LAKE ZURICH
LAKE MANAGEMENT PLAN
2022



4/10/2023

Protecting LAKE ZURICH for today & tomorrow

Acknowledgements

Our biggest asset in Lake Zurich is our lake. It provides the community with its name, its aesthetic advantage, recreation, wildlife and natural beauty, and a unique setting within proximity of a major metro center.

Since the early days of the community, the lake has played an important role. This manual was developed to ensure that residents from all sectors of the community understand their role and share responsibility to enjoy, manage, and contribute to the protection of this asset for generations to come. This document also is intended to be a living and dynamic guide and reference to help protect this natural asset and habitat as well as encourage participation in maintaining the overall health and beauty of the lake.

Specials thanks to Tracy Baldaccini, Paul Dawidczyk, Terry Herlihy, Larissa Klavins, Teresa Lach, Dave Mock, Alaina Murawski, and Lee Plate of the Lake Property Owner's Association (LPOA) Lake Management Planning Committee (LMP) for their assistance and significant effort in creating and developing the Lake Zurich Lake Management Plan.

Thank you to Lee Plate of the LPOA's Aquatic Plant Control Committee, Paul Dawidczyk for overseeing all ongoing water quality testing activities, Dave Mock for leading and monitoring an abundant fishery life, and Terry Herlihy of the Safe Capacity Watercraft Limits Committee.

Thank you also to Lake County Health Department. Since 1976, the Lake County Health Department Lakes Management Committee (now Population Health) has been conducting studies and providing guidance to lake owners throughout Lake County, Illinois. Every five years, Lake County Health Department performs extensive testing and analysis of most lakes in the county. With the LPOA's encouragement and support, Lake County completed testing of Lake Zurich during the summer of 2020. The report can be found online on the Lake County website at: https://www.lakecountyil.gov/2400/Lake-Reports

This Lake Management Plan was developed by the Lake Management Planning Committee beginning in April of 2022 and completed in May 2023. This plan will serve as the foundation for future planners and reflects the current condition and assessment of the Lake. Funding of the Lake Management Plan program is accomplished through the Lake Property Owner's Association.

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EXECUTIVE SUMMARY

The Lake Zurich (LZ) Lake Management Plan is the result of a comprehensive effort spearheaded by the Lake Management Committee, one of several active volunteer committees associated with the Lake Property Owner's Association (LPOA), and with the aid of other local organizations and constituencies. The purpose of the plan is to provide a comprehensive lake management plan for Lake Zurich to guide in improving and maintaining water quality, sustaining a healthy lake ecosystem, and protecting the varied lake uses that do not always complement one another. These committees work to protect the beautiful community asset for which the Village is named.

It is the Committee's intent that the lake management plan brings together stakeholders with a common interest – the life, health, and effectiveness of the lake, whether those stakeholders are totally aware of the extent of their common bond or their part in it, or not. If they are not aware of their common interest and the part their actions play, the plan outlines ways to inform, educate and proactively participate and serves as a starting point to gain buy-in and volunteers from stakeholders. As a volunteer organization, the Lake Management Committee encourages and welcomes the contributions and involvement of stakeholders who would be interested in donating their time, energy, and brainpower.

The management goals, objectives, and activities described in this plan were ideated and developed as a collaborative effort between the Lake Property Owner's Association and the Lake Management Planning Committee. In addition to the benefits of preserving, utilizing, and enhancing this unique natural body of water, the Committee also strove to establish a common platform and interest across the many constituencies that enjoy and savor the splendors of Lake Zurich.

The Committee identified and prioritized eight focus areas for the management plan, developing and defining respective goals, objectives, and action items for each focus area respectively. Overall, the goals focus on best management practices that will achieve a healthy lake ecosystem, facilitate high levels of water quality, support multi-use recreational activities, and encourage pride of ownership and adoption of these strategies and actions by all stakeholders, including residents, visitors, and local municipalities. The goals also aim to retain the highly valued lake aesthetic and all that Lake Zurich offers to the community, at large.

Each section provides a description of the important features and characteristics of the factor, as well as data and information about Lake Zurich's respective baseline, aspects, activities, issues, and challenges. The sections are as follows:

- Water Quality
- Aquatic Plants / Vegetation
- Shoreland Buffer and Impacts
- Fisheries Management Plans
- Water Quantity / Levels
- Recreation
- Communications / Organization
- Partners / Resources / Stakeholders

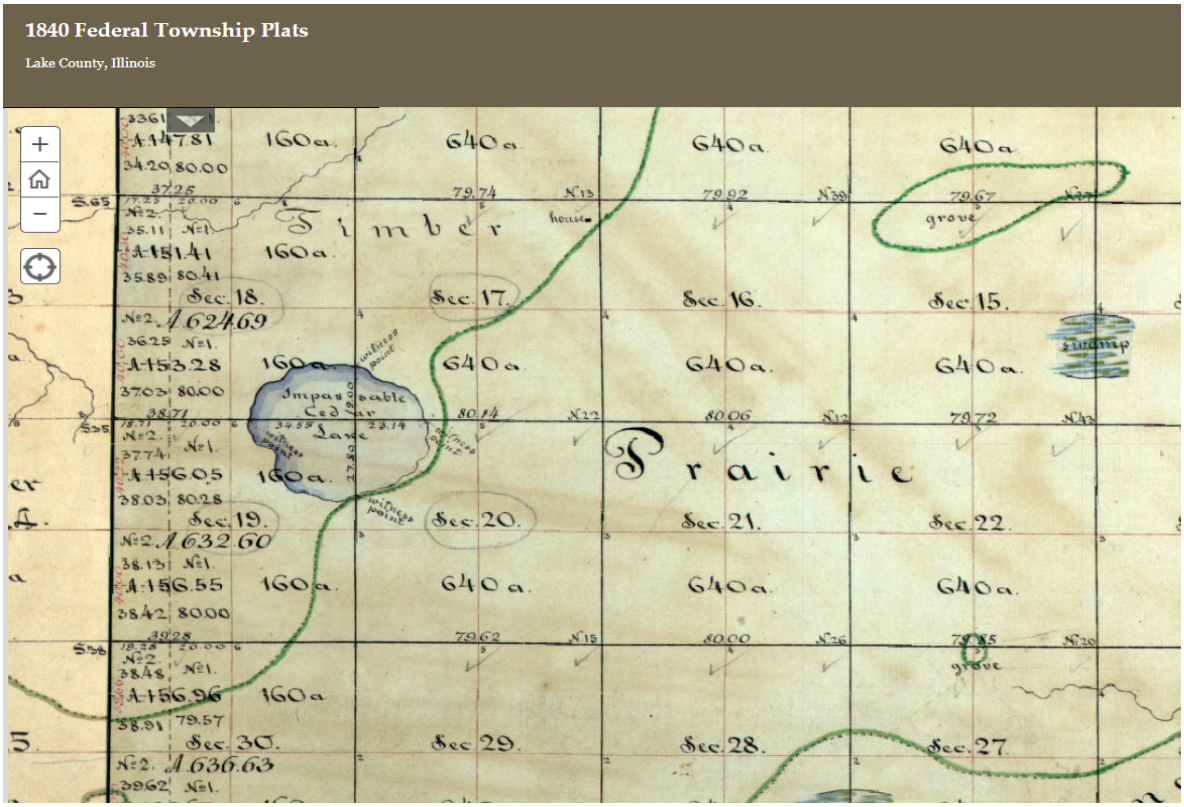
The plan is intended to be a living and dynamic document that may expand to include other focus areas, as deemed appropriate, and will be evaluated on a regular basis and updated as necessary to ensure goals and community expectations are being met.

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2022

PROTECTING LAKE ZURICH FOR TODAY & TOMORROW

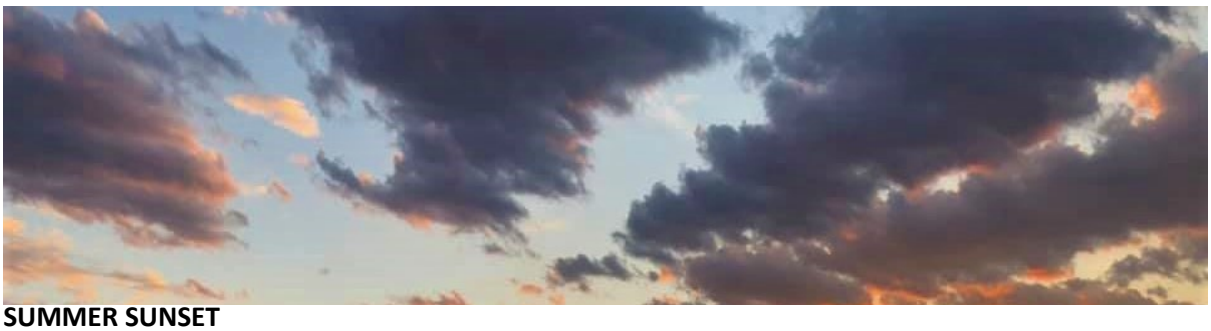
INTRODUCTION

Lake Zurich is located in the village of Lake Zurich, Illinois, a northwest suburb of Chicago in southwestern Lake County, Illinois about forty miles from downtown Chicago. The village of Lake Zurich has a population of 19,759 (2020 US Census). The area was first settled by Native Americans prior to European settlers, beginning with Seth Paine, an early pioneer, who settled land east of the lake around 1836. The original Lake was named Cedar Lake but there was another lake in the County of the same name and thus Paine named his settlement Lake Zurich, consequently renaming the lake, Lake Zurich.



1840 FEDERAL TOWNSHIP PLATS – SOURCE: HTTPS://MAPS.LAKECOUNTYIL.GOV

Lake Zurich is a natural 232-acre glacial lake and is popular for family recreation, motorized and non-motorized water sports, and fishing. The shoreline measures 2.80 miles around its full perimeter. Properties around the lake include single family residential homes, townhomes, and multi-family subdivisions and private associations, as well as two parks and beaches owned and operated by the Village of Lake Zurich. The lake is managed by the Lake Property Owner's Association (LPOA), a volunteer organization made up of lake property owners and residents.



SUMMER SUNSET



Overarching Lake Vision

Lake Zurich is a focal point for the community, where residents, visitors, and local businesses enjoy its unique natural features and resources. The lake is valued for its varied recreational uses and beauty by families and friends.

The overall mission of this comprehensive lake management plan is to balance all the uses and demands on our precious natural resource with the goal of ultimately preserving, promoting, and enhancing clean water, high quality habitat for fish, aquatic plants, waterfowl, and wildlife species, to benefit the residents of the region with access to varied recreational activities and sport fishing for decades to come.



SUMMER SUNRISE ON LAKE ZURICH



WINTER SUNSET FROM BREEZEWALD PARK



SNOW SWANS

Lake Facts

Following are summary data points providing an overview of qualities of Lake Zurich that are typically gathered and used to understand the features and characteristics of a lake. Information was collected from Lake County Health Department's 2020 Lake Zurich Summary Report, maps, and generally accepted public facts. Additional information can be found through Lake County's Lakes Management Unit website: https://www.lakecountyil.gov/2381/Lakes-Management-Unit

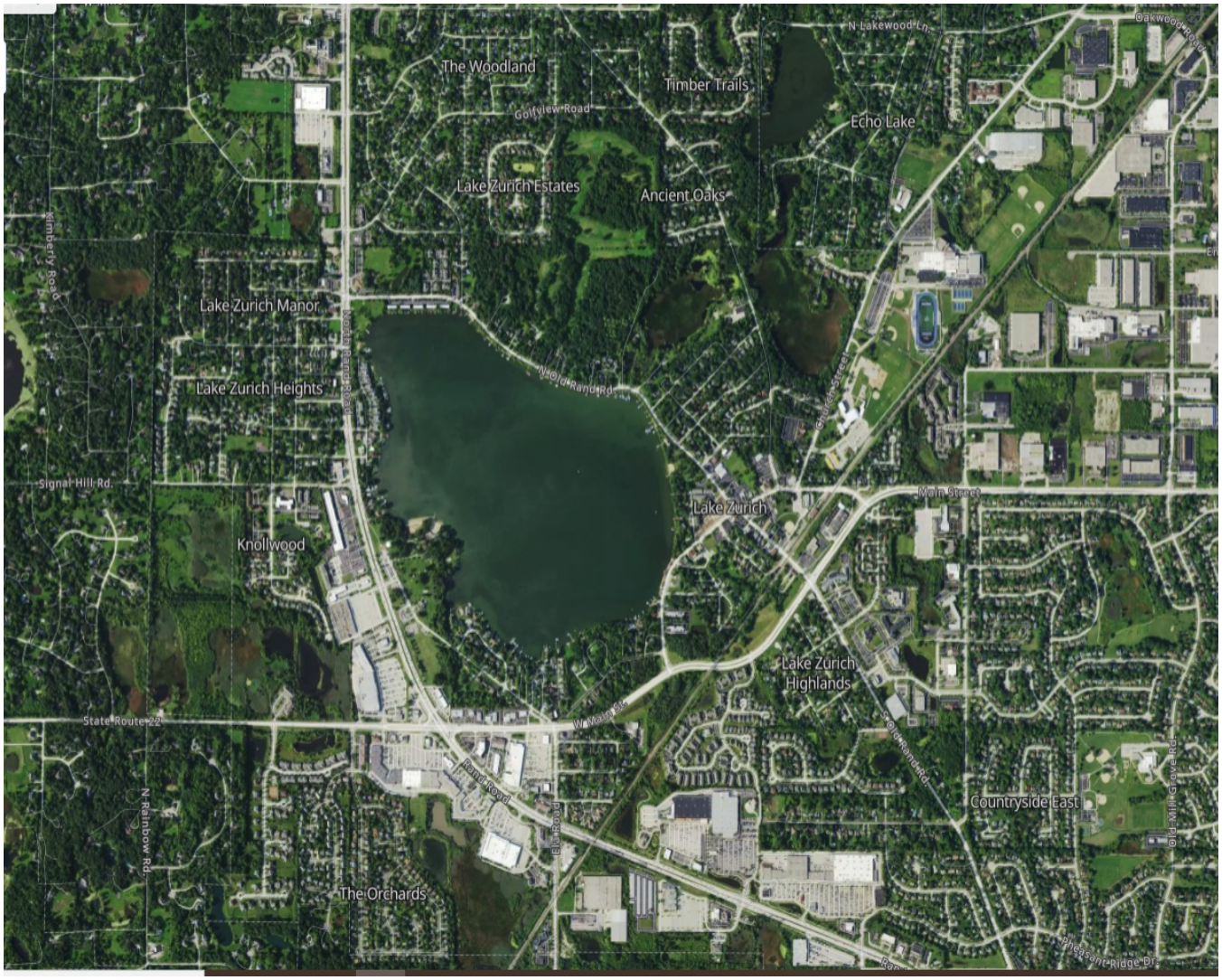
TABLE 1. LAKE IDENTIFICATION, LOCATION, AND MORPHOMETRY

Lake Name / County	Lake Zurich / Lake County
Illinois EPA Lake Code	IL_RTS
Lake Type / Year Constructed	Glacial
Major Watershed	Fox River Watershed HUC Number: 07120006 HUC Name: Upper Fox
Sub-Watershed	Flint Creek
Major Inflowing Tributaries	None
Receiving Waterbody	Unnamed tributary to Echo Lake
Ownership (lake bottom)	Private, Village of Lake Zurich, and Lake Zurich Lions Club
Lake Elevation (feet above MSL)[a]	843.55 feet above MSL
Surface Area[a]	232.3 acres
Maximum Depth [a]	33.0 feet
Average Depth[a]	7.0 feet
Lake Volume Estimate[a]	1,600 – 2,200 acre-feet
Shoreline Length[a]	2.80 miles (14,784 feet)
Maximum Fetch[a]	East/West 3,710 ft.; North/South 4.654 ft.
Watershed Area[a]	605 acres (0.95 sq mi)
Watershed to Lake Ratio	3:1
Average Water Residence Time	3.43 years (1,253.03 days)
Flushing Time	0.32 times per year (estimated & variable)

Data sources: a) Lake County Health Department 2020 Lake Zurich Summary Report

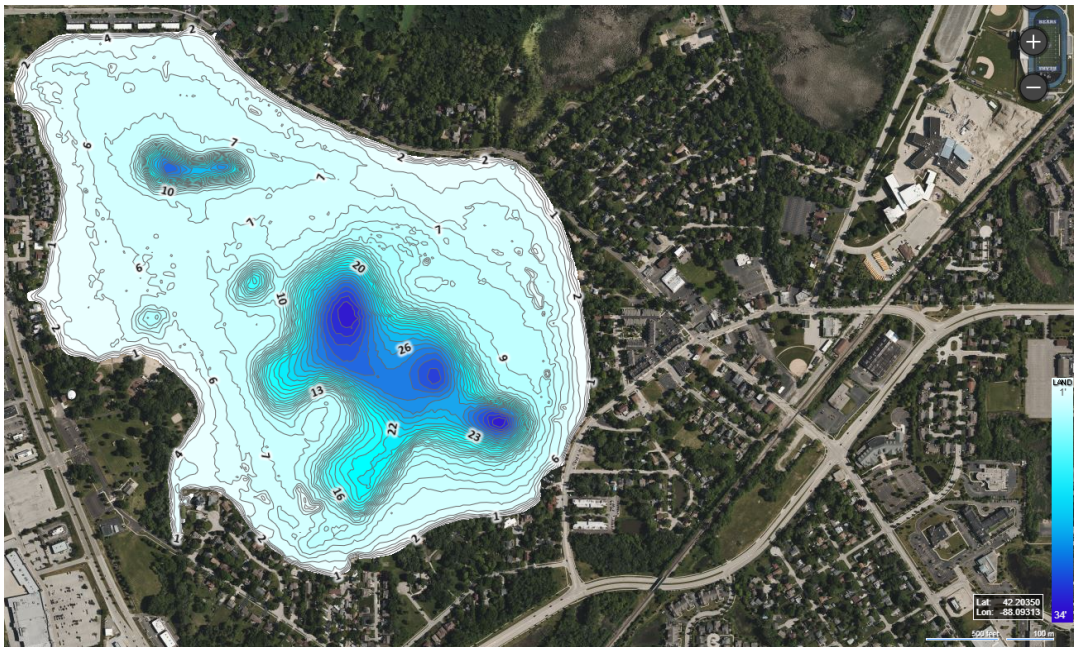
Aerial view of Lake Zurich in its more recent development phase (Google Maps 2020) prior to the construction of LifeTime fitness center and The Sanctuary (northeast and southeast corners of Rand Road and Old Rand Road, respectively).

FIGURE 1. AERIAL VIEW OF LAKE ZURICH – SOURCE: GOOGLE MAPS 2021


The Woodland
Timber Trails
Golfview Road
Echo Lake
Lake Zurich Estates
Ancient Oaks
N Lakewood Ln
Oakwood Road
Lake Zurich Manor
Lake Zurich Heights
N Old Rand Rd
Quentin Road
Signal Hill Rd.
Main Street
Lake Zurich
Knollwood
Lake Zurich Highlands
State Route 22
W Main St
Old Rand Rd
Countryside East
Pleasant Ridge Dr
The Orchards

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

FIGURE 2. BATHYMETRIC MAP OF LAKE ZURICH, 2021



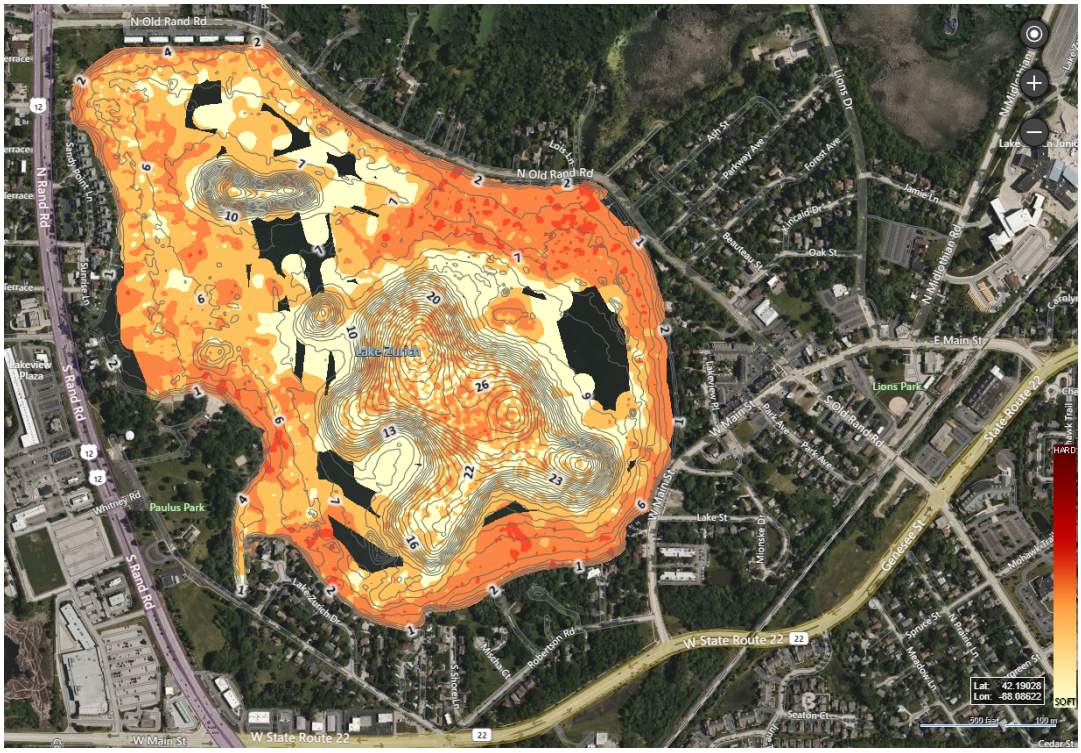


FIGURE 3. LAKE ZURICH COMPOSITION 2021

CURRENT CONDITIONS – WATERSHED

A watershed is an area of land where all surface water from rain, melting snow and ice, converge at a lower elevation, usually a lake, river, or other body of water. Watersheds have no political or municipal boundaries, and traverse across multiple county, village, and town jurisdictions.

The Lake Zurich watershed is 605 acres and is in the upper portion of the Flint Creek Watershed (Figure 4). The Watershed is comprised of the Fox River (major watershed) and Flint Creek (sub-watershed). Lake Zurich is at the top of the Flint Creek Watershed.

The watershed to lake ratio is important in understanding how nutrients enter the lake. Lake Zurich has a low watershed to lake ratio (3:1), which can make it easier to manage external inputs of nutrients. The retention time of Lake Zurich, meaning how long water stays in the lake, is 3.43 years. This emphasizes the importance of reducing external nutrient loads since they can remain in the water for longer periods of time.

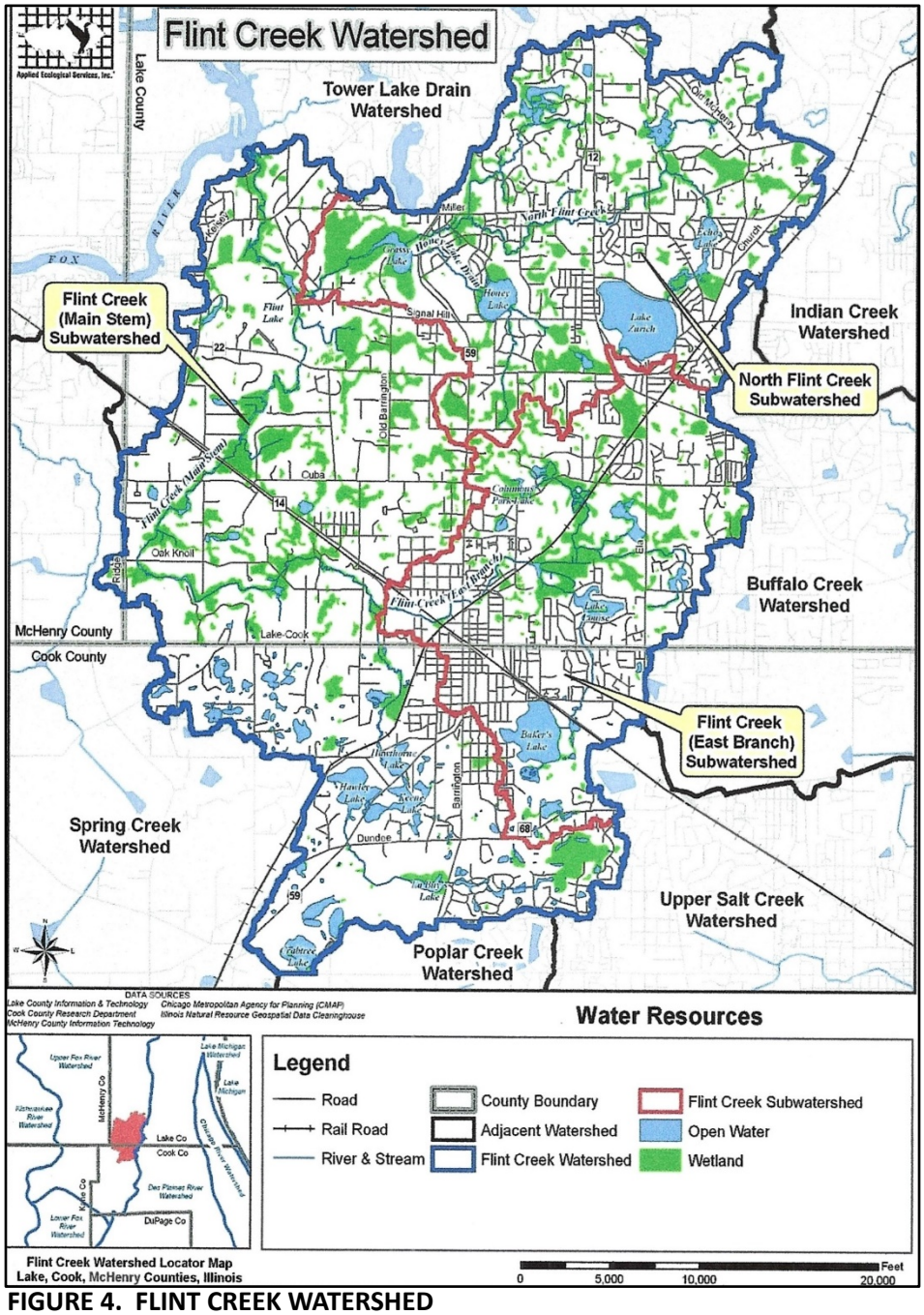


FIGURE 4. FLINT CREEK WATERSHED

Additionally, source of a lake's water supply (surrounding watersheds) and nearby land use contribute to overall water quality and health of a lake, all of which affect decisions in lake management strategies. Lake Zurich's Land Use is captured in Figure 5. For additional information about the Flint Creek Watershed, visit: https://flintcreekspringcreekwatersheds.org/

CURRENT CONDITIONS – LAND USE

Land use plays a significant role on the water quality of a lake. Based on the 2020 land use data (Table 2), the current external sources affecting Lake Zurich are from the following dominant land uses: Water (38.9%), Single-Family (21.8%), and Transportation (9.1%). As areas become more developed, that typically results in an increase in impervious surfaces, reducing the amount of open space for infiltrating and storing stormwater or excess precipitation. Impervious surfaces (i.e., parking lots, roads, buildings, compacted soils) impact water quality in lakes by increasing the volume of runoff to water bodies, bringing pollutants with them, and often increasing water temperature. During storm events, pollutants such as excess nutrients (nitrogen and phosphorus), metals, oil and grease, and bacteria are easily transferred from impervious surfaces to rivers, wetlands, and lakes.

TABLE 2. LAKE ZURICH LAND USE

Land Use	Acreage	% of Total
Disturbed Land	0.94	0.2%
Government and Institutional	22.00	3.6%
Industrial	5.90	1.0%
Multi Family	35.11	5.8%
Public and Private Open Space	73.07	12.1%
Retail/Commercial	37.42	6.2%
Single Family	132.20	21.8%
Transportation	54.76	9.1%
Water	235.17	38.9%
Wetlands	8.49	1.4%
Total Acres	**605.06**	**100.0%**

SOURCE: LAKE COUNTY HEALTH DEPARTMENT & COMMUNITY HEALTH CENTER 2020

For additional information and a robust and vast resource of historical data, visit Lake County, Illinois' online maps website: https://maps.lakecountyil.gov/mapsonline/

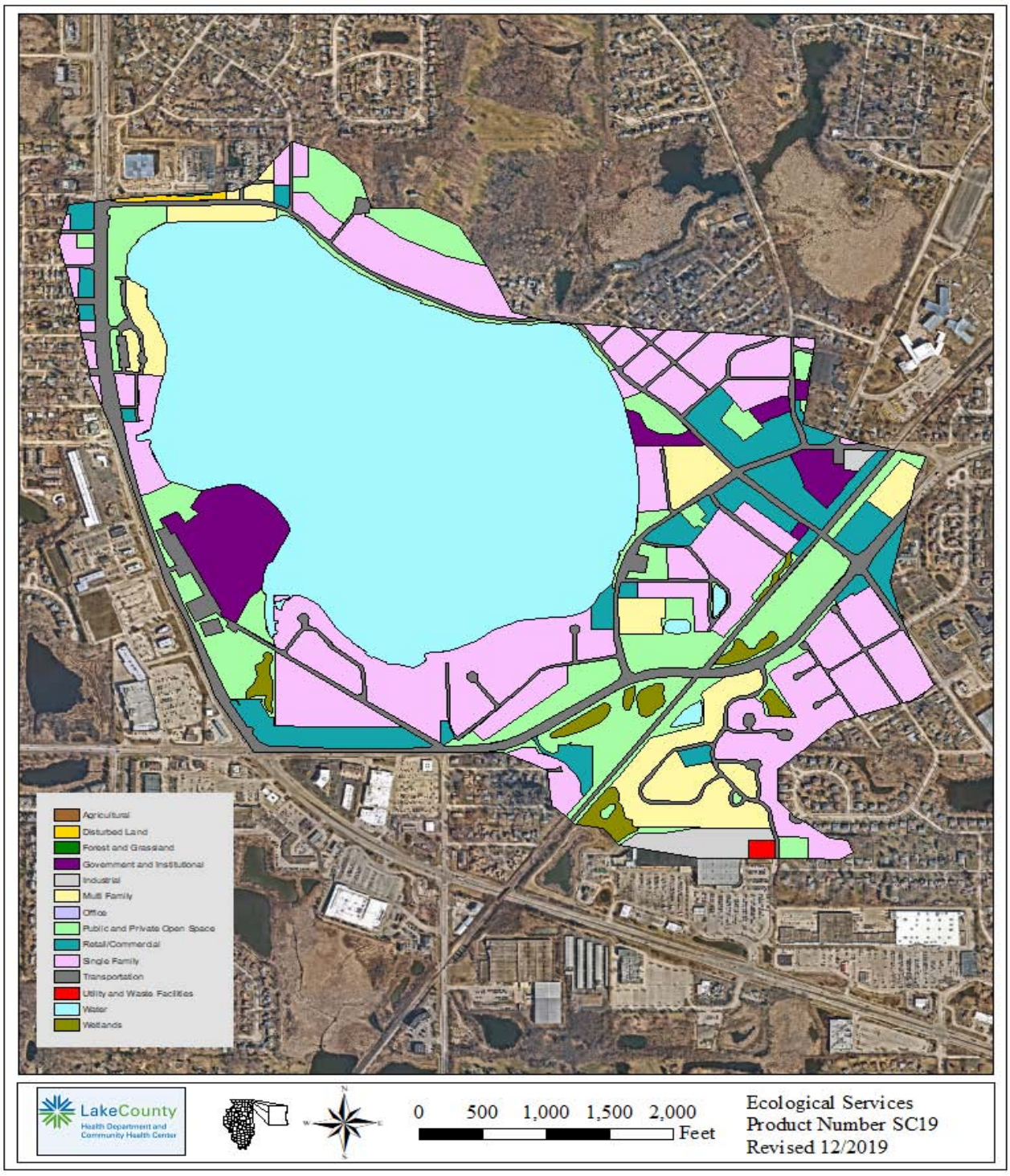
CURRENT CONDITIONS – LAKE

Water Quality

Water quality is often determined by water clarity. This is typically measured with a Secchi disk and primarily used as an indicator of algal abundance and general lake health. Although it is only one indicator, Secchi disk depth is the simplest and one of the most effective tools for estimating a lake's productivity. It also provides an indirect measurement of the amount of suspended materials in the water. Several factors can interfere with light penetration and reduce water clarity. These include algae, water color, re-suspended bottom sediments, erosion, and invasive species such as carp, alien mussels and the like.

FIGURE 5. LAKE ZURICH LAND USE, 2020

Lake Zurich Land Use 2020



The 2020 average water clarity in Lake Zurich was 7.08 ft., which was comparable to the 2012 sampling where the Secchi depth was 7.24 ft. Compared to other lakes in Lake County, Lake Zurich remains slightly above the median Lake County Secchi depth of 3.02 ft.

Secchi depth and total suspended solids (TSS) are inversely related. As TSS solids increase, there is a decrease in Secchi depth, and vice versa. Figure 6 depicts this inverse relationship between TSS and Secchi depth in Lake Zurich during the 2020 monitoring season. Algae can play a role in decreasing water clarity. Algae blooms have been observed on Lake Zurich, causing reduced water clarity. In 2021, Starry Stonewort, a micro-algae, was identified and found in Lake Zurich.

Refer to Appendix A for specific Water Quality readings (i.e., Secchi, Dissolved Oxygen, etc.).

FIGURE 6. LAKE ZURICH WATER QUALITY MONITORING SITES, 2016 & 2020. SOURCE: LAKE COUNTY

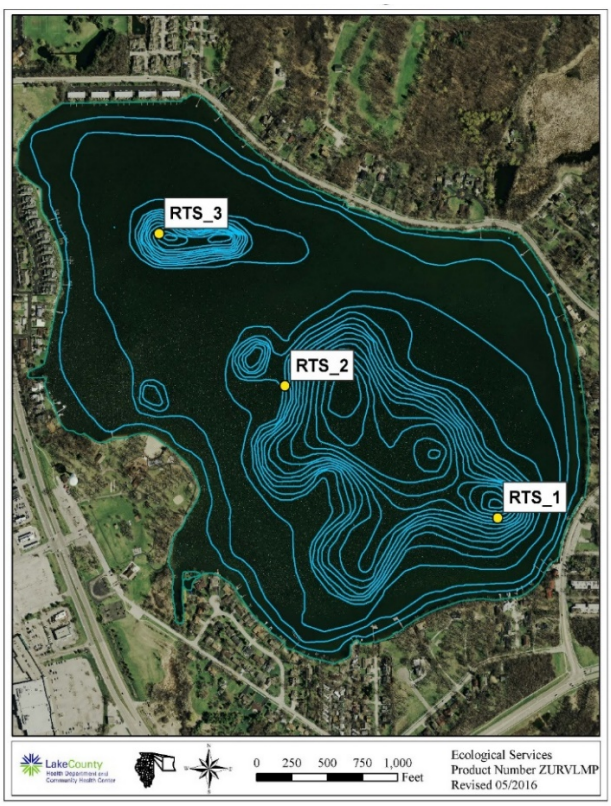




TABLE 3. LAKE ZURICH AVERAGE ANNUAL WATER QUALITY CHARACTERISTICS, 2014 – 2016, 2020

IEPA lake code		**IL_SGB** ***at least one sample was below the method detection limit**							
Year		**2014**				**2015**	**2016**	**2020**	**2020**
Parameter	***Units***	***Site*** *(near surface)*	***Site 1*** *(near bottom)*	***Site 2*** *(near surface)*	***Site 1*** *(near surface)*	***Site 1*** *(near surface)*	***Site 1*** *(near surface)*	***Site 1*** *(3 feet)*	***Site 1*** *(25.2 feet))*
Secchi transparency (Disk Depth)	inches	258	---	252	254	233	254	84.96	NA
	feet	21.5	---	21.0	21.2	19.4	21.2	7.08	NA
Total Phosphorus (TP)	mg/L	0.011	0.376	0.012	0.008	0.010	0.008	0.024	0.098
Dissolved Phosphorus (DP)	mg/L	---	---	---	---	---	---		
Nitrite + Nitrate Nitrogen (NO_2+NO_3)	mg/L	0.056*	0.016*	0.047*	0.101	0.051*	0.101	0.054*	0.06*

Ammonia Nitrogen (NH_3)	mg/L	0.040*	1.88	0.042*	0.023*	0.023*	0.023*	<0.100	.430*
Total Kjeldahl Nitrogen (TKN)	mg/L	0.29	2.43	0.32	0.45	0.28	0.45	0.71*	1.199*
Total Suspended Solids (TSS)	mg/L	1*	5*	2*	0*	1*	0*	4.53*	7.0*
Volatile Suspended Solids (VSS)	mg/L	1*	4*	2*	0*	3*	0*	0.47	NA
Dissolved Solids (DS)	mg/L	---	---	---	---	---	---		
Alkalinity	mg/L	104	152	104	115	97	115	97	135
Chloride (Cl)	mg/L	237	309	239	197	236	197	134	139
Conductivity	µS/cm	---	---	---	---	---	---	0.6132	0.6862
pH	units	---	---	---	---	---	---	8.65	7.35
Chlorophyll a (corrected)	µg/L	5.96*	---	5.07*	---	---	---		
Chlorophyll b	µg/L	0.00*	---	0.00*	---	---	---		
Chlorophyll c	µg/L	0.00*	---	0.00*	---	---	---		
TSI_{Secchi}	--								
$TSI_{phosphorus}$	--								
$TSI_{chlorophyll}$	--								

NUTRIENTS: PHOSPHORUS - Organisms take nutrients in from their environment. In a lake, the primary nutrients needed for aquatic plant and algal growth are phosphorus (P) and nitrogen (N). Phosphorus is a vital nutrient for converting sunlight into usable energy and essential for cellular growth and reproduction. Phosphorus occurs in dissolved organic and inorganic forms or attached to sediment particles. Phosphates, the inorganic form, are preferred for plant growth but other forms can be used. Phosphorus builds up in the bottom sediments of a lake. The source of phosphorus to a lake can be external, internal, or both.

Phosphorus originates from a variety of external sources, many of which are related to human activities including: human and animal waste, soil erosion, detergents, sewage treatment plants, septic systems, and runoff from lawn fertilizers. Internal sources of phosphorus originate within the lake and are typically linked to lake sediment. When it remains in the sediments, it is generally not available for use by algae. However, various chemical and biological processes can allow phosphorus to be released from the sediment and available in the water column. Sediment resuspension and subsequent phosphorus release can occur through wind/wave action.

Phosphorus is a common nutrient found in lawn fertilizer and is one of the most problematic pollutants in stormwater. It wreaks havoc on aquatic ecosystems, particularly in streams and lakes. High levels of phosphorus result in excess algae growth that depletes the water of oxygen, drastically reduces water quality, and ultimately can cause fish kills. It is important to decrease the amount of phosphorus to improve watershed health, and for most yards, phosphorous is often unnecessary. A soil test will be able to determine whether a fertilizer with phosphorus is needed.

Phosphorus has a direct effect on the amount of plant and algal growth in lakes. Lakes with concentrations exceeding 0.050 mg/L may support high densities of algae and aquatic plants, which can reduce water clarity and dissolved oxygen levels, and are considered impaired by the IEPA.

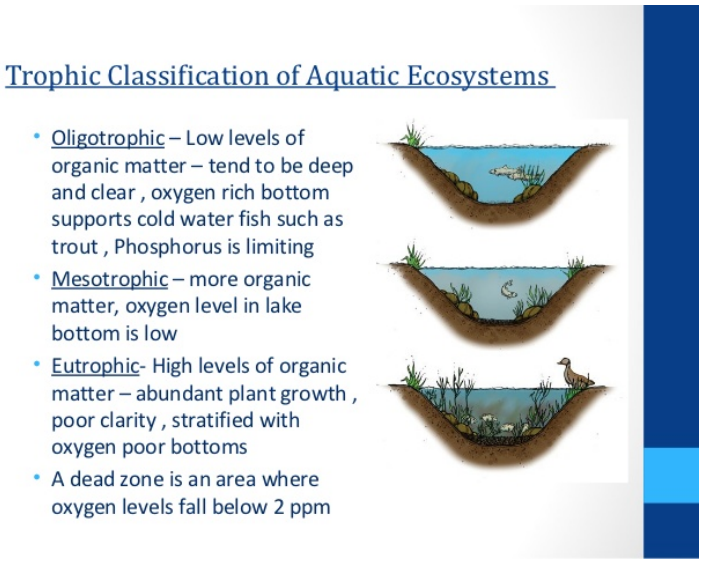
The 2020 average total phosphorus (TP) epilimnion (near surface sample) concentration in Lake Zurich was 0.024 mg/L, an increase of 14% from the 2015 concentration (0.021 mg/L). The aquatic plants found in Lake Zurich during the 2020 survey helps maintain a low TP concentration. Algae blooms were frequent during the latter part of the summer as TP concentration steadily increased. Decaying plant material, caused by a variety of factors such as weather, boating, lake management activities, among others, adds to TP concentration.

Lakes are dynamic systems with a natural evolution that occurs without man's influence. The natural process is to eventually decay. The goal of a lake management plan is to protect, reduce, and minimize those natural processes while still maintaining natural integrity and managing man's influence on this natural state and process.

See Appendix A for detailed graphs and charts regarding Water Quality readings.

TROPHIC STATE INDEX - Total phosphorus is also used to calculate the Trophic State Index (TSI) value. Trophic state describes the overall productivity of a lake and refers to the amount of nutrient enrichment. This has implications for the biological, chemical, and physical conditions of the lake. Lakes are classified into four main categories: oligotrophic, mesotrophic, eutrophic, and hypereutrophic. These range from nutrient poor and least productive (oligotrophic) to most nutrient rich and most productive (eutrophic).

In 2020, Lake Zurich had a TSI value of 50, which categorizes the lake as eutrophic and is considered poor water quality. A eutrophic lake means that the lake is high in nutrients and usually either weedy or subject to frequent algae blooms or both. Lake Zurich has switched back and forth from being algae dominated to aquatic plant-dominated. Native aquatic plants play a significant role in reducing excess nutrients in the water column that can reduce algae blooms.



Shoreline

Lake Zurich is a focal point for the community, where lake residents, visitors and local businesses enjoy its unique natural setting and resources. The actions of our entire community as well as those who visit, directly impact the health and beauty of Lake Zurich. By increasing public awareness and engagement, we can hopefully inspire everyone to pitch in and do what we can to preserve the "gem" of our town.

SHORELINE EROSION - Erosion is a natural process along lake shorelines primarily caused by wind, wave action, and even ice heave, resulting in the relocation of sediment from the shoreline. Disturbed shorelines caused by human activity such as clearing of vegetation and beach rocks and increasing runoff will accelerate erosion. Eroded materials cause turbidity, sedimentation, nutrients, and pollutants to enter a lake. Excess nutrients are the primary cause of algal blooms and increased aquatic plant growth. Once in the lake, sediments, unwanted nutrients, and pollutants are harder and more expensive to remove.

A shoreline erosion assessment was conducted on Lake Zurich in 2020 (Figure 8 and Table 4). The shoreline was evaluated for none, slight, moderate, and severe erosion ratings based on exposed soil and tree/plant roots, failing infrastructure, and undercut banks. Based on the 2020 data, 10% of the shoreline had slight erosion. A majority (90%) of the shoreline had no erosion, because of the seawalls, riprap, and emergent vegetation that have been installed and protect the shoreline against erosion. Comparatively, in 2008, Lake County assessed Lake Zurich for erosion. Approximately 40% of Lake Zurich's shoreline had some degree of erosion (Figure 7). Severe erosion was noted on 1% of the shoreline. Moderate erosion was classified on an additional 8% of the shoreline.

SLIGHT SHORELINE EROSION

Frequent increase or decrease of water level can negatively influence a variety of the lake parameters, including nutrients, suspended solids, lake volume, and aquatic plants by increasing shoreline erosion.



Emergent plants absorb wind and wave energy, preventing soil erosion. Native plants add habitat for wildlife and can also help filter pollutants and nutrients from the near shore areas.

The riparian zone includes the area from the shoreline into the water roughly between 10-20 feet and the area out from the water's edge roughly the same length or greater. Good buffers of plant life in either riparian zone protect shorelines and create the best stabilization. While ideal riparian buffers create the best stabilization, they are not always realistic especially in recreational lakes. Thus, we strive to find good alternatives to maintain the shoreline as best as possible.

FIGURE 7. LAKE ZURICH SHORELINE EROSION CONDITION, 2008

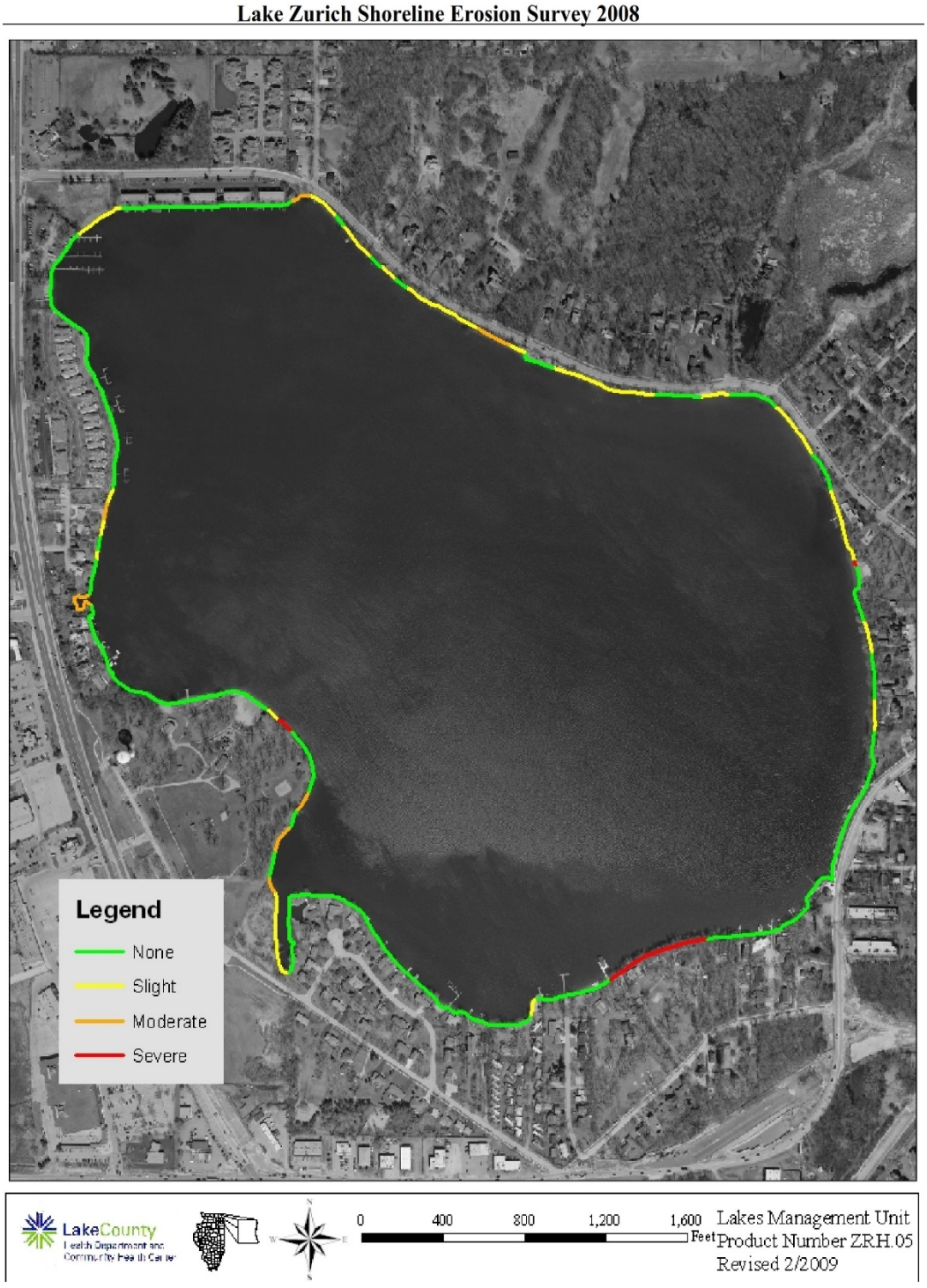


FIGURE 8. LAKE ZURICH SHORELINE EROSION CONDITION, 2020



TABLE 4. SHORELINE EROSION ASSESSMENT SUMMARY, 2020

Erosion	None		Slight		Moderate		Severe		Total
	Linear ft.	%	Linear Ft.	%	Linear Ft.	%	Linear Ft.	%	Linear Ft.
Lake Zurich Shore-line	11979.0	80%	2986.7	00%	0.0	0%	64.4	0%	15030

SHORELAND BUFFER - A shoreland buffer helps stabilize sediment near the lake's edge which prevents soil erosion. The buffer will filter out pollutants and unwanted nutrients from entering the lake. Buffer strips should be at least 25 feet wide and can include native wildflowers, grasses, and wetland plants. Wider buffers may be needed for areas with a greater slope or additional runoff issues. Areas with severely or moderately eroding shoreline may require bolstering the buffer strip for additional stability.

Native plants have a deep root system that keeps soil in place. It is advantageous to establish buffers or not mow to lake's edge to allow native grasses to grow. Buffers composed of tall grass along the shoreline will discourage geese from coming ashore. Geese have a natural fear of predators lurking in the bushes.

In 2020, the condition of Lake Zurich's shoreland buffer was assessed by looking at the land within 25 feet of the lake's edge on aerial images in ArcGIS. Shoreland buffers were classified into three categories: poor, fair, or good based on the amount of un-mowed grasses, forbs, tree trunks and shrubs, and impervious surfaces within that 25-foot range. It was determined that Lake Zurich 7.6% of the shoreline was classified good, 20.2% fair, and 53.5% with poor buffer conditions (Figure 9 and Table 5).

FAIR BUFFER CONDITION



FIGURE 9. LAKE ZURICH SHORELINE BUFFER CONDITION, 2020

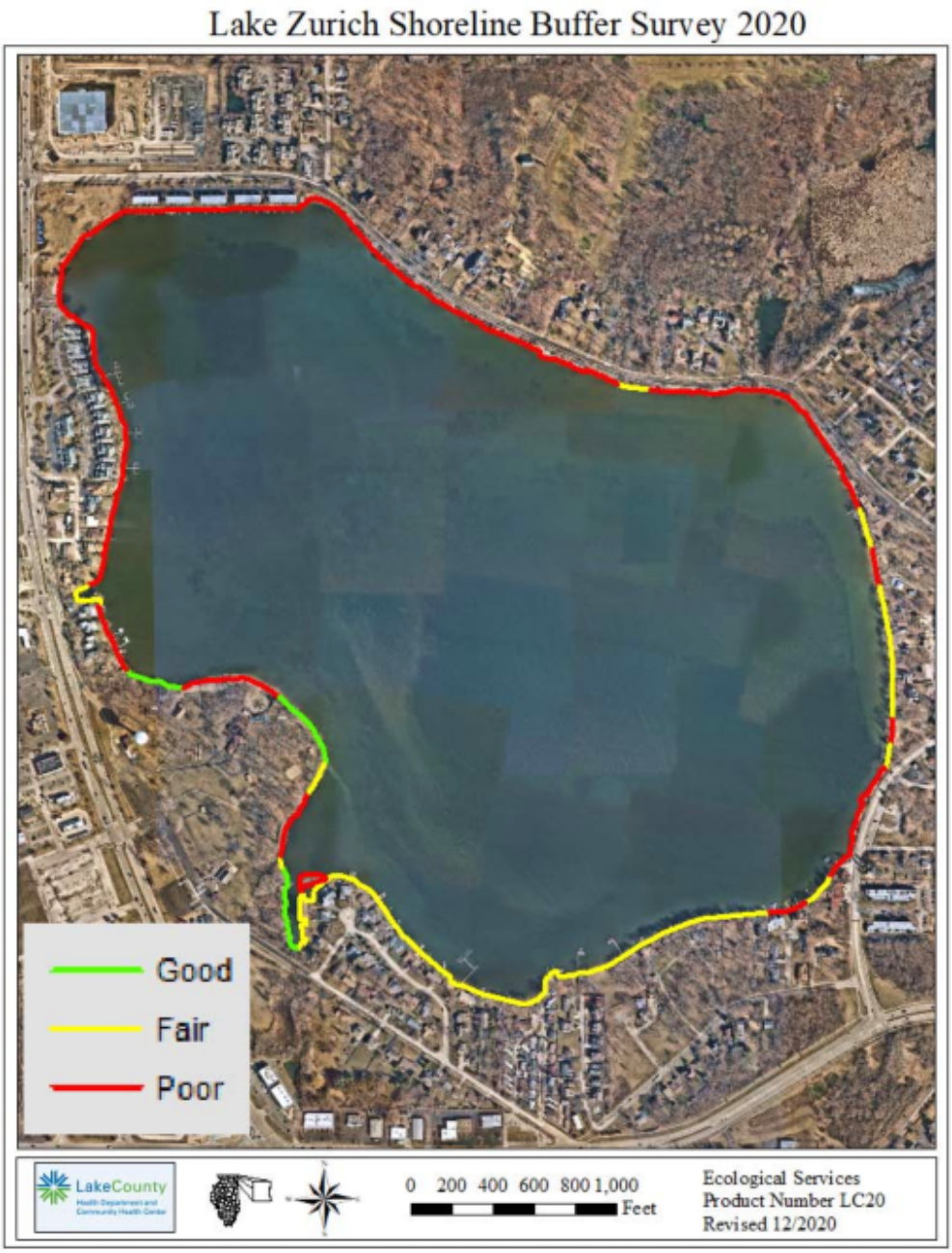


TABLE 5. SHORELINE BUFFER ASSESSMENT SUMMARY, 2020

Buffer	Good Condition		Fair Condition		Poor Condition		Shoreline Length Assessed
	Linear ft.	%	Linear Ft.	%	Linear Ft.	%	Linear Ft.
Lake Zurich	1140.4	7.6	5845.3	20.2	8044.3	53.5	15030.0

Aquatic Plants

The optimal lake habitat for aquatic life is one that provides a beneficial environment for various animal populations through a diversity of native plants. Dense plant beds reduce the ability of predatory fish to see their prey and deprive lifeforms of the nutrients they require to thrive. As we have seen through various agency reports, this also results in creating an environment with many small, stunted forage fishes and poor production of game fishes. To ensure optimal lake habitat, balance is critical – balance among all the living things in the lake so that each may thrive. According to sources such as Department of Natural Resources (DNR), biologists, EPA, and others, the ideal plant-to-open-water ratio is 20-40% plants (in some cases, 50%) and is dependent on a wide range of issues for each lake.

Aquatic plants play an important role in a lake's ecosystem by providing habitat for fish and shelter for aquatic organisms; their presence is natural and welcome in lakes. Aquatic plants provide oxygen and reduce nutrients, such as phosphorus, to prevent algae bloom and help stabilize sediment. Depending on various conditions, a native plant community tends to be diverse and usually does not impede lake activities such as boating, swimming, and fishing.

A pristine lake where everything is balanced and stable is very rare. The biggest challenge to achieve those ideal pristine conditions is when a lake is surrounded by homes and used for recreation. Because of Lake Zurich's average overall shallow depth, size overall, and good clarity, Lake Zurich is often inundated by excess nutrients and an over-abundance of desirable plants, along with periodic foreign or invasive species such as Brittle Naiad, Starry Stonewort, among others.

A 'garden' or living body requires attention and evolves over time; Lake Zurich is no different. Like great gardens, lakes require a balance of plants, enough room to thrive on available nutrients, and periodic removal of plants that challenge the balance. Similarly, lakes, like gardens, respond to their environment, usage, and surroundings, and are constantly changing and adapting. An "optimal", one-size-fits-all solution to lake management is unrealistic.

Recent studies of Lake Zurich by Lake County Health Department and Rollins Aquatics show that Lake Zurich's aquatic plant life is out of balance. In 2020, Lake County found the lake approximately 70% covered in plant growth. Measurements taken in 2021 found nearly 80% plant coverage in depths between 3 to 16 feet. Our Lake County partners suggest that plant coverage of 70% or greater, can negatively impact the overall health of the lake. Too many plants create an overabundance of nutrients, depriving other lake lifeforms of oxygen, stunting fish growth, and producing muck on the lake bottom. Concern has been expressed by many to look for ways to address these issues.

Fish studies and anecdotal reports from local fishermen, Keystone Hatcheries, and Illinois Department of Natural Resources, indicate that predator fish in Lake Zurich are not growing bigger as would have been expected, likely due to plant growth rates. Additionally, high plant growth eventually will generate greater plant die-off, causing increased sediment (muck) to build up on the bottom. Because Lake Zurich is considered generally shallow with an average depth between 6-7 feet, it is challenging to institute lake management initiatives and action plans that address the lake's divergent priorities and interest groups, especially between lake usage versus overall health. The best lake management efforts cannot offset the detrimental impact that a lake without usage guidelines will suffer. If all users implemented best management practices, the detriments of recreational user impacts could be

minimized. Also, without proactive and better usage management policies, it will be difficult to take the steps that are necessary to focus on long-term health of the lake.

We have two primary tools to influence and manage our 'garden' of aquatic plants – aquatic herbicides and mechanical harvesting. While our lake enjoys many years of wonderful ecological balance, this has not occurred without ongoing intervention to manage that balance. For our lake to have a healthier balance, we need to implement proactive strategies. Invasive plants -- ones that crowd out desired plants or negatively affect recreational usage patterns of the lake -- require swift and deliberate removal. Control of invasive plants enhances desirable plant diversity and water quality, both of which are degraded by dense plant growth, and will help restore and maintain the overall health of the lake.

Aquatic herbicides are one of the smallest niches of specialty plant control products, yet they also are among the most regulated by the EPA. Successfully registered aquatic herbicides undergo 6-10 years of testing before being formally approved. Herbicide concerns remain widespread despite extensive research and much-improved application guidelines, along with use and registration requirements that are enforced by regulatory agencies. Because these products are added directly to water, the EPA requires extensive data to assess safety of an herbicide before it can be registered for use in aquatic systems. Many years of testing and use have shown that registered aquatic weed control products, when properly applied, can be used safely in all areas of the US. In addition, rigorous safety and monitoring tests have been conducted in the laboratory and the field to determine exactly how a given product should be used in a particular situation.

Also, the treatment level (or concentration in water) of an herbicide is typically much lower than the concentration that might be harmful to you, your pets, or non-target organisms that live in the lake. For example, one of the products that has been most helpful controlling invasives and maintaining lake balance is Fluridone. It is rated safe for human, fish, and lake invertebrate life up to 150ppb (parts-per-BILLION). Our application typically aims for 5 to 7ppb. No aquatic herbicides currently registered by the EPA have fish consumption restrictions. Additionally, professional applicators of herbicides undergo annual and regular training and follow safety protocol for herbicide applications, which is why the hiring of professionals is a critical aspect of lake safety practices.

Herbicides are most effective when used in the spring before plants start actively growing. Existing plant growth dies off in winter and falls to the bottom of the lake. Organic matter is a product of this existing growth dying off and settling in the substrate, thus creating muck. Research has shown that when the growth of plants is restricted or controlled with herbicides, much less organic matter is produced than if plants are left untreated. The bottom line is - most material produced by a plant over the course of a year is added to the lake bottom annually. Reducing plant growth with herbicides can reduce organic matter production and accumulation. Additionally, dense weed stands also increase sedimentation (muck) by trapping particles suspended in the water column.

While aquatic herbicides are primarily used for invasive plant species, when used properly, they can be a powerful tool in managing excessive vegetation and be more cost-effective when compared to other management techniques. A properly implemented plan can provide season-long control with minimal applications. Herbicides used most often in Lake Zurich include the following:

Fluridone (Sonar, Avast)
https://dnr.wi.gov/lakes/plants/factsheets/FluridoneFactsheet.pdf

Aquathol K
https://dnr.wi.gov/lakes/plants/factsheets/EndothallFactsheet.pdf

Diquat (Tribune, Reward)
https://dnr.wi.gov/lakes/plants/factsheets/Diquat.pdf

Copper based algaecides
https://dnr.wi.gov/lakes/plants/factsheets/CopperFactsheet.pdf

New and innovative products are being developed and tested regularly, such as probiotics, enzymes, and bacteria that eat the muck from the lake bottom. As new treatments and recommendations are available, the LPOA team will evaluate the potential use and application on our lake. The good news is that there are universities and professional studies of lake treatments being developed regularly around the country.

Mechanical harvesting is the other tool to manage the 'garden' and is utilized best once plants have grown and are established. Harvesting is a cosmetic procedure that does not directly influence lake health. It does not eradicate plant growth; instead, harvesting shears back plants by cutting the tops off at varying lengths. Typically, this can be as far down as 5 feet depending on the machine used. It can be a quick answer to plant growth that reaches the surface and interferes with human lake activities. It is not selective and can remove native vegetation along with targeted plants.

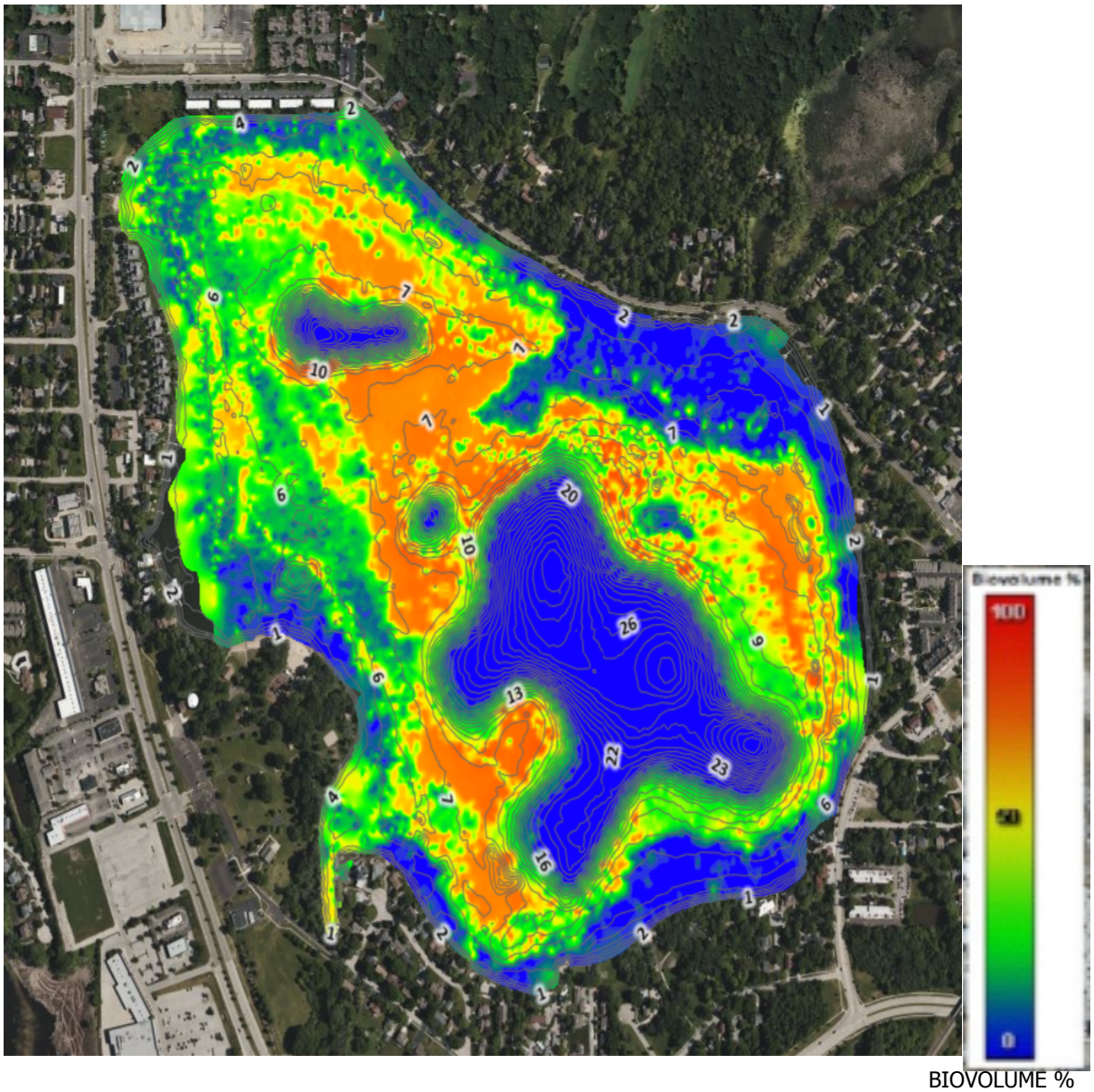
harvesting can be a viable methodology to manage healthy aquatic plant growth. However, according to the Lake County Health Department, harvesting is not generally recommended for invasive plants because it multiplies infestations by spreading seeds and shoots of the plants that are harvested. Likewise, it also stimulates excessive growth in native plants, causing an over abundant plant growth. Regrowth of desired vegetation can occur quickly, much like when bushes are trimmed. For example, Hydrilla and Curly Leaf Pondweed can grow up to 4" per day.

While harvesting systems are more efficient today, some cuttings escape collection and fall to the bottom. Another potential downside to harvesting is by-catch. 'By-catch' is the term for harvesting non-target life like fish, crayfish, snails, and frogs. While research has shown by-catch impact some species of aquatic life, modern machines and their operators are much better than older systems in this regard.

HARVESTER



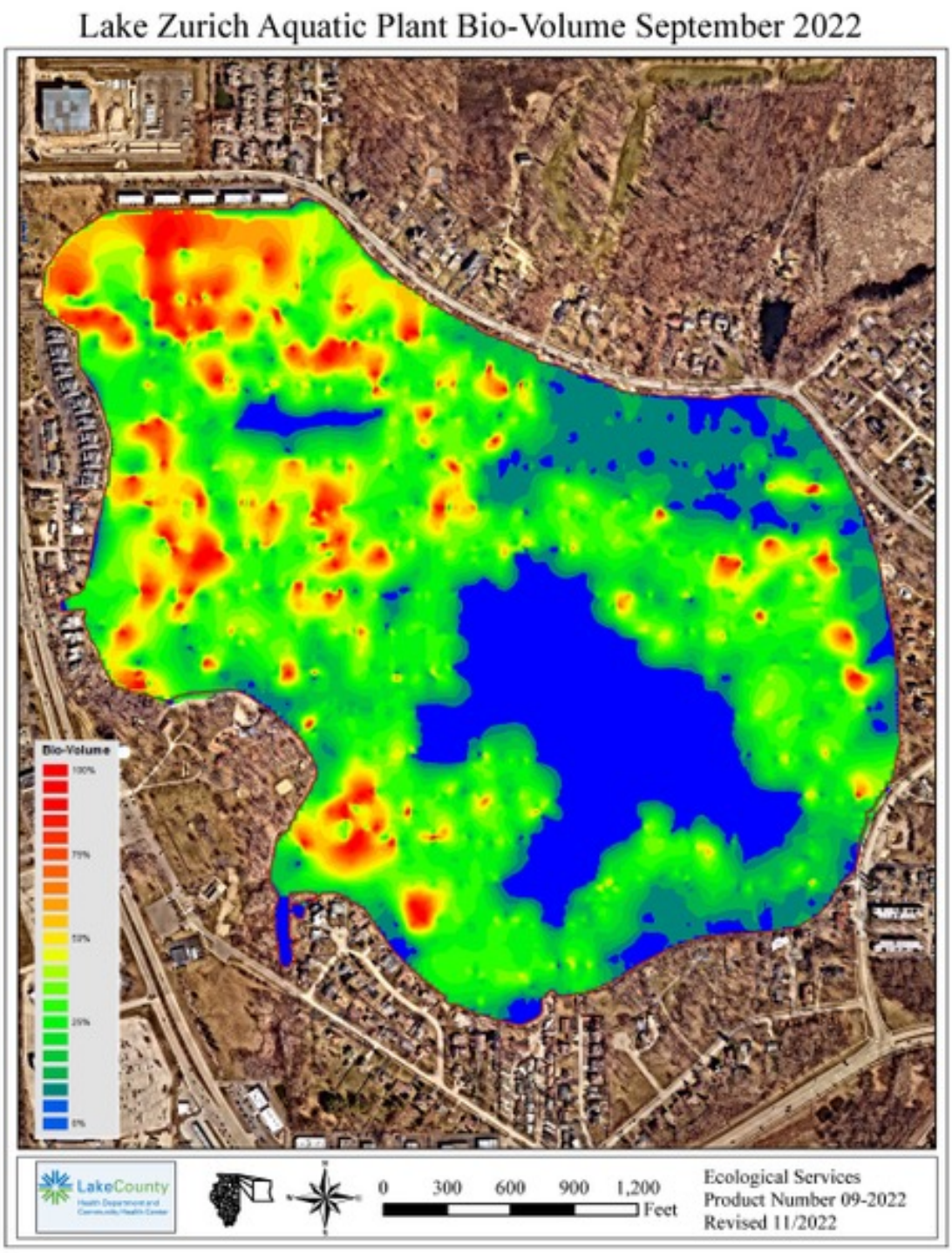
FIGURE 10. LAKE ZURICH SUBMERGED AQUATIC VEGETATION MAP, 2021



BIOVOLUME %

Biovolume refers to the volume of the water column taken up by plants.

FIGURE 11. LAKE ZURICH SUBMERGED AQUATIC VEGETATION MAP, 2022



2021 PLANT INVENTORY (observed) Native Plants (Pictures for illustrative purposes):

Small (Slender) Pondweed – heavy growth



Largeleaf Pondweed – heavy growth



Vallisneria – light growth



American Pondweed – light growth



Southern Naiad – light growth

Chara – light growth



White Water Lily – scattered patches



Spatterdock – scattered patches





AQUATIC INVASIVE PLANT SPECIES

Aquatic invasive species (AIS) are species that are typically not native to Illinois and cause economic or environmental harm, or harm to human health. Furthermore, AIS causes economic harm because they tend to form dense monocultures through aggressive and early growth patterns. While we have had significant Eurasian Watermilfoil issues in the past, none was sighted in 2021. Two invasives were identified in Lake Zurich in 2021 (pictures for illustrative purposes): Curly-leaf Pondweed and Starry Stonewort. Another non-native invasive species, Brittle Naiad, was identified with high occurrences in 2020 and 2022. Visit Lake County's Lake Report page: https://www.lakecountyil.gov/2400/Lake-Reports

Curly-leaf pondweed is native to Eurasia, Africa, and Australia. It was likely introduced when common carp were intentionally introduced into Midwest waters as a game fish in the 1880s. The species was likely spread through the movement of watercraft and water-related equipment.

Starry stonewort is also native to Eurasia, from the west coast of Europe to Japan. The species was unintentionally introduced into the Great Lakes through discharge of contaminated cargo ship ballast water. The first occurrence in the US was in 1978 along the St. Lawrence River. Like curly-leaf pondweed, people spread starry stonewort primarily through movement of water-related equipment. Fragments get tangled in trailers, motors, anchors and inside watercrafts (boats, canoes, and kayaks) and are transported through water.

Brittle Naiad is native to Europe and Asia and was intentionally introduced to lakes to increase food for waterfowl, which readily consume its seeds. It may also have been introduced by aquarium dumping into local waterways. Waterfowl can excrete the viable seeds in new areas. Fragments of brittle naiad can cling to boat trailers or equipment such as waders, duck hunting decoys, or even dogs.

CURLY-LEAF PONDWEED



As an early bloomer, Curly-leaf aggressively outcompetes native submersed vegetation. It grows in low or intense light and continues growing under the ice of winter and loves lakes like ours. It is sometimes considered an indicator of pollution and eutrophication because of its tolerance for bad water conditions. It can grow 4 inches per day, leaving dense mats on the water surface that shades out desired plant growth. As it ages and decomposes, Curly-leaf decreases oxygen in the water column stressing aquatic life forms. Algae blooms commonly occur after this decomposition and decrease water clarity. If not aggressively defeated, Curly-leaf will challenge recreation programs, reduce native plant growth, and has potential to foster an unfriendly ecosystem for fish and other fauna. We found about 20 acres of Curly-leaf in Lake Zurich in 2021 (Figure 12).

FIGURE 12. LOCATION OF CURLYLEAF ON LAKE ZURICH, 2021



STARRY STONEWORT



Starry Stonewort is another Eurasian infiltrator that is finding new homes in the US and Canada. It is a grass-like form of algae that creates a blanket of plant life that shades native plants and interferes with recreational lake use. With the right conditions, it can reach heights of up to 30 feet in the water column and create dense mats called "pillows" that become so thick that they replace native macroalgae and displace aquatic plants and animals. Starry Stonewort produces small, star-shaped structures called "bulbils" that allow it to reproduce by bulbils and fragments.

Like Curly-leaf Pondweed, Starry Stonewort primary infiltration is believed to come from improper watercraft procedures, mechanical harvesting also will spread this invasive by releasing these bulbils (seed pods). Fragments attach to boats, trailers, boat lifts, anchors, and any other water-related equipment not properly cleaned before launching into a lake. It is alleged to have been transported from Canada into Minnesota and Wisconsin, and now is in Illinois.

To prevent the spread of invasive species such as curly-leaf pondweed and starry stonewort, proper procedures include the following:

- Thoroughly clean watercraft and equipment of all mud, debris, aquatic plants and prohibited invasive species before leaving access area.
- Drain all water by removing drain plugs and keeping them out during transport.
- Remove all plant fragments from the boat, propeller, and boat trailer.
- Dispose of unwanted bait and plant material in the trash.
- Dry boats and equipment for 5 days before transporting to a new body of water.
- Do not dispose aquarium water or plants into water bodies.

Lake County Health Department, Ecological Service Program suggested that Lake Zurich might be the first lake in Lake County to have this invasive species. In 2021, Lake Zurich expedited treatments with copper-based products that are typically used for control of this species. However, they were only moderately successful. While it remained somewhat stunted last year, there is currently no known product to ensure killing Starry Stonewort outright. Each of our ramps that access the lake has a sign from the DNR on the proper procedures for cleaning lake equipment.

EURASIAN WATERMILFOIL



Eurasian Watermilfoil was not observed during the aquatic plant survey conducted in September 2020 or in 2021. Past plant management records show effective treatment of EWM. In 2015 and 2018, early treatment using Fluridone was successful in targeting and mitigating this invasive species. Given our history with this aggressive invasive, it is always on our radar for return.

Eurasian Watermilfoil (EWM) is an invasive, submersed aquatic plant that reproduces through stem fragmentation and runners. A single segment of stem and leaves can take root and form an entire new colony, eliminating native vegetation and allowing for EWM to overtake a lake. It tolerates lower temperatures and starts growing earlier than other aquatic plants, quickly forming thick underwater stands of tangled stems and vast mats of vegetation at the water's surface. As Eurasian watermilfoil multiplies, its dense weed beds at the surface can impede navigation. EWM also displaces and reduces native aquatic plant diversity, which is needed for a healthy fishery. Infestations impair water quality due to dissolved oxygen depletion as thick stands die and decay. On the side of good news, lakes with well-established populations of native plants create a challenging environment for EWM to grow.

BRITTLE NAIAD





Brittle Naiad was observed during the aquatic plant survey conducted in September 2020 and in 2022. Brittle naiad can grow in very dense patches and outcompete native vegetation. This species is so aggressive that it has even been known to outcompete two other very invasive aquatic plants – Eurasian watermilfoil and Hydrilla. It is difficult to control once it is established. Manual removal of this plant can be difficult because it easily fragments. Left over fragments can potentially produce new plants, especially if they contain fruits. Mechanical harvesters have been used to remove brittle naiad but will likely spread the plant further via fragmentation. Successful chemical control can be achieved with diquat, endothall, and fluridone herbicides. A successful biological control agent is not known at this time.

HARMFUL ALGAE BLOOMS

There have been many articles published on toxic algae, but no major harmful algae blooms were reported on Lake Zurich in 2020 or 2021. Decomposition of Curly-leaf Pondweed is known to foster Algae blooms. Algae grow quickly in water and is often associated with increased concentrations of nutrients, such as nitrogen and phosphorus. Algae are always present in natural bodies of water like lakes and rivers, though only a few types produce toxins. Blue-green algae or "cyanobacteria" are a type of algae that bloom and produce toxins like bacteria in structure but utilize photosynthesis to grow. In these algae, environmental factors such as light, temperature, and nutrient levels can stimulate toxins. Algal toxins are released into the surrounding water or air. Certain species of blue-green algae that produce toxins are identified as harmful algal blooms (HAB). HABs pose a health risk to people, animals, fish, and other parts of the ecosystem when they are exposed to them in large enough quantities.



Summary of Invasive Management: There is no one size fits all approach to managing our lake ('garden'). The goal is to manage aquatic plant growth that is in the best interests of maintaining a

healthy lake. This will often conflict with human demands of lake usage and requires appropriate balance between the two. Every year can be different which requires assessing our aquatic plant growth. At the end of every season, plant inventory should be observed and recorded. Additionally, early evaluation in Spring should be conducted to understand the year ahead. Together, Fall and Spring inventories and evaluations will set the stage for first level responses.

1. While data reporting from all who use the lake is extremely helpful, the process will be best managed by a committee of 3 or 4 people that will make and record plant observations.
2. All vendor programs will require follow up treatments as needed based on a minimum of 4 lake visits per year for professional evaluation and recommended subsequent treatments.
3. Prior to our yearly budget allocation for aquatic plant management, the committee will continue to seek recommendations from various professional organizations like our Lake County Health Department, IDNR, ILMA, and USEPA. Working with other local partners will provide useful opportunities to understand regional lake issues and trends.
4. All treatments will use approved modalities, as noted by IDNR and EPA, and consistent with the Lake County Health Department Ecological Services Department recommendations.

Fisheries

Fish depend on aquatic plants to provide habitat and forage for food. Most fish rely on aquatic plants at some point during their life stage. Plant composition and density play an important role in the nesting, growth, and foraging success of freshwater fish. While many fish require some aquatic vegetation for



growth, excessive amounts of aquatic vegetation can negatively impact growth by reducing foraging success. Parameters of ideal fish habitats change based on the size and species of fish, type of lake, structures present in the lake and many other factors.

Lake Zurich LPOA's Fish Stocking Committee is dedicated to pro-actively building and maintaining a healthy fishery. The goal is to create a fishery that will yield a productive combination of quantity and quality of certain species. Information and specific data are collected regularly from fishermen, IDNR, and Keystone Hatchery to assist in working towards these goals.
Recent efforts include:

•October 2021 – 1,520 Bluegills, 496 Walleye, and 63 Crappie were stocked

- Summer 2020 - 350 lbs. of Shiner Minnows, 3-5" Bluegills, Muskie and Walleye were stocked
- Successful campaigns and organized teams have removed and eradicated 1000 pounds of invasive common Carp in conjunction with Algonquin-based, "Environmental Aquatic Management" team - 65 carp were removed in 2021 and 198 were removed in 2020.
- October 2018 - collaborating with the IDNR, 90+ Carp were removed and 350 lbs. of Shiner Minnows and 1,500 3-5" Bluegills were stocked
- Spring 2018 - 825 Walleye were stocked
- Spring 2017 - Muskie and Perch were stocked and 90+ Carp were removed
- In previous years, Large-mouth Bass and Walleye were stocked

Lake Zurich LPOA Fishing Recommendations – Based on creel surveys, IDNR Biologist recommendations, Keystone Hatchery Biologist, and feedback from local fisherman. Lake Zurich falls under the jurisdiction of Illinois state fishing regulations as do other lakes in the state. Regulations are enforced by the Illinois Department of Natural Resources (IDNR). All anglers 16 and older must carry a valid license when fishing; this applies to both residents and non-residents. Licenses can be purchased through the IDNR website or fishing license vendors, such as Walmart or local bait/tackle shops. To acquire an Illinois Fishing License, visit the DNR Direct License website. To see the list of vendors, click on: https://www2.illinois.gov/dnr/LPR/Pages/FishingLicensesFees.aspx

Lake Zurich LPOA Specific Fishing Recommendations

Largemouth Bass: Keep 12"-14" limit of 3 per day; all other sizes should be released back to the lake.
Walleye: Keep 14"-18" limit of 3 per day; all other sizes should be released back to the lake.
Northern Pike: State minimum to keep is 24" limit of 3 per day
Muskie: Release all back to the lake - CPR - CATCH PHOTO RELEASE
Panfish: Any combination of 10 of following species can be kept:

- Bluegill, Sunfish and Perch – 6-8"

● Crappie 10” minimum to ensure good spawning populations

Carp: REMOVE FROM LAKE AT ANY OPPORTUNITY

Recent data indicates that the size of Largemouth Bass in Lake Zurich is stunted when compared to Largemouth Bass in other lakes in Lake County. Below is a chart from Windy City Fishing that lists the average size compared to age of Largemouth Bass in northern Illinois. On average, a typical 6-year-old bass in northern Illinois is 17.4" versus Lake Zurich, they are only 13-14" based on limited data.

Largemouth Bass Age Chart for Northern Illinois 2018

Length of Fish	Age in Years
6.3	1
9.0	2
11.6	3
13.5	4
15.8	5
17.4	6

Largemouth Bass Age Chart for 2018

Northern Illinois	Lake Zurich
Length and Age of Fish	**Length and Age of Fish**
13.5” 4 Yrs.	12.0” 5 Yrs.
15.8” 5 Yrs.	13.0” 6 Yrs.
17.4” 6 Yrs.	14.0” 7 Yrs.

The 2018 Creel Survey data was submitted to Keystone Hatcheries for analysis and recommendations. Data was collected from anglers; it was not a scientific survey. Enough consistency existed in the reported data that Keystone were confident in their results.

The reported sizes of Northern Pike and Largemouth Bass and their estimated ages lead them to believe that the fish population is suffering from predator stunting. Predator stunting occurs when predator fish (in this case Northern Pike and Largemouth Bass) do not have enough forage fish to eat, or dense plant growth makes it difficult for them to find and feed on forage fish.

Keystone recommended for the 2019 fishing season to harvest as many Largemouth Bass and Northern Pike in the following size ranges as is practical:

- Largemouth Bass: keep 12”-15”, throw back under 12” and over 16”
- Panfish (Bluegill, Crappie, Sunfish): throw back everything for now
- Stock as many 5”-7” Bluegill as available and within budget

The goal of these recommendations is to allow the Largemouth Bass and Northern Pike populations to get closer to the average sizes found in northern Illinois lakes and to balance the populations of both predator and forage fish. Please see Appendix B for the Keystone Hatcheries' full report.

Water Quantity / Levels

Generally, Lake Zurich's total lake volume has not noticeably decreased over the last few years, which is positive. The planning committee envisions managing consistent water levels in Lake Zurich through maintenance and management of the culvert and best practices in surrounding groundwater practices. It is anticipated that Lake Zurich will have typical historic water levels at or near the ordinary high-water mark (844 feet).

Historical Data:

100-year flood stage = 844 feet (1998, Village of Lake Zurich)

10-year flood state =	843.7 feet (1998, Village of Lake Zurich)
USGS Static level =	843 feet (1998, Village of Lake Zurich)

Army Corps of Engineers recommendation: 844 feet (1998, to counter "wave overflow," loss of water due to wave action)

Wildlife

Lake Zurich and its surrounding shoreline areas provide natural habitats for many wildlife species, including a variety of birds including hawks and eagles, muskrats, and turtles, among others. The lake contains important foraging and nesting habitats for wading bird species such as Great Blue Herons. Additionally, the lake provides important resting and foraging habitats in Spring and Fall for migratory birds, (waterfowl and songbirds), such as Tundra Swans and many duck species.

PAIR OF JUVENILE BALD EAGLES





YELLOW SWALLOWTAIL BUTTERFLY



COOPER'S HAWK



TUNDRA SWANS

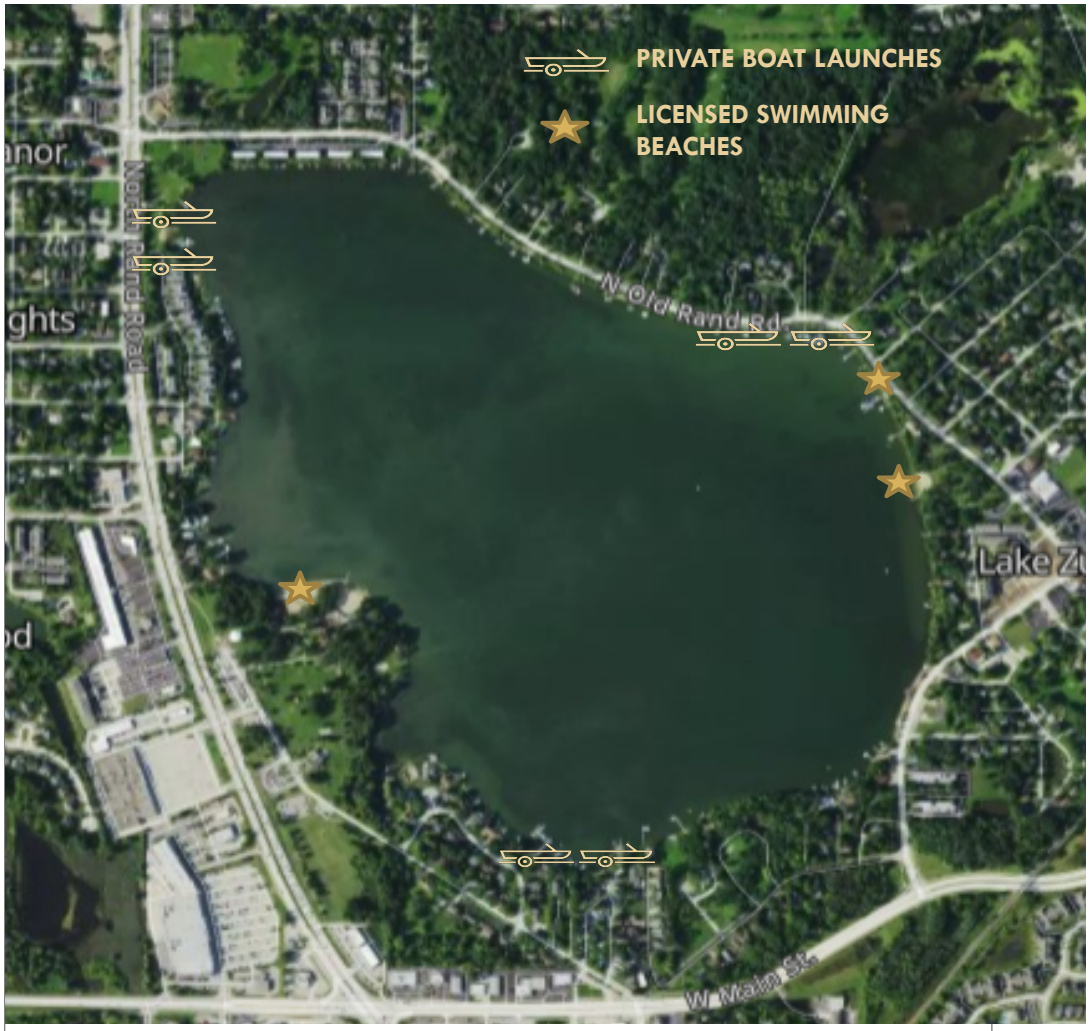
Recreation

Lake Zurich provides year-round recreational activities for the enjoyment of homeowners, residents, and visitors. In Spring and Summer, the lake is enjoyed by people who swim, boat including water sports such as waterskiing and wakeboarding, paddling, and sailing, and fish. Fall offers colorful leaves, picnics, and clear water to enjoy. Winter finds skaters, occasional cross-country skiers, and an active fishing community drilling holes through the ice and catching fish. Lake Zurich is enjoyed by many people throughout the year who appreciate its natural scenic beauty, including beautiful sunrises and sunsets. The Village of Lake Zurich maintains two public parks with sand swim beaches (Paulus Park and Breezewald Park) where numerous popular family-oriented festivals are held during the year.

Lake Zurich has six private boat landings. No Wake hours are from sunset to 9:00am. Motorized crafts travel counterclockwise outside of No Wake designated areas. Watercrafts include kayaks, canoes,

paddleboards, pedal boats, motorized, and non-motorized boats. Rules are distributed to LPOA members via email annually. All boat launches should have signage about boat cleaning guidelines.

FIGURE 13. LAKE ZURICH BOAT LAUNCHES AND LICENSED SWIMMING BEACHES, 2021



CAPACITY / Safe Capacity Watercraft Limits

In 2020, Lake Zurich conducted a lake use study to evaluate the safe use capacity of the lake. The following information summarizes the results of the study.

LAKE ZURICH LAKE USE STUDY 2020

Purpose of the study:

Recreational carrying capacity is defined as "the amount of development and activity a body of water can handle before it starts to deteriorate," Jacquie Colburn of the New Hampshire Department of Environmental Services.

The purpose of the study was to collect tangible data to guide and support decision-making to ensure and balance the 1) safety of everyone that uses the lake, 2) protect the ecosystem that supports a healthy body of water, and 3) satisfies the collective recreational expectations of the users. Please see

Appendix C for data collection methodology and evaluation, overcapacity definitions and formulations, and actual monthly survey data.

Study Summary:

The completed survey helped quantify the actual recreational usage of Lake Zurich. Unsurprisingly, weekends are busier than weekdays and good weather promotes more lake usage. Typically, the most common boating activity in the early mornings was fishing, followed by an increase in activity from ski boats after the no-wake restrictions are lifted at 9am. Afternoons and evenings tend to be the most crowded. Non-motorized/paddle craft numbers have been growing and prove to be a common activity.

Summary of the capacity readings are as follows:

- Overall, Lake Zurich is under capacity 81.8% of the time.
- Five of the overcapacity recordings came on a weekday; none were before 9AM even on the weekends.
- Weekends registered overcapacity 40.7% of the time. This number increases to 48.6% if we back out the data during no-wake hours.
- Lake Zurich experiences overcapacity by 100AC 20.9% of the time on weekends.

Recommendations:

The following are areas for further possible efforts/actions:

- Perform multi-year capacity studies to gather additional data points to better understand usage trends and potential issues.
- Review and establish consensus of how we define the term "over-capacity" to ensure values used are consistent with the specific desired usage of Lake Zurich.
- Continue to enforce existing rules and regulations of the lake and review data collected from enforcement to better understand usage trends.
- Monitor and update lake usage rules and regulations based on current and trending usage interests and volume.

Community Organization / Partners / Resources / Stakeholders

The Lake Zurich community and stakeholders will be connected and informed in lake stewardship. Working together on common values will help to achieve the goals that are outlined in this plan. These individuals and organizations can provide information, suggestions, or services to accomplish objectives and achieve goals. The following table lists organization names and their common acronyms used in this plan. This list should not be considered all-inclusive – assistance may also be provided by other entities, consultants, and organizations.

Resource	Acronym
MUNICIPAL	
Village of Barrington	BARR
Lake Zurich Chamber of Commerce	LZCC
Village of Lake Zurich	VOLZ
STATE / REGIONAL	

Illinois Department of Natural Resources	DNR
Lake County Health Department	LKCO
State of Illinois	ST/IL

FEDERAL

Army Corps of Engineers	ACENG

CONTRACTORS

Environmental Aquatic Management	EAM
ILM Environments	ILM
Keystone Hatcheries	KEYST

LOCAL NON-PROFIT ORGANIZATIONS

Ancient Oaks Foundation	AOF
Citizens for Conservation	CFC
Flint Creek Watershed Partnership	FCWP
Illinois Lakes Management Association	ILMA
Lake Property Owner's Association	LPOA
Lake Management Planning Committee	LMP
Lake Zurich Lions Club	LIONS
Business Owners / Lake Zurich	BIZLZ

GOALS, OBJECTIVES, & ACTIONS

Overarching Lake Vision

The following goals, objectives, and associated actions were derived from the values and concerns of the LPOA's Lake Management Planning Committee, and the known information about Lake Zurich, its ecosystem, and the landscape within its watershed. Lead persons and resources are given under each objective of this plan.

Implementing and regularly updating the goals and actions in the Lake Zurich Lake Management Plan will ensure that the vision is supported, and that changes or new challenges are incorporated into the plan. A management plan is a living document that changes over time to meet the current needs, challenges, and desires of the lake and its community. The goals, objectives and actions listed in this plan should be reviewed annually and updated with any necessary changes.

Water Quality

Goal 1

Protect overall water quality to support a healthy lake ecosystem and great recreation.

Objective	Action	Lead	Timeline	Resources
Objective 1.1 Conduct resource inventories and monitor water quality on a regular basis to assess conditions that may be affecting water quality	Continue Secchi Disk readings and reporting per the Lake County VLMP program.	Paul Dawidczyk	On-going	LKCO
Objective 1.2 Identify potential water quality threats through expanded monitoring utilizing citizen scientists and LPO research.	Expand trained resources to create sustainable comprehensive monitoring team.	Paul Dawidczyk	2023	
	Enhance monitoring to include dissolved oxygen, phosphorus, suspended solids, chloride, alkalinity, temperature,	To be assigned	2024	TBD

Objective 1.3 Reduce phosphorus, nutrient & other pollution by educating property and landowners and landscape contractors on the effectiveness of native buffers and porous pavements.	Publish and share water quality monitoring results with village constituents. Publicize impact of road salt on water quality, aquatic, and native wildlife species; develop recommendations for education, alternatives, and	Paul Dawidczyk TBD	TBD TBD	TBD TBD
Objective 1.4 Research best green infrastructure practices and work with government agencies to encourage best green management practices in ordinances and codes.	Establish liaison to create communication link with village to generate best practices for improved lake quality. Collaborate with organizations and neighboring communities to leverage resources, garner	Paul Dawidczyk TBD	TBD TBD	TBD FCWP ILMA
Objective 1.5 Educate public about protecting water quality by using best green infrastructure practices.	Establish PR campaign that encourages use of non-phosphorus lawn fertilizer and limiting yard waste discharge.	Paul Dawidczyk	TBD	TBD

Shorelands

Goal 2

Ensure Lake Zurich's shorelines are utilized, designed, and maintained according to best practices that contribute to overall health and quality of the Lake.

Objective	Action	Lead	Timeline	Resources

Objective 2.1 Make use of publicly accessed shorelines to increase awareness, engagement, and support.	Reduce garbage on shorelines by placing garbage cans that are conveniently located around the entire lake. Enhance Promenade and recreational area directly across the street including installing: ▪ Educational signage featuring information on fish species, aquatic plants, and other wildlife; lake maintenance practices and associated costs ▪ Protective signage featuring fishing regulations as well as invasive species advisement ▪ Porta-potties and enhanced landscaping in recreational area across the street from promenade ▪ Receptacles for used fishing line recycling ▪ Permanently installed fish measurement devices ▪ Signage with website information to report catches, make donations, define volunteer	To be assigned To be assigned	Complete by Spring 2023 Summer 2023	VOLZ Parks & Rec. VOLZ Parks & Rec.
Objective 2.2 Educate and inspire property owners to take personal responsibility for preserving and restoring the health and beauty of our lake with these outcomes: **<u>Shoreline Erosion</u>** – All properties meet standard of **None** or **Slight**. **<u>Shoreline Buffer Conditions</u>** – 60% of properties meet	Continuously engage and support property owners about best practices re: shoreline vegetation, structural design, and overall yard maintenance. Work with VOLZ to address erosion concerns at Paulus Park. Monitor upcoming developments to ensure that proper erosion and buffering	TBD	TBD	TBD

Aquatic Plants

Goal 3

Ensure a healthy and diverse native aquatic plant community that supports a balanced fishery, promotes good water quality while allowing for unimpeded recreation, and controls noninvasive species. Reestablish closer to the ideal 20-40% healthy plant growth in Lake Zurich and lay the foundation for measured healthy growth going forward.

Objective	Action	Lead	Timeline	Resources
Objective 3.1 Eliminate invasive species of plants by leveraging and maintaining best practices for aquatic plant management, including deploying a variety of methodologies such as pro-active herbicide treatments and harvesting, as well as managing volume of good healthy plants.	Establish and maintain balance between appropriate aquatic plants and open water for an overall healthy lake.	Alaina Murawski	Ongoing	Qualified 3rd party aquatic plant management professionals; various lake advisory agencies
	Test and consider probiotic/ enzyme/bacteria technology for reducing the decomposed plant level at strategic lake bottom sites.	Alaina Murawski	Ongoing	Qualified 3rd party aquatic plant management professionals; various lake advisory agencies
	Gather monthly inventory of various plant observations and report data to LPOA to outline needs for plant management the following year.	Alaina Murawski Other committee members	Monthly	Qualified 3rd party aquatic plant management professionals
	Obtain bids from at least 2 professional lake management firms and add the corresponding expense to the LPOA budget.	Alaina Murawski	Once per season	

Fisheries

Goal 4

LPOA will continue ongoing fish stocking practices and lake management strategies to encourage and maintain a productive, well-balanced, and sustainable multi-species fishery that is conducive to sport fishing enthusiasts and hobbyists, as well as a habitat that promotes animal bio-diversity.

Objective	Action	Lead	Timeline	Resources
Objective 4.1 To provide both quantity and quality fishing environments and opportunities for owners, LZ community, and visitors.	Query and survey fisherman, DNR, and Hatchery contacts. Maintain records to determine best approach and techniques.	Dave Mock LMP	Annually	Fishermen DNR KEYST LPOA
Objective 4.2 Identify and remove non-native and invasive fish, including carp.	Keep carp levels to a minimum with an ongoing carp removal program, which includes engaging assistance of paid agencies, DNR, and fisherman to aid in removal of carp.	Dave Mock LMP	Annually	Fishermen DNR EAM LPOA
Objective 4.3 Keep owners and community apprised of recommendations, status, and opportunities about Lake Zurich's fish population and ongoing management	Inform and educate groups and individuals in Spring and Fall through LPOA meetings and website, LZ Facebook page, among others.	Dave Mock LMP	Annually	DNR VOLZ LPOA
Objective 4.4 Continuously monitor progress of fish management program with viable data and inputs.	Collaborate with DNR for periodic surveying (shock surveys). Engage fisherman to provide continuous feedback and insights from active catches. Use signage, on-line forms, and contest incentives to	Dave Mock	Annually	DNR KEYST Fishermen
Objective 4.5 Adopt best management practices to support fishery habitat, water quality, and recreational opportunities for	Identify current habitat needs vs natural and artificial structure; supplement as needed.	Dave Mock LMP	Annually	DNR EAM Fishermen Qualified 3rd party agencies

Objective 4.6 Promote and encourage continued recreational fishing on Lake Zurich for all ages.	Publicize fishing and ice fishing regulations, such as valid fishing licenses, bag limits, fish shanties, and tip-ups. Promote interest in fishing of children by sponsoring and providing continued support of annual fishing contests.	Fishing Committee	Ongoing	Fishing Committee LPOA DNR VOLZ

Water Quantity/Levels

Goal 5

Lake Zurich will strive to maintain ideal water levels within agreed upon acceptable ranges and adapt water level management techniques with naturally occurring fluctuations.

Objective	Action	Lead	Timeline	Resources
Objective 5.1 Understand water fluctuations (natural vs man-made) in and near Lake Zurich, including surrounding watershed.	Collect and provide updated data to LPOA members via email or website regarding proactive water withdrawals, culvert management efforts, and natural impacts on lake	LPOA LIONS	Ongoing	LPOA LIONS ACENG VOLZ
Objective 5.2 Initiate and define lake level monitoring program, including determining a viable threshold lake level.	Work with qualified 3rd party resources to assess current and prior monitoring methods and consider best practices to monitoring lake level.	LMP LPOA	Ongoing	LMP LPOA LIONS ACENG VOLZ
	Work with LMP, LPOA, Lions Club, VOLZ, and Army Corps to establish a viable threshold lake level for Lake Zurich.	LMP LPOA LIONS	Q2 & Q3 2022	
Objective 5.3 Work with Lake Zurich citizens and elected officials to ensure that Lake Zurich maintains "normal" lake levels.	Connect with neighboring watershed bodies and other lake groups in the area focused on water level/groundwater issues in Lake County.	LMP LPOA	Ongoing	LMP LPOA LIONS LKCO ACENG
	Collaborate with other lake communities and their residents on groundwater legislation and managing groundwater withdrawals.			LMP LPOA LIONS LKCO ACENG VOLZ
	Educate association members, LZ citizens, and VOLZ regarding impacts to lake levels and measures that can be instituted to help manage viable lake levels.			LMP LPOA LIONS VOLZ
	Nurture collaborative and positive relationship between LPOA and Village of Lake Zurich to maintain mutually agreed	LPOA LIONS		LPOA LMP VOLZ

Recreation

Goal 6

Sustain and support recreational activities, tourism, and local businesses/industry in a manner consistent with optimal water quality protection, public safety, VOLZ and DNR regulations, and lake rules.

Objective	Action	Lead	Timeline	Resources
Objective 6.1 Communicate and post activity-specific recreational rules and guidelines to lakeshore property owners, beachgoers, and fishermen.	Maintain and post fishing and boating/watercraft guidelines at appropriate locations (i.e., Promenade, Paulus Park).	Fishing Committee	Ongoing	Fishing Committee LPOA
	Request that VOLZ provide information about safety and critical areas (ski lanes), and NO WAKE areas when signs are next updated or during summer season.	LPOA	Ongoing	LPOA VOLZ
	Continue to communicate at LPOA annual meetings information for lake residents and their guests about lake rules and NO WAKE guidelines.			
	Create and distribute brochures to lake property owners and citizens regarding boating regulations.	LPOA	Ongoing	LPOA
	Promote clean boating practices and state boating regulations at marinas, boat launches, fishing tournaments,			

Communications/Organization/Outreach

Goal 7

Lake Zurich community and stakeholders will be connected and informed in lake stewardship. Working together on common values will help to achieve the goals that are outlined in this plan. Increase participation in overall lake stewardship among all stakeholders.

Objective	Action	Lead	Timeline	Resources
Objective 7.1 Develop and implement effective outreach and education efforts within community, engage all lake stakeholders and constituents, and convey constituents' respective roles in the use and protection of Lake Zurich, including communicating with new homeowners and redevelopment planners.	Utilize all forms of media including social media, email, print materials, advertising, presentations, and workshops, and other forms of communication. Maintain LPOA website and/or create an LPOA Facebook page to provide a common source of communication. Maintain an email list of lake association members (LPOA). Distribute a welcome packet to all new property owners with lake stewardship information, regulations, and brochures. Share regular updates about lake management activities and plans with residents and users of the lake via email list and/or newsletter. Host annual meeting with property owners to share	COMM Committee, LPOA	Ongoing	COMM Committee LPOA VOLZ

Objective 7.2 Achieve effective communication with clubs, municipalities, agency staff, elected officials, other lake groups and organizations interested in Lake Zurich or lake health.	Network and spearhead productive relationships with LZ stakeholders who will participate, assist, or benefit in having a healthy and robust community.	LMP LPOA	Ongoing	LMP LKCO LPOA LIONS VOLZ BIZLZ
	Establish and nurture positive relationship, collaboration, and communications between LPOA and Village of Lake Zurich.	LPOA	Ongoing	LPOA LMP VOLZ
	Network with other lake groups in Lake County and the state to leverage knowledge and learn successful lake management strategies utilized by other communities. ***https://ilma-lakes.org/current-members***	LMP	Ongoing	LMP LKCO ST/IL BARR
	Send a member from the LMP to the Illinois Lake Management Association and Illinois Chapter of the American Fisheries Society joint Annual Conference.	LMP	March	LMP
	Leverage organizations with departments dedicated to the preservation of natural lake resources, such as University of Wisconsin – Stevens Point's Lake Leaders Institute and participate in their ongoing educational programs. ***https://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/programs/***	LMP	Ongoing	LMP

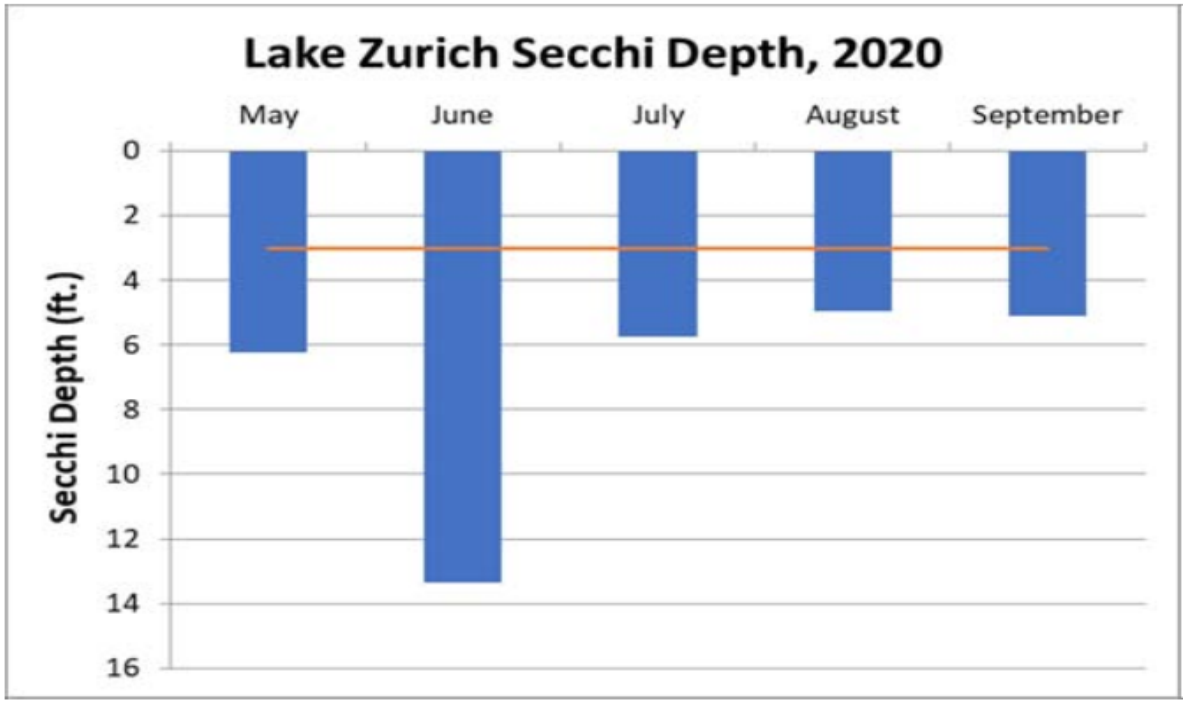
EVALUATION AND MOVING FORWARD

Issue or Problem	Recommended Actions	Timeline			Estimated Cost	Estimated Volunteer Hours	Benefit of Action	Project Status
		Begin	Halfway Checkpoint	Complete				

APPENDICES

APPENDIX A – WATER QUALITY READINGS

FIGURE 7. LAKE ZURICH WATER QUALITY – SECCHI TRANSPARENCY, 2020



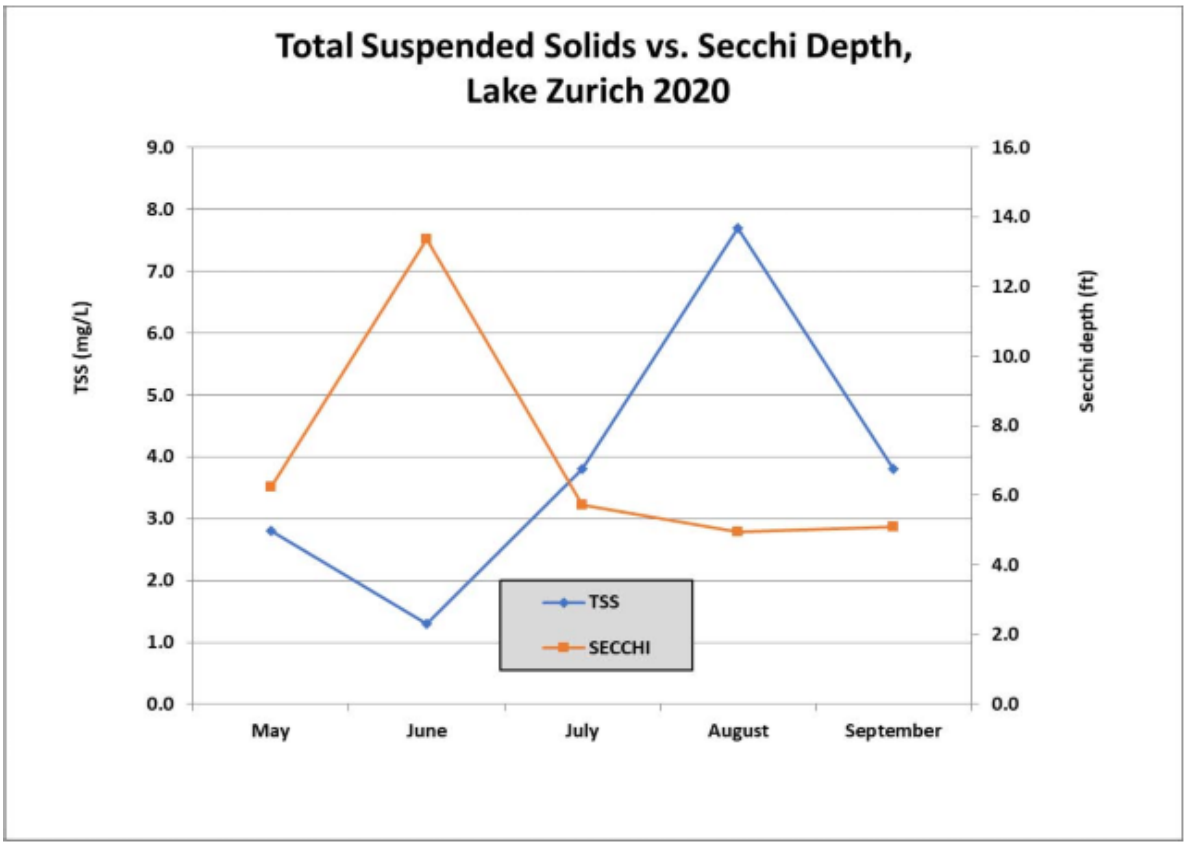


FIGURE 8. LAKE ZURICH HISTORICAL SECCHI READINGS VLMP / LCHD DATA, 2020
ANNUAL AVERAGE, MINIMUM, & MAXIMUM SECCHI TRANSPARENCY, SITE 1, 1994-2016

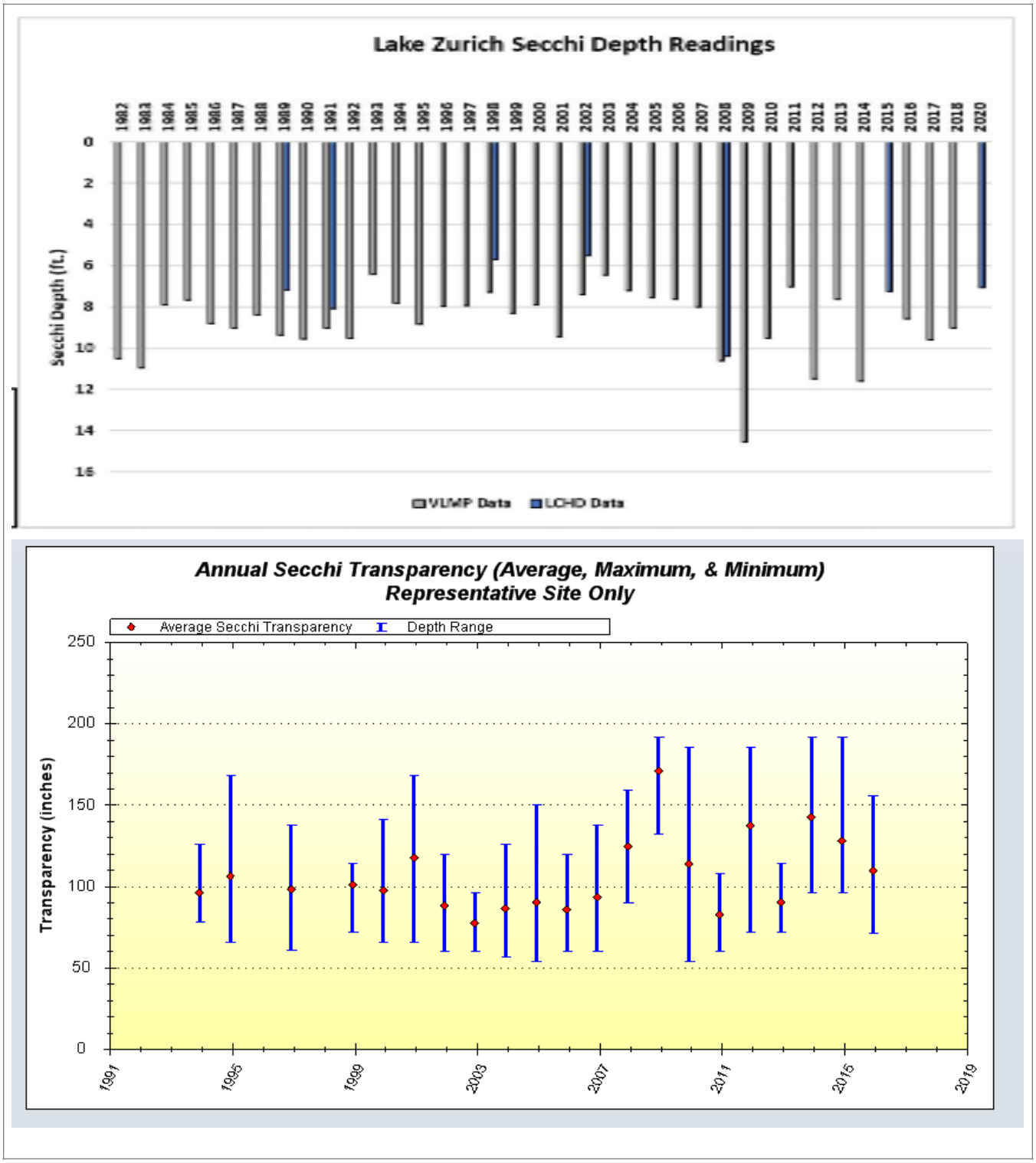
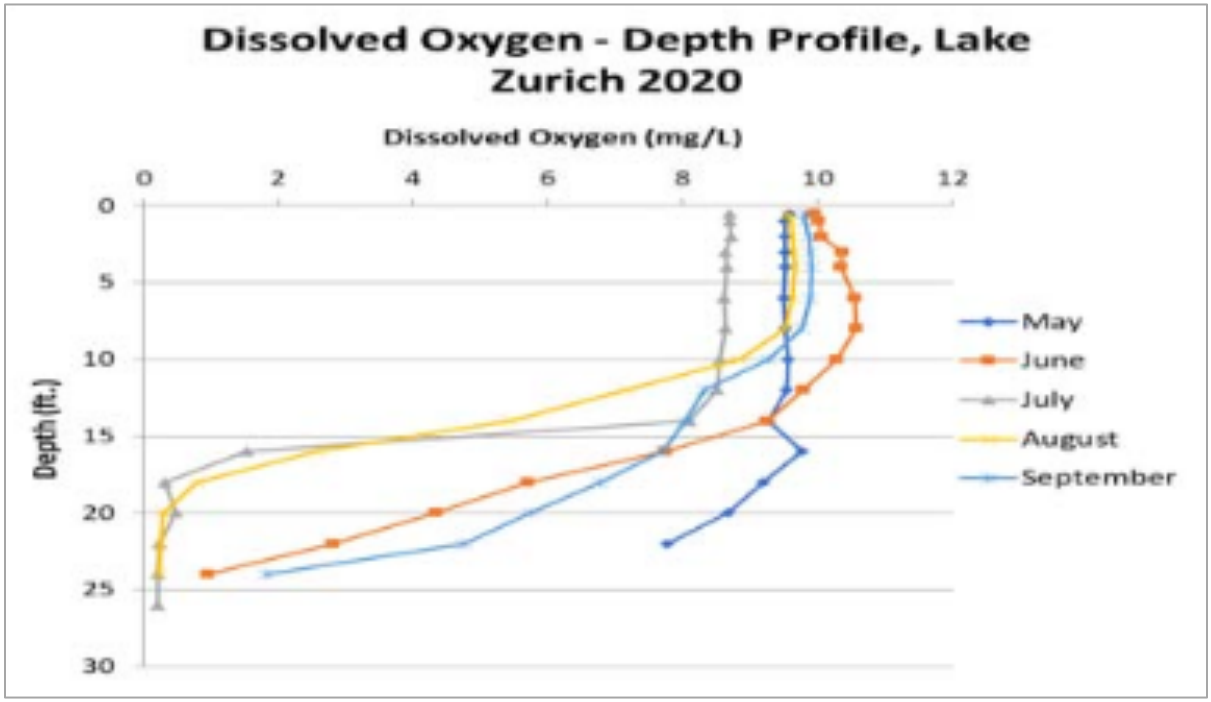


FIGURE 9. LAKE ZURICH DISSOLVED OXYGEN PROFILES, 2020



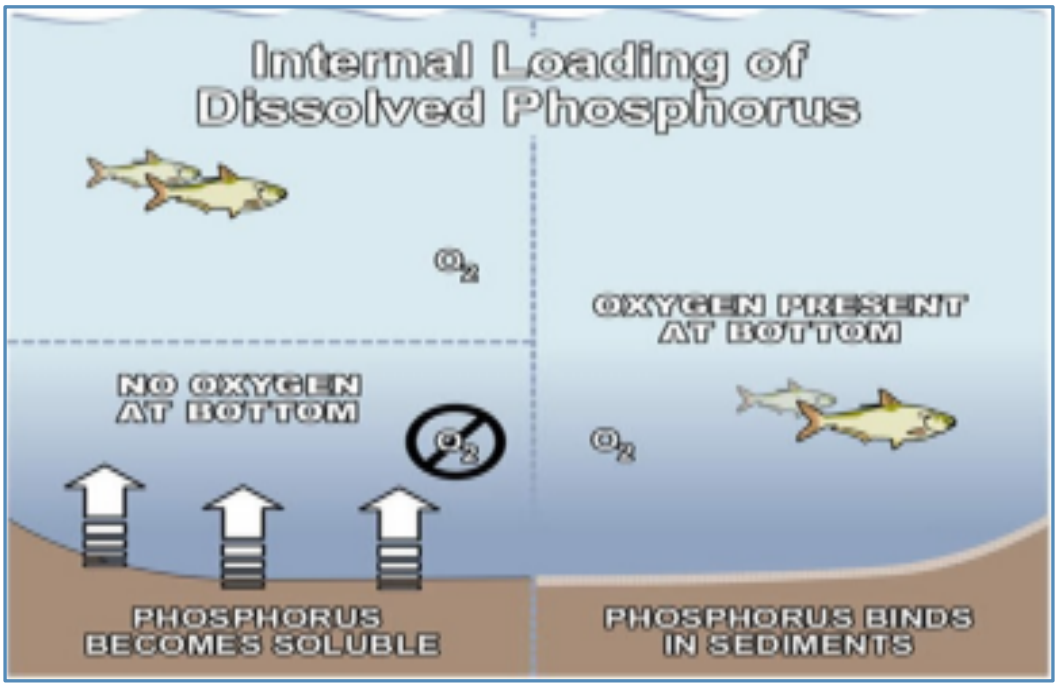
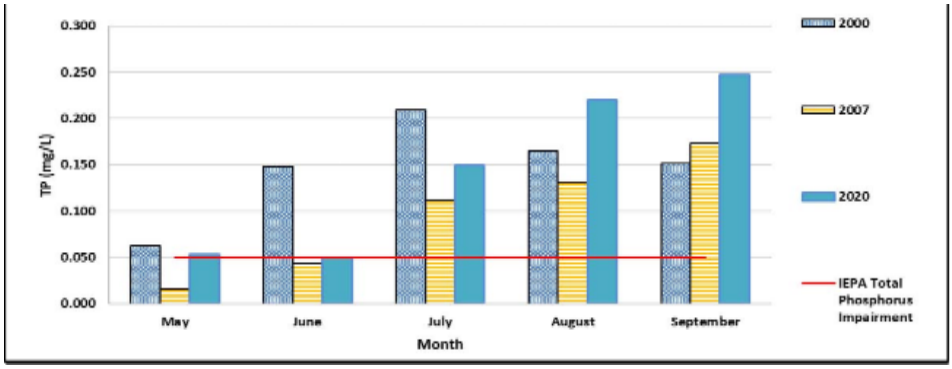


FIGURE 10. LAKE ZURICH MONTHLY TOTAL PHOSPHORUS CONCENTRATIONS, 2001-2020



KEYSTONE
HATCHERIES

February 11, 2019

Report on 2018 Creel Survey of Lake Zurich, and plan to improve the fish population

Hi Chris,

As promised, I put together the data from the creel surveys, and aged the scale samples. Based on that information I came up with the following conclusions and recommendations for you.

First, I want to emphasize that this is not a scientific survey, but rather a simple, practical and inexpensive approach to analyzing the fish population with the limited data available to us. The conclusions and recommendations that I give are based entirely off of the information that you gave me, and could be inaccurate if that data was inaccurate. However, it appears that the individual fishing results were pretty consistent throughout, so that increases my confidence in these results.

The table below summarizes the data for the creel survey. The general impressions are that largemouth bass and northern pike are the dominant species caught/fished for, and that the sizes caught are below average. Both of these things lead me to believe that the fish population is suffering from predator stunting:

Summary of Lake Zurich 2018 Creel Survey

	LMB	NRP	WLY	BULL	YLBASS	BCR	BLG
Total caught	81	19	2	1	1	1	2
Ave Length	13.5	20.9	20	12	11	10	3.5
Max Length	18	29	22	12	11	10	4
Min Length	11	15	18	12	11	10	3

The scale samples lend further credence to the idea that the bass are suffering from stunting. There were 4 samples for bass, plus a couple others, and these were the results:

- 12" Largemouth Bass: ~5 years old
- 13" Largemouth Bass: ~6 years old
- 14" Largemouth Bass: ~6 years old
- 15" Largemouth Bass: unfortunately, the scales were sampled in the wrong location, and could not be aged.
- Bluegill (size not given): ~4 years old
- Rock Bass (size not given): ~5 years old

815.678.2537ph 815.678.2437f • 11409 keystone road richmond illinois 60071
info@keystonehatcheries.com • keystonehatcheries.com

The size of Largemouth Bass at different ages is going to vary considerably based on many factors, but the big 2 are food availability and water temperatures. Basically, bass from warmer water grow faster, and bass in colder water grow slower, but live longer. That is partially why the record book bass all come from Florida and Georgia. But regionally, food availability is a much bigger factor. Think about it this way, if there is X amount of food available in a balanced water body, 1,000 bass will grow at a certain normal rate. However, if there are 10,000 bass in that same water body, they will grow 10 times slower because of limited food. The results tend to snowball, because overpopulation devastates the forage base, leading to long term imbalances. The lack of panfish in the creel survey either indicates that people were not fishing for them, or that there is a significant shortage in the population.

Comparing the Largemouth Bass in Lake Zurich to other lakes further indicates a significant issue. Below is a chart from Windy City Fishing that lists the average size compared to age of Largemouth Bass in Northern Illinois. On average, a 6 year old bass in Northern Illinois is 17.4" according to their chart, and in Lake Zurich they are only 13-14", based on our limited data.

Largemouth Bass Age Chart for Northern Illinois

Length of Fish	Age in Years
6.3	1
9.0	2
11.6	3
13.5	4
15.8	5
17.4	6
18.9	7
19.8	8
20.3	9
20.7	10

The age of largemouth bass compared to the size varies throughout the country. The above chart in an approximation of the age of largemouth bass in Northern Illinois and the Chicago area.

For another comparison, Bekker's Fishes of Wisconsin lists the Age and Growth for 6 year old Largemouth Bass in various Wisconsin lakes to range from 13.6 in the far north to 17.2 further south. Wisconsin water is colder than Northern Illinois, which will undoubtedly give slower growth rates. So, it is not good for a northern Illinois Lake to be behind Wisconsin averages.

I suspect that Northern Pike are much the same story, although we lack scale samples to verify this. Bekker's Fishes of Wisconsin lists 5 year old pike to range from 22.1" in the far north, to 33.7" further south. Because of the size profile in the Creel Survey, and lack of large pike, I strongly suspect that the pike in this lake are stunted.

Also, below is a summary of the other info gathered on the creel survey. Catch rates are highly variable between and within water bodies, so this info on its own doesn't mean that much. But what it does tell you is that significant amounts of fish are being caught per effort.

	catch/person	Catch/hour/person
Average	3.3	1.7
Max	6.5	3
Min	1	0.4

The big question is what to do to correct the bass and pike stunting. In short, you want to reduce the predator population and increase the forage population. Unfortunately, you probably will not be able to correct the situation by just stocking more forage species. Bass have an incredible capacity to devour food in their target range. We commonly stock 100 pounds of minnows per surface acre in stunted bass ponds, and they tend to wipe out that food boost in under a month. So, I recommend that you combine targeted harvesting along with a forage stocking program. For 2019, you should harvest as many Largemouth Bass and Northern Pike in the following size ranges as is practicable:

- Largemouth Bass, keep 12-15". Throw back under 12" and over 16"+
- Northern Pike, keep anything under 25". By doing this you will increase the average size of the pike. As the average size of the pike increases, the size of the bass they eat will also increase. Eventually, they will help manage the bass population for you.
- Panfish, throw back everything for now

Regarding stocking, I'd recommend putting in as many 5-7" Bluegill as are available and within your budget, plus maybe some minnows to distract the predators. FYI, 5-7" Bluegill are not always commercially available, but I believe we will have a decent supply this spring if you order early.

Chris, if I missed anything that you wanted to address please let me know. Otherwise, I believe this plan would be a good starting point to improve the fish population in Lake Zurich.

Thanks,

Mike Robinson
Owner/Biologist
Keystone Hatcheries LLC

815.678.2537*ph* 815.678.2437*f* • 11409 keystone road richmond illinois 60071
info@keystonehatcheries.com • **keystonehatcheries.com**

APPENDIX C – LAKE USE STUDY

FIGURE 15. LAKE ZURICH LAKE USE SCENARIO 1

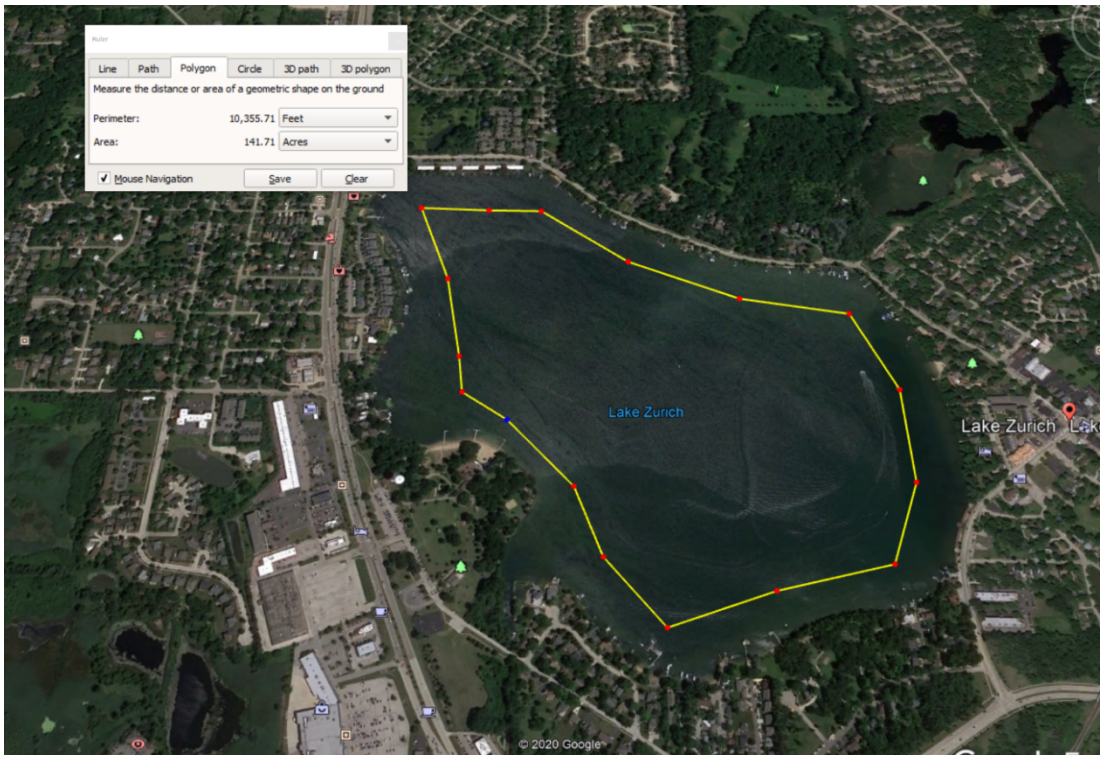
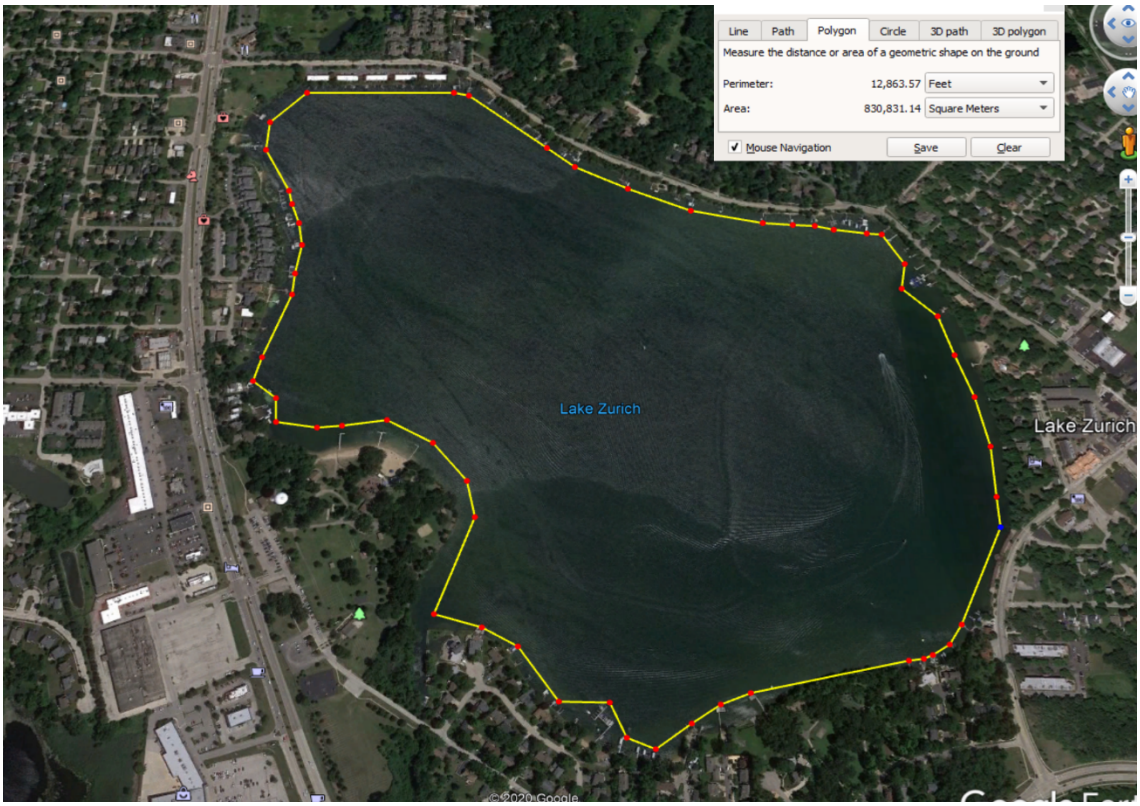


FIGURE 16. LAKE ZURICH LAKE USE SCENARIO 2



Data Collection:

Blend of the Lake Ripley study, which appears to be the baseline for many other published studies that exist. Lake Ripley is also a good comparison because it is a smaller inland lake like Lake Zurich. Studies from larger lakes, like Lake Champlain (313,576 AC), have some value but are significantly larger bodies of water.

The plan was to begin collecting data Saturday, May 16, 2020 and conclude Sunday, September 20, 2020, two weeks prior to the Memorial Day holiday weekend and two weeks after the Labor Day holiday weekend.

The excel sheet on the following pages contains the data points to fill in. Observer writes their name, records the date, time (military is probably easiest), temperature, if it is raining, wind speed and direction, cloud conditions, # of speed boats, # of pontoon boats, # of fishing boats, # of sail boats, # of paddle crafts (non-motorized, non-sail boats such as kayaks, canoes, paddle boats, paddle boards, etc.), # of boats towing a person (skiing, tubing, wake boarding, wake surfing, etc.), # of boats Idle or slow no wake, and # of boats producing a wake. Boats anchored in the middle are to be counted as idle/SNW. Fishing boats that are anchored, drifting, or trolling with an electric motor would also be categorized as Idle/SNW.

To gather different data perspectives, it was recommended that 3-5 volunteers, including the Capacity Committee Chair and police, record the data. Recordings did not have to be taken on a set schedule, and weekdays would be difficult. It was recommended that 3-5 recordings on the weekends be taken: early morning, mid to late morning, midday, late afternoon, and right before sunset.

The weather information explains why numbers may be high or low at a given time. For example, rain on the 4th of July or 60 degrees with 22 mph winds on Labor Day would reduce the overall number of boats.

Data Evaluation:

During the season and especially at the end of the year, data will be compiled into graphs as seen on page 32 of the Ripley report. This data will help determine the lake's use and if it is over or under capacity. Thereafter, informed and statistically backed decisions can be made to ensure safety and quality of the lake.

Carrying Capacity Formulas:

Scenario #1 in the Lake Ripley study involves subtracting portions of the lake that are already restricted (for safety and other reasons) from the lake's total surface area; this would be everything inside the buoys. This does not include the swim area in the middle where many boats will anchor. The inconsistent size of the middle swim area left it difficult to quantify just how much needed to be blocked out. Collecting a season of

data may offer better insight on averages in the future. Scenario #1 removes 90.67 AC of the 232.38 total surface acres, leaving +/- 141.71 AC usable lake area (Lake Zurich Buoy Line, Figure 15).
However, Scenario 1 does not account for boat use within the buoys which does happen with non-motorized watercrafts and boats traveling slowly around the lake and some boats that are fishing. Scenario 2 accounts for the usable area to be extended to the 3-foot depth contour. Since we don't have a document that clearly displays this, the dock/pier line across the lake seemed like a more appropriate use boundary. Scenario #2 removes 27.08 AC of the 232.38 total surface acres, leaving +/- 205.30 AC usable lake area (Lake Zurich Buoy Line Scenario 2, Figure 16). 1 sq meter = 0.000247105 acres or 830,831.14 sq meters = 205.30 AC. Both scenarios are applicable. Example: Boats making a wake should be held to Scenario 1. If our total boats exceed the density for Scenario 1 but the ratio of boats making a wake vs not making a wake fit into the overflow of Scenario 2, then we are still within capacity.

The team found 5 main sources and studies to develop lake density formulas. These formulas were generated with the safety of boaters and the lake's natural well-being in mind. The table below illustrates their findings and can be found in both the Lake Ripley and Indiana reports. The 1971 Ashton and 1989 Jackson study seemed to be the most lenient. Others called for 30 AC per motorized boat regardless of

activity. While that density is desirable, it is not reasonable for Lake Zurich during peak use. It is important to note that the Ashton study used 3 specific lakes. We still need to compare how our lake measures up to the 3 they examined. It is also important to recognize that how the lake is used impacts the density. 4 of the 5 studies called for at least 20 AC per boat that are making a wake.

Study	Boating Use	Suggested Density
Ashton	All uses combined Cass Lake	5-9 AC per boat
	All uses combined Orchard Lake	4-9 AC per boat
	All uses combined Union Lake	6-11 AC per boat
Kusler	Waterskiing + All uses	40 AC per boat
	Waterskiing only	15-20 AC per boat
Jackson	Waterskiing and Motorboat Cruising	20 AC per boat
	Fishing/Idle	10 AC per boat
	Canoeing, Kayak, Sailing	8 AC per boat
	All uses combined	10 AC per boat
Wagner	All Boats	25 AC per boat
Warback	All Motorized Uses Over 5 MPH	30 AC per boat

Throughout this process, it is important to keep in mind any special conditions that may cause us to adjust our calculations. For example, using Jackson, which appears to be the most comprehensive study, if half the boats on the lake are making a wake and the other half are fishing or idle, the ideal density would be 15 AC per boat. Using Scenario 2, the most accommodating interpretation of our usable acreage, the lake could support 13.6 boats.

This was the basis for our study which utilized the Jackson method for calculating density. This method was reasonable and somewhat current (1989) – they don't seem to come out with too many new versions of lake capacity studies. http://lakeripley1.homestead.com/files/Lake_Ripley_Carrying_Capacity_Report.pdf

In looking at the attached data, three extra columns were added. Lake Acreage (buoy line) represents the useable lake area past the Buoys where boats can make a wake. Lake Acreage end of docks represents the amount of lake past the docks. The end of dock is the most relevant as it encompasses the usable area we have for all types of boats. The 3rd added column is AC Used based on the Jackson Study (20 AC for boats making a wake, 10 for stationary/not making a wake, 8 AC for non-motorized boats). Green represents the recordings where we are not over capacity. Yellow represents recordings where we were over capacity based on the lake area beyond the buoys, but still under capacity based on the 205 AC past the dock line. The red represents recordings where we are over the 205 AC dock line capacity. The darker red indicates times where we were more than 100 AC over capacity.

Recorder error should also be noted. It is realistic to point out that depending on one's vantagepoint, not all boats will be visible. However, the error should be minimal as it is unlikely that 10-20 boats would have been missed in a count. When totaling the numbers, some recorder calculations were incorrect and were corrected. Common mistakes were not including non-motorized boats in the Idle or SNW total, addition errors, and illogical numbers between total boats towing and total boats making a wake.

Month by Month Survey Breakdown:

May (15-31):

Mostly put on hold due to Covid hindering many people's ability to launch their boats. We also had a designated Slow/No Wake during this period as well.

June (All): *There were a few late May entries as well

Total Recordings	Under Capacity (Green and Yellow)	Under Capacity (Green and Yellow)	Over Capacity (Red and Dark Red)	Over Capacity (Red and Dark Red)	Over Capacity by 100+ AC (Dark Red)	Over Capacity by 100+ AC (Dark Red)
98	88	89.8%	10	10.2%	4	4.1%

Total Weekend & Holiday Recordings	Under Capacity (Green and Yellow)	Under Capacity (Green and Yellow)	Over Capacity (Red and Dark Red)	Over Capacity (Red and Dark Red)	Over Capacity by 100+ AC (Dark Red)	Over Capacity by 100+ AC (Dark Red)
35	27	77.1%	8	22.9%	4	11.4%

Total Boats	Speed/Ski Boat	Pontoon Boat	Fishing Boat	Sail Boat	Non-Motorized	Boats Towing	Boats Making a Wake	Boats Idle or SNW
909	398	167	84	3	257	136	182	698

Comments:

June and late May saw some unseasonably cold weather during 2 of the weekends (5/30-5/31 and 6/13-6/14) that likely lead to lower capacity numbers, specifically on the weekends. Work from home and canceled activities probably increased weekday and weeknight usage. How much remains to be seen as this was our base year. It is light until 8:30pm this time of year. Early evening usage may be normal with or without covid. 8/10 over capacity recordings took place on the weekend/holiday. Speed/ski boats were our most common vessel, followed by non-motorized and pontoon boats. From an activity standpoint, non-motorized (kayak/canoe/etc.) was the most common, followed by towing (ski/tube/wake surf), then fishing. Before 9AM, fishing is the most common activity. We didn't track it specifically this year, and we probably should in 2021, but anchoring in the middle of the lake is probably the most widely seen lake use.

July (All):

Total Recordings	Under Capacity (Green and Yellow)	Under Capacity (Green and Yellow)	Over Capacity (Red and Dark Red)	Over Capacity (Red and Dark Red)	Over Capacity by 100+ AC (Dark Red)	Over Capacity by 100+ AC (Dark Red)
73	57	78.1%	16	21.9%	10	13.7%

Total Weekend & Holiday Recordings	Under Capacity (Green and Yellow)	Under Capacity (Green and Yellow)	Over Capacity (Red and Dark Red)	Over Capacity (Red and Dark Red)	Over Capacity by 100+ AC (Dark Red)	Over Capacity by 100+ AC (Dark Red)
28	14	50.0%	14	50.0%	10	35.7%

Total Boats	Speed/Ski Boat	Pontoon Boat	Fishing Boat	Sail Boat	Non-Motorized	Boats Towing	Boats Making a Wake	Boats Idle or SNW
879	422	177	55	4	219	121	170	672

Comments:

July saw fewer recordings with people going on vacations. The numbers for over capacity went up as the summer got into swing, the weather improved, and 4th of July. Similar to June, 14/16 overcapacity recordings took place on a weekend or holiday. 9/14 under capacity weekend recordings were taken before 9AM. Taking those 9 away, only 5/19 weekend recordings were below capacity. July was a very busy and most crowded month on the lake. Like June, speed/ski boats were the most common vessel followed by non-motorized, then pontoon boats. From an activity standpoint, non-motorized (kayak/canoe/etc.) was again the most common, followed by towing (ski/tube/wake surf), then fishing. Before 9AM, fishing was the most common activity.

August (All):

Total Recordings	Under Capacity (Green and Yellow)	Under Capacity (Green and Yellow)	Over Capacity (Red and Dark Red)	Over Capacity (Red and Dark Red)	Over Capacity by 100+ AC (Dark Red)	Over Capacity by 100+ AC (Dark Red)
41	30	73.2%	11	26.8%	3	7.3%

Total Weekend & Holiday Recordings	Under Capacity (Green and Yellow)	Under Capacity (Green and Yellow)	Over Capacity (Red and Dark Red)	Over Capacity (Red and Dark Red)	Over Capacity by 100+ AC (Dark Red)	Over Capacity by 100+ AC (Dark Red)
16	6	36.7%	10	63.3%	3	18.8%

Total Boats	Speed/ Ski Boat	Pontoon Boat	Fishing Boat	Sail Boat	Non-Motorized	Boats Towing	Boats Making a Wake	Boats Idle or SNW
498	221	93	32	2	131	43	99	380

Comments:

Our number of recordings continued to trend downward, but we still saw similar trends with weekends being the most crowded and represented the highest % of overcapacity recordings. I can't speak for others, but I didn't record as many morning recordings as I mostly fish in the afternoon come August. Like the previous months, 10/11 over capacity recordings took place on the weekends. Despite less recordings, like June and July, speed/ski boats were the most common vessel followed by non-motorized, then pontoon boats. From an activity standpoint, non-motorized (kayak/canoe/etc.) was again the most common, followed by towing (ski/tube/wake surf), then fishing. Before 9AM, fishing was the most common activity.

September (1-15):

Total Recordings	Under Capacity (Green and Yellow)	Under Capacity (Green and Yellow)	Over Capacity (Red and Dark Red)	Over Capacity (Red and Dark Red)	Over Capacity by 100+ AC (Dark Red)	Over Capacity by 100+ AC (Dark Red)
8	5	62.5%	3	37.5%	1	12.5%
Total Weekend & Holiday Recordings	Under Capacity (Green and Yellow)	Under Capacity (Green and Yellow)	Over Capacity (Red and Dark Red)	Over Capacity (Red and Dark Red)	Over Capacity by 100+ AC (Dark Red)	Over Capacity by 100+ AC (Dark Red)
7	4	57.1%	3	42.9%	1	14.3%

Total Boats	Speed/ Ski Boat	Pontoon Boat	Fishing Boat	Sail Boat	Non-Motorized	Boats Towing	Boats Making a Wake	Boats Idle or SNW
114	50	24	7	0	33	11	24	90

Comments:

September had our fewest recordings but did include Labor Day Weekend. Only 1 entry came on a weekday. Post Labor Day Weekend there were no overcapacity recordings. Like the other months 3/3 over capacity recordings occurred on the weekend or holiday. With the season coming to an end and less recordings, the trends remained the same. Speed/ski boats were our most common vessel, followed by non-motorized, then pontoon boats. From an activity standpoint, non-motorized (kayak/canoe/etc.) was again the most common, followed by towing (ski/tube/wakesurf), then fishing. Before 9 AM, fishing was the most common activity.

Total:

Total Recordings	Under Capacity (Green and Yellow)	Under Capacity (Green and Yellow)	Over Capacity (Red and Dark Red)	Over Capacity (Red and Dark Red)	Over Capacity by 100+ AC (Dark Red)	Over Capacity by 100+ AC (Dark Red)
220	180	81.8%	40	18.2%	18	8.2%
Total Weekend & Holiday Recordings	Under Capacity (Green and Yellow)	Under Capacity (Green and Yellow)	Over Capacity (Red and Dark Red)	Over Capacity (Red and Dark Red)	Over Capacity by 100+ AC (Dark Red)	Over Capacity by 100+ AC (Dark Red)
86	51	59.3%	35	40.7%	18	20.9%

APPENDIX D – US FISH & WILDLIFE SERVICE

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Lake County, Illinois



Local office

Chicago Ecological Service Field Office

(312) 485-9337

U.s. Fish And Wildlife Service Chicago Ecological Services Office
230 South Dearborn St., Suite 2938
Chicago, IL 60604-1507

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Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Northern Long-eared Bat Myotis septentrionalis Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Threatened

Birds

NAME	STATUS
Piping Plover Charadrius melodus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/6039	Endangered
Red Knot Calidris canutus rufa Wherever found There is **proposed** critical habitat for this species. https://ecos.fws.gov/ecp/species/1864	Threatened

Insects

NAME	STATUS

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Karner Blue Butterfly Lycaeides melissa samuelis — Endangered
Wherever found
There is **proposed** critical habitat for this species.
https://ecos.fws.gov/ecp/species/6656

Monarch Butterfly Danaus plexippus — Candidate
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/9743

Flowering Plants

NAME	STATUS

Eastern Prairie Fringed Orchid Platanthera leucophaea — Threatened
Wherever found
This species only needs to be considered if the following condition applies:
- Follow the guidance provided at https://www.fws.gov/midwest/endangered/section7/s7process/plants/epfos7guide.html

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/601

Pitcher's Thistle Cirsium pitcheri — Threatened
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/8153

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

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There are no critical habitats at this location.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

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For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Oct 15 to Aug 31
Black-billed Cuckoo *Coccyzus erythropthalmus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31
Cerulean Warbler *Dendroica cerulea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/2974	Breeds Apr 21 to Jul 20
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Henslow's Sparrow *Ammodramus henslowii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3941	Breeds May 1 to Aug 31

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Lesser Yellowlegs Tringa flavipes This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Prothonotary Warbler Protonotaria citrea This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker Melanerpes erythrocephalus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rusty Blackbird Euphagus carolinus This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Wood Thrush Hylocichla mustelina This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have

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higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

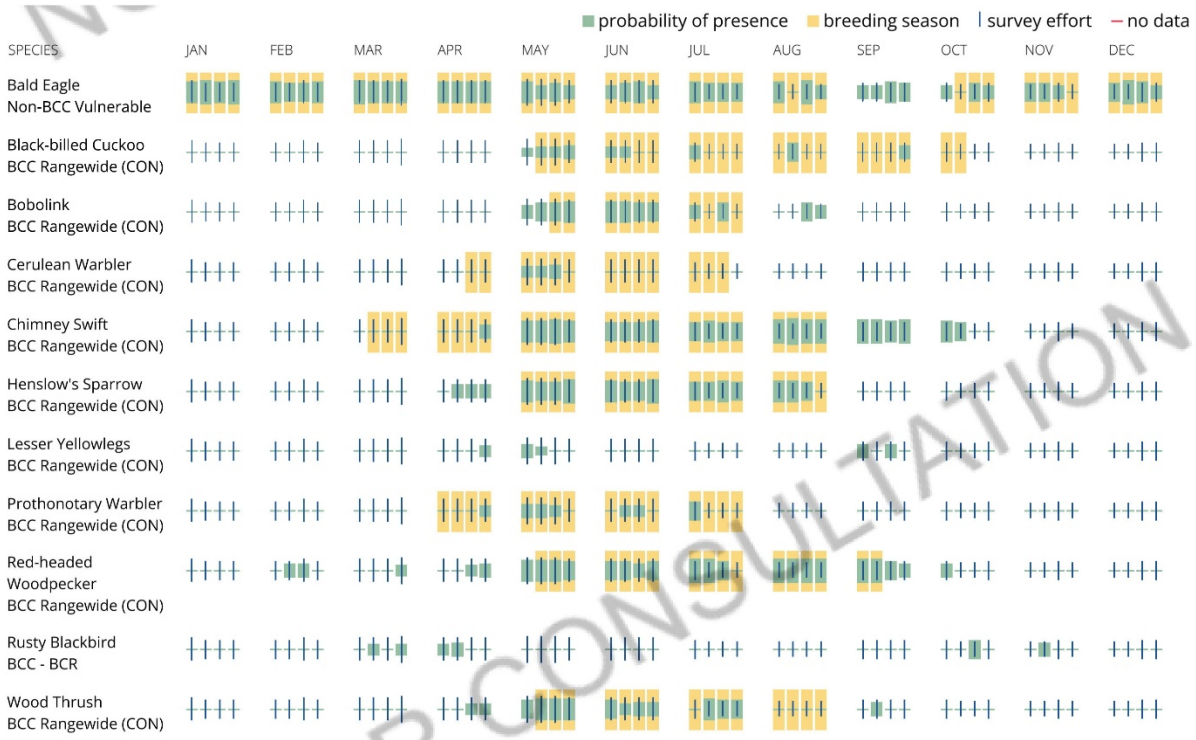
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure.

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To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

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Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In

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contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Coastal Barrier Resources System

Projects within the John H. Chafee Coastal Barrier Resources System (CBRS) may be subject to the restrictions on federal expenditures and financial assistance and the consultation requirements of the Coastal Barrier Resources Act (CBRA) (16 U.S.C. 3501 et seq.). For more information, please contact the local Ecological Services Field Office or visit the CBRA Consultations website. The CBRA website provides tools such as a flow chart to help determine whether consultation is required and a template to facilitate the consultation process.

There are no known coastal barriers at this location.

Data limitations

The CBRS boundaries used in IPaC are representations of the controlling boundaries, which are depicted on the official CBRS maps. The boundaries depicted in this layer are not to be considered authoritative for in/out determinations close to a CBRS boundary (i.e., within the "CBRS Buffer Zone" that appears as a hatched area on either side of the boundary). For projects that are very close to a CBRS boundary but do not clearly intersect a unit, you may contact the Service for an official determination by following the instructions here: https://www.fws.gov/service/coastal-barrier-resources-system-property-documentation

Data exclusions

CBRS units extend seaward out to either the 20- or 30-foot bathymetric contour (depending on the location of the unit). The true seaward extent of the units is not shown in the CBRS data, therefore projects in the offshore areas of units (e.g., dredging, breakwaters, offshore wind energy or oil and gas projects) may be subject to CBRA even if they do not intersect the CBRS data. For additional information, please contact CBRA@fws.gov.

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Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Wetland information is not available at this time

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the NWI map to view wetlands at this location.

Data limitations

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The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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