lucky Lake	7.0	7.0
146	North Tower Lake	7.0	7.0
147	Lake Forest Pond	6.9	8.5
148	Ozaukee Lake	6.7	8.7
149	Leisure Lake	6.4	9.0
150	Peterson Pond	6.0	8.5
151	Little Bear Lake	5.8	7.5
152	Deer Lake Meadow Lake	5.2	6.4
153	ADID 127	5.0	5.0
154	Island Lake	5.0	5.0
155	Liberty Lake	5.0	5.0
156	Oak Hills Lake	5.0	5.0
157	Slough Lake	5.0	5.0
158	International Mining and Chemical Lake	5.0	7.1
159	Diamond Lake	3.7	5.5
160	Lake Charles	3.7	5.5
161	Big Bear Lake	3.5	5.0
162	Sand Pond (IDNR)	3.5	5.0
163	Harvey Lake	3.3	5.0
164	Half Day Pit	2.9	5.0
165	Lochanora Lake	2.5	5.0
166	Echo Lake	0.0	0.0
167	Hidden Lake	0.0	0.0
168	St. Mary's Lake	0.0	0.0
169	Willow Lake	0.0	0.0
170	Woodland Lake	0.0	0.0
	Mean	**14.1**	**15.2**
	Median	**13.4**	**15.0**

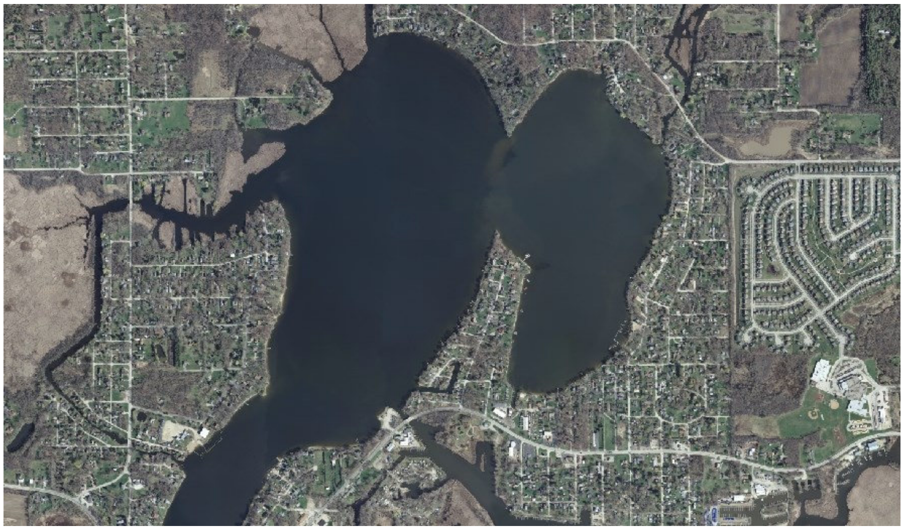
LAKE COUNTY, ILLINOIS

2014 SUMMARY REPORT CHANNEL LAKE

PREPARED BY THE

LAKE COUNTY HEALTH DEPARTMENT

Population Health-Ecological Services



Lake Catherine (right) and Channel Lake (left) 2010 Aerial Photo.

Channel Lake is one of the 13 lakes sampled in the Fox Chain 'O' Lakes during 2014 by the LCHD-ES. It is a glacial lake whose maximum depth is 36 feet and whose surface area is 371.0 acres. The water elevation is influenced by the McHenry Dam which was built in 1939. Lake Catherine is hydrologicaly connected to Channel Lake, however this was not always the case as there was once a gravel bar that separated the two. Most of that bar is now eroded away and both lakes form one large footprint. Boaters are still observed anchored at the remaining sandbar on the eastern shoreline, swimming and recreating. Catherine and Channel lakes are both located at the bottom of their watershed, and are the deepest of the lakes in the Fox Chain 'O' Lakes. Like Catherine, Channel Lake is in the Trevor Creek Watershed which flows from Wisconsin and is part of the Fox River Watershed. Channel Lake receives waters from Peat Lake, Center Lake and Camp Lake located in Kenosha County Wisconsin. The effluent of these lakes meander through large wetland complexes before entering into Channel Lake on its north end. There are also several small tributaries and stormwater drainage outfalls entering the lake. Data supplied by the Lake County

ENVIRONMENTAL SERVICES WATER QUALITY SPECIALISTS

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INSIDE THIS ISSUE:

SUMMARY (CONTINUED)

Mapping Services Division and Southeastern Wisconsin Regional Planning Commission estimate the Trevor Creek watershed to be approximately 12,581.67 acres; agriculture, single family and wetlands are the dominant land uses. However single family and transportation contribute the greatest percentage runoff into Channel Lake at 38.8% and 24.9% respectively.

Channel lake is well known by anglers, and has two public boat launches allowing access to the public. There are other private, public launches on the Fox Chain ‘O’ Lakes, as well as two public launches located in Chain ‘O’Lakes and Oak Point State Parks.

In 2014, the LCHD-ES sampled the lakes for the water quality parameters discussed in this report. Once a month water chemistry samples were collected at the deep hole of the lake at 3 feet from the surface (epilimnion) and lake bottom (hypolimnion) by use of a Van Dorn sampler. A multi-parameter sonde was used to collect depth profile data. Additionally, a Secchi disc was lowered into the water column to measure the water clarity of the lake. Other environmental data was recorded including air temperature, water elevation and any observations of wildlife in the area.

The water clarity has significantly decreased in Channel Lake since 2002. The 2014 average Secchi depth was 2.8 feet, this is a decrease of 140% from the average Secchi depth in 2002 of 6.75 feet. The cause of the decrease is unknown however, VLMP data supports that there was a significant change in water clarity that occurred between 2011 and 2012, and again between 2012 and 2013. The average Secchi depth in 2014 ranked Channel Lake number 89 out of the 158 lakes whose water clarity has been measured since 2000 and it was close to the median Secchi depth for lakes measured between 2000 and 2014 of 2.95 feet.

Like many of the lakes in our county, Channel Lake is impaired for phosphorus based upon the Illinois Environmental Protection Agency’s (IEPA) phosphorus standard for general use of ≥ 0.05 mg/L TP for lakes with a surface area greater than 20 acres. It only takes one exceedance of the standard per season to be considered impaired. The average TP concentration during 2014 was 0.068 mg/L. This is well below the 2014 median TP concentration for all Fox Chain ‘O’ Lakes of 0.126 mg/L and is equivalent to the 2014 county median TP concentration for lakes in the county whose TP concentration has been recorded since 2000. Channel ranked 77 out of 173 lakes in the county sampled for TP since 2000.

A aquatic vegetation survey using the point intercept method was conducted in April on Channel Lake. In order to accomplish this a randomized grid was placed over the footprint of the lake using ARCGIS 10.2 and points falling within the footprint were sampled by lowering a rake at each grid point and applyimg a score in order to estimate the cover of aquatic vegetation at that point. Aquatic vegetation colonized 25.9% of the points sampled with an average cover of 31.19%. This was above the average cover of aquatic vegetation found at all points sampled on the Fox Chain ’O’ Lakes. Dominant species in the lake were Coontail, White Water Lily and Star Duckweed. A floristic quality assessment was conducted on the 11 aquatic plant species found in Channel Lake in 2014 resulting in an FQI score of 18.7. Floristic quality assessements are used to identify natural areas, for site comparisons, monitoring of restoration projects and long term monitoring of sites. Channel Lake ranked 56th out of 170 lakes in the county scored for FQI and was above the median score of 15.2 (Appendix A, Table 8).

Lake Facts:

Major Watershed: Fox River

Sub-Watershed: Fox River

Location: T43N, R9E, Section 11

Surface Area: 164.7 acres

Shoreline Length: 6.24 miles

Maximum Depth: 39.00 ft.

Average Depth: 16.7 ft.

Lake Volume: 2881.90 acre-ft

Watershed Area: 12,581.67 acres (WI and IL)

Lake Type: Glacial

Management Entity:

Fox Waterway Agency

State of Illinois

Homeowners Associations (various)

Current Uses: fishing, swimming, boating, aesthetics

Access: Private although there are public launches on other lakes of Fox Chain ‘O’ Lakes.

SUMMARY (CONTINUED)

There are three licensed beaches on Channel Lake: Turtle Beach, Bluffs Lodge Subdivision and Lake Shore Park. In 2014, none of the beaches had swim bans due to elevated E-coli colonies (235 colonies/mL). However, Turtle Beach and Lake Shore Park have historically had swim bans. The cause of the swim bans at Turtle Beach could be due to either waterfowl or stormwater as there is an outlfall adjacent to the beach. Bans at Lake Shore Park are waterfowl related.

On May 31, 2013, the LCHD-ES was informed of a blue green algal bloom at Lake Shore Park beach. This was not a routine sample day. The beach was sampled for both E-coli and the HAB. The HAB was tested for presence of microcystin, a toxin that is produced by Microcystis spp., which is a species of blue green algae, the level was above 10 ppb. The beach manager was contacted and they decided to close the beach until the bloom subsided, additionally the E-coli concentration was above the 235 colonies/mL threshold and a swim ban was issued. The sample was sent to an independent lab for ELISA enzyme linked immunoabsorbant assay and was reported to have toxins above the no contact limit defined by the World Health Organization of 20 ppb.

WATERSHED

A general definition of a watershed is an area of land defined by two or more high ridges, however they are usually much more complex than that due to the engineering of drainage areas to more efficiently remove stormwater from the landscape which can make boundaries hard to decifer at times.

Both Channel Lake and Lake Catherine are part of the Trevor Creek subwatershed which is approximately 12,581.67 acres (SEWRPC and Lake County Mapping Division). According to the land use data, the subwatershed was dominated by Agricultural (42.5%), Single Family (15.5%) and Wetlands (15.1%). The main tributary into Channel comes from a different source than that of Catherine. Waters flowing from Peat Lake, Camp Lake and Center Lake in Kenosha County find there way to Channel Lake by way of a ditch system. It is estimated that the total percent runoff coming from the Trevor Creek watershed is from Single Family and Transportation representing 36.5% and 26.7% respectively (Appendix A, Table 1).

LCHD-ES recommends that the stakeholders within the watershed become educated on practices that can help reduce phosphorus loading into the Fox Chain 'O' Lakes as they are all impaired for phosphorus. Practices such as nutrient management plans for the agricultural community. Homeowners in the watershed ensuring their septic systems are maintained and eroding shorelines are repaired. Winter maintenance crews should develop winter road maintenance plans and incorporate practices into their program that will alleviate chlorides from entering into Channel Lake as well as the entire Fox Chain 'O' Lakes system.

Produced by Lane Council of Governments

WATER CLARITY

Water clarity is important as it allows light to penetrate into the water column. This light is used by the primary producers (plants and phytoplankton) in the water. Water clarity is measured by lowering a Secchi disk into the water until it can no longer be seen by the naked eye. The resulting depth is recorded.

The average Secchi depth of 2.80 feet measured in Channel Lake during 2014 was slightly below the county median of 2.95 feet for lakes measured between 2000 and 2014 for water clarity (Figure 1; Appendix A, Table 2). Water clarity in the lake ranged from a Secchi depth of 1.3 feet in September to 6.9 feet in June. All of the lakes in the Fox Chain 'O' Lakes experienced decreased water clarity since 2002, however none suffered as much as that of Channel and Catherine lakes (Figure 2).

The water clarity in Channel Lake decreased 140% since 2002 when the average Secchi depth was 6.7 feet compared to the 2014 average Secchi depth. Lake Catherine also experienced similar declines in water clarity, indicating that some event happened between the two dates that caused significant declines in water clarity for both lakes. VLMP data collected since 2011 suggests that a something occurred between 2011 and 2012; and again from 2012 to 2013, that accounted for the decline in water clarity. Declines of 108.6% and 60.1%, were measured between monitoring years, 2012-13 and 2013-14, respectively (Figure 4; Appendix A, Figure 4).

Many factors can influence water clarity, weather patterns, aquatic plants, algal blooms, sediments and nutrient loading as well as recreational boating can affect water clarity.

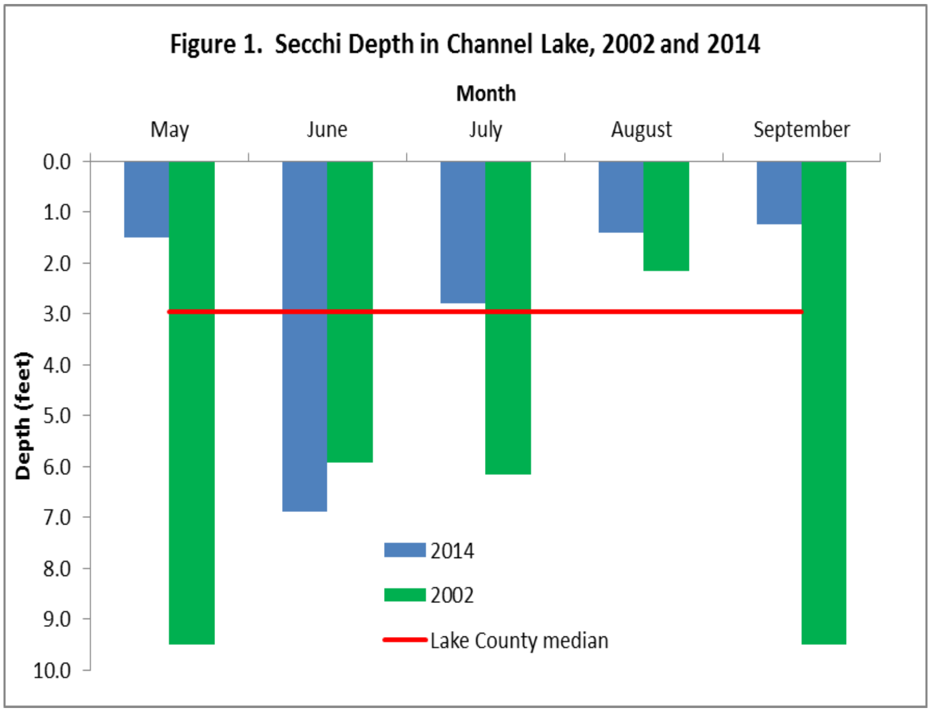


Figure 2. Water clarity of Channel Lake, 2002 versus 2014.

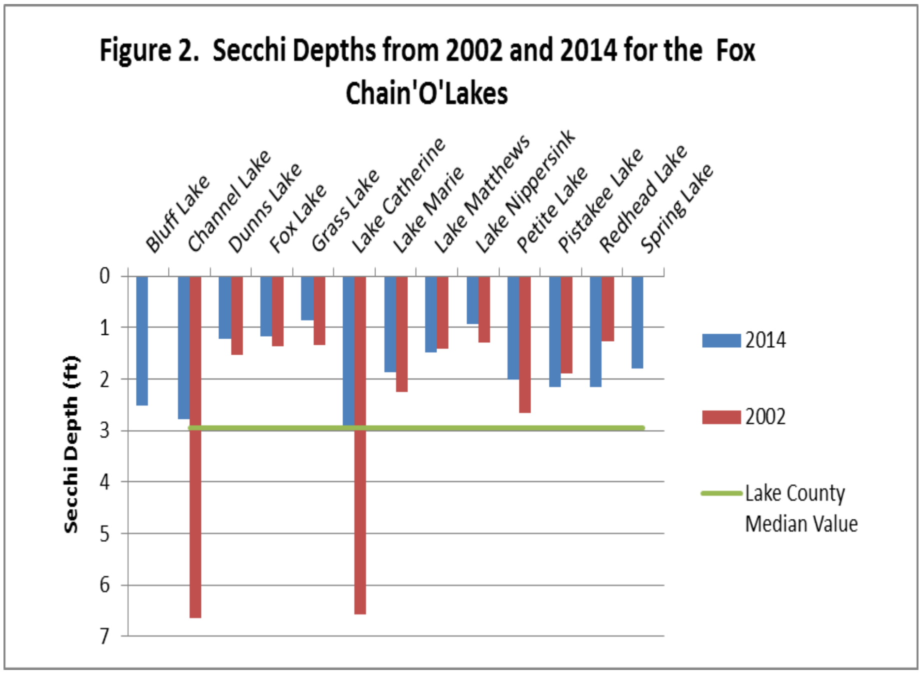
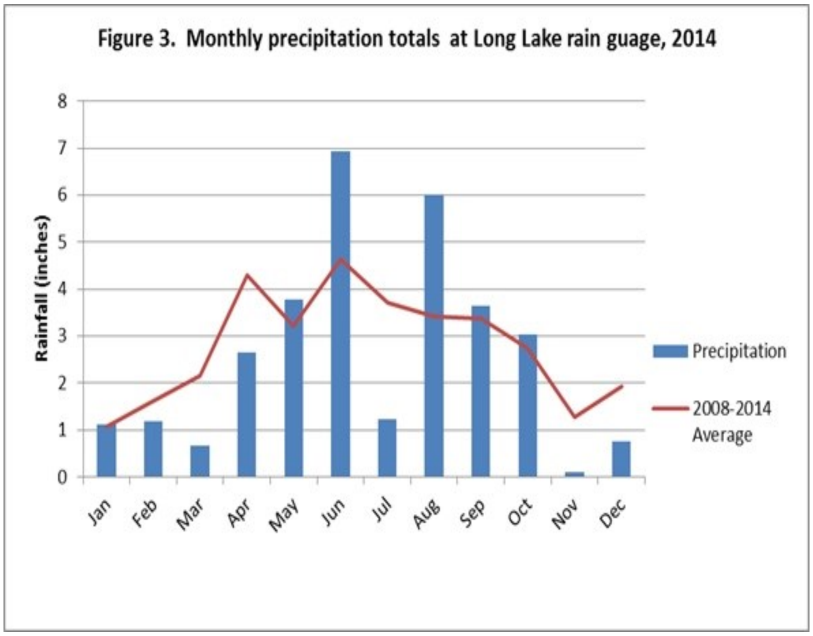


Figure 3. Secchi depths from 2002 and 2014 for all lakes' on the Fox Chain. Note the significant decreases in water clarity for Channel and Catherine lakes.

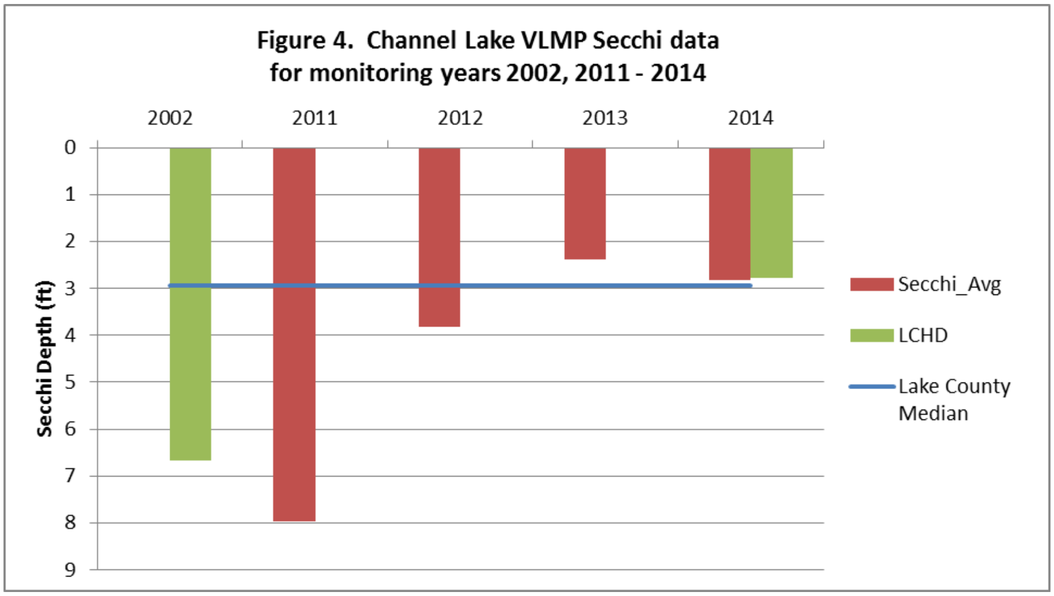
WATER CLARITY (CONTINUED)

In 2014, a planktonic algal bloom was observed in September, which impacted the water clarity and resulted n a Secchi depth reading of 1.3 feet. Algal blooms are usually a result of aquatic vegetation lacking in lakes as well as is an indication of excess nutrients.

Storm events can also impair water clarity. According to the Long Lake rain gauge (Lake County Stormwater Commission), May precipitation measurements accumulated to a total of 3.77 inches of rainfall, which is comparable to the average May precipitation measurement of 3.21 inches. In June, precipitation was well above the 12 year average of 4.64 in., with a total of 6.93 inches recorded at Long Lake however for thetwo weeks prior to our June 2014 sampling event cumulatively only 1.01 inches of rain that fell in the region. This could explain the increase in Secchi depth in June and the subsequent decrease in Secchi depth between June (6.9 ft.) and July (2.8 ft.). Above average precipitation also occurred in August which likely deposited stormwaters into Channel Lake, and increased algae in the lake causing decreased water clarity for the remainder of the monitoring season.



VOLUNTEER LAKE MONITORING PROGRAM



Volunteer Lake Monitoring Program (Continued)

The Volunteer Lake Monitoring Program was established in 1981 to assist in gathering water quality information on Illinois lakes and to provide an educational program for citizens interested in lake water quality. The primary measurement taken by all volunteers in the program is Secchi disk (water clarity). Other observations such as algal blooms, vegetation, water color, and wildlife, plus any observations that the VLMP feels noteworthy are recorded. The sampling season is May through October. Two visits a month are required under the program.

Data presented in Figure 4 arejust one example on how invaluable VLMP data is in assisting lake managers in rapidly identifying and correcting problems impacting their lake. VLMP data additionally provides a continuous dataset to agencies when the lake is not actively being monitored under their programs. Jim Lubkeman, President of Channel Lake Shores subdivision has agreed to be the VLMP on Channel Lake beginning 2015. Thank Jim, for his help!

VLMP Secchi disk data displayed in Figure 4 are of the average Secchi disk measurements across all 3 VLMP sites on Channel Lake for years 2011—2014. This data indicates that the water clarity in Channel Lake decreased by 52% between 2011 through 2012; and again from 2012 to 2013. The data indicates that water clarity improved in the lake between the 2002 monitoring by LCHD and the beginning of the VLMP sampling in 2011. This increase in water clarity was likely due to the explosion of zebra mussels in the northern lakes between the two sampling periods. The water clarity improved slightly from 2013 to 2014 and were similar to the results from the LCHD 2014 monitoring season.

Total Suspended Solids

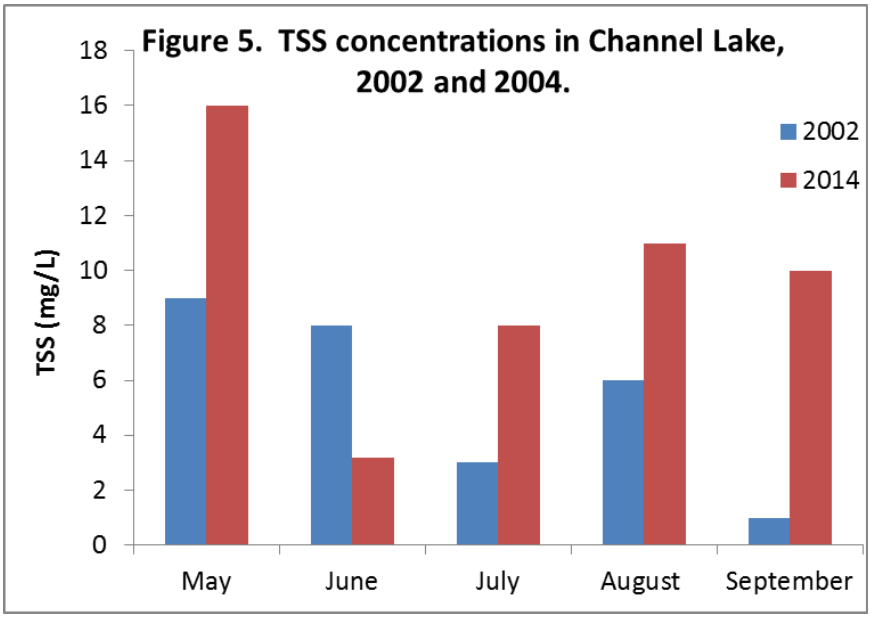


Figure 5. TSS concentrations in Channel Lake, 2002 and 2004.

Total Suspended Solids (Continued)

Total suspended solids (TSS) are comprised of volatile (organic) materials and nonvolatile (inorganic) materials within the water column. Total suspended solids reduce water clarity and can impact both flora and fauna when prevalent. Examples of volatile solids are algae, plankton and plant material as well as small macroinvertebrates. Non-volatile solids are sediments. TSS concentrations are inversely correlated to water clarity, hence when TSS concentrations are elevated, water clarity is diminished.

In 2014, TSS concentrations in Channel Lake ranged from 3.2 mg/L in June to 16.0 mg/L in May (Figure 5; Appendix A, Table 3). The 2014 average TSS concentration of 9.6 mg/L was greater than the median TSS concentration of 8.2 mg/L for lakes in the county measured for TSS since 2000. 2002 TSS concentrations averaged 5.4 mg/L, with concentrations ranging from 1.0 mg/L to 9.0 mg/L.

In 2014, Total volatile solids (TVS) ranged from 102 mg/L in September to 126 mg/L in June. The average TVS concentration measured in the epilimnion in 2014 was 119 mg/L., this is less than the county median concentration of 121 mg/L for county lakes measured for TVS since 2000. In 2002, TVS concentrations ranged from 1 mg/L to 4 mg/L. The large differences between TVS concentrations in 2014 and 2002 are likely due to analytical differences used at different labs and are not comparable.

In 2014, non-volatile suspended solids (NVSS) in the form of sediments ranged from 9.05 mg/L in May to 1.11 mg/L in June. Non volatile solids were elevated throughout the entire water column in May with concentrations in the hypolimnion of 9.33 mg/L. Elevated NVSS is likely due to spring rains flushing the system and waters remaining well mixed.

Activities in the watershed likely contributed to the increases in the TSS concentrations in Channel Lake, however, recreational boating, low coverage of aquatic vegetation and eutrophication likely played a role in the algal blooms observed in September, as there were biologically available nutrients (SRP, NO^3, NO^{-2} and NH_3) in the waters of the epilimnion during both August (SRP) and September (NH_3).

LCHD-ES recommends outreach occur to residents, businesses and the agriculture community on best management practices that they can incorporate into their daily lives that can reduce sediments from entering into waters that eventually discharge into Channel Lake. Practices such as remediating eroding shorelines by incorporating native plantings with hardscaping should be encouraged. Those who live near the water should be reminded to maintain septics in order to prevent seepage of additional nutrients and sewage into Channel Lake and other areas around the Fox Chain 'O' Lakes. Additionally, Channel Lake residents should promote a long term aquatic plant management plan on the Fox Chain 'O' Lakes to allow for expansion of vegetation in sensitive areas as aquatic vegetation can filter sediments and other pollutants out of the water column as well as provide competition to algae.

SEDIMENTS

Sedimentation naturally occurs in our environment, however, human activities can increase the amount of sediment that ends up in our streams and subsequently our lakes. Sediments are usually fine grained sands, silts and clays that can cover up the coarser bottom sediments and the spaces between rocks and cobbles that provide habitat for aquatic life.

In the Midwest region, sediments entering into our lakes and stream through erosion are laden with phosphorus and is a major source of eutrophication of surface waters. Sediments also reduce water clarity and the amount of light penetrating into the water which impacts the ability of plant to photosynthesize, and plant propagules (seeds) to reestablish. Subsequently reducing the amount of habitat for fish and macro-invertebrates. Sediment particles bury and suffocate fish eggs and gravel nests and absorb warmth from the sun resulting in increased water temperatures. This can cause problems with dissolved oxygen and cause stress to fish.

The Fox Waterway Agency (FWA) provides the service of removing sediments deposited from the Fox River and other tributaries to the lakes within the Fox Chain 'O' Lakes. The sediment load coming from all tributaries has been calculated to be steady at approximately 100,000 yds^3/year. Of that sediment, 12%, or approximately 12,000 yds^3/year enter the Fox Chain 'O' Lakes through Lake Catherine from Trevor Creek.

The FWA frequently tests the dredged soils and results from a 2005 sampling by conducted by Hey and Associates shows that sediment concentrations for most parameters (total phosphorus as P, Arsenic, Cadmium, Chromium, copper, Lead, Manganese, Nickel, Zinc, and Mercury) fall within the "Low" or "Normal" classification based on the IEPA's Illinois Lake Sediment Classification, therefore sediments are recyclable. Sediment guidelines from MacDonald et al (2000) support these findings as the concentrations measured in the sediments in 2005 are considered clean to marginally polluted and no affects on a majority of the sediment dwelling organisms are expected.

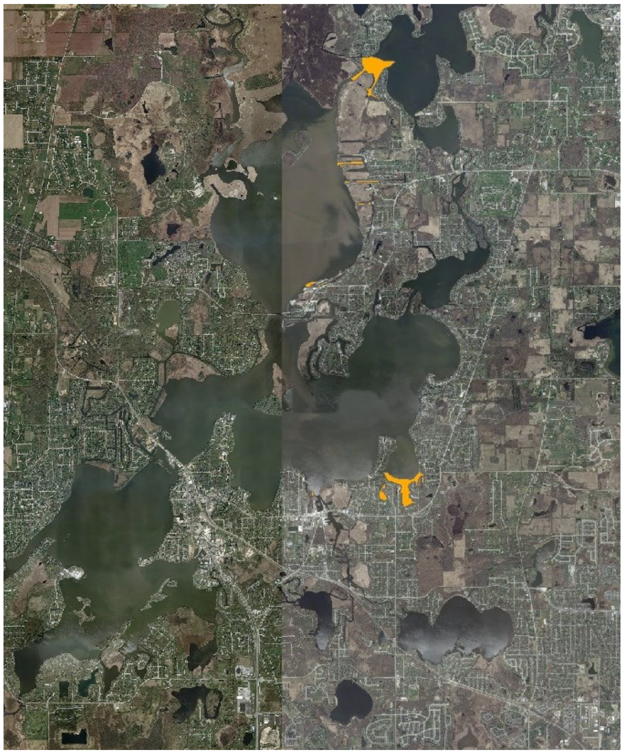


Figure 7. Location of dredging activities on the Fox Chain 'O' Lakes, 2014.

Figure 8. Fox Waterway Agency dredging a channel in Lake Marie, 2014.

SEDIMENTS (CONTINUED)

Table 1. Most of the pollutants sampled in dredging sediments by Hey and Associates compared to IEPA and Macdonald Sediment Classifications

Metal	Value (Hey & Associates)	IEPA Illinois Lake Sediment Classification	MacDonald et al. Sediment Guidelines
Arsenic	12 mg/kg	Normal (4.1 to <14)	Below ERL
Cadmium	<0.5 mg/kg	Normal (<5)	Below LEL
Chromium	20 mg/kg	Normal (13 to <27)	Below LEL
Copper	14 mg/kg	Low (<16.7)	Below LEL
Lead	18 mg/kg	Normal (14 to <59)	Below LEL
Mercury	0.11 mg/kg	Normal (<0.15)	Below LEL
Nickel	14 mg/kg	Low (<14.3)	Below LEL
Zinc	51 mg/kg	Low (<59)	Below LEL

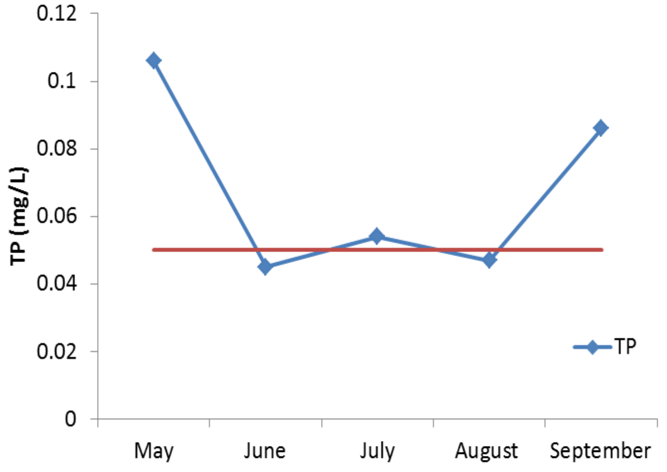
ERL: Effect range-low: represents the chemical concentration below which adverse effects would be rarely observed

LEL: Sediments are considered to be clean to marginally polluted. No effects on the majority of sediment dwelling organisms are expected below this concentration

NUTRIENTS

Phosphorus and nitrogen are essential, naturally occurring nutrients needed for plant growth; however, in excess they can impair water quality in lakes. Phosphorus is usually the nutrient responsible for water quality problems in lakes. Phosphorus can come from both internal and external sources, and in general is the easiest of the limiting nutrients to manipulate due to the ability of some plants and algal species to fix nitrogen. High phosphorus levels can lead to excessive algae and aquatic plant growth which can harm aquatic life and impair recreational use. Additionally, it can reduce water clarity, and deplete oxygen levels. External sources are those that occur within the watershed, however, in deep lakes such as Channel, anoxic bottom sediments can be a contributing factor as they release phosphorus into the waters of the hypolimnion. In fall, the nutrient laden waters from the hypolimnion mix with those of the epilimnion causing spikes in TP (Figure 6). Eroding shorelines, Carp and propellers from recreational water craft can also be a cause of increased nutrients.

Figure 6. TP concentrations in the epilimnion, Channel Lake, 2014



NUTRIENTS

Like many of the lakes within Lake County, Channel Lake is impaired for total phosphorus (TP) under the Illinois Environmental Protection Agency (IEPA) standard. A lake is considered impaired if TP concentrations in lakes ≥20 acres are above 0.05 mg/L at anytime during the growing season. Epilimnetic TP concentrations in 2014 ranged from 0.044 mg/L in August to 0.110 mg/L occurring in May (Appendix A, Table 3). TP concentrations in the hypolimnion were higher. The average TP concentration in Channel Lake was 0.068 mg/L, during the monitoring season (May—Sept) and was equivalent to the median TP concentration of lakes within the county during the period of 2000—2014.

As indicated in Figure 9, the epilimnetic TP concentrations in 2002 were not considered impaired with a maximum concentration of 0.049 mg/L (Figure7; Appendix A, Table 3) . In 2014 most of the TP concentrations were well above the maximum TP concentration measured in 2002.

A ratio between total nitrogen and total phosphorus (TN:TP) is a tool utilized to determine which nutrient is limiting plant or algal growth. Ratios of less than 10:1 indicate a system limited by nitrogen, while lakes with ratios greater than 20:1 are limited by phosphorus. The TN:TP ratio calculated for Channel Lake in 2014 was 25, therefore phosphorus was the limiting nutrient. This means that any additional phosphorus into the epilimnetic waters could cause nuisance plant or algal growth. In May , the TSIp score was 16, therefore neither nutrient was limiting the growth of plants or algae at that time. The monthly TSIp score remained above 20 for the remainder of the 2014 monitoring season.

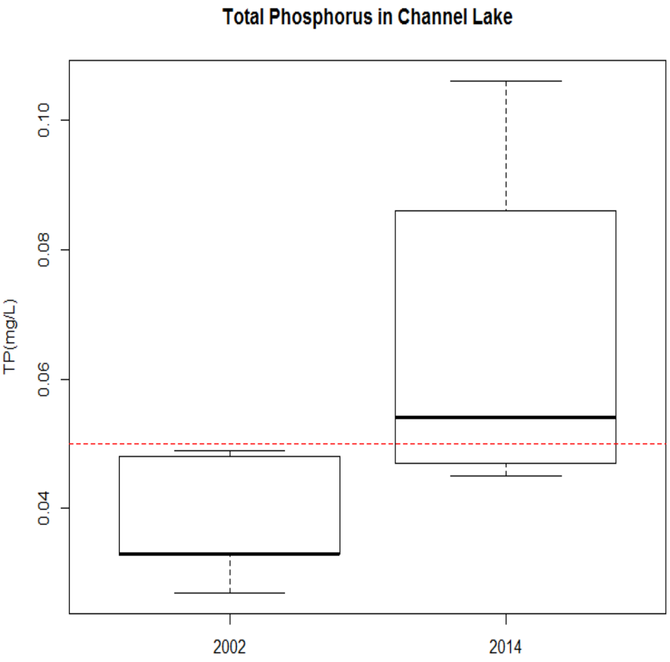


Figure 7. Comparison of TP concentrations in Channel Lake rom 2002 and 2014. Red dashed line is represented of IEPA standard (0.05 mg/L).

TROPHIC STATE INDECES

OLIGOTROPHIC:

Lakes are generally clear, deep and free of weeds or large algae blooms. Though beautiful, they are low in nutrients and do not support large fish populations.

MESOTROPHIC:

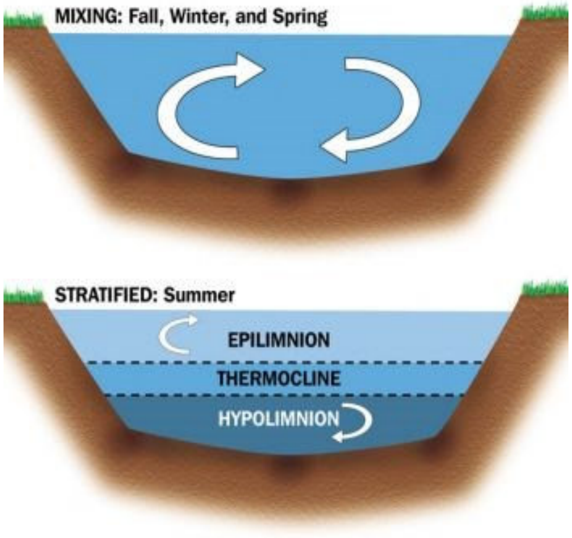
Lakes lie between the oligotrophic and eutrophic stages. Devoid of oxygen in late summer, their hypolimnions limit cold water fish and cause phosphorus cycling from sediments.

EUTROPHIC:

Lakes are high in nutrients, they are usually either weedy or subject to frequent algae blooms, or both. Eutrophic lakes often support large fish populations, but are also susceptible to oxygen depletion.

A Trophic State Index (TSI) based on phosphorus (TSIp) is commonly used to classify and compare lake productivity levels (trophic states). Excessive phosphorus entering a lake can accelerate the rate of eutrophication. Eutrophication is a natural aging process where nutrients eventually increase resulting in productive lakes. 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 normally takes thousands of years, however, human activities that supply lakes with additional phosphorus speed up the eutrophication process significantly. The TSIp index classifies the lake into one of four categories: oligotrophic (nutrient-poor, biologically unproductive) mesotrophic (intermediate nutrient availability and biological productivity), eutrophic (nutrient-rich, highly productive), or hypereutrophic (extremely nutrient-rich, productive). In 2014 Channel Lake was considered eutrophic with a TSIp score of 64.91. The TP phosphorus concentrations measured in Channel Lake ranked it 77 of 173 lakes in the county whose TP concentrations have been ranked since 2000 (Appendix A, Table 5).

STRATIFICATION

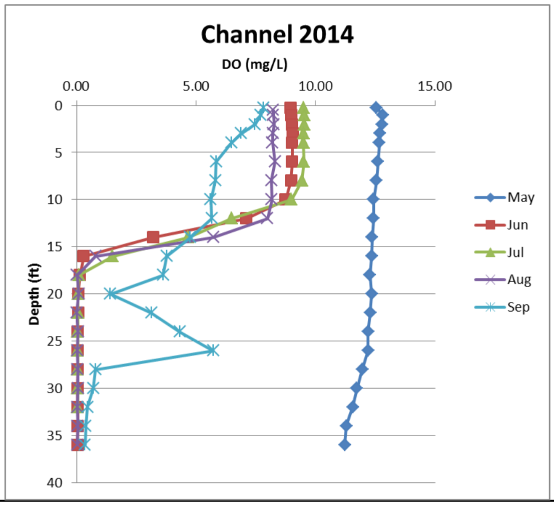


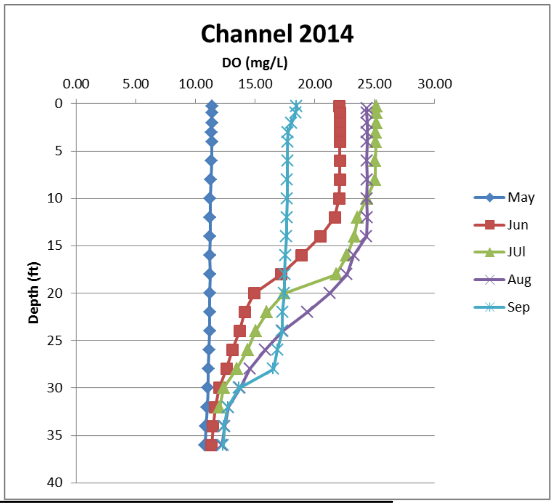
Thermal stratification occurs when the lake separates into an upper layer (epilimnion) and a lower layer (hypolimnion). Thermal stratification usually takes place in deep lakes where the wind and water currents are not strong enough to continually mix warmer waters with the cooler bottom waters and waters of the hypolimnion eventually experience anoxic conditions (where dissolved oxygen concentration fall <1 mg/L). Conditions in the hypolimnion during stratification can have profound effects on water quality, as most pollutants become concentrated as DO is depleted in the hypolimnion.

DO and temperature profiles are a good visual of stratification taking place in a lake. The profiles collected at the deep hole of Channel Lake are presented below. A multi-parameter sonde was used to record data. Measurements were recorded at every foot from the surface to 4 ft below the surface and every foot thereafter until the lake bottom

STRATIFICATION

was reached. The temperature and DO measurements are used to determine the depth of relative thermal resistance or where in the water column that lake stratification has set up (Appendix A, Table 6). In 2014, Channel Lake stratified between 12 feet and 16 feet during June through August.





DISSOLVED OXYGEN

Dissolved Oxygen (DO) is essential for the survival of fish and invertebrates in a lake and influences many different biological and chemical processes in lakes (Indiana Department of Environmental Management, 2011).

Fish become stressed as DO concentrations fall below 5 mg/L and as DO concentrations become anoxic or fish are no longer present. Anoxic conditions did occur in Channel Lake in 2014, as expected in deep lakes, however, concerns do arise in the summer when strong thermal stratification develops near the surface of the lake where water temperatures are prohibitive for most fish species. In 2014, Channel Lake became anoxic at 16 ft in June and August and 18 ft in July. The fisheries biologist from the IDNR suggests that as long as anoxic conditions do not expand above 14', there is a sufficient volume of oxygenated water for fish to utilize. However, in a year of extreme drought like what was experienced in 2012, the expansion of anoxic zones higher into the water column due to low water levels can become problematic.

Concerns arise when %DO saturation levels becomes supersaturated (>100%). DO is considered saturated when the %DO is 100%, or is equivalent to the ambient oxygen concentration, it becomes supersaturated due to algae and plants producing oxygen more rapidly than it can escape into the atmosphere. Although rare, excess DO can cause "gas bubble disease", this is where oxygen bubbles or emboli block the flow of blood in the blood vessels of fish. Channel Lake exhibited supersaturated % DO throughout the entire water column in May and between 6 to 8 feet during June through August.

While most water quality parameter concentrations increase in the hypolimnion, DO tends to get used up by detrivores in the bottom sediments causing anoxic conditions both in the water and bottom sediments. As DO concentrations approach 2 mg/L near the lake bottom, bottom sediments become anoxic, this allows for phosphorus to release from sediments. As indicated in Figures (8 and 9) above, Channel Lake stratified from June through September. By September the average TP concentration in the hypolimnion of Channel Lake was 1.16 mg/L setting up a conditions conducive for fall algal blooms.

ALGAE

Algal blooms have historically occurred on Channel Lake during our monitoring years and planktonic blooms were again noted in Channel Lake during 2014. Algae, like plants utilize dissolved phosphorus and nitrogen for their growth and can have balanced populations or they can become imbalanced and a bloom can occur, usually because of excess nutrients. Shifts in populations from a balanced population to one dominated by blue green algal species can also occur. In 2013, Channel Lake experienced a blue green algal bloom on one of it's beaches, Lake Shore Park Beach. The beach is routinely monitored as part of our beach monitoring program. However, the bloom occurred outside of the regular schedule. The beach manager was contacted and the beach was closed until the bloom subsided.

Recently, increased awareness in Harmful Algal Blooms (HABs) has initiated an effort to track such blooms in lakes within Lake County as well as statewide. In 2013, the LCHD-ES chose a subset of beaches that would routinely be sampled for HABs. Lake Shore Beach on Channel Lake was selected to as one of those beaches. A water sample is collected during E-coli sampling of the beach. If a blue-green algal bloom is present at the time of sampling, an Abraxis test is performed on a subsample to determine if toxins are present. Otherwise the sample is sent to an independent laboratory to have ELISA (enzyme-linked immunosorbent assay) testing performed. If the results of Abraxis test indicated that toxins are present at >10 ppb, the beach manager is advised of the results. Regardless of presence of a blue green bloom, the sample taken is sent out for ELISA testing.

In May, 2013, a blue-green algal bloom was reported to be present at Lake Shore Beach, the LCHD-ES collected a sample . The sample tested positive for toxins at a concentration of ≥10 ppb; the beach manager was contacted and advised to close the beach until the bloom subsided, the results of ELISA indicated that the toxin level was above the recommended level for no contact at ≥20 ppb by the World Health Organization (WHO).

Stakeholders of Channel Lake should make sure that they are servicing their septic systems and are incorporating best management practices designed to reduce nutrients from entering surface waters. This will help to alleviate some of the algal blooms observed on Channel Lake in the future.

CHLORIDES/CONDUCTIVITY

Conductivity measures the amount of ions in water, the more ions or salts in the water the higher its conductivity. It can be used to estimate both total dissolved solids ($R^2 = 0.96$) and chloride concentrations due to a strong correlation ($R^2 = 0.94$) between these parameters. Sources of chlorides are road salts (40% chloride) which are used in winter deicing programs by both public and private maintenance crews and water softener systems. The USEPA has determined that 230 mg/L of chloride is the critical concentration in which adverse impacts to aquatic ecosystems are possible if the critical concentration is maintained for prolonged periods. Although certain species can be impacted at much lower concentrations. It only takes 1 teaspoon of salt (chloride) to pollute 5 gallons of water (230 mg/L).

Recent trends show increasing chloride concentrations in surface and ground waters in the County. The chloride ion does not bind to soils or sediments so once in the water they remain there indefinitely, unless the water is diluted or treated by a reverse osmosis system, which is a very costly and not very practical for most surface water applications.

In 2014, the average chloride concentration in Channel Lake was 90 mg/L with concentrations ranging from 81.0 mg/L to 95.0 mg/L. Chloride was not a parameter tested for in 2002. Conductivity which was measured in 2002 was used to estimate chloride concentrations and it is estimated that the average chloride concentration was 85 mg/L, representing a slight increase (5.9%) since 2002.

Although chloride concentrations were not highly elevated in 2014, single family and transportation were estimated to be the two highest contributors of total percent runoff, and therefore homeowners and those winter road maintenance crews should minimize their salt usage. Many residences in the Fox Chain 'O' Lakes remain on septic. If they are using a water softener, there is no removal of chloride from the waste water as it percolates through the soils and eventually into the lake. Shifts in algal populations to blue green algae and native plant communities to non-native invasive plant communities can occur, these both can have management consequences related to them. Additionally, saltwater is more dense than freshwater and therefore can get trapped in bottom waters eventually changing the volume of water mixed in the lake which can affect the entire lake ecosystem.

The LCHD-ES and Lake County Stormwater Management Commission (LCSMC) have been holding annual training sessions targeting deicing maintenance personnel for both public and private entities. Since 2010 we have provided training to approximately 468 winter maintenance personnel on the recommended application rates for applying deicers while still maintaining safe passageways. Almost all deicing products contain chloride so it is important to read and follow product labels for proper application. For instance, at a pavement temperature of 30° F, rock salt will efficiently melt ice; however at 10°F it is ineffective and therefore another product would be required to melt ice. Check with your HOA to see what is required of private companies hired to deice roads in your subdivisions. Support changes in deicing policies proposed by the local township in their

EPavement Temp. ºF	One Pound of Salt (NaCl) melts	Melt Times
30	46.3 lbs of ice	5 min.
25	14.4 lbs of ice	10 min.
20	8.6 lbs of ice	20 min.
15	6.3 lbs of ice	1 hour
10	Dry salt is ineffective and will blow away before it melts anything	

AQUATIC PLANTS

Aquatic plants are a critical component in lakes as they contribute to the uptake of available nutrients such as phosphorus from the water column making it unavailable for use by algae, filter sediments and other pollutants from the water, and stabilize bottom substrates. They also provide habitat for nesting and nursery for fish and other aquatic organisms. At times, nuisance growth has been encountered by lake managers due to invasive species and eutrophication. Good data allows lake managers to be more efficient and environmentally sound when managing lake vegetation.

In April, 2014, an aquatic vegetation survey was conducted on Channel using the point survey method. In order to accomplish this a randomized 60-meter grid was overlaid on an aerial photo of Channel Lake using ARCGIS10. A total of 413 points fell within the lake footprint. Above the 12 ft depth, which is the average depth that plants are likely to be detected given a 3—5 ft. Secchi depth, every point was sampled regardless of whether plants were detected or not, if plants dropped out of the littoral zone after 12 ft. depth, points lying at greater depths were not sampled. To sample the vegetation, a rake was lowered into the water and then scored from 1—5 (Appendix A, Table 7). Each species was scored from a modified scale. The scales were then converted to a percentage value using the midpoint of a percentage range which was associated with each score. The midpoint was used to establish species cover. A total of 227 points were sampled and species cover, relative cover, frequency, relative frequency and relative importance were quantified using a modified Braun-Blanquet scale (Mueller-Dombois, Ellenberg, 2002) Appendix A, Table 7 presents the estimated cover, frequency and relative importance for each species detected in the April, 2014 survey. A ranking of relative importance determined dominant species in the lake.

In 2014, vegetation was found at 46.7% of the 227 points sampled in the lake with an estimated cover of 31.2%. Ten plant species and Chara, a macro-algae were detected. Three floating plants were co-dominant; Coontail, White Water Lily and Star Duckweed. Coontail, is a native submerged aquatic species, and is tolerant of low light conditions. Due to the early sampling that took place in Channel Lake,

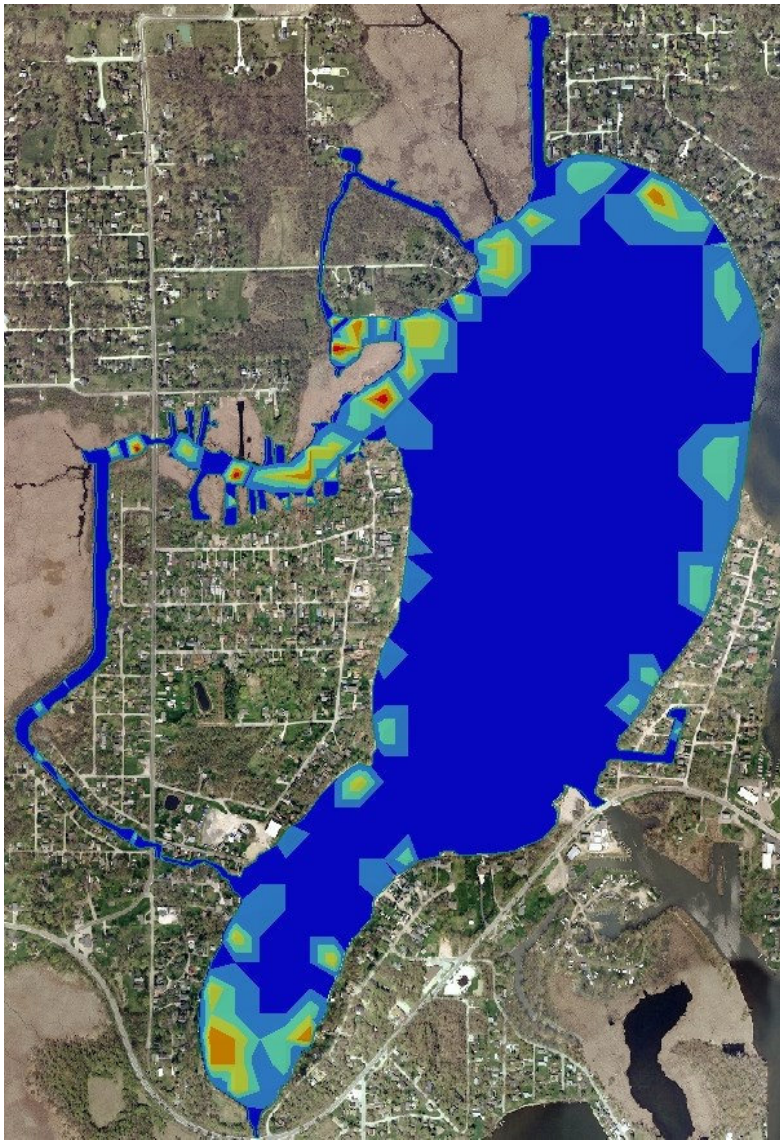


Figure 10. Status of vegetation in Channel Lake, July, 2014.

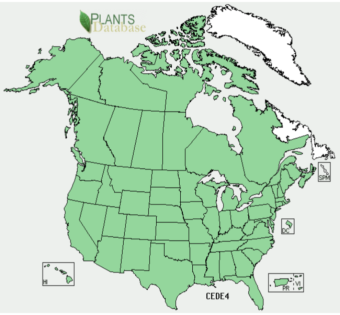
AQUATIC PLANTS (CONTINUED)

some species may have not emerged due to cool water temperatures. In May, the water temperature in Channel Lake averaged 11.2°C (52.16°F). Many native aquatic plants do not begin to actively grow until water temperatures reach 59°F. Figure 10 is a map displaying areas of vegetation in Channel Lake based upon the April survey (Appendix A, Figure 6).

A floristic quality assessment was performed using the aquatic plant species found in Channel Lake generating a floristic quality index (FQI) of 18.8. A floristic quality assessment is commonly used in four applications; identification of natural areas, comparisons among sites, long term monitoring and monitoring of habitat restoration. Although there is no record of residents or associations managing the aquatic vegetation in Channel Lake the FQI can be a tool to lake managers or home owner associations (HOA's) to determine if activities in the watershed might be having an impact on the plant community and to keep a long term record of the dynamics of the aquatic vegetation. Due to the sampling of the vegetation occurring in April, it is likely that later in the season there were more species present and the FQI would have been higher. The LCHD-ES is recommending that Channel Lake adopt a long term aquatic plant management plan that is developed by all stakeholders of the lake (lake associations, citizens, townships, park districts etc.). The plan would provide a template that describes the goals of aquatic plant management in Channel Lake and defines objectives to help attain those goals. If a plan is not developed it is recommended that the native plant community be increased in areas where plants can colonize, if chemical treatments are used to control invasive species, they should occur when water temperatures are cooler in order to retard the microbial breakdown of chemical as well as to ensure that chemicals have minimal if any impact to native plant populations. Other considerations are whether plants are monocots or dicots; Curlyleaf Pondweed (monocot) and Eurasian Watermilfoil (Dicot) were both present in the April survey; Therefore the strategy might differ for targeting one species over the other or if you were to target both.

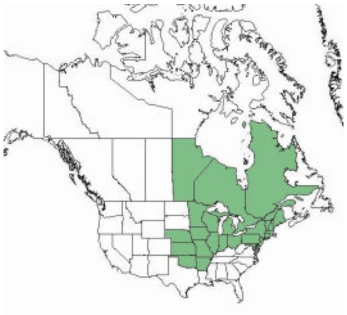
COONTAIL (DICOT)

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.



WHITE WATER LILY (MONOCOT)

White Water Lily (Nymphaeae tuberosa odorata) is a widespread native in and around the United States and Canada. It is identified by its floating round leaf with a slit from near the center of the leaf to the leaf edge. The leaf stalk is round in cross section. It has a showy white composite flower that sits on the surface of the water. It can be confused with Spatterdock and American Lotus.



AQUATIC PLANTS (CONTINUED)

STAR DUCKWEED (MONOCOT)

Star Duckweed (Lemna trisulca) is a widespread native aquatic plant. Star Duckweed is usually forming large mats under the water surface, this is unlike Giant or Common Duckweed which float upon the water surface.

INVASIVE SPECIES—EURASIAN WATERMILFOIL

Eurasian Watermilfoil (EWM) is a non-native invasive 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 (Couch & Nelson), 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.

Results from the April survey found that EWM was present at 5.29% of the points sampled with an average cover of 1.09%. The cover of EWM was likely underestimated due to the early sampling date and cool water temperatures. EWM has been found to be rapidly growing at water temperatures approaching 59°F. As mentioned earlier, the average water temperature at the deep hole was 52.15°F during our May sample event. So it is likely that temperatures were even cooler during April.

There is no record of herbicide treatments occurring in Channel Lake. Recently a hybrid milfoil (a cross between Eurasian Watermilfoil and the native Northern Watermilfoil) has been encountered on many lakes in the region who have conducted genetic testing on plants collected from Eurasian watermilfoil populations. The hybrid milfoil has proven to be less sensitive than either parental species to certain herbicides. Therefore, it is important to know whether the hybrid is present or to occasionally switch chemicals used to treat EWM to reduce the chance of chemical sensitivity being reduced in the future.

ILLUSTRATION OF EURASIAN WATERMILFOIL

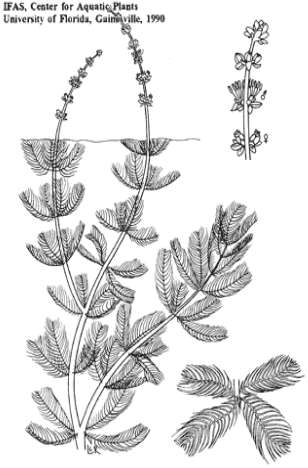


illustration provided by:
IFAS, Center for Aquatic Plants
University of Florida, Gainesville, 1990

Invasive Species—Eurasian Watermilfoil (Continued)

Eurasian watermilfoil was Not a dominant member of the aquatic vegetation in Channel Lake in April 2014.

Common Name	Average Cover	Frequency	Importance
EWM	1.09	5.29	7.99

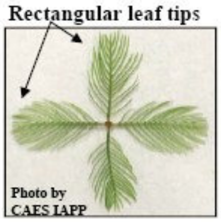
Myriophyllum spicatum Exotic*

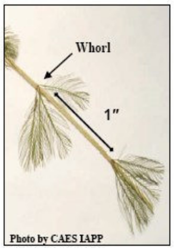
Common Names:
Eurasian watermilfoil

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; Hybrid Milfoil 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.

Illustration of Curlyleaf Pondweed

Flora Londinensis- William Curtis (1746-1799)

Invasive Species—Curlyleaf Pondweed

Curlyleaf Pondweed (*Potamogeton crispus;* CLP) is a non-native invasive pondweed. Like our native pondweeds it is a perennial monocot. This has management consequences as our native pondweeds and other of our native plant species are equally sensitive to herbicides that are effective in controlling this plant. CLP however, does have a life history that differs from our native pondweeds. The vegetative part of the plant dies back completely in early summer and only seeds and turions over-summer. The turions (which are the main source of reproduction in CLP) sprout in fall, and are rapidly able to elongate in spring after ice melts as temperatures reach 5°C. Vigorous growth of CLP occurs as most of our native plants are just beginning to emerge, senescing by late June and early July after turion production giving it a competitive advantage. Algal blooms have been associated with larges stands of senescing or dying plants of CLP, as nutrients used by the plant for growth are released into the water upon its death.

Curlyleaf Pondweed is identifiable by its entire leaves with prominent mid-vein and curly toothed edge which alternate along the stem of the plant.

INVASIVE SPECIES—CURLYLEAF PONDWEED (CONTINUED)

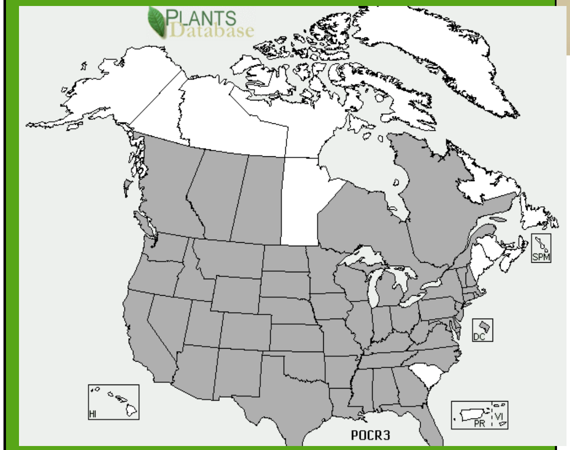
POTAMOGETON CRISPUS EXOTIC*

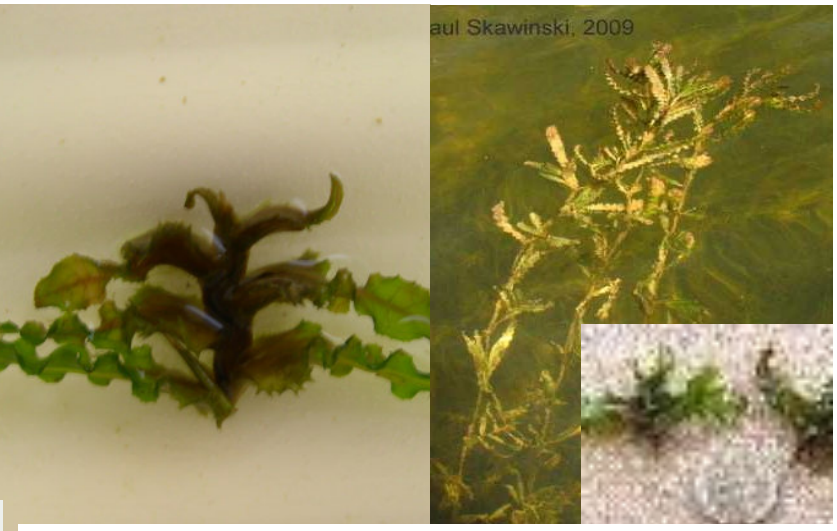
COMMON NAMES:
CURLYLEAF PONDWEED

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

IMPORTANCE:
EARLY GROWTH OF CLP NEGATIVELY IMPACTS BOTH THE ESTABLISHMENT AND DISTRIBUTION OF NATIVE MACROPHYTES.

LOOK ALIKES:
ILLINOIS PONDWEED (*POTAMOGETON ILLINOENSIS*)
RICHARDSON'S PONDWEED





KEY FEATURES:

LEAF: ALTERNATE, ENTIRE WITH PROMINENT MIDVIEN , STALKLESS, CURLY TOOTHED EDGE, OBLONG, NO FLOATING LEAVES, STIPULES FUSED AT BASE

PLANT: CAPABLE OF GROWING OVER WINTER EMERGING EARLY SPRING BEFORE MOST SPECIES, COMPLETES CYCLE BEFORE MID-JULY, STEMS SLIGHTLY FLAT, SLENDER RHIZOMES

FLOWER: SMALL GREEN BROWN FLOWERS ON CURVED SPIKE ABOVE WATER;

LOOK ALIKES: RICHARDSON'S PONDWEED

AQUATIC PLANT MANAGEMENT

FOR FULL DETAILS OF PART 895 SEE:

HTTP://WWW.ILGA.GOV/COMMISSION/JCAR/ADMINCODE/017/01700895SECTIONS.HTML

Herbicide application is a tool utilized by home owner associations, individual residents and lake managers to control aquatic plants in lakes of the Fox Chain 'O' Lakes. Targeted species are usually non-native invasive species; however our records indicate that there has been some treatments over the years, targeting native species. In 2014, there was no record of any herbicide applications occurring in Channel Lake.

By Administrative Code, applying herbicides on Channel Lake or any other lake in the Fox Chain 'O' Lakes requires a permit by the Illinois Department of Natural Resources (IDNR) 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). It should minimally document the location and area of treatment. The targeted species, pesticide and application rate as well as an estimated time when pesticide will be applied. The application can be obtained at the Fox Waterway Agency or its website (http://www.foxwaterway.state.il.us/). The IDNR has 45 days to issue or deny the permit. The Fox Waterway agency has the right to review all applications and can recommend denial of a permit if it feels that it could cause harm to the environment. Chemicals should only be used if they are labelled and registered with the Illinois Environmental Protection Agency. More information is available at the link to Part 895 of the Administrative Code which covers management of aquatic plants on the Fox Chain 'O' Lakes.

A NPDES permit is required before applying pesticides over or near waters of the state. A notice of intent to apply pesticides needs to be filed with the state and can be found its website (http://www.epa.state.il.us/water/permits/pesticide/forms/noi.pdf). There is a 14 day public notice period and additional information may be requested so plan ahead. Either the homeowner or its representative can apply for the permit. Once issued the permit is good for 5 years. If your treatments exceed 80 acres annually additional reporting is required. Additional documentation is required in the cases where adverse affects due to a spill or overdosing occur.

The LCHD is encouraging homeowner associations and individuals and agencies to formulate a long-term Aquatic Plant Management Plan (APMP) for the Fox Chain 'O' Lakes that can be used as a template by any entity or homeowner applying pesticides into the lake. Developing the plan should consider all stakeholders that utilize the lake. The plan should describe all methods of control and select the best management tool to address problems identified and explain why it was chosen. The plan should consider timing of pesticide application, targeted species, and pesticide selection. Distributing information on pesticides that are approved for aquatic use should be included so that the person(s) responsible for lake management decisions are knowledgeable about the pesticides being applied to the lake and any risks associated with those chemicals. This allows them to formulate a clear concise Request for Proposal (RFP) that addresses the key considerations, sets reasonable goals and the objectives for achieving those goals. The APMP should also require monitoring of the lake vegetation to ensure that the goals are being met. This would allow for modifying strategies if goals defined in the APMP are not met.

ZEBRA MUSSELS

ZEBRA MUSSEL

ZEBRA MUSSELS WERE NOT DETECTED BY LCHD-ES IN LAKE CATHERINE DURING 2014 SURVEYS.

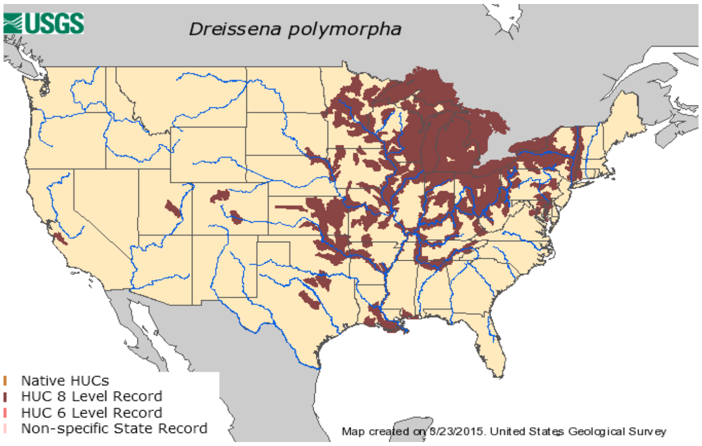
In the late 1990's, the presence of zebra mussels (Dreissena polymorpha) was confirmed in the Fox Chain O Lakes. These mussels are believed to have been spread to this country in the mid 1980's by cargo ships from Europe that discharged their ballast water into the Great Lakes. The mussels spread throughout the Great Lakes and by 1991 had made their way into the Illinois and Mississippi Rivers. Currently, 32 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 can go unnoticed.

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. They can live as long as five years and have an average life span of about 3.5 years. 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, 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 mussels clogging water intake pipes have caused economic hardships for power plants, public water supplies, and industrial facilities. Boats stored on the water offer suitable areas for zebra mussels to start a colony. They can eventually affect cooling and exhaust systems on boats and create

Photo by Myriah Richerson



Map created on 8/23/2015. United States Geological Survey

KEY FEATURES:

THE ZEBRA MUSSEL IS A SMALL SHELLFISH NAMED FOR THE STRIPED PATTERN OF ITS SHELL. COLOR PATTERNS CAN VARY TO THE POINT OF HAVING ONLY DARK OR LIGHT COLORED SHELLS AND NO STRIPES. IT IS TYPICALLY FOUND ATTACHED TO OBJECTS, SURFACES, OR OTHER MUSSELS BY THREADS EXTENDING FROM UNDERNEATH THE SHELLS. ALTHOUGH SIMILAR IN APPEARANCE TO THE QUAGGA MUSSEL (*DREISSENA BUGENSIS*), THE TWO SPECIES CAN BE EASILY DISTINGUISHED. WHEN PLACED ON A SURFACE ZEBRA MUSSELS ARE STABLE ON THEIR FLATTENED UNDERSIDE WHILE QUAGGA MUSSELS, LACKING A FLAT UNDERSIDE, WILL FALL OVER. SEE MACKIE AND CHLOSSER (1996) FOR A KEY TO ADULT DREISSENIDS

ZEBRA MUSSELS (CONTINUED)

extra drag causing lower fuel economy. Studies on the transport of the zebra mussel have shown that they can be found in any area of a boat that holds water, including the engine cooling system, bilge water, and bait buckets used in fishing. 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. Therefore, it is important that all boats and trailers entering or leaving the Fox Chain O' Lakes are inspected for aquatic plants and all water from the bilge and motors are drained.

Recently, an experimental biocide called Zequanox has shown to be effective against zebra mussels and it is not toxic to humans, native bivalves, and fish. In-lake tests show that it reached 97.1% mortality on zebra mussels within 14 days of treatment . Zequanox is a non-chemical solution made from dead cells of a naturally occurring microbe (Psuedomonas flourescens). It is highly selective to zebra and quagga mussels and has low toxicity (Marrone Bio Innovasions). Currently winter drawdowns have exposed the zebra mussels along the shorelines, however prevention is the best defest against any invasive species spread. The Great Lakes Sea Grant Network provides the following tips to 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.

BEACHES

Channel Lake has 3 licensed beaches along its shore; Turtle Beach, Bluffs Lodges Subdivision Beach and Lake Shore Park Beach. Licensed beaches are sampled bi-weekly for E-coli during the beach season, Memorial Day through Labor Day. If E-coli colonies are ≥ 235 colonies/100 mL, a swim ban is issued. Since 2004, Turtle Beach has had 8 swim bans; none have occurred at Bluffs Lodges Subdivision Beach, and 12 have occurred at Lake Shore Park Beach, most occurring between 2009 and 2010. The record does not show a ban placed on Lake Shore Park Beach in May, 2013 as it occurred before the swim season and was detected during a response to a harmful algal bloom that was taking place at the beach.

Since 2013, Lake Shore Park Beach was selected for routine sampling of blue-green algae as part of a pilot program developed by the LCHD and IEPA. Samples collected are sent out to an independent laboratory for enzyme-linked immunosorbent assay (ELISA). If a bloom is present an Abraxis test is run to test for presence of toxin. If present at concentrations above 10 ppb, the beach manager is contacted and it recommended that the beach close until the bloom subsides. In 2013, the results of ELISA were well below the recommended level by the World Health Organization for no contact (≥20 ug/L).

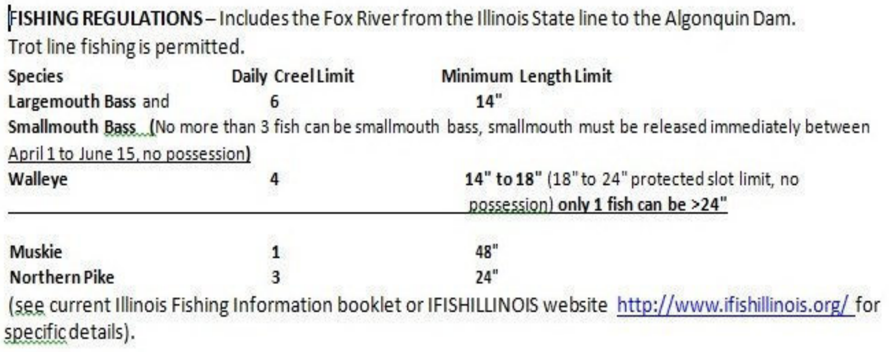
FISH

The Illinois Department of Natural Resources continuously monitors the fish populations in the Fox Chain 'O' Lakes through biennial fish surveys. They normally catch between 35—40 fish species during these surveys. In 2013, the IDNR conducted their biennial survey on the Fox Chain 'O' Lakes. During this survey they sampled Lake Catherine and Channel Lake and found 27 species of fish. Bluegill was the most abundant fish caught (354 individuals), however, Muskellunge (3) and Carp (7) were the fish having the greatest average weight, 8.4 lbs. and 7.6 lbs., respectively.

The Fox Chain 'O' Lakes is annually stocked with 243,000 2"walleye fingerlings, 2 million walleye fry, and at least 2000 muskie fingerlings. Sixty-five thousand 4" to 6" largemouth bass fingerlings are stocked every other year. Natural reproduction maintains all other species.

Fish Species in Lake Catherine and Channel Lake, 2013.

Black Crappie
Blue Gill
Bluntnose minnow
Bowfin
Brown Bullhead
Brook Silverside
Carp
Channel Catfish
Emerald Shiner
Fresh Water Drum
Golden Shiner
Green Sunfish
Gizzard Shad
Johnny Darter
Large Mouth Bass
Log Perch
Muskellunge
Northern Pike
Pumpkinseed
Spottail Shiner
Quillback
Walleye
Warmouth
White Bass
Yellow Bullhead
Yellow Perch
Yellow Bass



FISHING REGULATIONS – Includes the Fox River from the Illinois State line to the Algonquin Dam.
Trot line fishing is permitted.

Species	**Daily Creel Limit**	**Minimum Length Limit**
Largemouth Bass and	6	**14"**
Smallmouth Bass (No more than 3 fish can be smallmouth bass, smallmouth must be released immediately between April 1 to June 15, no possession)		
Walleye	**4**	**14" to 18"** (18" to 24" protected slot limit, no possession) **only 1 fish can be >24"**
Muskie	**1**	48"
Northern Pike	**3**	24"

(see current Illinois Fishing Information booklet or IFISHILLINOIS website http://www.ifishillinois.org/ for specific details).

LakeCounty
Health Department and
Community Health Center

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 Channel Lake:

- Develop an aquatic plant management plan that can be used as a template for lake managers, homeowners and other entities charged with aquatic plant management on Channel Lake.
- Encourage groups within the Trevor Creek watershed to incorporate best management practices to reduce the nutrient load (especially phosphorus) into Channel Lake and the Fox Chain 'O' Lakes.
- The IEPA has prioritized the funding of projects through 319 grant funds for the Fox River Watershed. Channel Lake is part of that watershed. It is recommended that a work group be formed that can identify potential projects to include in a proposal. The LCHD-ES is willing to provide guidance for producing the application proposal and implementation of any projects funded. The workgroup should include partner volunteers from the entire Fox Chain 'O' Lakes to strengthen the proposal. At least one of the partners should be an entity that has legal status to receive funds from the State of Illinois; including state and local governmental units, non-for profit organizations, citizen and environmental groups, individuals and businesses. They are funding projects identified under approved watershed plans, (Sequiot Creek). Applications are due in Springfield on August 1, 2015. Contact the LCHD at (847) 377-8030 for more information.

STOP AQUATIC HITCHHIKERS!™

Prevent the transport of nuisance species.
Clean all recreational equipment.
www.ProtectYourWaters.net

When you leave a body of water:

- Remove any visible mud, plants, fish or animals before transporting equipment.
- Eliminate water from equipment before transporting.
- Clean and dry anything that comes into contact with water (boats, trailers, equipment, clothing, dogs, etc.).
- Never release plants, fish or animals into a body of water unless they came out of that body of water.

APPENDIX A

FIGURES AND TABLES
CHANNEL LAKE
2014

Figure 1. LCHD water quality sampling points – Channel Lake, 2014.

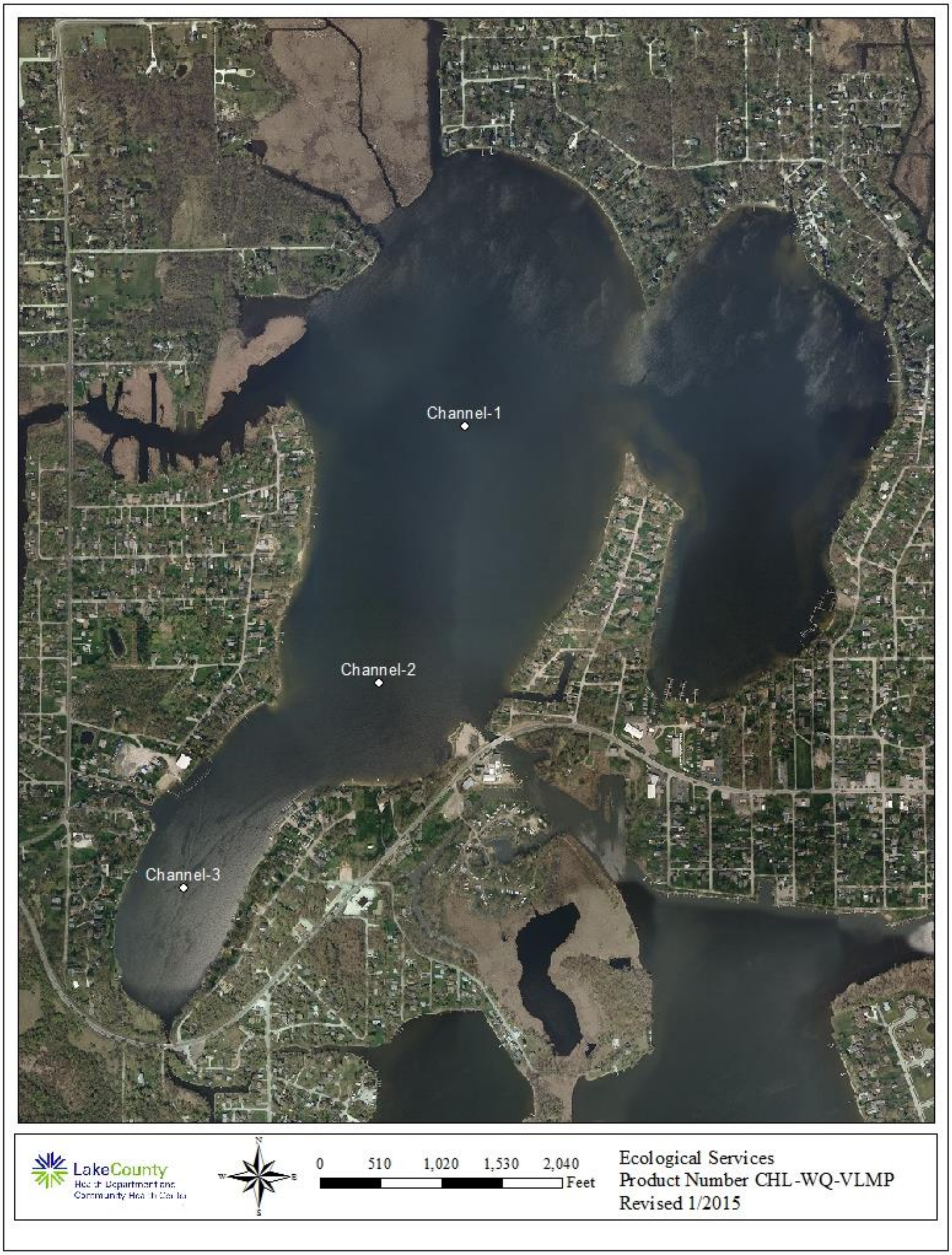


Table 1. Approximate land uses and retention time for Channel Lake. (Lake County Mapping Services and SEWRPC data)

Land Use	Acreage	% of Total
Agricultural	4588.33	36.5%
Disturbed Land	48.34	0.4%
Forest and Grassland	832.73	6.6%
Government and Institutional	95.22	0.8%
Industrial	50.06	0.4%
Multi Family	26.95	0.2%
Public and Private Open Space	400.49	3.2%
Retail/Commercial	105.38	0.8%
Single Family	2260.50	18.0%
Transportation	870.90	6.9%
Utility and Waste Facilities	0.00	0.0%
Water	1500.81	11.9%
Wetlands	1801.97	14.3%
Total Acres	**12581.68**	**100.0%**

Land Use	Acreage	Runoff Coeff.	Estimated Runoff, acft.	% Total of Estimated Runoff
Agricultural	4588.33	0.05	630.9	13.1%
Disturbed Land	48.34	0.05	6.6	0.1%
Forest and Grassland	832.73	0.05	114.5	2.4%
Government and Institutional	95.22	0.50	130.9	2.7%
Industrial	50.06	0.50	37.1	0.8%
Multi Family	26.95	0.50	165.2	3.4%
Public and Private Open Space	400.49	0.15	165.2	3.4%
Retail/Commercial	105.38	0.85	246.3	5.1%
Single Family	2260.50	0.30	1864.9	38.8%
Transportation	870.90	0.50	1197.5	24.9%
Utility and Waste Facilities	0.00	0.30	0.0	0.0%
Water	1500.81	0.00	0.0	0.0%
Wetlands	1801.97	0.05	247.8	5.2%
TOTAL	**12581.68**		**4806.9**	100.0%

Lake volume	**4895.00**	**acre-feet**
Retention Time (years)= lake volume/runoff	**1.02**	**years**
	371.69	**days**

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Figure 2. Land Use and Watershed for Channel Lake (Lake County Mapping Services and SEWRPC data).

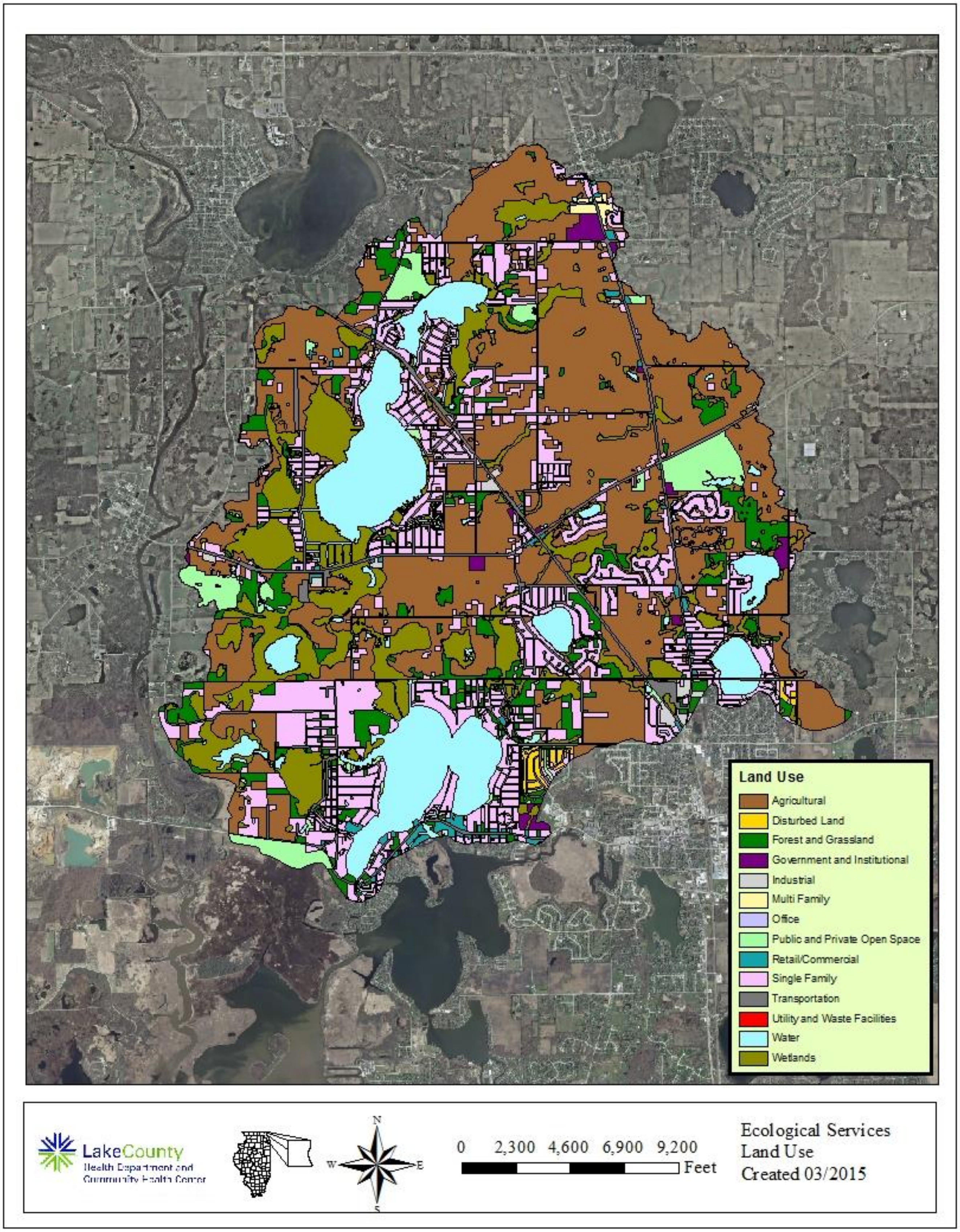

Table 2. 2000 - 2014 Water Quality Parameters, Statistics Summary.

	ALKoxic	
	<=3ft00-2014	
Average	163	
Median	161	
Minimum	65	IMC
Maximum	330	Flint Lake
STD	39	
n =	870	

	ALKanoxic	
	2000-2014	
Average	197	
Median	189	
Minimum	103	Heron Pond
Maximum	470	Lake Marie
STD	46	
n =	231	

	Condoxic	
	<=3ft00-2014	
Average	0.8699	
Median	0.7900	
Minimum	0.2260	Schreiber Lake
Maximum	6.8920	IMC
STD	0.5210	
n =	868	

	Condanoxic	
	2000-2014	
Average	1.0183	
Median	0.8320	
Minimum	0.3210	Lake Kathyrn, Schreiber Lake
Maximum	7.4080	IMC
STD	0.8073	
n =	233	

	NO3-N, Nitrate+Nitrite,oxic	
	<=3ft00-2014	
Average	0.145	
Median	<0.05	*ND
Minimum	<0.05	*ND
Maximum	9.670	S. Churchill Lake
STD	0.533	
n =	870	

76.1% of samples < detection limit of 0.05 mg/L
Statistics assume ND=0.049 mg/L
Beginning in 2006, Nitrate+Nitrite was measured.

	NH3-Nanoxic	
	2000-2014	
Average	1.875	
Median	0.978	
Minimum	<0.1	*ND
Maximum	18.400	Taylor Lake
STD	2.412	
n =	233	

21.8% of samples < detection limit of 0.1 mg/L
Statistics assume ND=0.09 mg/L

	pHoxic	
	<=3ft00-2014	
Average	8.34	
Median	8.33	
Minimum	5.24	Red Wing Slough
Maximum	10.50	Antioch Lake
STD	0.47	
n =	868	

	pHanoxic	
	2000-2014	
Average	7.28	
Median	7.24	
Minimum	5.80	Third Lake
Maximum	9.16	White Lake
STD	0.45	
n =	233	

	All Secchi	
	2000-2014	
Average	4.21	
Median	2.95	
Minimum	0.18	McDonald 2/Ozaukee/Rollins 2
Maximum	29.23	Bangs Lake
STD	3.60	
n =	787	

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Table 2. 2000 - 2014 Water Quality Parameters, Statistics Summary (continued.

	TKNoxic <=3ft00-2014	
Average	1.516	
Median	1.200	
Minimum	<0.1	*ND
Maximum	41.200	Almond Marsh
STD	1.690	
n =	870	

*ND = 1.0% Non-detects from 5 different lakes

	TKNanoxic 2000-2014	
Average	3.149	
Median	2.270	
Minimum	<0.5	*ND
Maximum	21.000	Taylor Lake
STD	2.584	
n =	233	

	TPoxic <=3ft00-2014	
Average	0.113	
Median	0.068	
Minimum	<0.01	*ND
Maximum	7.270	Almond Marsh
STD	0.274	
n =	869	

*ND = 1.8% Non-detects from 6 different lakes

	TPanoxic 2000-2014	
Average	0.357	
Median	0.176	
Minimum	0.012	Independence Grove, W. Loon
Maximum	3.800	Taylor Lake
STD	0.461	
n =	233	

	TSSall <=3ft00-2014	
Average	15.9	
Median	8.2	
Minimum	<1	*ND
Maximum	220.0	Rollins 2
STD	22.3	
n =	875	

*ND = 1.5% Non-detects from 9 different lakes

	TVSoxic <=3ft00-2014	
Average	125.1	
Median	121.0	
Minimum	34.0	Pulaski Pond
Maximum	1090.0	Almond Marsh
STD	49.3	
n =	870	

	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 2000-2014	
Average	193	
Median	124	
Minimum	3.5	Schreiber Lake
Maximum	2390	IMC
STD	298	
n =	194	

	CLoxic 2000-2014	
Average	174	
Median	139	
Minimum	2.7	Schreiber Lake
Maximum	2760	IMC
STD	191	
n =	802	

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 2000-2014 (n=3516).

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

LCHD Environmental Services ~ 12/10/2014

LakeCounty
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Community Health Center

Table 3. Water Quality Data Summary for Channel Lake, 2014.

2014	**Epilimnion**															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N*	TP	SRP	Cl-	TDS**	TSS	TS	TVS	SECCHI	COND	pH	DO
May	3	187	1.73	<0.100	<0.05	0.106	<0.005	92.5	370	16.0	441	125	1.5	0.642	8.79	12.71
June	3	187	1.15	<0.100	<0.05	0.045	<0.005	94.8	378	3.2	422	126	6.9	0.6579	8.48	9.04
July	3	173	1.20	<0.100	<0.05	0.054	<0.005	81.0	374	8.0	398	110	2.8	0.6488	8.41	9.5
August	3	181	1.46	<0.100	<0.05	0.047	0.008	90.2	362	11.0	419	133	1.4	0.6259	8.57	8.22
September	3	174	1.78	0.199	<0.05	0.086	<0.005	90.4	361	10.0	385	102	1.3	0.6240	7.90	9.27
	Average	180	1.46	<0.199^{k}	<0.05	0.068	<0.008	89.8	369	9.6	413	119	2.8	0.6397	8.43	9.75

2002	**Epilimnion**															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N*	TP	SRP	Cl-**	TDS**	TSS	TS	TVS	SECCHI	COND	pH	DO
9-May	1	280	2.24	0.070	0.2	0.033	0.013	87.3	371	9	NR	3	9.5	0.6425	8.26	9.45
12-Jun	1	205	1.09	0.010	0.22	0.027	0.011	81.9	362	8	NR	3	5.9	0.6249	8.45	9.42
17-Jul	1	245	1.20	<0.100	<0.05	0.048	0.006	78.6	356	3	NR	3	6.2	0.6141	8.49	8.43
14-Aug	1	185	<0.10	<0.100	<0.05	0.033	0.005	79.6	358	6	NR	4	2.2	0.6176	8.54	7.13
2-Oct	1	240	<0.10	0.240	0.03	0.049	0.006	95.1	383	1	NR	1	9.5	0.6682	8.04	7.39
	Average	231	<1.51^{k}	<0.107^{k}	<0.15^{k}	0.038	<0.008	84.5	366	5.4	NR	3	6.7	0.6335	8.36	8.36

Glossary

ALK = Alkalinity, mg/L $CaCO_3$
TKN = Total Kjeldahl nitrogen, mg/L
NH_3-N = Ammonia nitrogen, mg/L
NO_2+NO_3-N = Nitrate + Nitrite nitrogen, mg/L
NO_3-N = Nitrate + Nitrite nitrogen, mg/L
TP = Total phosphorus, mg/L
SRP = Soluble reactive phosphorus, mg/L
Cl^- = Chloride, mg/L

TDS = Total dissolved solids, mg/L
TSS = Total suspended solids, mg/L
TS = Total solids, mg/L
TVS = Total volatile solids, mg/L
SECCHI = Secchi disk depth, ft.
COND = Conductivity, milliSiemens/cm
DO = Dissolved oxygen, 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
**=Estimated based on Conductivity
NR = no measurement taken
ND = data not available

Table 3. Water Quality Data Summary for Channel Lake, 2014.

2014	**Hypolimnion**															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N*	TP	SRP	Cl-	TDS**	TSS	TS	TVS	SECCHI	COND	pH	DO
6-May	33	183	1.77	<0.100	<0.05	0.110	<0.005	93.8	371	17.0	437	120	NA	0.6437	8.71	11.43
10-Jun	33	226	6.38	5.190	<0.05	0.771	0.716	94.0	404	6.0	445	115	NA	0.7095	7.18	0.05
8-Jul	30	229	5.14	4.700	<0.05	0.618	0.604	97.3	433	5.4	444	117	NA	0.7661	7.16	0.05
12-Aug	34	261	8.37	7.390	<0.05	0.982	0.965	97.4	429	3.6	462	127	NA	0.7586	6.99	0.05
16-Sep	33	278	10.30	9.440	<0.05	1.160	1.070	94.4	457	6.4	439	93	NA	0.8140	6.65	0.43
	Average	235	6.39	6.680	<0.05	0.728	0.839	95.4	419	7.7	445	114	NA	0.7384	7.34	2.40

2002	**Hypolimnion**															
DATE	DEPTH	ALK	TKN	NH_3-N	NO_2+NO_3-N*	TP	SRP	Cl-**	TDS**	TSS	TS	TVS	SECCHI	COND	pH	DO
9-May	33	265	1.47	0.44	0.16	0.089	0.060	89.1	374	7.0	NR	3	NA	0.6484	7.74	4.55
12-Jun	33	205	2.80	0.85	0.04	0.199	0.180	96.3	385	8.0	NR	2	NA	0.6721	7.48	0.12
17-Jul	33	300	4.09	2.2	<0.05	0.477	0.445	103.1	396	3.0	NR	3	NA	0.6941	7.15	0.09
14-Aug	35	285	<0.10	2.3	<0.05	0.428	0.358	107.2	403	3.0	NR	2	NA	0.7075	7.08	0.05
2-Oct	33	290	<0.10	5.6	<0.05	0.884	0.840	127.1	436	5.0	NR	5	NA	0.7727	6.86	0.01
	Average	269	2.79	2.278	<0.10	0.415	0.377	104.6	399	5.2	NR	3	NA	0.6989	7.262	0.964

Figure 3. Channel Lake 2002 and 2014 Secchi Depths.

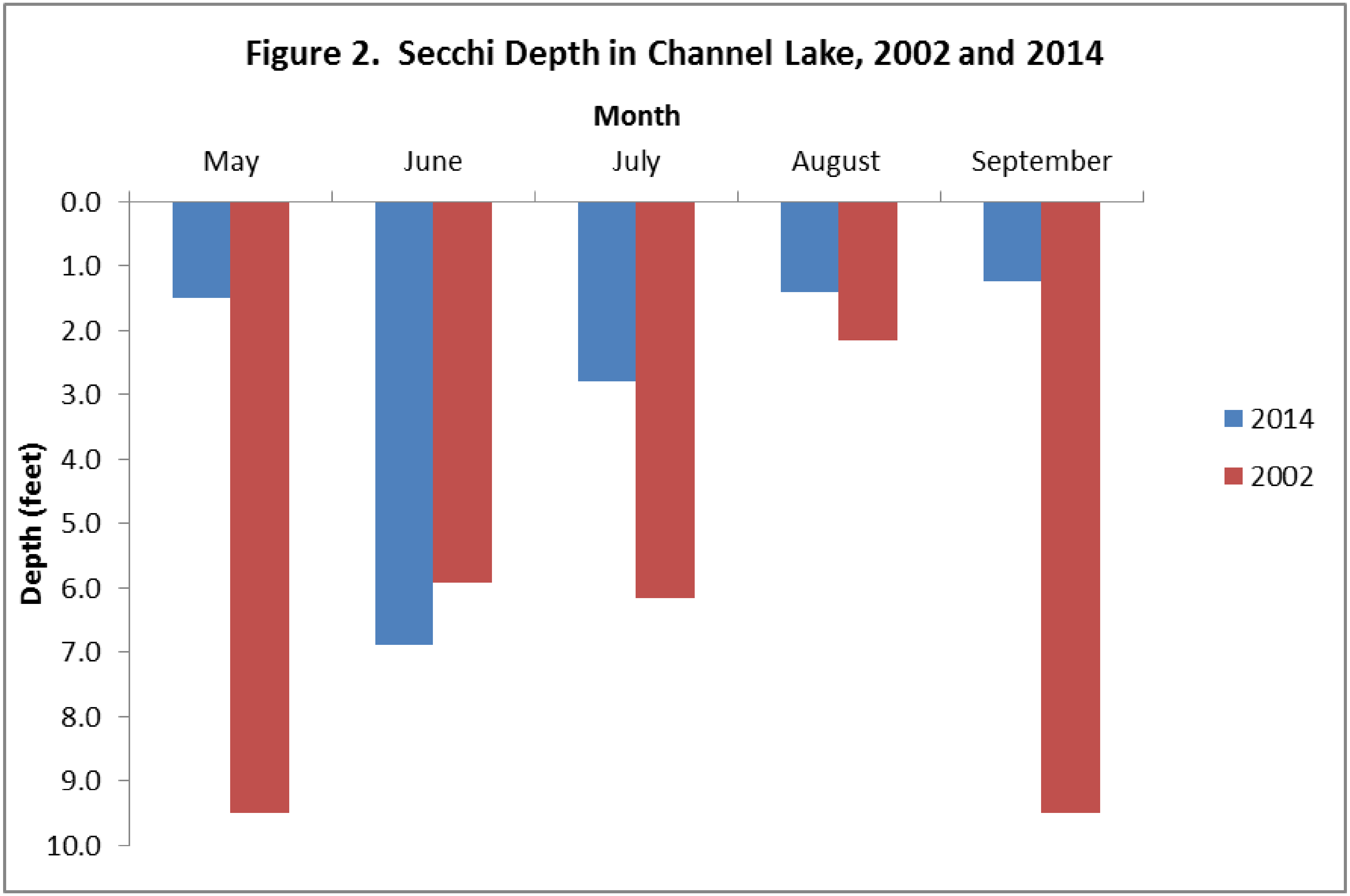

Table 4. Average Secchi depths measured from lakes in Lake County, 2000-2014.

RANK	LAKE NAME	SECCHI AVE	TSIsd
1	Windward Lake	14.28	38.79
2	Lake Carina	13.21	39.92
3	Cedar Lake	12.55	41.00
4	Druce Lake	12.25	41.00
5	Pulaski Pond	11.69	41.68
6	West Loon Lake	11.55	41.85
7	Independence Grove	11.50	41.92
8	Sterling Lake	11.35	42.10
9	Lake Zurich	10.40	43.37
10	Third Lake	9.76	44.00
11	Davis Lake	9.65	44.44
12	Harvey Lake	9.47	44.72
13	Little Silver Lake	9.42	44.79
14	Old School Lake	9.40	44.82
15	Lake Kathryn	9.39	44.84
16	Dugdale Lake	9.22	45.10
17	Dog Training Pond	9.04	45.39
18	Banana Pond	8.85	45.69
19	Deep Lake	8.83	45.72
20	Stone Quarry Lake	8.81	45.76
21	Lake of the Hollow	8.74	45.87
22	Cross Lake	8.18	46.83
23	Ames Pit	8.14	46.90
24	Bangs Lake	8.02	47.00
25	Briarcrest Pond	8.00	47.15
26	Sand Lake	7.48	48.12
27	Sand Pond (IDNR)	7.42	48.23
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	Lake Helen	6.43	50.30
38	Sun Lake	6.33	50.52
39	Lake Barrington	6.12	51.00
40	Cranberry Lake	5.94	51.00
41	Lake Fairfield	5.89	51.56
42	Gages Lake	5.45	52.68
43	Wooster Lake	5.33	47.00
44	Owens Lake	5.30	53.08
45	Valley Lake	5.05	53.78
46	McGreal Lake	5.04	53.81
47	Old Oak Lake	4.85	54.36
48	Waterford Lake	4.70	54.82
49	Lake Linden	4.60	55.13

Table 4. Average Secchi depths measured from lakes in Lake County, 2000-2014.

RANK	LAKE NAME	SECCHI AVE	TSIsd
50	Peterson Pond	4.51	55.41
51	Timber Lake (South)	4.46	56.00
52	Crooked Lake	4.39	55.79
53	Mary Lee Lake	4.35	55.93
54	Butler Lake	4.35	55.93
55	Crooked Lake	4.28	56.17
56	Deer Lake	4.20	56.45
57	Seven Acre Lake	4.18	56.51
58	Lambs Farm Lake	4.17	56.54
59	Grays Lake	4.08	56.86
60	Lake Naomi	4.05	56.96
61	White Lake	3.96	57.29
62	Hook Lake	3.95	57.32
63	Turner Lake	3.92	57.43
64	North Tower Lake	3.89	60.00
65	Leisure Lake	3.85	57.69
66	Salem Lake	3.77	58.00
67	Lake Fariview	3.75	58.00
68	Countryside Glen Lake	3.64	58.50
69	Taylor Lake	3.52	58.99
70	Hastings Lake	3.52	58.99
71	Duck Lake	3.49	59.11
72	Fish Lake	3.47	59.19
73	Bishop Lake	3.47	59.19
74	Lake Lakeland Estates	3.41	59.00
75	Lake Holloway	3.40	59.49
76	Stockholm Lake	3.38	59.57
77	East Loon Lake	3.30	59.92
78	Bresen Lake	3.28	60.00
79	Summerhill Estates Lake	3.27	60.05
80	Lucky Lake	3.22	60.27
81	Diamond Lake	3.17	60.50
82	Liberty Lake	3.16	60.54
83	International Mining and Chemical Lake	3.08	60.91
84	Long Lake	3.05	61.00
85	Lake Christa	3.01	61.24
86	Lucy Lake	2.99	61.34
87	Lake Catherine	2.90	62.00
88	St. Mary's Lake	2.79	62.34
89	Channel Lake	2.77	62.00
90	Werhane Lake	2.71	62.76
91	East Meadow Lake	2.61	63.30
92	Buffalo Creek Reservoir 1	2.60	64.00
93	Countryside Lake	2.58	63.00
94	Kemper Lake 1	2.56	63.58
95	Bluff Lake	2.51	64.00
96	Broberg Marsh	2.50	63.92
97	Antioch Lake	2.48	64.03
98	Little Bear Lake	2.38	64.63

Table 4. Average Secchi depths measured from lakes in Lake County, 2000-2014.

RANK	LAKE NAME	SECCHI AVE	TSIsd
99	Island Lake	2.32	65.00
100	Tower Lake	2.31	56.00
101	Buffalo Creek Reservoir 2	2.30	67.00
102	Woodland Lake	2.28	65.00
103	Rivershire Pond 2	2.23	65.57
104	Lake Charles	2.20	65.76
105	College Trail Lake	2.18	65.89
106	Loch Lomond	2.17	65.96
107	Redhead Lake	2.16	65.00
108	Pistakee Lake	2.15	66.00
109	Echo Lake	2.11	66.36
110	Eagle Lake (S1)	2.10	66.43
111	West Meadow Lake	2.07	66.64
112	Forest Lake	2.04	66.85
113	Grand Ave Marsh	2.03	66.92
114	Columbus Park Lake	2.03	66.92
115	Grassy Lake	2.00	67.14
116	Petite Lake	2.00	67.00
117	Sylvan Lake	1.98	67.28
118	Bittersweet Golf Course #13	1.98	67.28
119	Fischer Lake	1.96	67.43
120	Spring Lake	1.78	69.00
121	Kemper Lake 2	1.77	68.90
122	Fourth Lake	1.77	68.90
123	Nippersink Lake	1.73	69.23
124	Deer Lake Meadow Lake	1.73	69.23
125	Lake Louise	1.68	69.65
126	Willow Lake	1.63	70.09
127	Slough Lake	1.63	70.09
128	Rasmussen Lake	1.62	70.17
129	Lake Farmington	1.62	70.17
130	Half Day Pit	1.60	70.35
131	Lake Marie	1.56	68.00
132	Longview Meadow Lake	1.51	71.19
133	Lake Matthews	1.48	72.00
134	Big Bear Lake	1.32	73.13
135	Fox Lake	1.28	74.00
136	Dunn's Lake	1.22	74.00
137	Lake Eleanor	1.16	74.99
138	McDonald Lake 1	1.13	75.37
139	Lake Napa Suwe	1.06	105.00
140	Rollins Savannah 1	1.05	76.43
141	Osprey Lake	1.03	76.70
142	Manning's Slough	1.00	77.13
143	Rollins Savannah 2	0.95	77.87
144	Dog Bone Lake	0.94	78.02
145	Redwing Marsh	0.88	78.97
146	Flint Lake Outlet	0.83	79.82
147	Slocum Lake	0.81	80.00

Table 4. Average Secchi depths measured from lakes in Lake County, 2000-2014.

RANK	LAKE NAME	SECCHI AVE	TSIsd
148	Fairfield Marsh	0.81	80.17
149	Oak Hills Lake	0.79	80.53
150	Grass Lake	0.78	77.00
151	Lake Nippersink	0.77	81.00
152	South Churchill Lake	0.73	81.67
153	Lake Forest Pond	0.71	82.07
154	ADID 127	0.66	83.12
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	0.50	87.12

Table 5. Lake County Average TSI phosphorus (TSIp) Ranking 2000-2014.

RANK	LAKE NAME	TP AVE	TSIp
1	Lake Carina	0.0100	37.35
2	Sterling Lake	0.0100	37.35
3	Cedar Lake	0.0130	41.14
4	Independence Grove	0.0130	41.14
5	Lake Zurich	0.0135	41.68
6	Druce Lake	0.0140	42.00
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	Banana Pond	0.0200	47.35
12	Gages Lake	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	Cross Lake	0.0220	48.72
19	Dog Training Pond	0.0220	48.72
20	Sun Lake	0.0220	48.72
21	Deep Lake	0.0230	49.36
22	Lake of the Hollow	0.0230	49.36
23	Round Lake	0.0230	49.36
24	Stone Quarry Lake	0.0230	49.36
25	Little Silver Lake	0.0250	50.57
26	Bangs Lake	0.0260	51.13
27	Lake Leo	0.0260	51.13
28	Cranberry Lake	0.0270	51.68
29	Dugdale Lake	0.0270	51.68
30	Peterson Pond	0.0270	51.68
31	Fourth Lake	0.0360	53.00
32	Lambs Farm Lake	0.0310	53.67
33	Old School Lake	0.0310	53.67
34	Grays Lake	0.0310	54.00
35	Harvey Lake	0.0320	54.50
36	Hendrick Lake	0.0340	55.00
37	Honey Lake	0.0340	55.00
38	Sand Lake	0.0380	56.00
39	Third Lake	0.0384	56.00
40	Sullivan Lake	0.0370	56.22
41	Ames Pit	0.0390	56.98
42	Diamond Lake	0.0390	56.98
43	East Loon	0.0400	57.34
44	Schreiber Lake	0.0400	57.34
45	Waterford Lake	0.0400	57.34
46	Hook Lake	0.0410	57.70
47	Nielsen Pond	0.0450	59.04
48	Seven Acre Lake	0.0460	59.36
49	Turner Lake	0.0460	59.36
50	Willow Lake	0.0460	59.36
51	East Meadow Lake	0.0480	59.97
52	Lucky Lake	0.0480	59.97
53	Old Oak Lake	0.0490	60.27

Table 5. Lake County Average TSI phosphorus (TSIp) Ranking 2000-2014.

RANK	LAKE NAME	TP AVE	TSIp
54	College Trail Lake	0.0500	60.56
55	Hastings Lake	0.0520	61.13
56	Butler Lake	0.0530	61.40
57	West Meadow Lake	0.0530	61.40
58	Wooster Lake	0.0530	61.40
59	Lucy Lake	0.0550	61.94
60	Lake Linden	0.0570	62.45
61	Lake Christa	0.0580	62.70
62	Owens Lake	0.0580	62.70
63	Briarcrest Pond	0.0580	63.00
64	Lake Barrington	0.0600	63.10
65	Redhead Lake	0.0608	63.20
66	Lake Lakeland Estates	0.0620	63.66
67	Lake Naomi	0.0620	63.66
68	Lake Tranquility (S1)	0.0620	63.66
69	Lake Catherine	0.0620	63.76
70	Liberty Lake	0.0630	63.89
71	North Tower Lake	0.0630	63.89
72	Werhane Lake	0.0630	63.89
73	Countryside Glen Lake	0.0640	64.12
74	Davis Lake	0.0650	64.34
75	Leisure Lake	0.0650	64.34
76	St. Mary's Lake	0.0670	64.78
77	Channel Lake	0.0680	64.91
78	Buffalo Creek Reservoir 1	0.0680	65.00
79	Mary Lee Lake	0.0680	65.00
80	Little Bear Lake	0.0680	65.00
81	Timber Lake (South)	0.0720	65.82
82	Lake Helen	0.0720	65.82
83	Grandwood Park Lake	0.0720	65.82
84	Crooked Lake	0.0710	66.00
85	ADID 203	0.0730	66.02
86	Broberg Marsh	0.0780	66.97
87	Redwing Slough	0.0822	67.73
88	Tower Lake	0.0830	67.87
89	Countryside Lake	0.0800	68.00
90	Lake Nippersink	0.0800	68.00
91	Woodland Lake	0.0800	68.00
92	Lake Fairview	0.0890	68.00
93	Potomac Lake	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	Pistakee Lake	0.0880	68.71
99	Rivershire Pond 2	0.0900	69.04
100	South Churchill Lake	0.0900	69.04
101	McGreal Lake	0.0910	69.20
102	Lake Charles	0.0930	69.40
103	Deer Lake	0.0940	69.66
104	Eagle Lake (S1)	0.0950	69.82
105	International Mine and Chemical Lake	0.0950	69.82
106	Valley Lake	0.0950	69.82

Table 5. Lake County Average TSI phosphorus (TSIp) Ranking 2000-2014.

RANK	LAKE NAME	TP AVE	TSIp
107	Buffalo Creek Reservoir 2	0.0960	69.97
108	Fish Lake	0.0960	69.97
109	Lochanora Lake	0.0960	69.97
110	Big Bear Lake	0.0960	69.97
111	Fox Lake	0.1000	70.52
112	Nippersink Lake - LCFP	0.1000	70.56
113	Sylvan Lake	0.1000	70.56
114	Petite Lake	0.1020	70.84
115	Longview Meadow Lake	0.1020	70.84
116	Lake Marie	0.1030	71.00
117	Dunn's Lake	0.1070	71.53
118	Lake Forest Pond	0.1070	71.53
119	Long Lake	0.1070	71.53
120	Grass Lake	0.1090	71.77
121	Spring Lake	0.1100	71.93
122	Kemper 2	0.1100	71.93
123	Bittersweet Golf Course #13	0.1100	71.93
124	Bluff Lake	0.1120	72.00
125	Middlefork Savannah Outlet 1	0.1120	72.00
126	Osprey Lake	0.1110	72.06
127	Bresen Lake	0.1130	72.32
128	Round Lake Marsh North	0.1130	72.32
129	Deer Lake Meadow Lake	0.1160	72.70
130	Lake Matthews	0.1180	72.94
131	Taylor Lake	0.1180	72.94
132	Island Lake	0.1210	73.00
133	Columbus Park Lake	0.1230	73.54
134	Echo Lake	0.1250	73.77
135	Lake Holloway	0.1320	74.56
136	Antioch Lake	0.1450	75.91
137	Lakewood Marsh	0.1510	76.50
138	Pond-A-Rudy	0.1510	76.50
139	Forest Lake	0.1540	76.78
140	Slocum Lake	0.1500	77.00
141	Middlefork Savannah Outlet 2	0.1590	77.00
142	Grassy Lake	0.1610	77.42
143	Salem Lake	0.1650	77.78
144	Half Day Pit	0.1690	78.12
145	Lake Eleanor	0.1810	79.11
146	Lake Farmington	0.1850	79.43
147	Lake Louise	0.1850	79.43
148	ADID 127	0.1890	79.74
149	Lake Napa Suwe	0.1940	80.00
150	Patski Pond	0.1970	80.33
151	Dog Bone Lake	0.1990	80.48
152	Summerhill Estates Lake	0.1990	80.48
153	Redwing Marsh	0.2070	81.05
154	Stockholm Lake	0.2082	81.13
155	Bishop Lake	0.2160	81.66
156	Ozaukee Lake	0.2200	81.93
157	Kemper 1	0.2220	82.08
158	Hidden Lake	0.2240	82.19
159	McDonald Lake 2	0.2250	82.28

Table 5. Lake County Average TSI phosphorus (TSIp) Ranking 2000-2014.

RANK	LAKE NAME	TP AVE	TSIp
160	Fischer Lake	0.2280	82.44
161	Oak Hills Lake	0.2790	85.35
162	Loch Lomond	0.2950	86.16
163	Heron Pond	0.2990	86.35
164	Rollins Savannah 1	0.3070	87.00
165	Fairfield Marsh	0.3260	87.60
166	ADID 182	0.3280	87.69
167	Slough Lake	0.3860	90.03
168	Manning's Slough	0.3820	90.22
169	Rasmussen Lake	0.4860	93.36
170	Albert Lake, Site II, outflow	0.4950	93.67
171	Flint Lake Outlet	0.5000	93.76
172	Rollins Savannah 2	0.5870	96.00
173	Almond Marsh	1.9510	113.00

Table 6. Multiparameter data for Channel Lake, 2014.

Channel Lake Multi-parameter 2014

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
5/6/2014	0.25	0.31	11.39	12.56	114.8	0.6424	9.05	3755	Surface	100%
5/6/2014	1	1.07	11.38	12.82	117.1	0.6421	8.80	3690	Surface	100%
5/6/2014	2	1.97	11.38	12.78	116.8	0.6420	8.79	159	0.22	4%
5/6/2014	3	3.01	11.36	12.71	116.1	0.6420	8.79	66	1.26	2%
5/6/2014	4	4.00	11.38	12.67	115.8	0.6420	8.80	335	2.25	9%
5/6/2014	6	6.05	11.34	12.62	115.2	0.6420	8.79	28	4.3	1%
5/6/2014	8	8.02	11.30	12.56	114.6	0.6421	8.79	15	6.27	0%
5/6/2014	10	10.02	11.24	12.43	113.3	0.6426	8.78	4	8.27	0%
5/6/2014	12	12.13	11.24	12.44	113.3	0.6425	8.78	2	10.38	0%
5/6/2014	14	14.05	11.24	12.37	112.7	0.6427	8.78	1	12.3	0%
5/6/2014	16	16.03	11.21	12.35	112.4	0.6427	8.77	1	14.28	0%
5/6/2014	18	18.05	11.22	12.28	111.8	0.6423	8.78	1	16.3	0%
5/6/2014	20	19.98	11.21	12.35	112.4	0.6427	8.78	0	18.23	0%
5/6/2014	22	22.41	11.19	12.30	112.0	0.6420	8.79	0	20.66	0%
5/6/2014	24	23.95	11.19	12.20	111.0	0.6428	8.78	0	22.2	0.0%
5/6/2014	26	26.07	11.14	12.21	110.9	0.6432	8.76	1	24.32	0.0%
5/6/2014	28	27.99	11.09	11.96	108.6	0.6436	8.74	1	26.24	0.0%
5/6/2014	30	30.02	11.06	11.73	106.4	0.6439	8.73	1	28.27	0.0%
5/6/2014	32	32.12	10.99	11.56	104.7	0.6439	8.71	1	30.37	0.0%
5/6/2014	34	34.08	10.87	11.29	102.0	0.6435	8.70	1	32.33	0.0%
5/6/2014	36	36.03	10.82	11.23	101.4	0.6420	8.70	1		

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
6/10/2014	0.25	0.27	22.08	8.97	103.0	0.6577	8.49	846	Surface	100%
6/10/2014	1	1.05	22.09	9.00	103.3	0.6576	8.49	706	Surface	100%
6/10/2014	2	2.05	22.10	9.01	103.5	0.6578	8.48	231	0.3	33%
6/10/2014	3	3.03	22.10	9.04	103.8	0.6579	8.48	116	1.28	16%
6/10/2014	4	3.97	22.10	9.03	103.7	0.6575	8.47	90	2.22	13%
6/10/2014	6	6.00	22.10	9.02	103.5	0.6575	8.47	56	4.25	8%
6/10/2014	8	8.02	22.10	8.98	103.1	0.6578	8.46	31	6.27	4%
6/10/2014	10	10.02	22.05	8.75	100.3	0.6577	8.43	18	8.27	3%
6/10/2014	12	11.99	21.67	7.11	80.9	0.6590	8.29	10	10.24	1%
6/10/2014	14	13.95	20.48	3.19	35.5	0.6613	7.91	7	12.2	1%
6/10/2014	16	16.00	18.87	0.29	3.0	0.6658	7.74	4	14.25	1%
6/10/2014	18	18.03	17.17	0.14	1.4	0.6672	7.74	3	16.28	0%
6/10/2014	20	20.01	14.92	0.06	0.6	0.6711	7.66	2	18.26	0%
6/10/2014	22	22.02	14.13	0.06	0.6	0.6705	7.64	2	20.27	0%
6/10/2014	24	23.96	13.69	0.05	0.5	0.6722	7.61	1	22.21	0%
6/10/2014	26	25.99	13.08	0.05	0.5	0.6773	7.52	1	24.24	0%
6/10/2014	28	27.98	12.59	0.05	0.5	0.6816	7.42	1	26.23	0%
6/10/2014	30	30.02	12.00	0.04	0.4	0.6952	7.28	1	28.27	0%
6/10/2014	32	31.99	11.65	0.05	0.5	0.7072	7.20	1	30.24	0%
6/10/2014	34	34.03	11.47	0.05	0.4	0.7118	7.15	0	32.28	0%
6/10/2014	36	35.99	11.36	0.04	0.4	0.7175	7.13	1	34.24	0%

Table 6. Multiparameter data for Channel Lake, 2014.

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
70814	0.25	0.52	25.14	9.49	116.9	0.6486	8.42	4986	Surface	100%
70814	1	1.06	25.15	9.52	117.2	0.6488	8.42	3883	Surface	100%
70814	2	1.91	25.13	9.54	117.4	0.6495	8.42	408	0.16	11%
70814	3	2.97	25.12	9.50	116.9	0.6488	8.41	822	1.22	21%
70814	4	4.03	25.10	9.49	116.7	0.6490	8.42	601	2.28	15%
70814	6	5.93	25.06	9.51	116.8	0.6498	8.41	218	4.18	6%
70814	8	7.95	25.06	9.44	116.1	0.6500	8.41	91	6.2	2%
70814	10	10.02	24.35	9.00	109.2	0.6529	8.19	38	8.27	1%
70814	12	11.97	23.60	6.49	77.6	0.6524	7.96	12	10.22	0%
70814	14	13.97	23.30	4.67	55.6	0.6544	7.84	3	12.22	0%
70814	16	16.00	22.68	1.51	17.7	0.6555	7.64	1	14.25	0%
70814	18	17.89	21.80	0.10	1.2	0.6654	7.60	0	16.14	0%
70814	20	20.10	17.42	0.06	0.7	0.7122	7.50	0	18.35	0%
70814	22	21.93	15.97	0.06	0.6	0.7218	7.45	0	20.18	0%
70814	24	24.05	15.05	0.05	0.5	0.7290	7.40	0	22.3	0%
70814	26	26.03	14.37	0.05	0.5	0.7327	7.37	1	24.28	0%
70814	28	28.01	13.46	0.05	0.5	0.7443	7.28	0	26.26	0%
70814	30	30.02	12.36	0.05	0.4	0.7661	7.16	1	28.27	0%
70814	32	31.99	12.01	0.05	0.4	0.7774	7.11	1	30.24	0%
									-1.75	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
8/12/2014	0.5	0.37	24.36	8.23	101.5	0.6264	8.57	1010	Surface	100%
8/12/2014	1	1.03	24.35	8.24	101.7	0.6260	8.57	887	Surface	100%
8/12/2014	2	2.03	24.37	8.26	102.0	0.6262	8.57	332	0.28	37%
8/12/2014	3	3.06	24.38	8.22	101.4	0.6259	8.57	97	1.31	11%
8/12/2014	4	3.98	24.38	8.21	101.3	0.6260	8.57	63	2.23	7%
8/12/2014	6	6.01	24.36	8.31	102.5	0.6260	8.57	12	4.26	1%
8/12/2014	8	7.97	24.38	8.16	100.7	0.6257	8.56	4	6.22	0%
8/12/2014	10	10.08	24.36	8.17	100.8	0.6253	8.57	1	8.33	0%
8/12/2014	12	11.96	24.37	7.99	98.5	0.6265	8.55	1	10.21	0%
8/12/2014	14	13.99	24.32	5.72	70.6	0.6264	8.42	1	12.24	0%
8/12/2014	16	15.96	23.25	0.80	9.7	0.6399	7.88	0	14.21	0%
8/12/2014	18	18.02	22.68	0.02	0.3	0.6433	7.74	1	16.27	0%
8/12/2014	20	19.96	21.23	0.09	1.0	0.6506	7.60	1	18.21	0%
8/12/2014	22	22.02	19.36	0.00	0.0	0.6669	7.44	0	20.27	0%
8/12/2014	24	23.98	17.30	0.06	0.7	0.6846	7.30	1	22.23	0%
8/12/2014	26	26.04	15.83	0.04	0.4	0.6964	7.25	1	24.29	0%
8/12/2014	28	28.15	14.56	0.05	0.5	0.7083	7.19	1	26.4	0%
8/12/2014	30	29.81	13.74	0.07	0.7	0.7205	7.12	1	28.06	0%
8/12/2014	32	31.96	12.75	0.04	0.4	0.7489	7.02	1	30.21	0%
8/12/2014	34	34.16	12.44	0.05	0.5	0.7586	6.99	1	32.41	0%
8/12/2014	36	36.01	12.22	0.04	0.3	0.7684	6.96	0		

Table 6. Multiparameter data for Channel Lake, 2014.

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	BGA	Depth of Light Meter feet	% Light Transmission Average
9/16/2014	0.25	0.25	18.49	7.82	83.5	0.6220	8.05	47324	Surface	100%
9/16/2014	1	1.00	18.39	7.72	82.1	0.6230	8.02	54220	Surface	100%
9/16/2014	2	2.00	18.06	7.48	79.0	0.6230	7.94	59653	0.25	110%
9/16/2014	3	3.00	17.76	6.90	72.2	0.6240	7.90	61532	1.25	113%
9/16/2014	4	4.00	17.73	6.49	67.2	0.6240	7.89	58927	2.25	109%
9/16/2014	6	6.00	17.70	5.85	61.4	0.6240	7.84	58516	4.25	108%
9/16/2014	8	8.00	17.69	5.81	61.1	0.6240	7.82	60004	6.25	111%
9/16/2014	10	10.00	17.67	5.62	59.0	0.6240	7.82	58840	8.25	109%
9/16/2014	12	12.00	17.65	5.66	59.5	0.6240	7.83	57986	10.25	107%
9/16/2014	14	14.00	17.61	4.77	49.8	0.6260	7.76	55190	12.25	102%
9/16/2014	16	16.00	17.54	3.77	38.8	0.6300	7.66	56385	14.25	104%
9/16/2014	18	18.00	17.47	3.62	37.9	0.6310	7.64	55629	16.25	103%
9/16/2014	20	20.00	17.43	1.41	14.9	0.6370	7.46	43662	18.25	81%
9/16/2014	22	22.00	17.29	3.14	34.2	0.6300	7.57	56744	20.25	105%
9/16/2014	24	24.00	17.27	4.33	45.5	0.6270	7.64	55759	22.25	103%
9/16/2014	26	26.00	16.87	5.72	59.3	0.6220	7.75	57126	24.25	105.4%
9/16/2014	28	28.00	16.52	0.80	8.5	0.6710	7.18	21026	26.25	38.78%
9/16/2014	30	30.00	13.67	0.70	6.5	0.7830	6.82	12820	28.25	23.6%
9/16/2014	32	32.00	12.73	0.46	4.3	0.8060	6.69	12046	30.25	22.2%
9/16/2014	34	34.00	12.39	0.39	3.7	0.8210	6.61	15796	32.25	29.1%
9/16/2014	36	36.00	12.32	0.36	3.2	0.8270	6.55	23072	34.25	42.6%

Figure 4. Channel Lake VLMP Secchi Data 2002, 2011 – 2014.

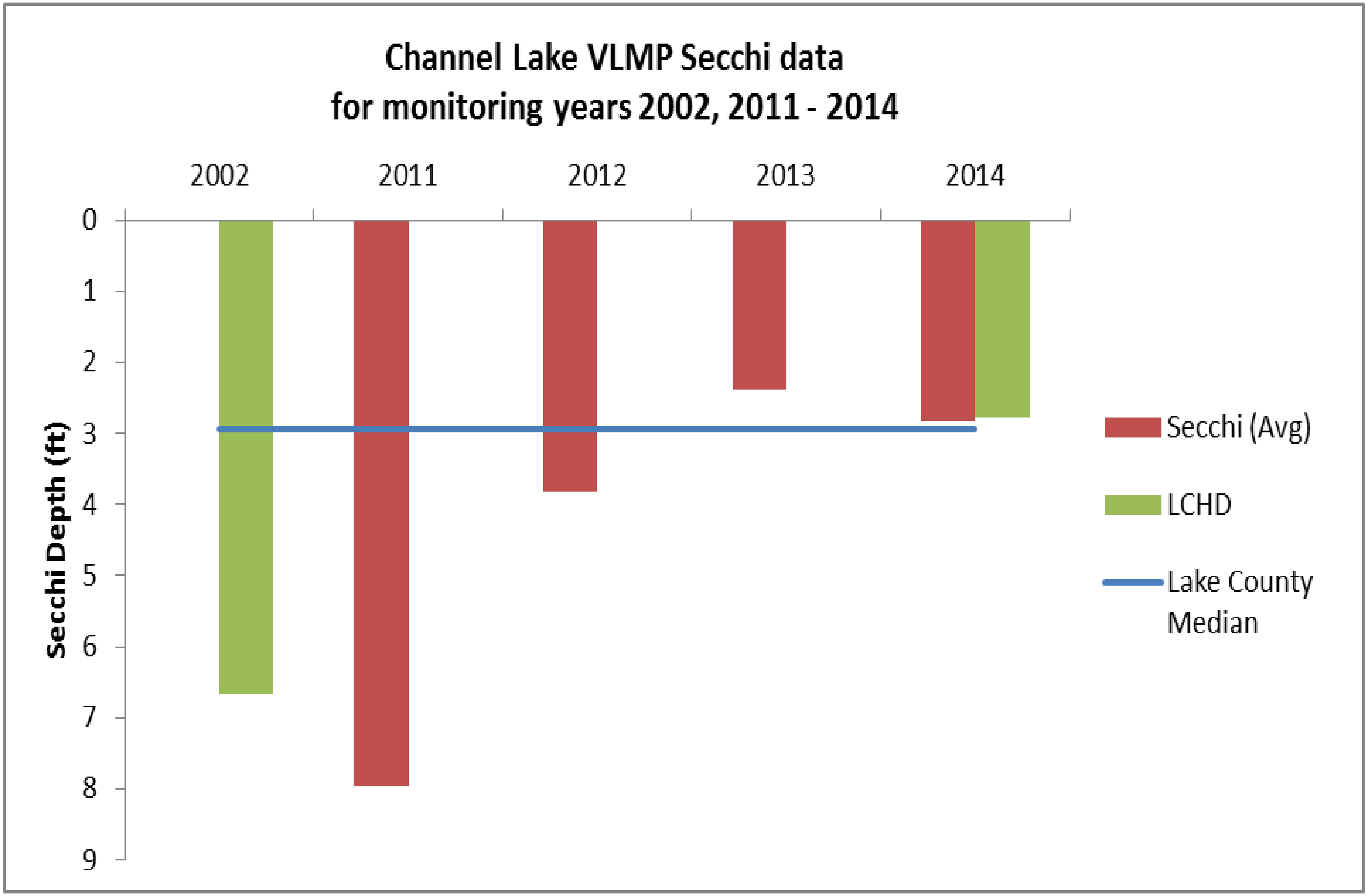

Figure 5. Monthly TP Concentrations measured in Channel Lake in 2002 and 2014 compared to Illinois EPA General Use Standard.

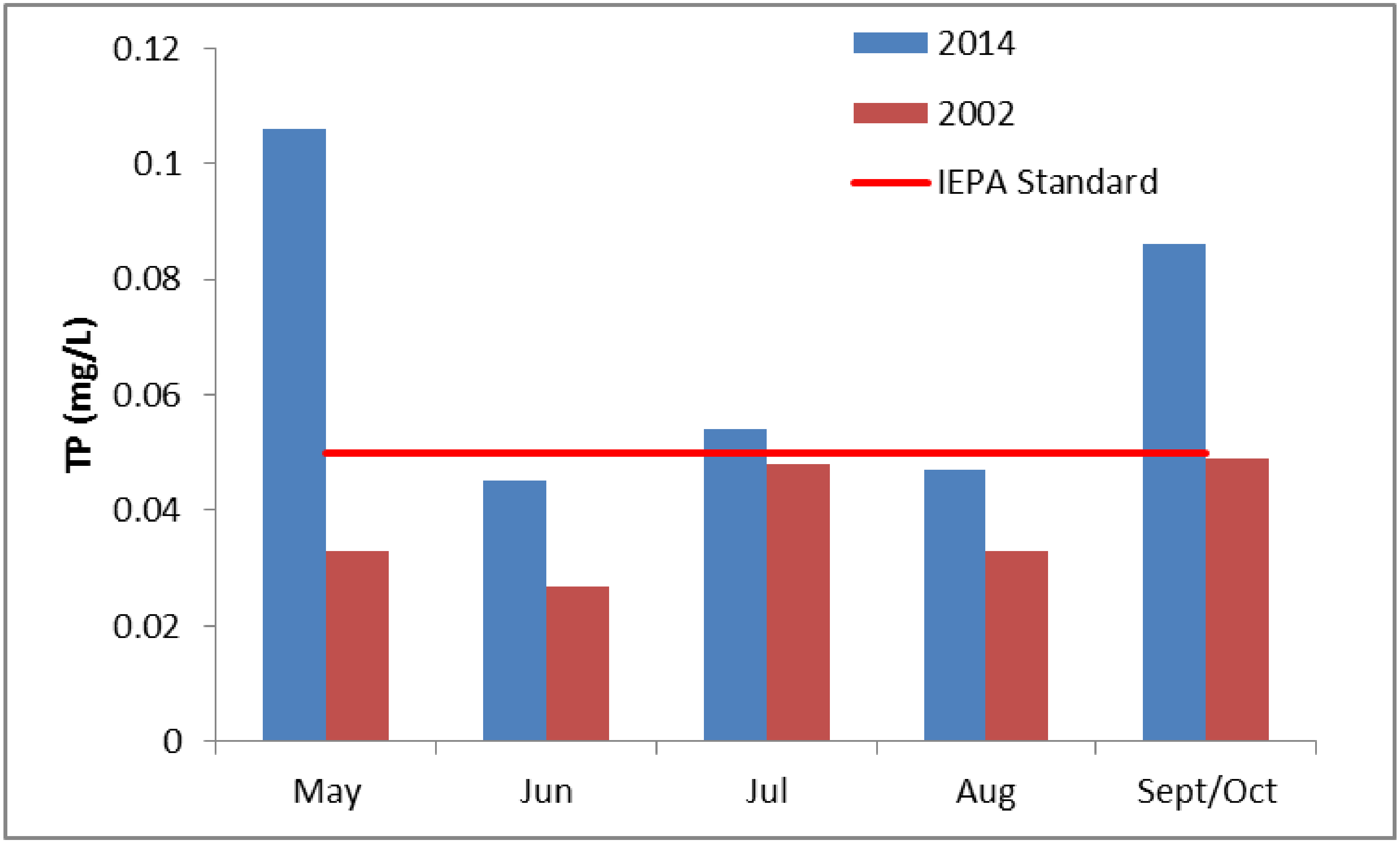

Table 7. Estimated Species Cover, Frequency, and Relative Importance per species for Lake Catherine, 2014.

Common Name	Scientific Name	Average Cover	Frequency	Relative Importance
Coontail	***Ceratophyllum demersum***	13.10	36.56	72.96
White Water Lily	***Nymphaea odorata***	4.04	11.45	22.64
Star Duckweed	***Lemna trisulca***	3.56	12.78	22.24
Common Duckweed	***Lemna minor***	2.98	12.78	20.39
Water Meal	***Wolffia spp.***	1.74	10.57	14.53
Curlyleaf Pondweed	***Potamogeton crispus***	1.61	7.93	11.86
Flat-stemmed Pondweed	***Potamogeton zosteriformis***	1.32	7.93	10.94
Sago Pondweed	***Stuckenia pectinata***	0.74	7.49	8.70
Eurasian Watermilfoil	***Myriophyllum spicatum***	1.09	5.29	7.99
Common Bladderwort	***Utricularia vulgaris***	0.76	3.96	5.79
Chara (macroalgae)	***Chara spp.***	0.26	1.32	1.97
	Total Average Cover	**31.19**		

Cover Abundance Scale	
Scale	Estimated Cover
0	No Plants
1	1%-10%
2	11% - 40%
3	41% - 60%
4	61% - 90%
5	≥ 91%

Figure 6. Estimated abundance and location of submersed aquatic vegetation found in Channel Lake, 2014.

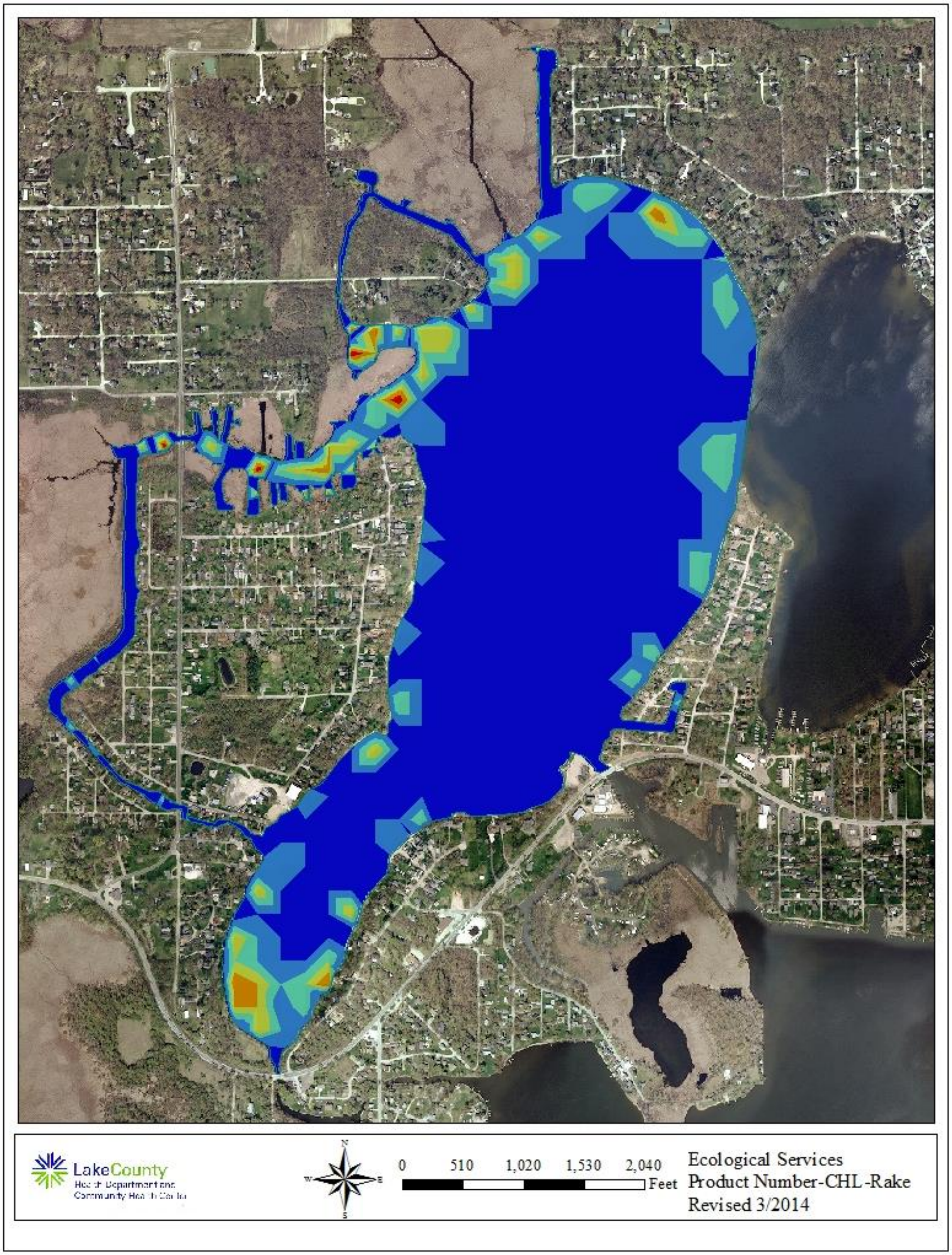

Table 8. Lake County average Floristic Quality Index ranking 2000 – 2014.

RANK	LAKE NAME	FQI (w/A)	FQI (native)
1	Cedar Lake	37.4	38.9
2	East Loon Lake	34.7	36.1
3	Cranberry Lake	29.7	29.7
4	Deep Lake	29.7	31.2
5	Little Silver Lake	29.6	31.6
6	Round Lake Marsh North	29.1	29.9
7	West Loon Lake	27.1	29.5
8	Sullivan Lake	26.9	28.5
9	Bangs Lake	26.2	27.8
10	Third Lake	25.1	22.5
11	Fourth Lake	24.7	27.1
12	Independence Grove	24.6	27.5
13	Sterling Lake	24.5	26.9
14	Sun Lake	24.3	26.1
15	Lake Zurich	24.3	27.1
16	Redwing Slough	24.0	25.8
17	Schreiber Lake	23.9	24.8
18	Lakewood Marsh	23.8	24.7
19	Deer Lake	23.5	24.4
20	Round Lake	23.5	25.9
21	Pistakee Lake	23.5	25.2
22	Lake Marie	23.5	25.2
23	Honey Lake	23.3	25.1
24	Lake of the Hollow	23.0	24.8
25	Cross Lake	22.4	24.2
26	Nippersink Lake (Fox Chain)	22.4	23.2
27	Countryside Glen Lake	21.9	22.8
28	Grass Lake	21.5	22.2
29	Davis Lake	21.4	21.4
30	Butler Lake	21.4	23.1
31	Lake Barrington	21.2	21.2
32	Duck Lake	21.1	22.9
33	Timber Lake (North)	20.9	23.4
34	Lake Catherine	20.8	21.8
35	ADID 203	20.5	20.5
36	Broberg Marsh	20.5	21.4
37	McGreal Lake	20.2	22.1
38	Fox Lake	20.2	21.2
39	Lake Kathryn	19.6	20.7
40	Fish Lake	19.3	21.2
41	Druce Lake	19.1	21.8
42	Turner Lake	18.6	21.2
43	Wooster Lake	18.5	20.2
44	Salem Lake	18.5	20.2
45	Lake Helen	18.0	18.0
46	Old Oak Lake	18.0	19.1
47	Potomac Lake	17.8	17.8
48	Redhead Lake	17.7	18.7
49	Long Lake	17.7	15.8
50	Hendrick Lake	17.7	17.7
51	Rollins Savannah 2	17.7	17.7
52	Grandwood Park Lake	17.2	19.0
53	Seven Acre Lake	17.0	15.5
54	Lake Miltmore	16.8	18.7
55	Petite Lake	16.8	18.7
56	Channel Lake	16.8	18.7
57	McDonald Lake 1	16.7	17.7
58	Highland Lake	16.7	18.9

Table 8. Lake County average Floristic Quality Index ranking 2000 – 2014.

RANK	LAKE NAME	FQI (w/A)	FQI (native)
59	Bresen Lake	16.6	17.8
60	Almond Marsh	16.3	17.3
61	Owens Lake	16.3	17.3
62	Windward Lake	16.3	17.6
63	Grays Lake	16.1	16.1
64	White Lake	16.0	17.0
65	Dunn’s Lake	15.9	17.0
66	Dog Bone Lake	15.7	15.7
67	Osprey Lake	15.5	17.3
68	Heron Pond	15.1	15.1
69	North Churchill Lake	15.0	15.0
70	Hastings Lake	15.0	17.0
71	Lake Tranquility (S1)	15.0	17.0
72	Forest Lake	14.8	15.9
73	Dog Training Pond	14.7	15.9
74	Grand Ave Marsh	14.3	16.3
75	Nippersink Lake	14.3	16.3
76	Taylor Lake	14.3	16.3
77	Manning's Slough	14.1	16.3
78	Tower Lake	14.0	14.0
79	Dugdale Lake	14.0	15.1
80	Eagle Lake (S1)	14.0	15.1
81	Crooked Lake	14.0	16.0
82	Spring Lake	14.0	15.2
83	Lake Matthews	13.9	15.5
84	Longview Meadow Lake	13.9	13.9
85	Bishop Lake	13.4	15.0
86	Ames Pit	13.4	15.5
87	Mary Lee Lake	13.1	15.1
88	Old School Lake	13.1	15.1
89	Summerhill Estates Lake	12.7	13.9
90	Buffalo Creek Reservoir 1	12.5	11.4
91	Buffalo Creek Reservoir 2	12.5	11.4
92	McDonald Lake 2	12.5	12.5
93	Rollins Savannah 1	12.5	12.5
94	Stone Quarry Lake	12.5	12.5
95	Kemper Lake 1	12.2	13.4
96	Pond-A-Rudy	12.1	12.1
97	Stockholm Lake	12.1	13.5
98	Lake Carina	12.1	14.3
99	Lake Leo	12.1	14.3
100	Lambs Farm Lake	12.1	14.3
101	Grassy Lake	12.0	12.0
102	Flint Lake Outlet	11.8	13.0
103	Albert Lake	11.5	10.3
104	Rivershire Pond 2	11.5	13.3
105	Antioch Lake	11.3	13.4
106	Hook Lake	11.3	13.4
107	Briarcrest Pond	11.2	12.5
108	Lake Naomi	11.2	12.5
109	Pulaski Pond	11.2	12.5
110	Lake Napa Suwe	11.0	11.0
111	Redwing Marsh	11.0	11.0
112	West Meadow Lake	11.0	11.0
113	Lake Minear	11.0	13.9
114	Nielsen Pond	10.7	12.0
116	Sylvan Lake	10.6	10.6
117	Gages Lake	10.2	12.5

Table 8. Lake County average Floristic Quality Index ranking 2000 – 2014.

RANK	LAKE NAME	FQI (w/A)	FQI (native)
118	College Trail Lake	10.0	10.0
119	Valley Lake	9.9	9.9
120	Werhane Lake	9.8	12.0
121	Loch Lomond	9.4	12.1
122	Columbus Park Lake	9.2	9.2
123	Lake Lakeland Estates	9.2	9.2
124	Waterford Lake	9.2	9.2
125	Bluff Lake	9.1	11.0
126	Lake Fairfield	9.0	10.4
127	Lake Louise	9.0	10.4
128	Fischer Lake	9.0	11.0
129	Lake Fairview	8.5	6.9
130	Timber Lake (South)	8.5	6.9
131	East Meadow Lake	8.5	8.5
132	South Churchill Lake	8.5	8.5
133	Kemper Lake 2	8.5	9.8
134	Lake Christa	8.5	9.8
135	Lake Farmington	8.5	9.8
136	Lucy Lake	8.5	9.8
137	Bittersweet Golf Course #13	8.1	8.1
138	Lake Linden	8.0	8.0
139	Sand Lake	8.0	10.4
140	Countryside Lake	7.7	11.5
141	Fairfield Marsh	7.5	8.7
142	Lake Eleanor	7.5	8.7
143	Banana Pond	7.5	9.2
144	Slocum Lake	7.1	5.8
145	Lucky Lake	7.0	7.0
146	North Tower Lake	7.0	7.0
147	Lake Forest Pond	6.9	8.5
148	Ozaukee Lake	6.7	8.7
149	Leisure Lake	6.4	9.0
150	Peterson Pond	6.0	8.5
151	Little Bear Lake	5.8	7.5
152	Deer Lake Meadow Lake	5.2	6.4
153	ADID 127	5.0	5.0
154	Island Lake	5.0	5.0
155	Liberty Lake	5.0	5.0
156	Oak Hills Lake	5.0	5.0
157	Slough Lake	5.0	5.0
158	International Mining and Chemical Lake	5.0	7.1
159	Diamond Lake	3.7	5.5
160	Lake Charles	3.7	5.5
161	Big Bear Lake	3.5	5.0
162	Sand Pond (IDNR)	3.5	5.0
163	Harvey Lake	3.3	5.0
164	Half Day Pit	2.9	5.0
165	Lochanora Lake	2.5	5.0
166	Echo Lake	0.0	0.0
167	Hidden Lake	0.0	0.0
168	St. Mary's Lake	0.0	0.0
169	Willow Lake	0.0	0.0
170	Woodland Lake	0.0	0.0
	Mean	**14.1**	**15.2**
	Median	**13.4**	**15.0**