LAKE COUNTY, ILLINOIS

2012 MANNING'S SLOUGH SUMMARY REPORT

PREPARED BY THE

LAKE COUNTY HEALTH DEPARTMENT

Population Health Environmental Services

Rainy Spring day on Manning's Slough, 2012.

Manning's Slough is an approximately 8.66 acre glacial lake located in Hawthorn Woods. Manning's Slough was preserved as part of the Hawthorn Woods Country Club development and used for aesthetics. The Country Club is responsible for the management activities taking place within the development which includes Manning's Slough.

In 2012, Manning's Slough was monitored for water quality by the LCHD-ES. A multiparameter sonde was used to collect temperature, pH, dissolved oxygen, and conductivity. Additionally water samples were collected using a Van Dorn sampler and tested for alkalinity, phosphorus, nitrogen, solids, and chloride. Assessments were made of aquatic vegetation, shoreline erosion, land use and the watershed.

The overall water quality of Manning's Slough is average. If it were greater than 20 acres, it would be considered impaired for phosphorus by the Illinois Environmental Protection Agency (IEPA). They have a total phosphorus standard of ≥ 0.05 mg/L that is applied to lakes whose surface area is greater than 20 acres. The total phosphorus (TP) concentrations in Manning's Slough ranged from 0.160 mg/L to 0.582 mg/L. All of these concentrations well exceed the standard. The 2012 average TP concentration was 0.382 mg/L and is well above the median TP concentration of 0.065 mg/L for lakes in the county monitored for phosphorus between 2000 and 2012.

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SPECIAL POINTS OF INTEREST:

- *Nutrients*
- *Dissolved Oxygen*
- *Aquatic Plants*

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SUMMARY (CONTINUED)

Lake Facts:

Major Watershed: Des Plaines

Sub-Watershed: Indian Creek

Location: T44N, R10E, Section 33

Surface Area: 8.66 acres

Shoreline Length: 1.98 miles

Maximum Depth: 4.4 feet.

Average Depth: 2.75 feet.

Lake Volume: 28.32 acre-feet

Watershed Area: 146.32 acres

Lake Type: Glacial Lake

Management Entities: Hawthorn Woods Country Club

Current Uses: aesthetics

Access: Private

Phosphorus and nitrogen are normally limiting nutrients in our region. The ratio of total nitrogen to total phosphorus (TN:TP) in 2012 was 6:1. This ratio indicates that plant and algal growth was very much limited by nitrogen availability; however, it is not because nitrogen was very low, instead it is due to the excessive amount of phosphorus in Manning's Slough waters.

Total Kjeldahl Nitrogen, (TKN) ranged from 0.97 mg/L in May to 3.99 mg/L in July. The average TKN concentration was 2.45 mg/L this exceeds the median TKN concentration from 812 samples taken from lakes in the county between 2000 and 2012 of 1.18 mg/L. TKN is the organic form of nitrogen and is usually tied up in plant and algal cells and therefore is biologically unavailable. The biologically available nitrogen (nitrate, nitrite and ammonium) in the water was non-detectable from May - August. However, there were nitrate and nitrite in the water in September, this was due to the lake becoming limited by phosphorus as it exhibited a TN:TP ratio of 20:1. Otherwise, any nitrogen that became available was taken up immediately by organisms.

Carlson's Trophic State Index (TSIp) uses average TP to estimate the trophic state of a lake. The TSIp for Manning's Slough was 90 and therefore it is considered a hypereutrophic or nutrient rich lake. It ranked 168th out of 174 lakes in the county measured for phosphorus between 2000 and 2012.

There are many potential sources of phosphorus available in Manning Slough. Internal cycling of phosphorus occurs when DO concentrations become low, ≤2.0 mg/L near the lake bottom allowing for the release of phosphorus from anoxic (dissolved oxygen ≤1 mg/L) sediments. Eroding shorelines can also introduce phosphorus rich sediments into the water column, although in Manning's Slough this was a minimal source. Activities taking place in the watershed such as turf fertilization and usage of the marsh by waterfowl can additionally cause increased TP concentrations. Reminding residents and golf course maintenance personnel to use phosphorus-free fertilizers and to take actions to minimize goose populations can go a long way in reducing phosphorus inputs into Manning's Slough.

There were filamentous algal blooms observed on Manning's Slough throughout the monitoring season. Elevated phosphorus promotes algal growth, and high chloride levels are known to shift algal populations towards blue green algae. The average chloride concentration was 151 mg/L which is below the critical concentration defined by the U.S. Environmental Protection Agency for general use of 230 mg/L. However, when compared to lakes in the county, it is considered elevated as the median chloride concentration from 552 samples taken from county lakes was 142 mg/L. The main contributing factor of increased chlorides has been linked to deicing products such as rock salt; however, water softener system discharges have also been identified as another source of chlorides and may have contributed to the elevated chloride concentrations measured in Manning's Slough. It only requires 1 teaspoon of salt to pollute 5 gallons of water to the critical concentration, and the ecosystem within a lake can be impacted if concentrations remain at the critical level 230 mg/L for extended periods of time.

Two assessments of the aquatic vegetation in Manning's Slough were conducted, one in May and the other in July of 2012. Thirty-five points were assessed and 97% percent of the points sampled were colonized by aquatic vegetation during both surveys. The estimated plant density found in the lake was 123% and 152% in May and July, respectively. There were eleven species found in the lake throughout the season. Nine species were detected in each of the surveys. Curlyleaf Pondweed and Common Duckweed were dominant in May; changing to a lake dominated by Common and Star Duckweed by July. Eurasian Water Milfoil was present during both surveys with an average density of 6% and 4% respectively in May and July. The Floristic Quality Index (FQI) score was 14.1, ranking it 61st of 160 lakes in the county whose FQI was calculated between 2000 and 2012.

WATER CLARITY

Water clarity is measured by Secchi disk. At each visit, the disk is lowered into the water column at the deepest part of the lake, until it is no longer visible.

Manning's Slough has excellent water clarity, although this is not reflected in the average Secchi depth of 1.00 foot. This is due to the Secchi disk being obstructed by plants in both May and August and in June and September the Secchi disk was visible on the bottom. Manning's Slough ranked 144th out of 158 lakes in the county whose average Secchi depths have been measured since 2000. Due to the depth of the lake and the abundance of vegetation Manning's Slough is limited in its ability to rank high for water clarity.

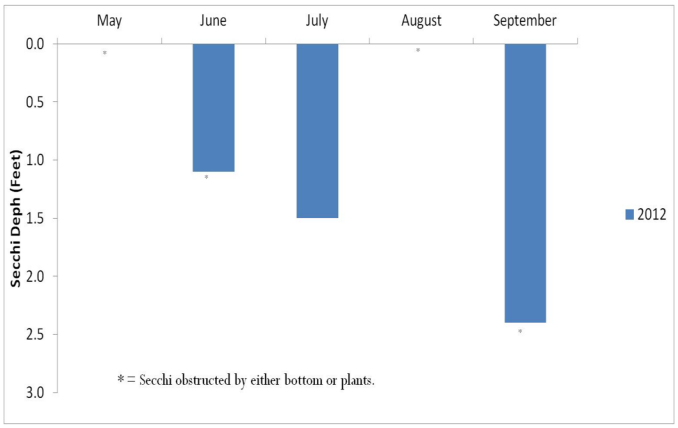

Figure 1. Water clarity in Manning's Slough, 2012.

TOTAL SUSPENDED SOLIDS

Total Suspended Solids (TSS) are made up of both volatile solids (TVS), which come from organic sources such as plankton and algae; and non-volatile solids or sediments (NVSS). Both adversely affect water clarity.

The average TSS in Manning's Slough was 14.5 mg/L. This is higher than the county median of 8.1 mg/L for lakes measured for TSS between 2000 and 2012. TSS concentations in Manning's Slough were low for most of the monitoring season, however the TSS concentration in July was 38.0 mg/L and is due to elevated TVS and NVSS concentrations occurring at that time.

Figure 2 shows the concentrations of TVS and NVSS found in Manning's Slough during 2012. TVS concentrations ranged from 77 mg/L in May to 163 mg/L in July . The average TVS was 125 mg/L which is slightly above the county median for lakes sampled since 2000 of 123 mg/L. There were filamentous algal blooms observed during the season, and likely a planktonic algal community did exist especially given the amount of phosphorus that was in the lake, although no planktonic blooms were noted.

Similarly, NVSS was low with the exception of a concentration occurring in July of 33.8 mg/L.

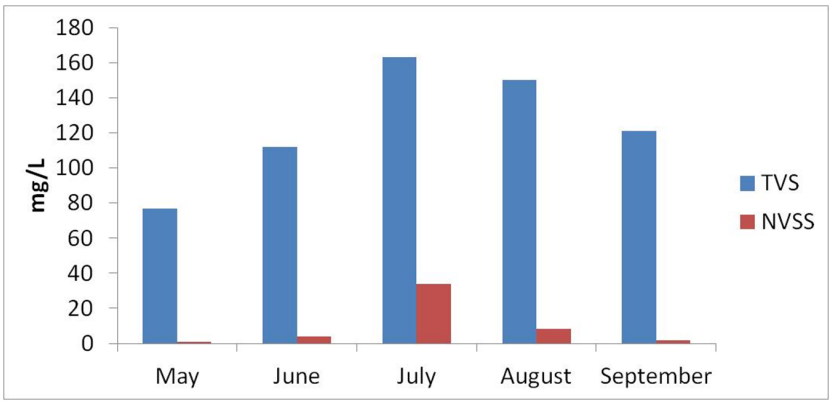

Figure 2. TVS and NVSS concentrations in Manning's Slough, 2012

NUTRIENTS

Phosphorus and nitrogen are normally limiting nutrients in natural systems. Like many lakes within Lake County, Manning's Slough had elevated phosphorus and if it had a greater surface area (≥ 20 acres) it would be considered impaired for total phosphorus (TP) by IEPA standards as TP concentrations in the lake ranged from 0.160 mg/L to 0.582 mg/L during 2012; all of which exceed the 0.05 mg/L standard for TP.

In 2012, the average TP concentration on Manning's Slough was 0.382 mg/L. This is well above the median TP concentration of 0.065 mg/L from lakes in the county monitored since 2000.

Total nitrogen to total phosphorus ratios (TN:TP) determine which of the two nutrients (phosphorus or nitrogen) limit the growth of plants and algae. Ratios over 20:1 indicate a system limited by phosphorus; under 10:1 the system becomes limited by nitrogen. Ratios falling between 10:1 and 20:1 indicate that the system has plenty of both nutrients to support nuisance plant and algae growth. Manning's Slough was very much limited by nitrogen, with a TN:TP ratio of 6:1. However, this was due to excessive phosphorus and not because of low nitrogen concentrations.

The average total kjeldahl nitrogen (TKN) was 2.45 mg/L. This is well above the median concentration of 1.18 mg/L for lakes in the county sampled for TKN between 2000 and 2012. TKN in Manning's Slough ranged from 0.97 mg/L in May to 3.99 mg/L in July. TKN is tied up in plant and algal cells; and therefore biologically unavailable. The biologically available forms of nitrogen (nitrate, nitrite and ammonium) were not detectable from May - August, however, in September nitrate and nitrite appeared at a concentration of 0.680 mg/L, this is well above the median for lakes in the county measured for nitrate nitrite concentrations since 2000. Manning's Slough at this time became a phosphorus limited system with a TK:TN ratio of 20:1. Realistically, the system had too much of both nutrients present in the water and organisms could not take it up fast enough.

Manning's Slough is considered a hypereutrophic lake based upon its Trophic State Index (TSIp) score of 90. The TSIp is based upon the total average phosphorus concentration. The higher the score the more nutrient enriched the lake is. Manning's Slough ranked 168th out of 174 lakes from the county that were assessed for phosphorus between the years 2000 and 2012.

Phosphorus (P) can be introduced into a system either from external sources (i.e. watershed) or internally from bottom sediments and aquatic organisms such as carp. Anoxic (≤ 1 mg/L DO) sediments release phosphorus into the water column and can occur when waters above the sediment are still oxic at approximately 2 mg/L (Nurnberg, 2013). Manning's Slough had DO concentrations from July - September ranging from 1.11 mg/L in July to 2.43 mg/L in August. Manning's Slough is a shallow lake, therefore the mixing of water may not exhibit the lowest hypoxia meanwhile the anoxic sediments contin-

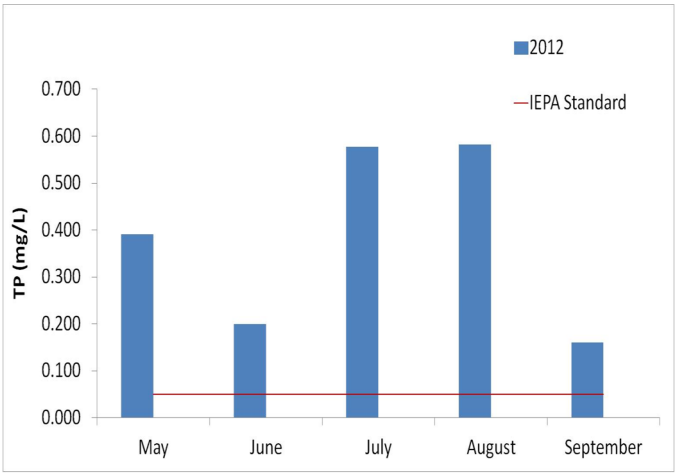

Figure 3. TP concentrations in Manning's Slough, 2012.

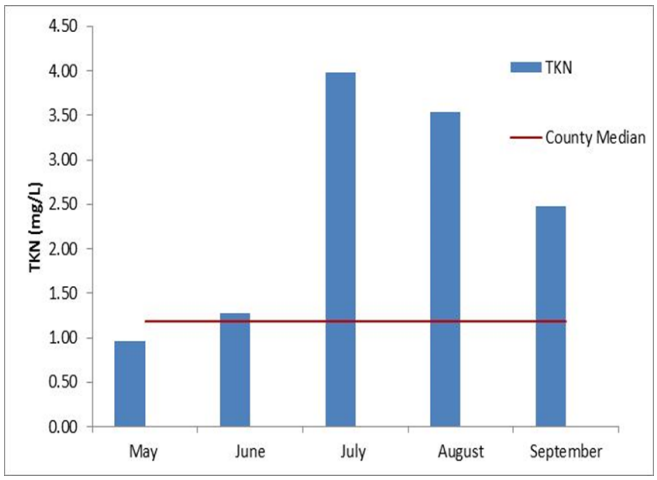

Figure 4. TKN concentrations in Manning's Slough, 2012.

Nutrients (continued)

ually are releasing phosphorus. It is recommended by the LCHD-ES that the Country Club and its residents utilize best practices in order to reduce phosphorus inputs into the lake this includes the use of phosphorus free fertilizers when maintaining turf grass as well as minimizing goose populations within the watershed near stormwater detention ponds and water features throughout the golf course.

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OLIGOTROPHIC:

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

MESOTROPHIC:

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

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

Figure 5. Trophic states illustrated.

Watershed

The watershed of Manning's Slough is estimated to be 146.32 acres. Land use in the watershed is comprised of 8 categories (Appendix A, Table 1). The dominant land uses were Single Family (34.1%), and Public and Private Open Space (28.2%) and Wetlands (11.6%). However, the percent total estimated runoff is almost exclusively from Single Family (41.2%), Public and Private Open Space (17.0%) and Transportation (14.4%). The ratio between watershed and lake volume is about 5:1. Therefore it is important that residents and businesses in the watershed maintain the landscape in such a way to minimize impacts to Manning's Slough. Total Maximum Daily Loads are being formulated for Indian Creek, in the future there may be a requirement for sources such as Manning Slough to conform to those loads. Practices such as phosphorus free fertilizers and minimizing goose habitat and populations can go a long way in alleviating some of the water quality problems addressed in this report.

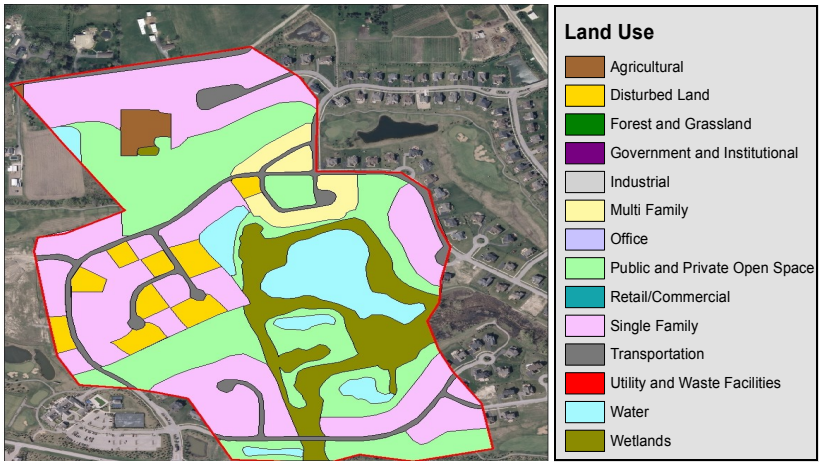


Figure 6. Watershed and land use of Manning's Slough, 2012.

Dissolved oxygen (DO)

Dissolved Oxygen (DO) is essential for the survival of fish and invertebrates and influences many different biological and chemical processes.

Manning's Slough did not thermally stratify during 2012. DO concentrations near the bottom sediments ranged from 1.11 mg/L in July to 12.74 mg/L in May. The DO concentrations near the bottom at times were low enough to cause release of phosphorus from anoxic bottom sediments (Nurnberg, 2013).

DO concentrations were low in Manning's Slough. Concentrations were ≤ 5 mg/L within a foot of the surface of the water and therefore Manning's Slough is not conducive for maintaining a fish population. It did however, have a abundant frog population, and is likely due to the absence of fish.

Conductivity/Chloride

Conductivity measures the amount of ions contained in a waterbody. The more ions or salts that a waterbody contains the higher its conductivity. Conductivity can be used to estimate both total dissolved solids (TDS) and chloride concentrations due to a strong correlation between these parameters. LCHD_ES has decided in more recent years to analyze chloride concentrations due to a strong relationship discovered between road salt usage (which contains 40% chloride) and increasing chloride concentrations in waters. Water softeners have been found to play an important role in increasing chloride concentrations than originally thought. It does not take much to increase chlorides, only1 teaspoon of salt (chloride) to 5 gallons of water can increase chlorides to the critical chloride concentration of 230 mg/L. Once chlorides are in the water they remain there indefinitely, unless the water is somehow diluted or treated by a reverse osmosis system, the latter being a very expensive alternative.

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

In 2012, the average chloride concentration in Manning's Slough was 151 mg/L. This is below the critical concentration of 230 mg/L. Chlorides ranged from 98 mg/L in May to a high of 177 mg/L in September (Figure 6). Normally, higher chloride concentrations occur earlier in the season due to snowmelt runoff; however, due to the extreme drought that occurred in 2012, chlorides may have become more concentrated or perhaps there are water softener are discharging into basins feeding into Manning's Slough. Adverse impacts can occur to the lake ecosystem and its inhabitants if chloride concentrations hit the critical concentration and are maintained for prolonged periods. Shifts in algal populations toward blue-green algae have been documented at concentrations as low as 12 mg/L.

Single family, public and private open space and transportation were estimated to contribute the greatest amount of runoff from the watershed and therefore residents and the Country Club grounds maintenance crews should be thoughtful of their salt usage whether it be from winter maintenance or water treatment. One golf courses in the county had to install a deep groundwater well to irrigate their greens due to the high concentrations of salts present in surface waters. The "What can I do to help?" tip box that follows, provides tips on how you can reduce salt use around your home.

CONDUCTIVITY/CHLORIDE (CONTINUED)

The LCHD-ES and Lake County Stormwater Management Commission (LCSMC) have been holding annual training sessions targeting deicing maintenance personnel for both public and private entities. This is an attempt to educate winter road maintenance crews on the recommended application rates for applying deicers and hopefully will reduce the amount of chloride being introduced into our environment while maintaining safe passageways.

Almost all deicing products contain chloride so it is important to read the product label for proper application. For instance, at 10° Fahrenheit, rock salt is not at all effective in melting ice and will blow away before it melts anything. Homeowners should encourage the local snow removal agency and support practices that reduce the usage of deicing products on their properties and roadways.

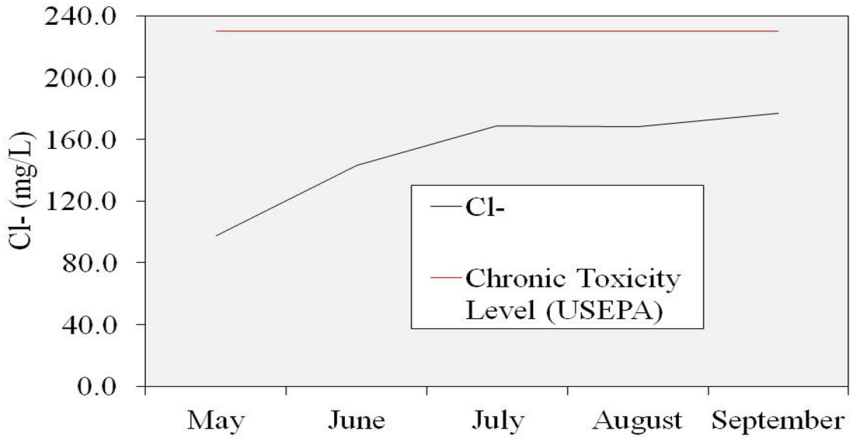


Figure 7. Chloride concentrations in Manning's Slough, 2012, compared to chronic toxicity level (USEPA).

What can I do to help?

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

Modified from (DuPage River Salt Creek Workgroup , 2008)

Aquatic Plants

Rake Density - May

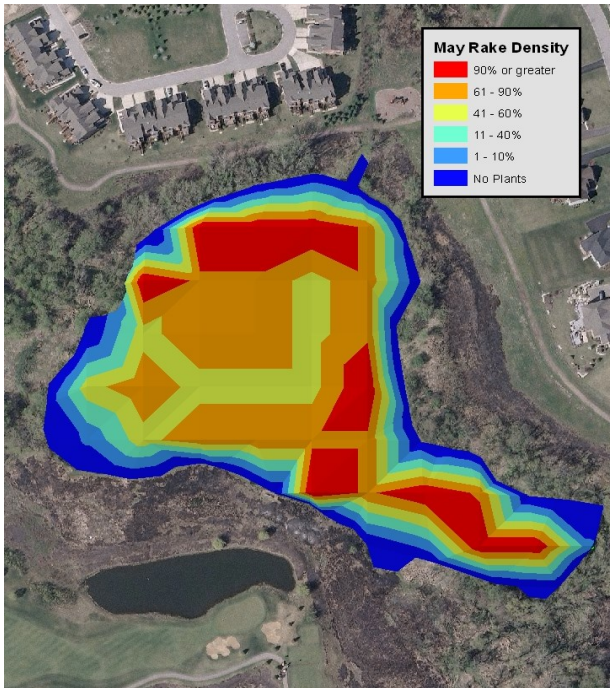


Figure 8. Rake density in Manning Slough, May, 2012.

Rake Density - July

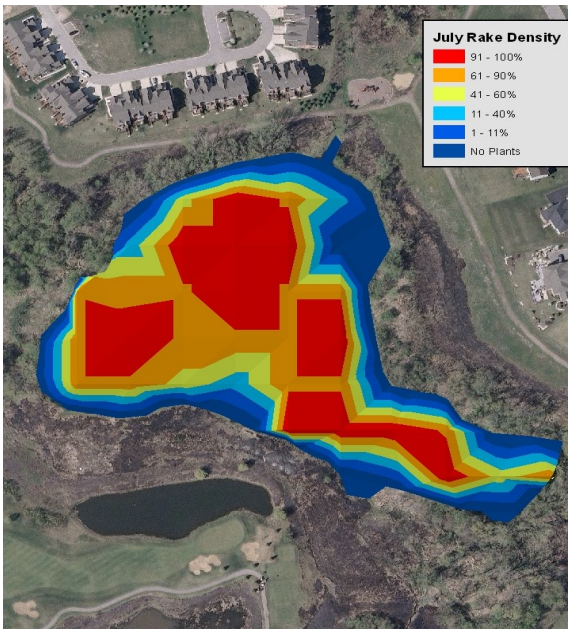


Figure 9. Rake Density in Manning Slough, July, 2012

Aquatic plants are a critical feature in lakes as they compete against algae for nutrients, improve water quality and provide fish habitat for nesting and nursery. Two aquatic vegetation surveys were conducted in Manning's Slough during 2012.

A 60-meter grid was randomly overlaid on an aerial photo of Manning's Slough and a total of 35 points fell within the lake footprint and were assessed. Ninety-seven percent of the points sampled were vegetated in both of the assessments. It is estimated that the total plant density was 123% (Figure 8) in May and 152% (Figure 9) in July. Curlyleaf Pondweed (CLP) and Duckweed were co-dominant in Manning's Slough in May. CLP had an average density of 51% and was present at 82.35% of the points sampled. CLP and Eurasian Water Milfoil (EWM) are both non native, invasive species. EWM was present in both surveys with average densities of 5.97% and 4.00% in May and July, respectively. There were no chemical treatments on Manning's Slough during 2012. LCHD-ES recommends that the Hawthorn Woods Country Club implement a strategy to reduce the abundance of CLP and EWM in Manning's Slough. There is a remnant native plant assemblage present that could be expanded in the absence of these invasive plant species.

There were a total of eleven species found in Manning's Slough in 2012. Nine species were detected in each of the surveys conducted (Table 1). CLP and Horned Pondweed were present in May and not July. In July, rather than finding those two species Sago Pondweed and Giant Pondweed were found. A FQI was calculated for Manning's Slough by combining species found in both surveys; it was 14.1. Floristic quality assessments allow for comparisons among sites. Manning's Slough ranked 61st of 160 lakes assessed in the county for floristic quality between 2000 and 2012.

May	July
Coontail	Coontail
Curlyleaf Pondweed	Common Duckweed
Common Duckweed	American Elodea
American Elodea	Eurasian Water Milfoil
Eurasian Water Milfoil	Giant Duckweed
Horned Pondweed	Sago Pondweed
Star Duckweed	Star Duckweed
White Water Lily	Watermeal
Watermeal	White Water Lily

Table 1. Species detected in Manning's Slough during May and July, 2012.

Aquatic Plant Management - Pesticides

Manning's Slough had two invasive submerged aquatic species detected during 2012. Curlyleaf Pondweed was dominant in the lake with an average density of 51% (Figure 10). Eurasian Watermilfoil was present during both surveys, representing an average density of 6% and 4%, in May and July respectively (Figure 10).

The LCHD-ES recommends that the Hawthorn Woods Country Club consider managing these two species in future years. Management of invasive species would allow the expansion of native plants into the lake. Care should be taken on the timing of treatments should they occur as some of the native species present can be sensitive to chemical treatments. Removal of too many plants could cause algal blooms as too much phosphorus remains in Manning's Slough and what is not taken up by plants would be utilized by algae in their absence.

As of 2010, a NPDES permit is required for pesticide applications. The application can be found at the web address supplied in the box to the left.

For full details of the Pesticide rule see:

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

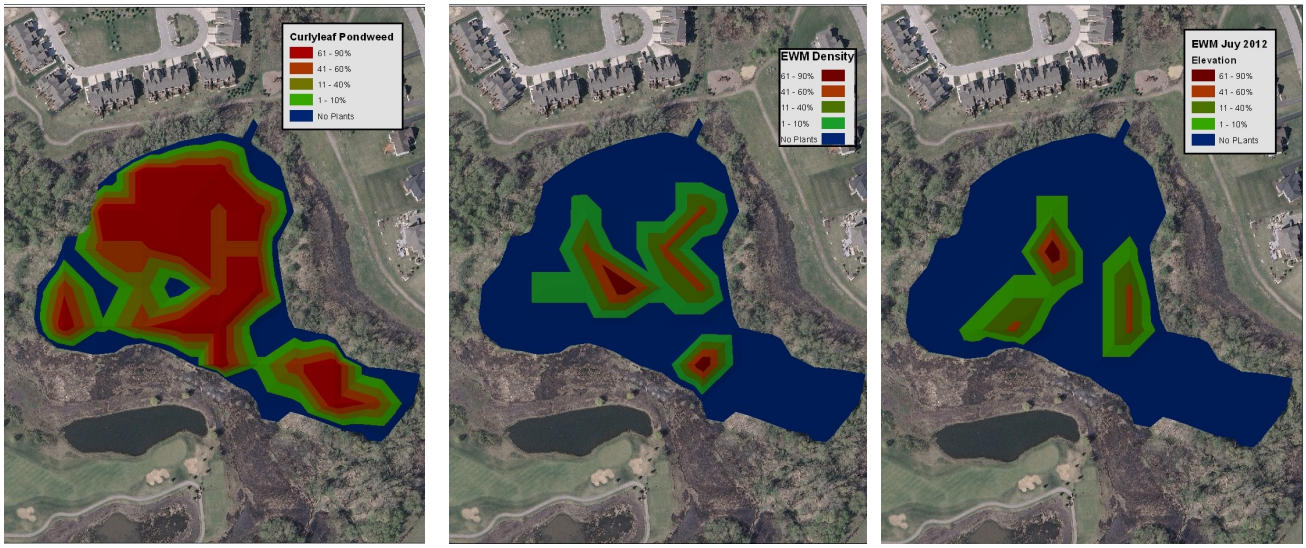


Figure 10. Location and density of aquatic invasives, Curlyleaf Pondweed (left) and Eurasian Water Milfoil (center and right). Curlyleaf was only present in May. EWM was detected in Manning's Slough during both assessments.

Shoreline vegetation

A random meander search was conducted along the shoreline areas of Manning's Slough and species were recorded at six locations along the shoreline. Thirty species were found at the six locations. The FQI was calculated at 13.9. There were invasive species present and consideration by the Hawthorn Woods Country Club development to manage their populations is recommended. Targeted species should be Canada Thistle, Reed Canary Grass, Common Reed, and European Buckthorn. There were extensive areas of Reed Canary Grass and if managed, consideration of seeding or plantings using native species need to be considered to suppress reestablishing populations of Reed Canary Grass .

Table 2. Shoreline species found along Manning's Slough in 2012.

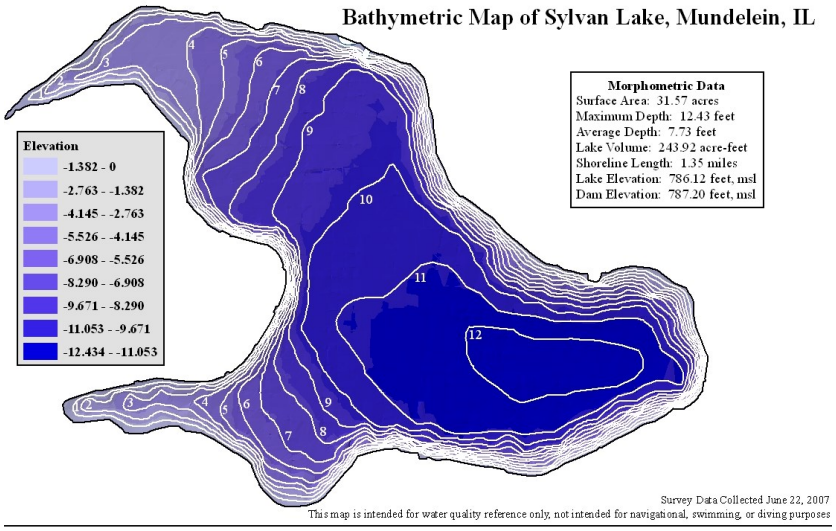
Common Name	Scientific Name	1	2	3	4	5	6
Boxelder	*Acer negundo*			+			
Swamp Milkweed	*Asclepias incarnata*		+				
New England Aster	*Aster novae-angliae*	+					+
False Nettle	*Boehmeria cylindrica*		+				
Hop Sedge	*Carex lupulina*	+					
Canada Thistle	*Cirsium arvense*	+	+				
Field Bindweed	*Convolvulus sepium*						+
Grey Dogwood	*Cornus racemosa*		+				
Queen Ann's Lace	*Daucus carota*	+	+	+			
Canada Rye	*Elymus canadensis*	+					
Virginia Rye	*Elymus virginicus*			+			
Bottlebrush Grass	*Hystrix patula*	+					
Rice Cut Grass	*Leersia oryzoides*	+		+			+
White Mulberry	*Morus alba*						+
Virginia Creeper	*Parthenocissus quinquefolia*	+	+				
Reed Canary Grass	*Phalaris arundinacea*	+	+	+	+	+	+
Common Reed	*Phragmites australis*	+					
Eastern Cottonwood	*Populus deltoides*	+					
European buckthorn	*Rhamnus cathartica*	+	+	+			
Common bucktorn	*Rhamnus frangula*			+			
Poison Ivy	*Rhus radicans*	+					
Black-eye Susan	*Rudbeckia hirta*			+			
Brown-eye Susan	*Rudbeckia subtomentosa*	+					
Crack Willow	*Salix fragilis*		+	+			+
Sandbar Willow	*Salix interior*		+	+			
Elderberry	*Sambucus canadensis*						+
Black Snakeroot	*Sanicula marilandica*		+				
Water	*Sium suave*	+					
Cattail	*Typha X glauca*						+
Tall Nettle	*Urtica procera*			+			
Riverbank Grape	*Vitis riparia*		+	+			
Golden Alexanders	*Zizia aurea*			+			

VLMP

Manning's Slough does not have a volunteer lake monitor actively participating in the VLMP program. It is recommended by the LCHD-ES that the Hawthorn Woods Country Club seek a volunteer to fill this vacancy. A Tier 1 VLMP collects Secchi disk readings for the Illinois Environmental Protection Agency program. The collection happens twice a month from May - October. If interested the VLMP can become more involved as either a Tier 2 or Tier 3 volunteer. Tier 2 and 3 volunteers collect additional data such as dissolved oxygen data and chlorophyll a. For more information or to volunteer, please contact the LCHD-ES at (847)377-8030.

BATHYMETRIC MAP

Manning's Slough does not have a bathymetric map. LCHD-ES recommends that Hawthorn Woods Country Club consider having a map made so they can utilize the map and morphometric data when estimating volumes for lake treatment and other decisions related to the overall plant management plan. Below is an example of a bathymetric map product provided by the LCHD-ES. If interested in obtaining a map, please feel free to contact the LCHD-ES at (847) 377-8030.



LakeCounty
Health Department and
Community Health Center

ENVIRONMENTAL SERVICES

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Libertyville, Illinois 60048-1331

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For more information visit us at:

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

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

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

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

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

RECOMMENDATIONS

LCHD-ES recommends the following actions for improving the water quality and overall health of Manning's Slough:

- Activities to reduce phosphorus inputs into Manning's Slough be initiated; such as using phosphorus free fertilizers and minimizing goose populations in detention ponds within the golf course and subdivision that feed into Manning's Slough.
- Reduce submerged aquatic vegetation by controlling Curlyleaf Pondweed and Eurasian Water Milfoil populations. Both these species are common invasive species in lakes.
- Remind residents about the problems chlorides can cause in aquatic systems. Ensure that water softener discharges are not entering water features such as detention ponds within the development.

STOP AQUATIC HITCHHIKERS!™

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

When you leave a body of water:

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

APPENDIX A

FIGURES AND TABLES
MANNING'S SLOUGH
2012

Figure 1. Water quality sampling point – Manning's Slough, 2012.

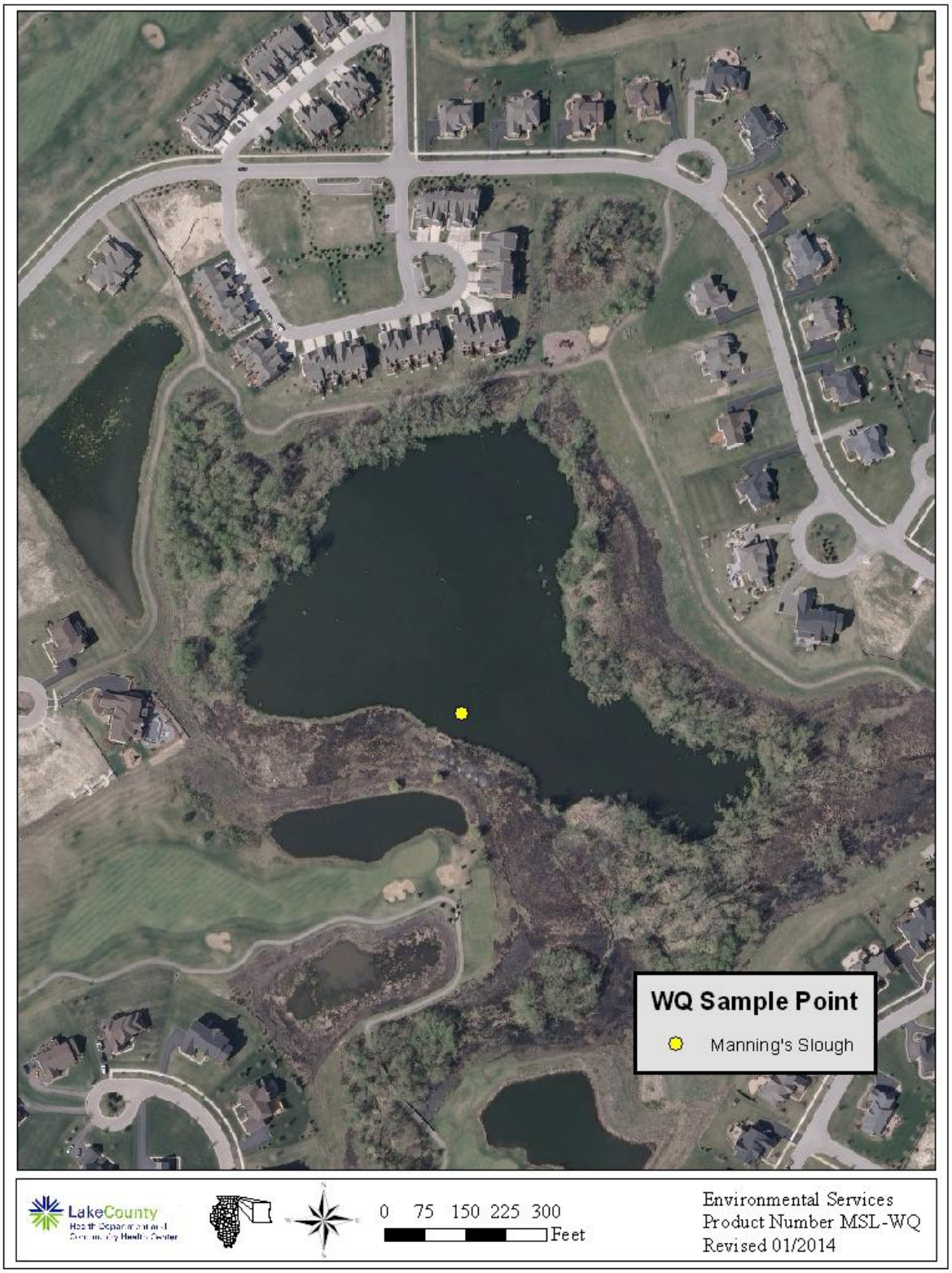

Figure 2. Watershed boundary – Manning's Slough, 2012.

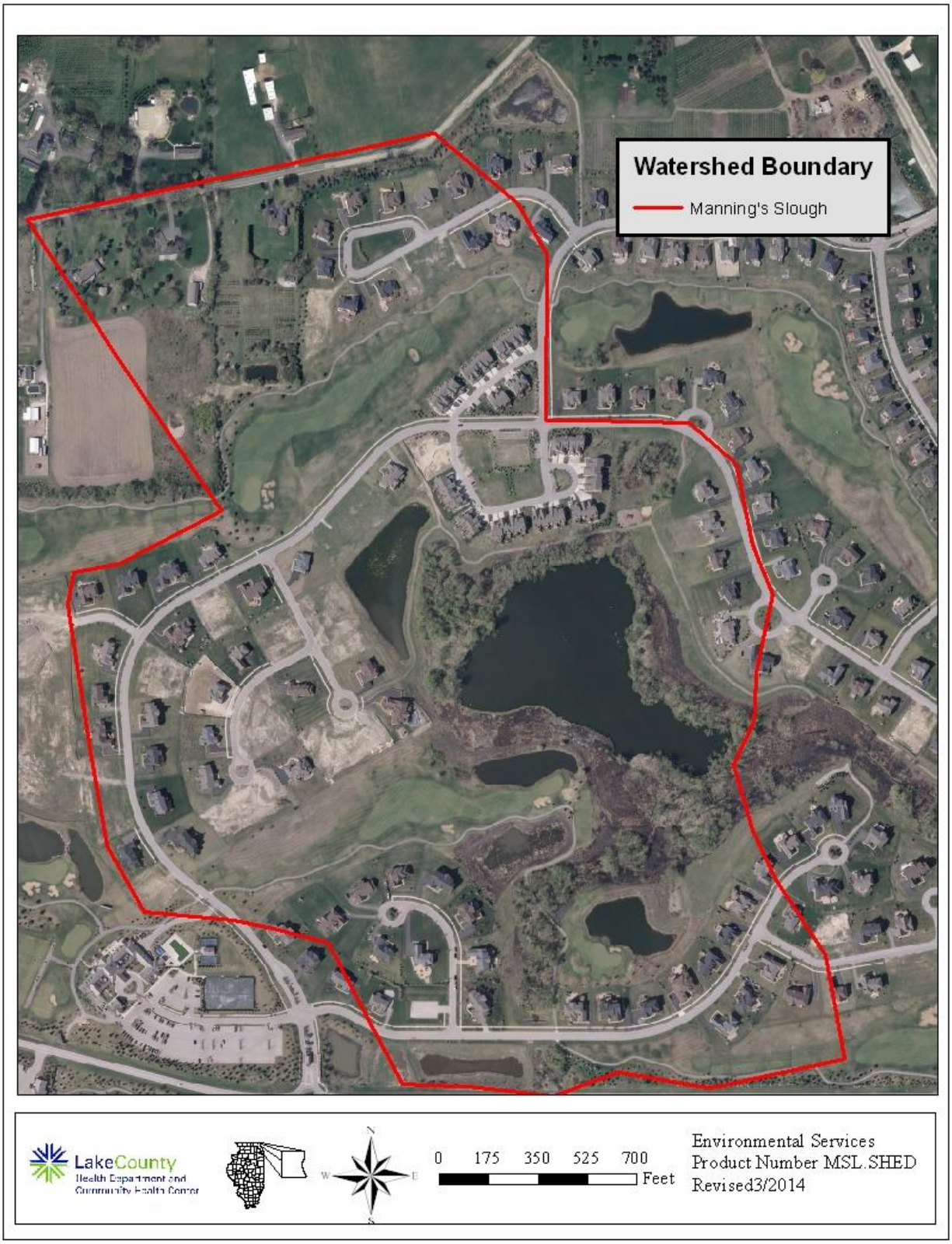

Figure 3. Land use – Manning's Slough, 2012.

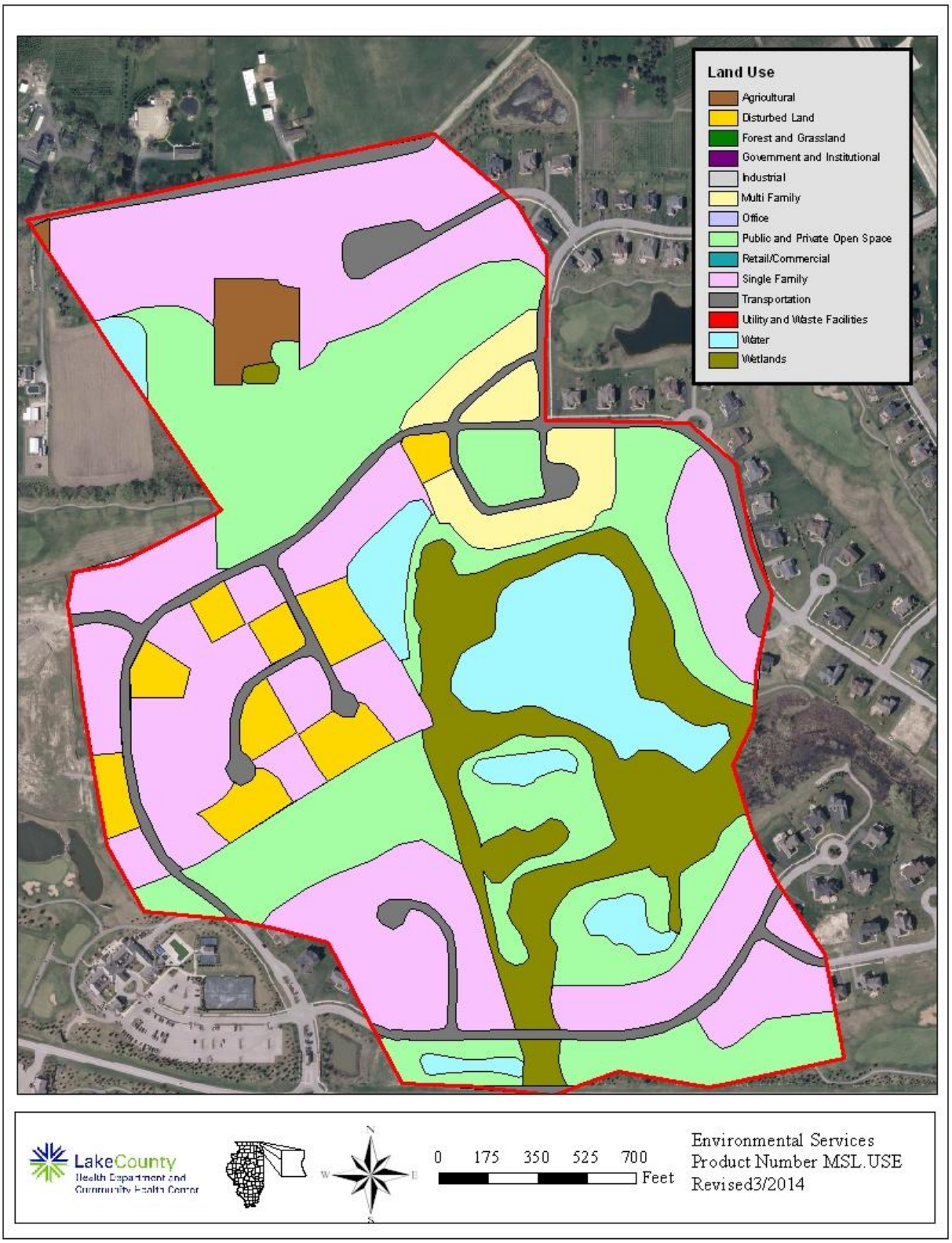

Table 1. Land use in Manning's Slough, 2012 (Based upon 2010 imagery).

Land Use	Acreage	% of Total
Agricultural	2.14	1.5%
Disturbed Land	7.33	5.0%
Forest and Grassland	0.00	0.0%
Government and Institutional	0.00	0.0%
Industrial	0.00	0.0%
Multi Family	5.42	3.7%
Office	0.00	0.0%
Public and Private Open Space	41.25	28.2%
Retail/Commercial	0.00	0.0%
Single Family	49.95	34.1%
Transportation	10.44	7.1%
Utility and Waste Facilities	0.00	0.0%
Water	12.78	8.7%
Wetlands	17.02	11.6%
Total Acres	**146.32**	**100.0%**

Land Use	Acreage	Runoff Coeff.	Estimated Runoff, acft.	% Total of Estimated Runoff
Agricultural	2.14	0.05	0.3	0.4%
Disturbed Land	7.33	0.05	1.0	1.2%
Forest and Grassland	0.00	0.05	0.0	0.0%
Government and Institutional	0.00	0.50	0.0	0.0%
Industrial	0.00	0.50	0.0	0.0%
Multi Family	5.42	0.50	7.5	8.9%
Office	0.00	0.85	0.0	0.0%
Public and Private Open Space	41.25	0.15	17.0	20.3%
Retail/Commercial	0.00	0.85	0.0	0.0%
Single Family	49.95	0.30	41.2	49.2%
Transportation	10.44	0.50	14.4	17.2%
Utility and Waste Facilities	0.00	0.30	0.0	0.0%
Water	12.78	0.00	0.0	0.0%
Wetlands	17.02	0.05	2.3	2.8%
TOTAL	**146.32**		**83.7**	100.0%

Lake volume	**28.32**	**acre-feet**
Retention Time (years)= lake volume/runoff	**0.34**	**years**
	123.54	**days**

Table 2. Water quality summary for Manning's Slough, 2012.

2012	Epilimnion															
DATE	DEPTH	ALK	TKN	NO2+NO3-N	NH3-N	TP	SRP	TDS	Cl-	TSS	TS	TVS	SECCHI	COND	pH	DO
16-May	0	164	0.97	<0.10	<0.05	0.391	0.291	369	98	2.4	402	77	0.0	0.6390	8.63	17.25
20-Jun	0	182	1.28	<0.10	<0.05	0.200	0.110	447	143	9.3	492	112	1.1	0.7940	7.71	4.51
18-Jul	0	207	3.99	<0.10	<0.05	0.577	0.032	473	169	38.0	618	163	1.5	0.8460	7.86	4.12
22-Aug	0	217	3.54	<0.10	<0.05	0.582	0.019	553	168	19.0	617	150	0.0	1.0050	8.09	8.05
19-Sep	0	249	2.48	0.68	<0.05	0.160	0.031	551	177	3.6	605	121	2.4	1.0010	7.42	5.35
	Average	204	2.45	0.68	<0.05	0.382	0.097	478	151	14.5	547	125	1.0	0.8570	7.94	7.86

Figure 4. Secchi depth (water clarity) in Manning's Slough during 2012.

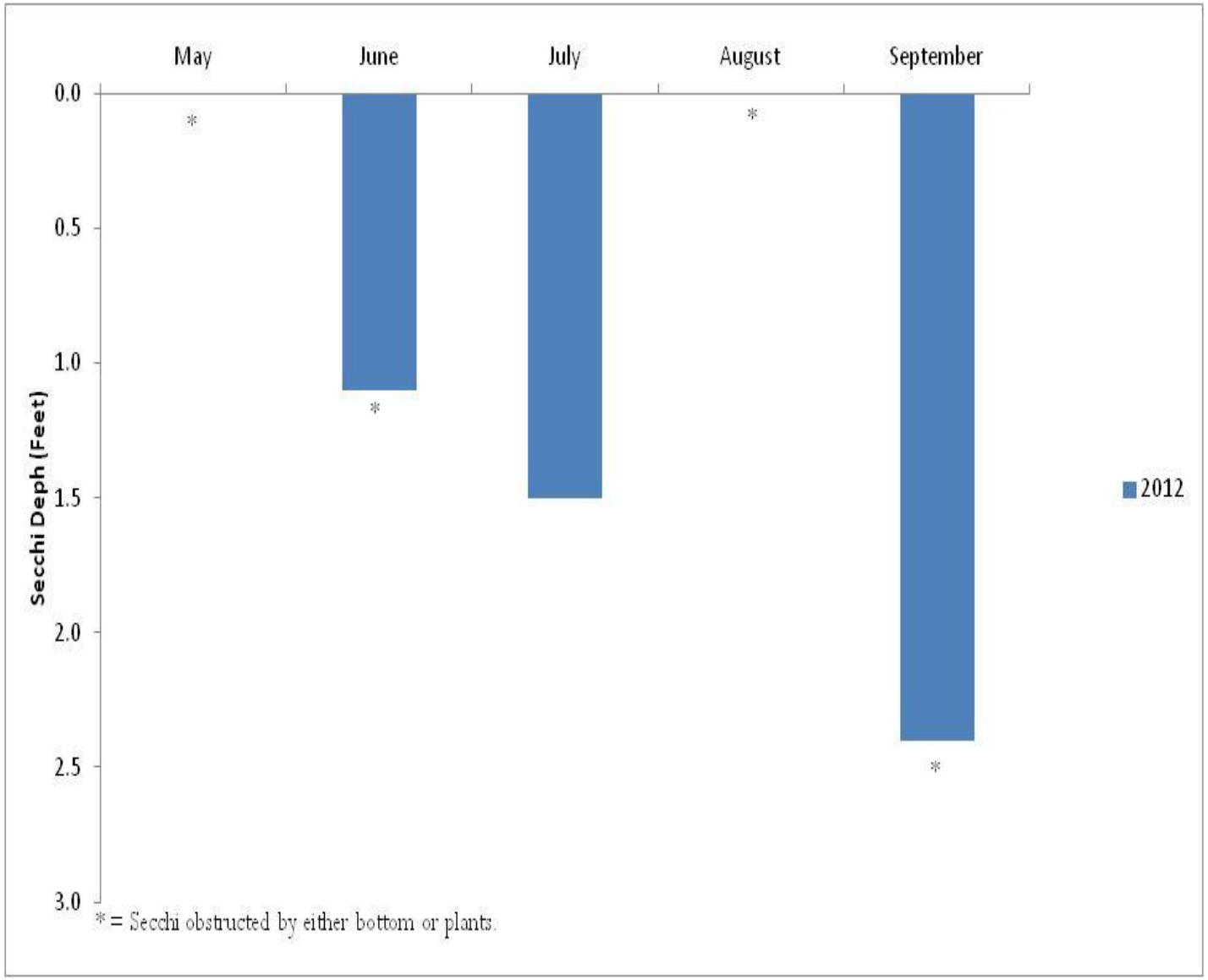

Table 3. Average Secchi depths measured from lakes in Lake County, 2000-2012.

RANK	LAKE NAME	SECCHI AVE	TSIsd
1	Windward Lake	14.28	38.79
2	Lake Carina	13.21	39.92
3	Druce Lake	12.25	41.00
4	Pulaski Pond	11.69	41.68
5	West Loon Lake	11.55	41.85
6	Independence Grove	11.50	41.92
7	Sterling Lake	11.35	42.10
8	Lake Zurich	10.40	43.37
9	Davis Lake	9.65	44.44
10	Harvey Lake	9.47	44.72
11	Little Silver Lake	9.42	44.79
12	Old School Lake	9.40	44.82
13	Lake Kathryn	9.39	44.84
14	Dugdale Lake	9.22	45.10
15	Dog Training Pond	9.04	45.39
16	Banana Pond	8.85	45.69
17	Deep Lake	8.83	45.72
18	Stone Quarry Lake	8.81	45.76
19	Lake of the Hollow	8.74	45.87
20	Bangs Lake	8.70	45.94
21	Cedar Lake	8.42	46.41
22	Cross Lake	8.18	46.83
23	Ames Pit	8.14	46.90
24	Briarcrest Pond	8.00	47.15
25	Sand Lake	7.48	48.12
26	Sand Pond (IDNR)	7.42	48.23
27	Cranberry Lake	7.40	48.27
28	Timber Lake (North)	7.37	48.33
29	Lake Miltmore	7.35	48.37
30	Lake Leo	7.31	48.45
31	Schreiber Lake	7.25	48.57
32	Nielsen Pond	7.23	48.61
33	Honey Lake	7.17	48.73
34	Lake Minear	7.13	48.81
35	Round Lake	7.01	49.05
36	Highland Lake	6.97	49.14
37	Channel Lake	6.65	49.81
38	Lake Catherine	6.58	49.97
39	Lake Helen	6.43	50.30
40	Third Lake	6.40	50.37
41	Sun Lake	6.33	50.52
42	Lake Lakeland Estates	6.31	50.57
43	Lake Barrington	6.00	51.30
44	Wooster Lake	5.92	51.49
45	Lake Fairfield	5.89	51.56
46	Lake Fairview	5.59	52.32
47	Gages Lake	5.45	52.68
48	Owens Lake	5.30	53.08
49	Valley Lake	5.05	53.78
50	McGreal Lake	5.04	53.81
51	Old Oak Lake	4.85	54.36
52	Waterford Lake	4.70	54.82
53	North Tower Lake	4.61	55.10

Table 3. Average Secchi depths measured from lakes in Lake County, 2000-2012.

RANK	LAKE NAME	SECCHI AVE	TSIsd
54	Lake Linden	4.60	55.13
55	Peterson Pond	4.51	55.41
56	Crooked Lake	4.39	55.79
57	Butler Lake	4.35	55.93
58	Mary Lee Lake	4.35	55.93
59	Tower Lake	4.31	56.07
60	Crooked Lake	4.28	56.17
61	Deer Lake	4.20	56.45
62	Seven Acre Lake	4.18	56.51
63	Lambs Farm Lake	4.17	56.54
64	Countryside Lake	4.10	56.79
65	Grays Lake	4.08	56.86
66	Lake Naomi	4.05	56.96
67	White Lake	3.96	57.29
68	Hook Lake	3.95	57.32
69	Turner Lake	3.92	57.43
70	Leisure Lake	3.85	57.69
71	Salem Lake	3.77	58.00
72	Countryside Glen Lake	3.64	58.50
73	Hastings Lake	3.52	58.99
74	Taylor Lake	3.52	58.99
75	Timber Lake (South)	3.51	59.03
76	Duck Lake	3.49	59.11
77	Bishop Lake	3.47	59.19
78	Fish Lake	3.47	59.19
79	Lake Holloway	3.40	59.49
80	Stockholm Lake	3.38	59.57
81	East Loon Lake	3.30	59.92
82	Bresen Lake	3.28	60.00
83	Summerhill Estates Lake	3.27	60.05
84	Lucky Lake	3.22	60.27
85	Diamond Lake	3.17	60.50
86	Liberty Lake	3.16	60.54
87	International Mining and Chemical Lake	3.08	60.91
88	Lake Christa	3.01	61.24
89	Lucy Lake	2.99	61.34
90	Long Lake	2.96	61.48
91	Island Lake	2.90	61.78
92	Bluff Lake	2.85	62.03
93	St. Mary's Lake	2.79	62.34
94	Werhane Lake	2.71	62.76
95	Lake Napa Suwe	2.66	63.02
96	Petite Lake	2.66	63.02
97	East Meadow Lake	2.61	63.30
98	Kemper Lake 1	2.56	63.58
99	Broberg Marsh	2.50	63.92
100	Antioch Lake	2.48	64.03
101	Spring Lake	2.46	64.15
102	Little Bear Lake	2.38	64.63
103	Lake Marie	2.25	65.44
104	Rivershire Pond 2	2.23	65.57
105	Lake Charles	2.20	65.76
106	College Trail Lake	2.18	65.89

Table 3. Average Secchi depths measured from lakes in Lake County, 2000-2012.

RANK	LAKE NAME	SECCHI AVE	TSIsd
107	Loch Lomond	2.17	65.96
108	Echo Lake	2.11	66.36
109	Eagle Lake (S1)	2.10	66.43
110	West Meadow Lake	2.07	66.64
111	Forest Lake	2.04	66.85
112	Columbus Park Lake	2.03	66.92
113	Grand Ave Marsh	2.03	66.92
114	Grassy Lake	2.00	67.14
115	Bittersweet Golf Course #13	1.98	67.28
116	Sylvan Lake	1.98	67.28
117	Fischer Lake	1.96	67.43
118	Pistakee Lake	1.88	68.03
119	Fourth Lake	1.77	68.90
120	Kemper Lake 2	1.77	68.90
121	Deer Lake Meadow Lake	1.73	69.23
122	Nippersink Lake	1.73	69.23
123	Woodland Lake	1.72	69.31
124	Lake Louise	1.68	69.65
125	Slough Lake	1.63	70.09
126	Willow Lake	1.63	70.09
127	Lake Farmington	1.62	70.17
128	Rasmussen Lake	1.62	70.17
129	Half Day Pit	1.60	70.35
130	Dunn's Lake	1.54	70.91
131	Longview Meadow Lake	1.51	71.19
132	Lake Matthews	1.41	72.18
133	Fox Lake	1.37	72.59
134	Grass Lake	1.33	73.02
135	Big Bear Lake	1.32	73.13
136	Lake Nippersink	1.28	73.57
137	Redhead Lake	1.27	73.68
138	Lake Eleanor	1.16	74.99
139	McDonald Lake 1	1.13	75.37
140	Buffalo Creek Reservoir	1.10	75.76
141	Rollins Savannah 1	1.05	76.43
142	Osprey Lake	1.03	76.70
143	Slocum Lake	1.03	76.73
144	Manning's Slough	1.00	77.13
145	Rollins Savannah 2	0.95	77.87
146	Dog Bone Lake	0.94	78.02
147	Redwing Marsh	0.88	78.97
148	Flint Lake Outlet	0.83	79.82
149	Fairfield Marsh	0.81	80.17
150	Oak Hills Lake	0.79	80.53
151	South Churchill Lake	0.73	81.67
152	Lake Forest Pond	0.71	82.07
153	ADID 127	0.66	83.12
154	Albert Lake	0.64	83.57
155	North Churchill Lake	0.61	84.26
156	Hidden Lake	0.56	85.54
157	Ozaukee Lake	0.51	86.84
158	McDonald Lake 2	0.5	87.12

Table 5. 2000 – 2012 Water quality parameters, statistics summary.

Manning Slough 2012 Multiparameter

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý
5/16/2012	0.5	0.499	16.94	17.25	178.6	0.642	8.58	3838.2
5/16/2012	1	1.037	16.44	15.08	154.5	0.639	8.63	3352.8
5/16/2012	2	2.011	15.81	14.91	150.7	0.65	8.53	1245.1
5/16/2012	3	2.993	14.92	14.00	138.9	0.712	8.29	307.4
5/16/2012	4	3.989	13.48	12.74	122.5	0.817	7.37	0.7

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý
6/20/2012	0.5	0.500	23.81	5.78	68.6	0.792	7.7	3671.5
6/20/2012	1	0.996	23.78	4.51	53.4	0.794	7.71	745.5
	2							

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý
7/18/2012	0.5	0.606	26.52	5.93	74.0	0.845	8.03	3457.8
7/18/2012	1	1.007	26.30	4.12	51.1	0.846	7.86	3321.7
7/18/2012	2	2.007	26.18	2.21	27.4	0.849	7.74	129.7
7/18/2012	3	2.676	25.92	1.11	13.7	0.842	7.6	0.2

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý
8/22/2012	0.5	0.940	19.11	8.05	87.2	0.499	8.34	3421
8/22/2012	1	0.936	18.48	2.43	26.0	1.005	8.09	2870.3
	2							

Date MMDDYY	Text Depth feet	Dep25 feet	Temp øC	DO mg/l	DO% Sat	SpCond mS/cm	pH Units	PAR æE/s/mý
9/19/2012	0.5	0.500	13.87	5.35	49.0	1.001	7.47	NR
9/19/2012	1	1.000	13.72	3.07	28.2	1.001	7.42	NR
9/19/2012	2	2.000	13.50	1.91	18.2	1.001	7.36	NR

Table 5. 2000 – 2012 Water quality parameters, statistics summary.

	ALKoxic <=3ft00-2010	
Average	**165**	
Median	**160**	
Minimum	**65**	**IMC**
Maximum	**330**	**Flint Lake**
STD	**42**	
n =	**812**	

	ALKanoxic 2000-2010	
Average	**201**	
Median	**192**	
Minimum	**103**	**Heron Pond**
Maximum	**470**	**Lake Marie**
STD	**52**	
n =	**249**	

	Condoxic <=3ft00-2010	
Average	**0.8629**	
Median	**0.7800**	
Minimum	**0.2260**	**Schreiber Lake**
Maximum	**6.8920**	**IMC**
STD	**0.5215**	
n =	**812**	

	Condanoxic 2000-2010	
Average	**1.0125**	
Median	**0.8678**	
Minimum	**0.3210**	**Lake Kathyrn, Schreiber Lake**
Maximum	**7.4080**	**IMC**
STD	**0.7821**	
n =	**248**	

	NO3-N, Nitrate+Nitrite,oxic <=3ft00-2010	
Average	**0.489**	
Median	**0.160**	
Minimum	**<0.05**	***ND**
Maximum	**9.670**	**South Churchill Lake**
STD	**1.054**	
n =	**812**	

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

	NH3-Nanoxic 2000-2010	
Average	**2.132**	
Median	**1.360**	
Minimum	**<0.1**	***ND**
Maximum	**18.400**	**Taylor Lake**
STD	**2.345**	
n =	**249**	

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

	pHoxic <=3ft00-2010	
Average	**8.37**	
Median	**8.36**	
Minimum	**7.07**	**Bittersweet #13**
Maximum	**10.40**	**Summerhill Estates**
STD	**0.46**	
n =	**810**	

	pHanoxic 2000-2010	
Average	**7.33**	
Median	**7.30**	
Minimum	**6.24**	**Banana Pond**
Maximum	**9.16**	**White Lake**
STD	**0.43**	
n =	**248**	

Table 5. 2000 – 2012 Water quality parameters, statistics summary.

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

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

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

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

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

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

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

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

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

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

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

No 2002 IEPA Chain Lakes

Table 5. 2000 – 2012 Water quality parameters, statistics summary.

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

No 2002 IEPA Chain Lakes.

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

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

LakeCounty
Health Department and
Community Health Center

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

Minimums and maximums are based on data from all lakes from 2000-2010 (n=1357).
Average, median and STD are based on data from the most recent water quality sampling year for each lake.

LCHD Environmental Services ~ 01/20/2011

Table 6. Lake County average TSI phosphorus (TSIp) ranking 2000-2012.

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

Table 6. Lake County average TSI phosphorus (TSIp) ranking 2000-2012.

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

Table 6. Lake County average TSI phosphorus (TSIp) ranking 2000-2012.

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

Table 6. Lake County average TSI phosphorus (TSIp) ranking 2000-2012.

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

Figure 5. TP concentrations on Manning's Slough, 2012.

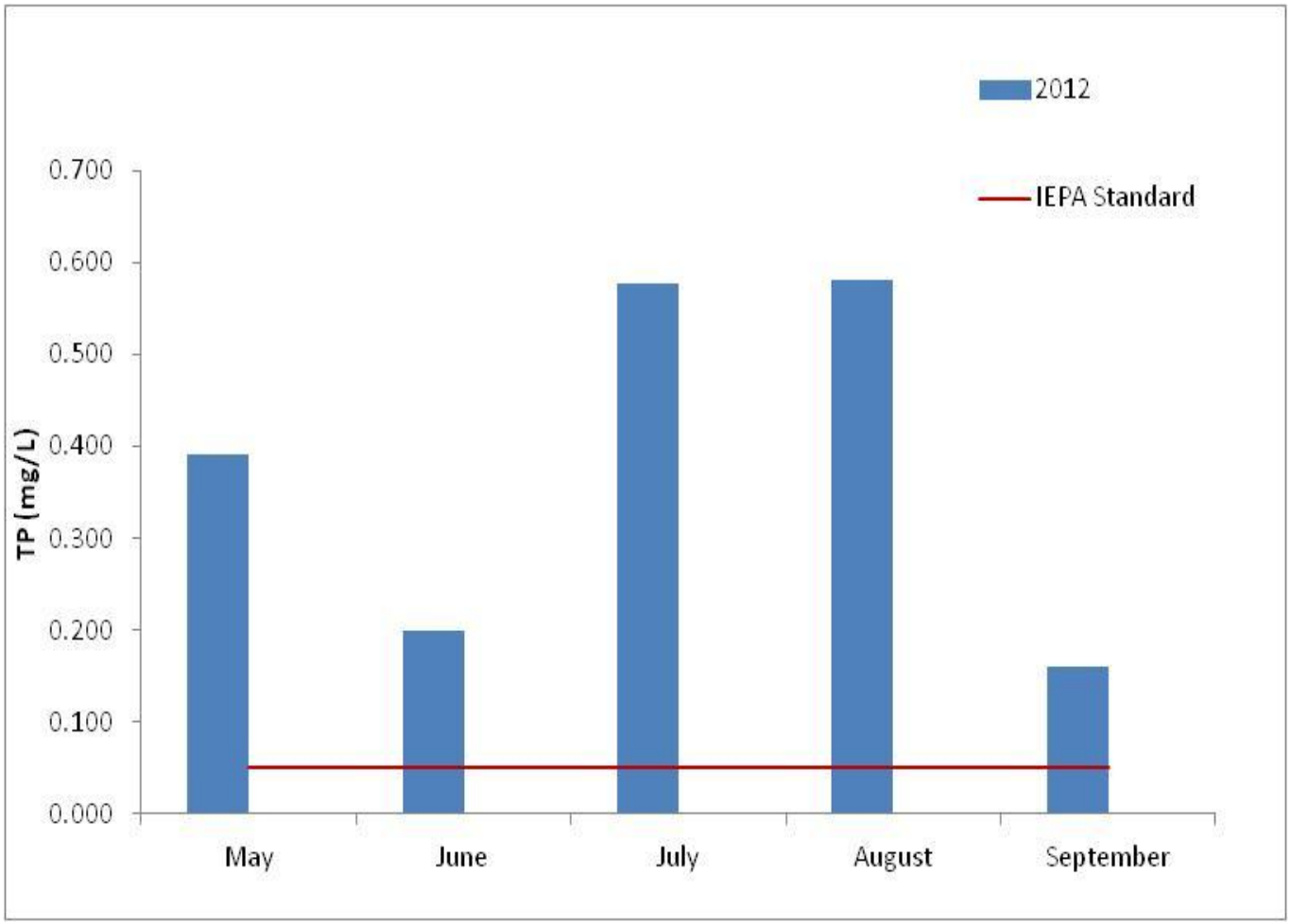

Table 7a. Aquatic vegetation species found at the 35 sampling sites on Manning's Slough, May 2012. Maximum depth that plants were found was 3.9 feet.

Plant Density	Coontail	Curlyleaf Pondweed	Common Duckweed	American Elodea	Eurasian Water Milfoil	Horned Pondweed	Star Duckweed	White Water Lily	Watermeal
Absent	19	6	2	33	24	33	3	25	32
Present	8	2	11	0	4	0	10	6	2
Common	3	1	10	0	4	0	11	3	0
Abundant	4	10	10	1	2	1	7	0	0
Dominant	0	15	1	0	0	0	3	0	0
% Plant Occurrence	44.1%	82.4%	94.1%	2.9%	29.4%	2.9%	91.2%	26.5%	5.9%

Table 7b. Distribution of rake density across all sampling sites, Manning's Slough, 2012.

Rake Density (Coverage)	# of Sites	%
No plants	1	2.9
>0 to 10%	2	5.9
>10 to 40%	0	0.0
>40 to 60%	8	23.5
>60 to 90%	14	41.2
>90%	9	26.5
Total Sites with Plants	33	97.1
Total # of Sites	34	100.0

Figure 6. Rake Density representing all species in Manning's Slough, May, 2012.

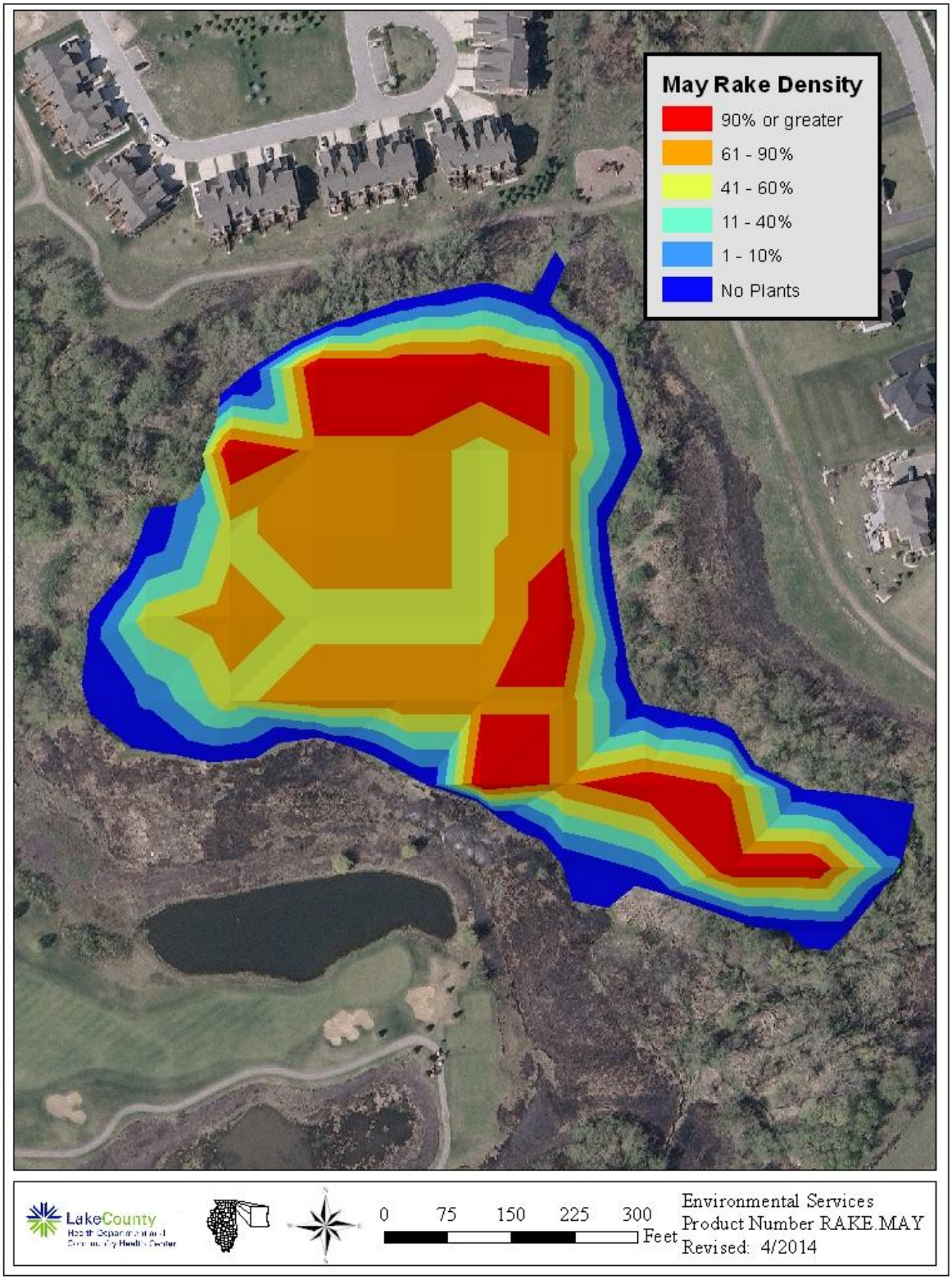

Figure 6. Rake Density representing all species in Manning's Slough, July, 2012.

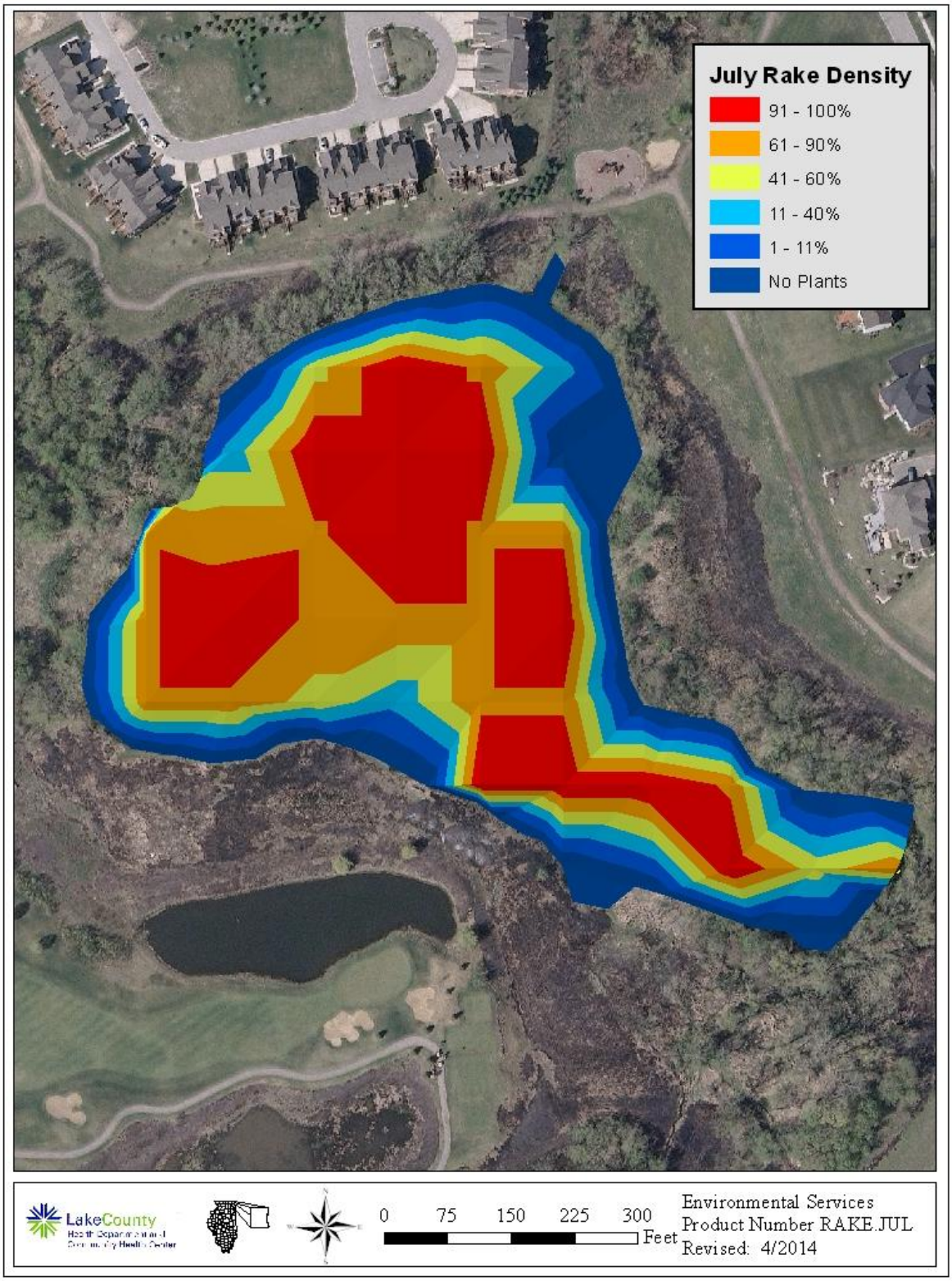

Figure 6. Rake Density representing Curlyleaf Pondweed in Manning's Slough, May, 2012.

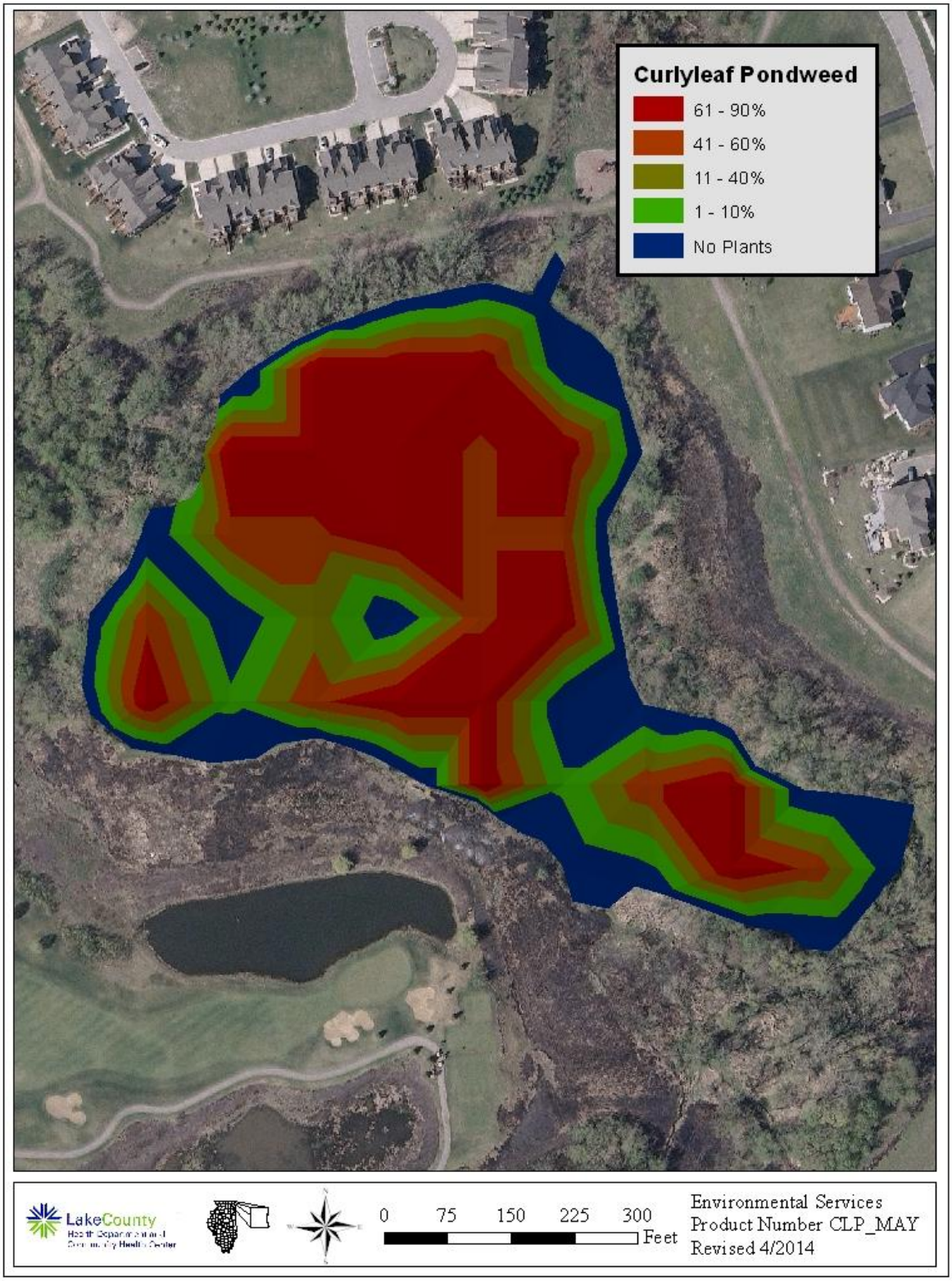

Figure 6. Rake Density representing Eurasian Water Milfoil in Manning's Slough, May, 2012.

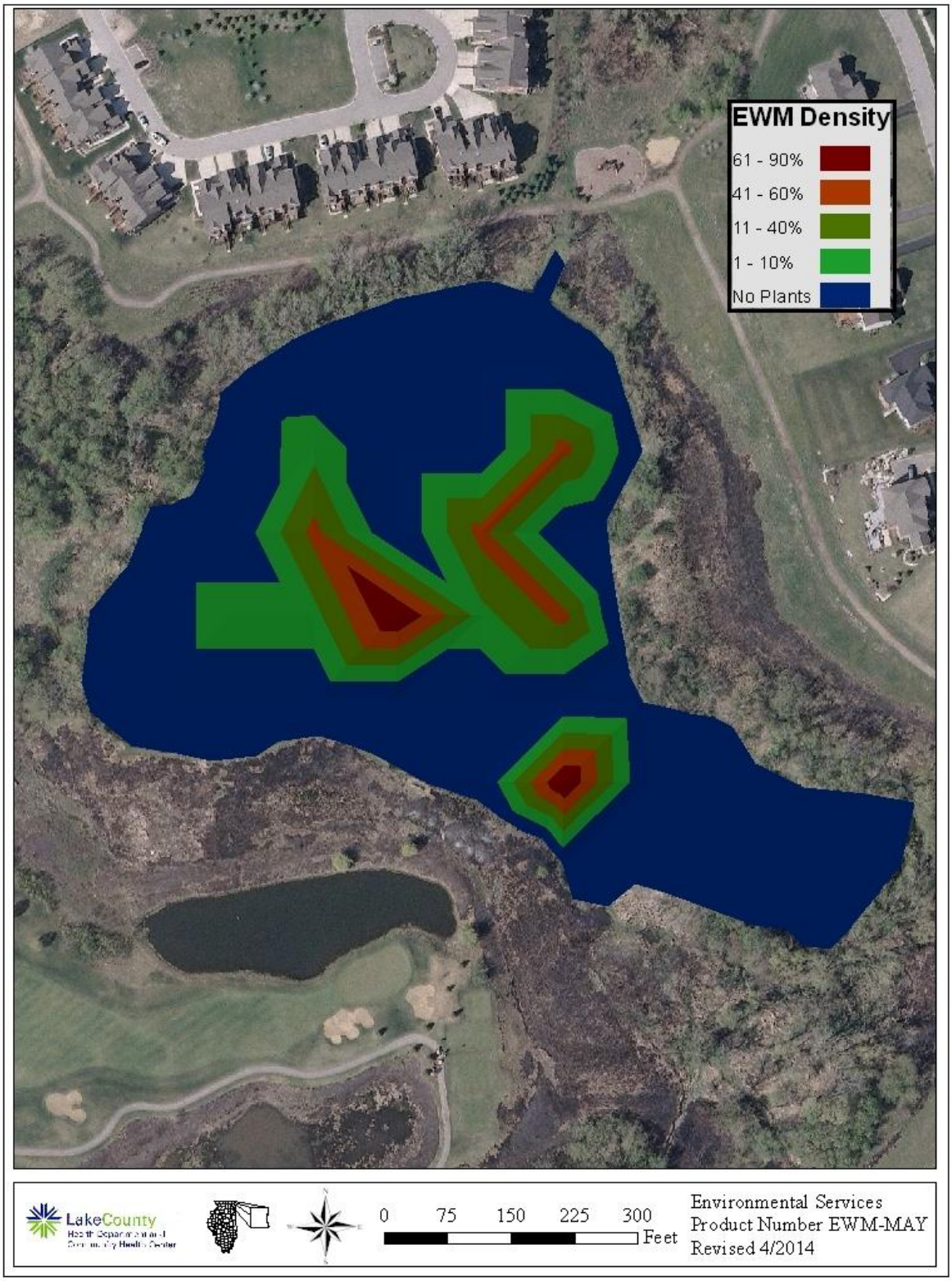

Figure 6. Rake Density representing Eurasian Water Milfoil in Manning's Slough, July, 2012.

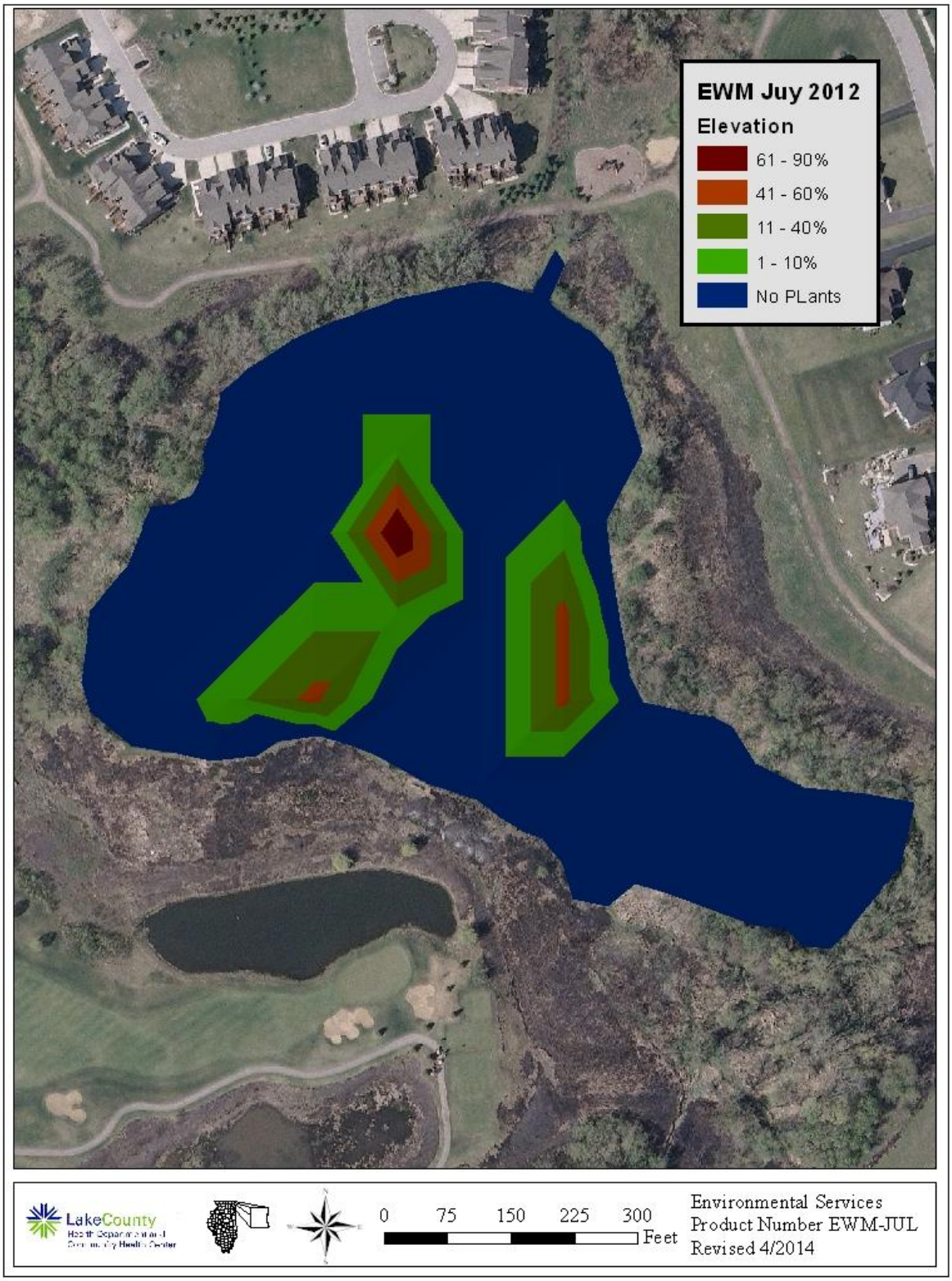

Table 8. Lake County average Floristic Quality Index ranking 2000 – 2012

RANK	LAKE NAME	FQI (w/A)	FQI (native)
1	Cedar Lake	36.8	38.0
2	East Loon Lake	34.7	36.1
3	Bangs Lake	33.8	35.2
4	Little Silver Lake	29.6	31.6
5	Deep Lake	29.7	31.2
6	Round Lake Marsh North	29.1	29.9
7	Cranberry Lake	29.7	29.7
8	West Loon Lake	27.1	29.5
9	Sullivan Lake	26.9	28.5
10	Independence Grove	24.6	27.5
11	Fourth Lake	24.7	27.1
12	Lake Zurich	24.3	27.1
13	Sterling Lake	24.5	26.9
14	Sun Lake	24.3	26.1
15	Round Lake	23.5	25.9
16	Redwing Slough	24.0	25.8
17	Honey Lake	23.3	25.1
18	Lake of the Hollow	23.0	24.8
19	Schreiber Lake	23.9	24.8
20	Lakewood Marsh	23.8	24.7
21	Deer Lake	23.5	24.4
22	Cross Lake	22.4	24.2
23	Third Lake	21.4	24.0
24	Wooster Lake	22.2	23.9
25	Timber Lake (North)	20.9	23.4
26	Butler Lake	21.4	23.1
27	Duck Lake	21.1	22.9
28	Countryside Glen Lake	21.9	22.8
29	McGreal Lake	20.2	22.1
30	Druce Lake	19.1	21.8
31	Long Lake	19.6	21.5
32	Broberg Marsh	20.5	21.4
33	Davis Lake	21.4	21.4
34	Fish Lake	19.3	21.2
35	Redhead Lake	19.3	21.2
36	Turner Lake	18.6	21.2
37	Lake Kathryn	19.6	20.7
38	ADID 203	20.5	20.5
39	Salem Lake	18.5	20.2
40	Old Oak Lake	18.0	19.1
41	Grandwood Park Lake	17.2	19.0
42	Highland Lake	16.7	18.9
43	Lake Miltmore	16.8	18.7
44	Lake Helen	18.0	18.0
45	Bresen Lake	16.6	17.8
46	Potomac Lake	17.8	17.8
47	Hendrick Lake	17.7	17.7
48	Lake Barrington	16.7	17.7
49	McDonald Lake 1	16.7	17.7
50	Rollins Savannah 2	17.7	17.7
51	Windward Lake	16.3	17.6
52	Almond Marsh	16.3	17.3
53	Osprey Lake	15.5	17.3
54	Owens Lake	16.3	17.3
55	Hastings Lake	15.0	17.0
56	Lake Tranquility (S1)	15.0	17.0

Table 8. Lake County average Floristic Quality Index ranking 2000 – 2012

RANK	LAKE NAME	FQI (w/A)	FQI (native)
57	White Lake	16.0	17.0
58	Island Lake	14.7	16.6
59	Grand Ave Marsh	14.3	16.3
60	Lake Fairview	15.2	16.3
61	Manning's Slough	14.1	16.3
62	Nippersink Lake	14.3	16.3
63	Taylor Lake	14.3	16.3
64	Grays Lake	16.1	16.1
65	Crooked Lake	14.0	16.0
66	Dog Training Pond	14.7	15.9
67	Forest Lake	14.8	15.9
68	Dog Bone Lake	15.7	15.7
69	Ames Pit	13.4	15.5
70	Seven Acre Lake	17.0	15.5
71	Dugdale Lake	14.0	15.1
72	Eagle Lake (S1)	14.0	15.1
73	Heron Pond	15.1	15.1
74	Mary Lee Lake	13.1	15.1
75	Old School Lake	13.1	15.1
76	Bishop Lake	13.4	15.0
77	North Churchill Lake	15.0	15.0
78	Timber Lake (South)	12.7	14.7
79	Buffalo Creek Reservoir	13.1	14.3
80	Lake Carina	12.1	14.3
81	Lake Leo	12.1	14.3
82	Lambs Farm Lake	12.1	14.3
83	Dunn's Lake	12.7	13.9
84	Lake Minear	11.0	13.9
85	Lake Napa Suwe	11.7	13.9
86	Longview Meadow Lake	13.9	13.9
87	Summerhill Estates Lake	12.7	13.9
88	Stockholm Lake	12.1	13.5
89	Antioch Lake	11.3	13.4
90	Hook Lake	11.3	13.4
91	Kemper Lake 1	12.2	13.4
92	Rivershire Pond 2	11.5	13.3
93	Flint Lake Outlet	11.8	13.0
94	Briarcrest Pond	11.2	12.5
95	Crooked Lake	10.2	12.5
96	Gages Lake	10.2	12.5
97	Lake Naomi	11.2	12.5
98	McDonald Lake 2	12.5	12.5
99	Pulaski Pond	11.2	12.5
100	Rollins Savannah 1	12.5	12.5
101	Stone Quarry Lake	12.5	12.5
102	Loch Lomond	9.4	12.1
103	Pond-A-Rudy	12.1	12.1
104	Grassy Lake	12.0	12.0
105	Lake Matthews	12.0	12.0
106	Nielsen Pond	10.7	12.0
107	Werhane Lake	9.8	12.0
108	Lake Lakeland Estates	10.0	11.5
109	Fischer Lake	9.0	11.0
110	Redwing Marsh	11.0	11.0
111	Tower Lake	11.0	11.0
112	West Meadow Lake	11.0	11.0
113	Lake Holloway	10.6	10.6
114	Sylvan Lake	10.6	10.6
115	Lake Fairfield	9.0	10.4

Table 8. Lake County average Floristic Quality Index ranking 2000 – 2012

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

Table 9. Shoreline vegetation assessed on Manning's Slough, July 2012.

FLORISTIC QUALITY DATA		Native	23	76.70%	Adventive	7	23.30%
23	NATIVE SPECIES	Tree	2	6.70%	Tree	2	6.70%
30	Total Species	Shrub	3	10.00%	Shrub	2	6.70%
3.3	NATIVE MEAN C	W-Vine	2	6.70%	W-Vine	0	0.00%
2.5	W/Adventives	H-Vine	0	0.00%	H-Vine	0	0.00%
15.8	NATIVE FQI	P-Forb	10	33.30%	P-Forb	1	3.30%
13.9	W/Adventives	B-Forb	0	0.00%	B-Forb	1	3.30%
-1.5	NATIVE MEAN W	A-Forb	0	0.00%	A-Forb	0	0.00%
-0.9	W/Adventives	P-Grass	5	16.70%	P-Grass	1	3.30%
AVG:	Faculative (+)	A-Grass	0	0.00%	A-Grass	0	0.00%
		P-Sedge	1	3.30%	P-Sedge	0	0.00%
		A-Sedge	0	0.00%	A-Sedge	0	0.00%
		Cryptogam	0	0.00%			

C	SCIENTIFIC NAME	W	WETNESS	PHYSIOGNOMY	COMMON NAME
0	Acer negundo	-2	FACW-	Nt Tree	BOX ELDER
4	Asclepias incarnata	-5	OBL	Nt P-Forb	SWAMP MILKWEED
4	Aster novae-angliae	-3	FACW	Nt P-Forb	NEW ENGLAND ASTER
7	Carex lupulina	-5	OBL	Nt P-Sedge	COMMON HOP SEDGE
0	CIRSIUM ARVENSE	5	UPL	Ad P-Forb	FIELD THISTLE
1	Convolvulus sepium	0	FAC	Nt P-Forb	HEDGE BINDWEED
1	Cornus racemosa	-2	FACW-	Nt Shrub	GRAY DOGWOOD
0	DAUCUS CAROTA	5	UPL	Ad B-Forb	QUEEN ANNE'S LACE
4	Elymus canadensis	1	FAC-	Nt P-Grass	CANADA WILD RYE
4	Elymus virginicus	-2	FACW-	Nt P-Grass	VIRGINIA WILD RYE
5	Hystrix patula	5	UPL	Nt P-Grass	BOTTLEBRUSH GRASS
4	Leersia oryzoides	-5	OBL	Nt P-Grass	RICE CUT GRASS
0	MORUS ALBA	0	FAC	Ad Tree	WHITE MULBERRY
2	Parthenocissus quinquefolia	1	FAC-	Nt W-Vine	VIRGINIA CREEPER
0	PHALARIS ARUNDINACEA	-4	FACW+	Ad P-Grass	REED CANARY GRASS
1	Phragmites australis	-4	FACW+	Nt P-Grass	COMMON REED
2	Populus deltoides	-1	FAC+	Nt Tree	EASTERN COTTONWOOD
0	RHAMNUS CATHARTICA	3	FACU	Ad Shrub	COMMON BUCKTHORN
0	RHAMNUS FRANGULA	-1	FAC+	Ad Shrub	GLOSSY BUCKTHORN
2	Rhus radicans	-1	FAC+	Nt W-Vine	POISON IVY
1	Rudbeckia hirta	3	FACU	Nt P-Forb	BLACK-EYED SUSAN
9	Rudbeckia subtomentosa	2	FACU+	Nt P-Forb	SWEET BLACK-EYED SUSAN
0	SALIX FRAGILIS	-1	FAC+	Ad Tree	CRACK WILLOW
1	Salix interior	-5	OBL	Nt Shrub	SANDBAR WILLOW
1	Sambucus canadensis	-2	FACW-	Nt Shrub	ELDERBERRY
6	Sanicula marilandica	3	[FACU]	Nt P-Forb	BLACK SNAKEROOT
7	Sium suave	-5	OBL	Nt P-Forb	TALL WATER PARSNIP
1	Typha X glauca	-5	OBL	Nt P-Forb	HYBRID CATTAIL
2	Urtica procera	-1	FAC+	Nt P-Forb	TALL NETTLE
7	Zizia aurea	-1	FAC+	Nt P-Forb	GOLDEN ALEXANDERS

Figure 7. Shoreline assessment sites.