VLAWMO

Vadnais Lake Area Water Management Organization

Wilkinson Lake Review, Ramsey County, MN

2024

Vadnais Lake Area Water Management Organization
800 County Road E East
Vadnais Heights, MN 55127
651-204-6070
www.vlawmo.org

TABLE OF CONTENTS

FULL REPORTS (BELOW) INDICATED IN APPENDIX AVAILABLE ON VLAWMO WEBSITE -> WILKINSON LAKE AND UNDER RESOURCES -> REPORTS

AQUATIC VEGETATION AND BIOVOLUME SURVEY REPORT (2017 BY RCSWCD)
BATHYMETRY REPORT (2017 BY RCSWCD)
FISH SURVEY (2017 BY BLUE WATER SCIENCE)
FROG AND TOAD CALL SURVEY REPORT (2019-2020)
REMOTE CAMERA SURVEY REPORT (2018-2020)
RETROFIT REPORT (2012 BY RCSWCD)
TOTAL MAXIMUM DAILY LOAD REPORT (2013)

FEASIBILITY STUDIES

EAST GOOSE, WEST GOOSE, AND WILKINSON LAKE ALUM FEASIBILITY STUDY (2017 BY BARR ENGINEERING)
WILKINSON LAKE WATER QUALITY IMPROVEMENT FEASIBILITY REPORT (2020 BY SEH)
TAMARACK AND WILKINSON LAKES IN-LAKE TREATMENT FEASIBILITY STUDY (2023 BY BARR ENGINEERING)
WILKINSON MEANDER CONCEPT ANALYSIS (2024 BY SEH)

1 INTRODUCTION

1.1 INTRODUCTION

Wilkinson Lake is located in North Oaks, Ramsey County and lies within the Vadnais Lake Area Water Management Organization. Wilkinson is a 105-acre shallow lake with an average depth of 3 feet. The lake is part of the Pleasant Lake chain which has water pumped in from the Mississippi River which eventually ends in East Vadnais Lake.

The City of North Oaks was settled by the Hill family prior to the 1900s, and many drainage projects were undertaken to enhance farming activities. Ditches and drain tile drained much of the land and connected many of the natural water bodies which previously had natural separation. In the late 1800s, the St. Paul Water Utility (SPWU) was established to provide a reliable water resource for the residents of the City. The Pleasant Lake chain was entrusted to the SPWU to accomplish this objective. Water conduits were extended from the Mississippi River to augment the water supply through the chain of lakes.

Prior to the dike installation in the 1990s, rapid fluctuation of the water levels in the Pleasant Lake chain has caused back-flushing into Wilkinson Lake. The shallow lake, directly connected to the Pleasant Lake chain and, consequently, the Mississippi River, was infested with common carp. The bottom of Wilkinson was continuously stirred up from common carp and other rough fish. The North Oaks Company (NOC) worked to reduce common carp by installing a fish barrier to reduce impact by rough fish on natural vegetation and waterfowl habitat. A dike and control structure was constructed in 1994 at the outlet on the western side of Wilkinson Lake in an attempt to restore the lake and remove the rough fish influx to the lake. When the structure was put in, NOC worked with MN DNR and others to conduct 2 draw-downs to remove carp and other rough fish. The main fish found were dogfish, bullheads and carp. The 2 goals of the 1994 restoration project were:

1. Improve the water quality of Wilkinson Lake
2. Improve the wetland habitat of Wilkinson Lake for wildlife

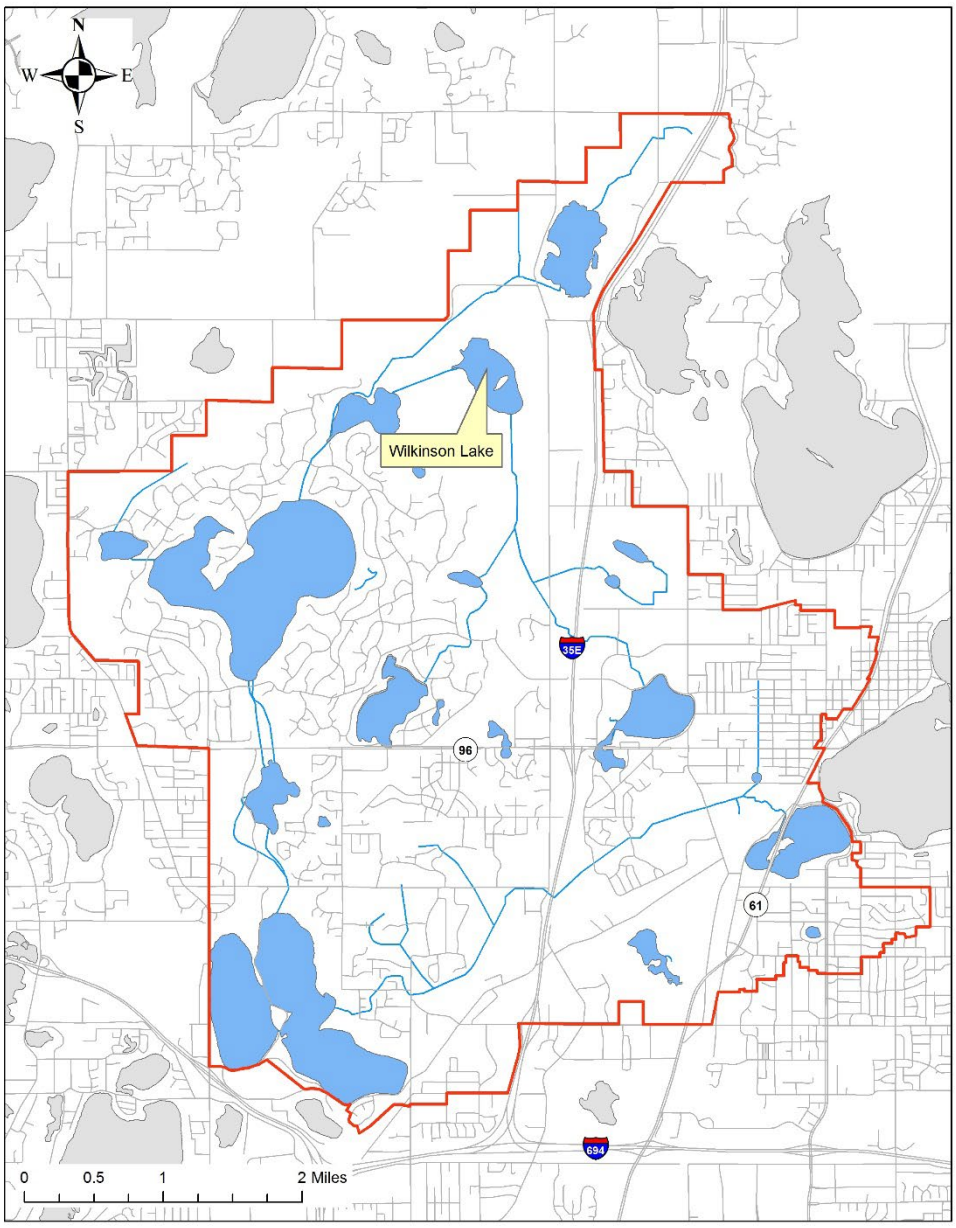
Gary Eagles, with NOC (now retired), stated in 2010 that he hadn't seen any back flow of Mississippi water into Wilkinson since the installation of the barrier. Flow is seen in the canal between Deep Lake and Wilkinson Lake. The barrier seems to prevent it from getting into Wilkinson. Temporary barriers are also in place in this system as part of the VLAWMO-led common carp removal effort (2019-present).

The lake is part of the Minnesota Land Trust (MLT) which preserves land in a natural condition. The City of North Oaks requires a 150 foot-buffer between the lake edge and any structures.

Wilkinson is impaired waters list for nutrients. Farmland runoff and internal loading were identified as potential contributors to poor water quality in the completed TMDL (2013).

MLT and NOC are important project partners as VLAWMO works to improve water-quality in Wilkinson Lake. Wilkinson Lake is part of the priority area designation for VLAWMO's participation in the small, priority watershed program, which is administered by the MPCA and funded by the EPA. A deep-water wetland restoration was constructed in 2023, as part of this program, and a possible meander is being investigated, in partnership with RC SWCD, that could be a next project in this program as of 2024.

Figure 1: Location map



2 WATERSHED FEATURES

2.1 AERIAL PHOTO HISTORY

Figure 2: 1940 aerial photo of Wilkinson Lake. In 1940, the area is largely undeveloped and Interstate 35E has not been constructed yet. The roads now known as County Road J and Centerville Road were constructed. To the east and north of the lake, there is agricultural land. The "island" in Wilkinson Lake is considerably larger in 1940 than it is currently, perhaps due to lower water levels.

Figure 3: 1953 aerial photo of Wilkinson Lake. In 1953, there is still no development around the lake. Water levels are higher at this time.

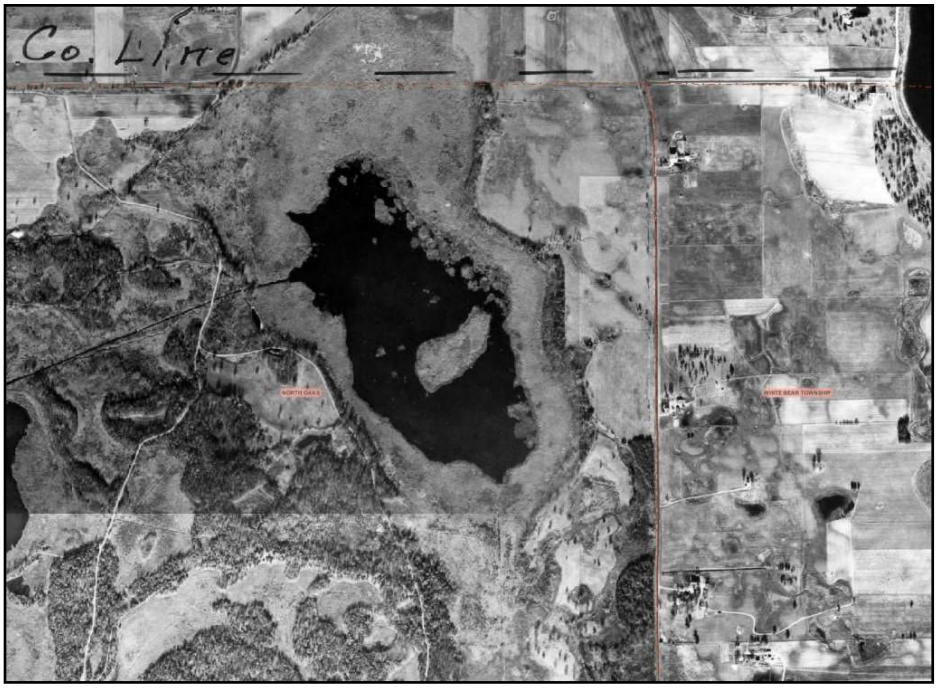


Figure 4: 1974 aerial photo of Wilkinson Lake. By 1974. Interstate 35E has been constructed and some industrial development has occurred on the east side of the lake. The property is now owned by Schwing America, Inc.

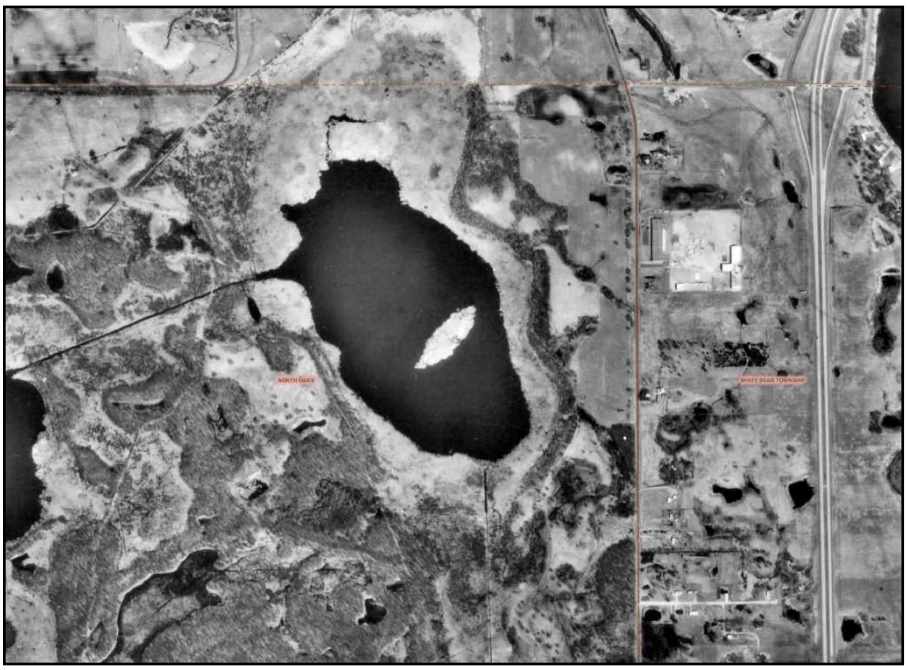


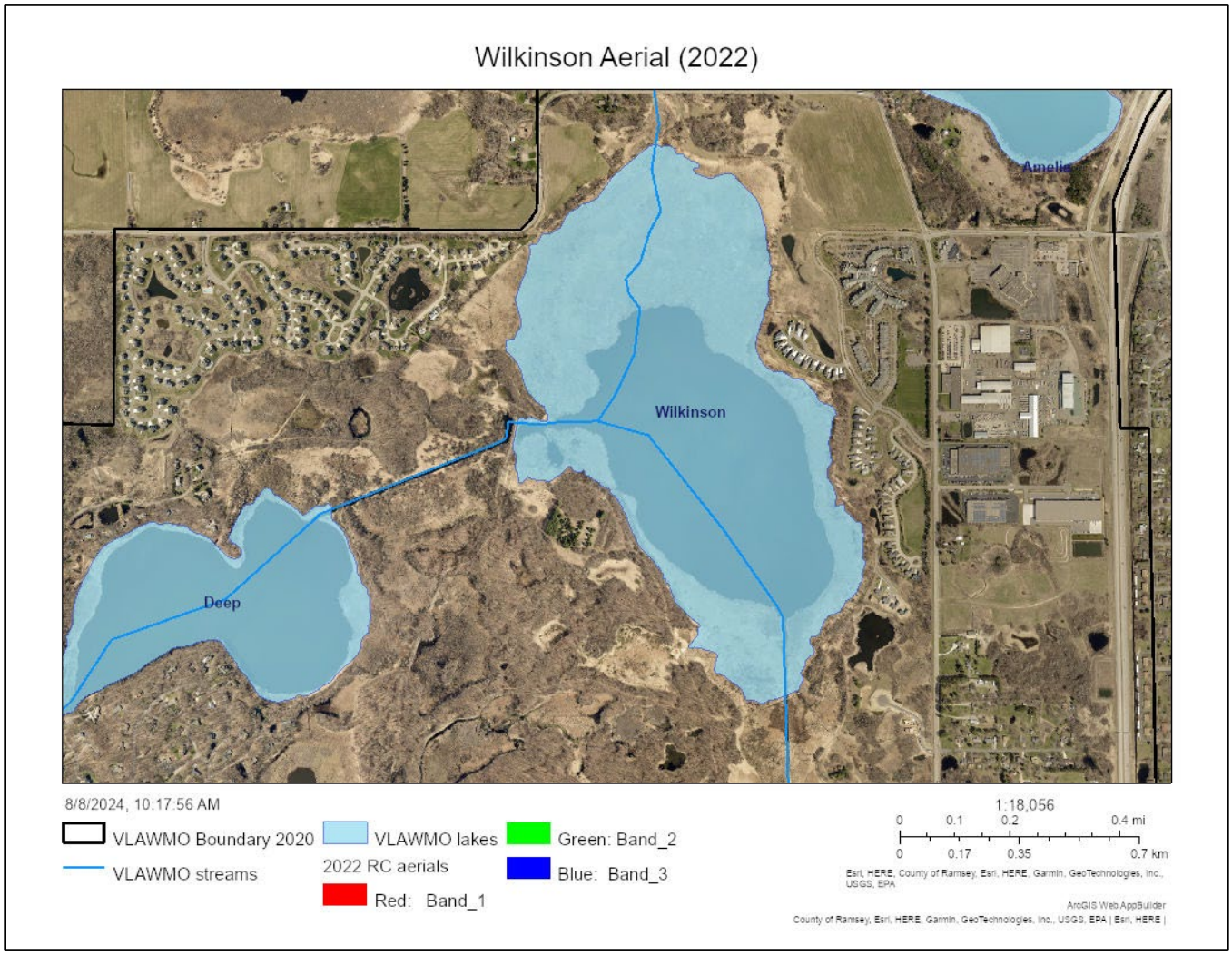
Figure 5: 1985 aerial photo of Wilkinson Lake. In 1985, more residential development has occurred east of the lake.

Figure 6: 2003 aerial photo of Wilkinson Lake. By 2003, more industrial and commercial development has occurred on the east side of the lake. Grading work has begun for what is now known as Waverly Gardens.

2 WATERSHED FEATURES

Figure 7: 2009 aerial photo of Wilkinson Lake. By 2009, Waverly Gardens has been constructed as well as the office area for the North Oaks Company and Tria Restaurant. Residential development is also going in south of Waverly Gardens and beginning on the west side of the lake.

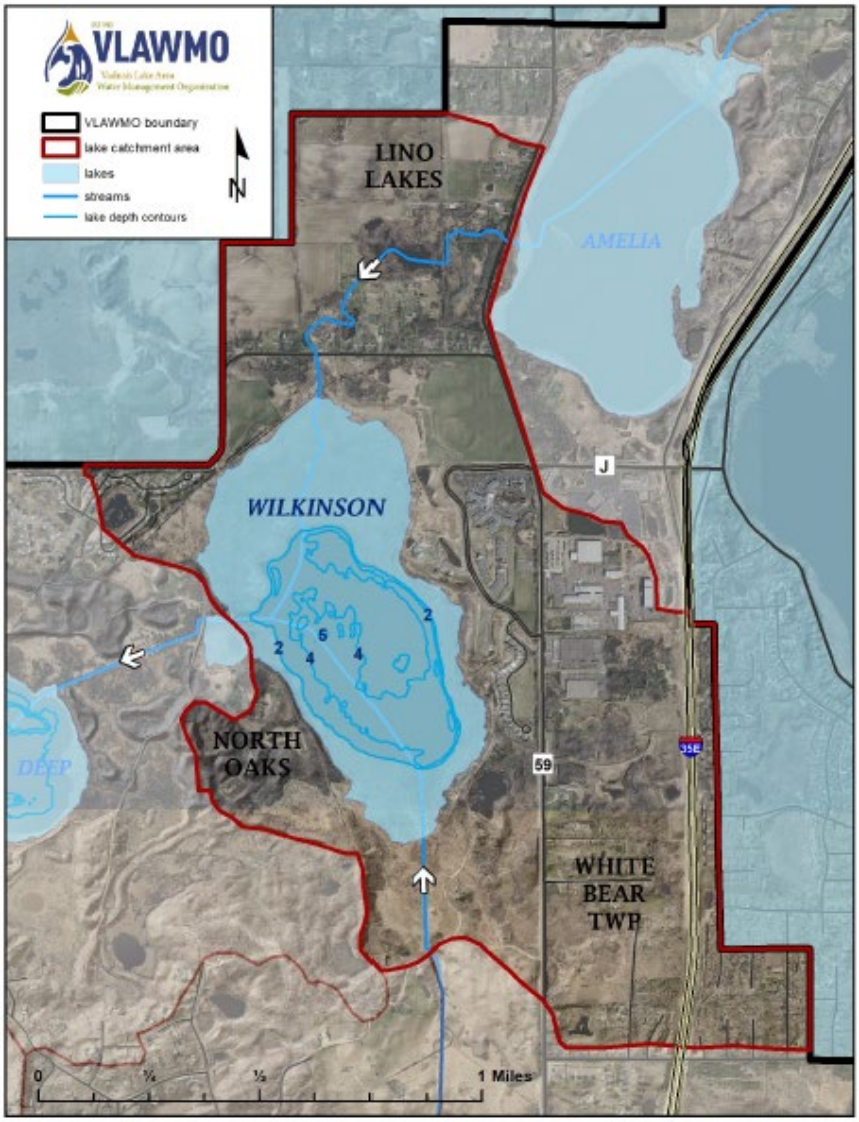
Figure 8: 2022 aerial photo of Wilkinson Lake. Development is ongoing at this time by NOC. The carp removal project is ongoing at this time, with a temporary barrier at the channel from Deep Lake into Wilkinson Lake. The deep-water wetland restoration project is being planned at this time (and was constructed in fall 2023.



2.2 WILKINSON LAKE DRAINAGE AREA

Wilkinson receives water from various sources. Some water is from storm sewer systems that collect water from 35E and the commercial and industrial area located between Centerville Road and 35E. Much of this water goes through storm ponds and natural low-lying areas before it enters the lake. Another area that water comes from is on the north side of lake, which is a mixture of commercial, residential, and agricultural. Water also enters through a ditch/creek on the south side of Wilkinson. Much of the land in this area is low density residential.

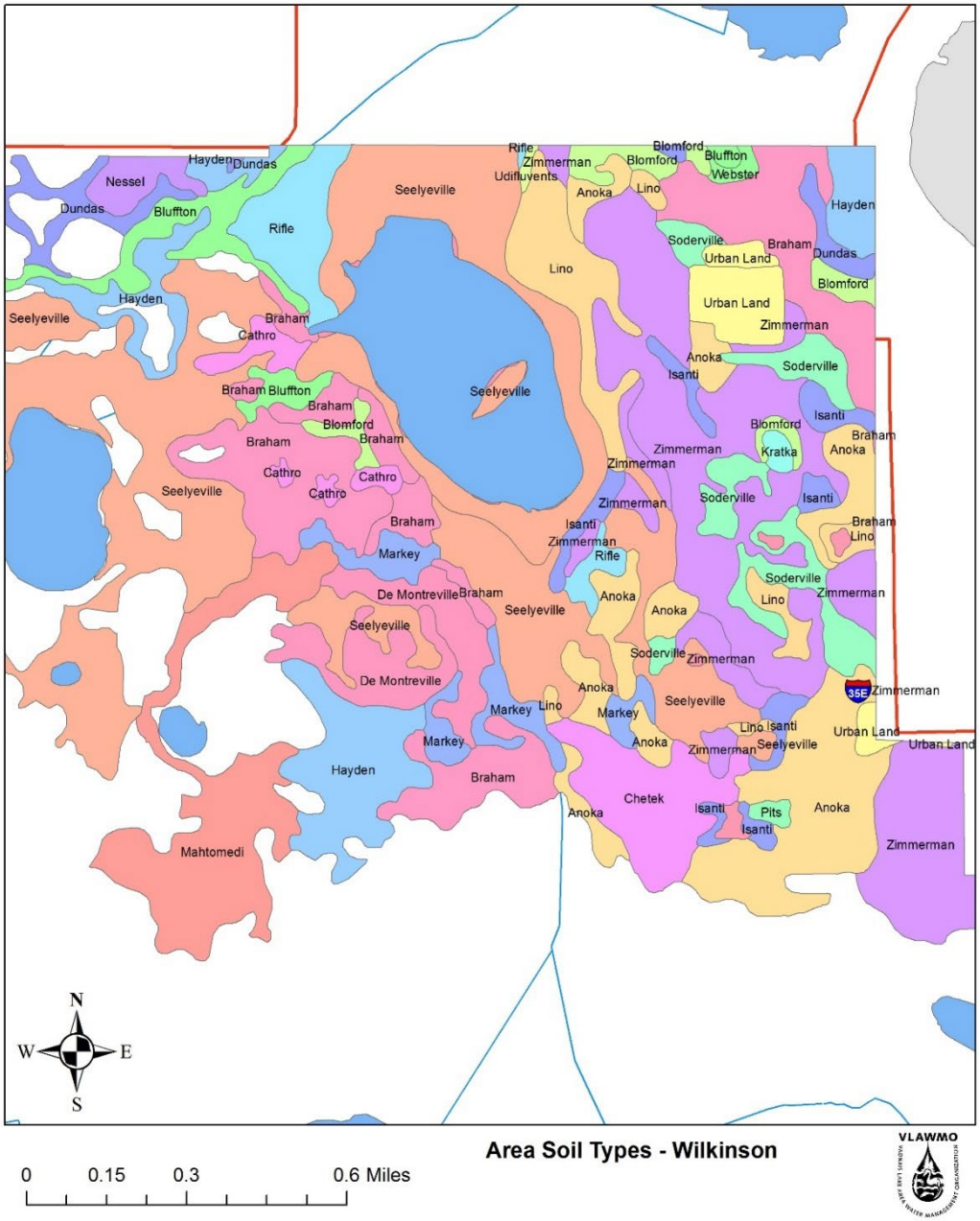
Figure 9: Wilkinson Lake Subwatershed and flow patterns



2.3 WILKINSON LAKE SOILS

The soil directly around Wilkinson Lake is Seelyeville, which is an organic muck. The soils near the lake are of the mucky types (Rifle, Markey, Cathro). Soils on the upland areas include Hayden, Zimmerman, Isanti, and Anoka, which are all fine sandy loams. These soils are suitable for parkland and development.

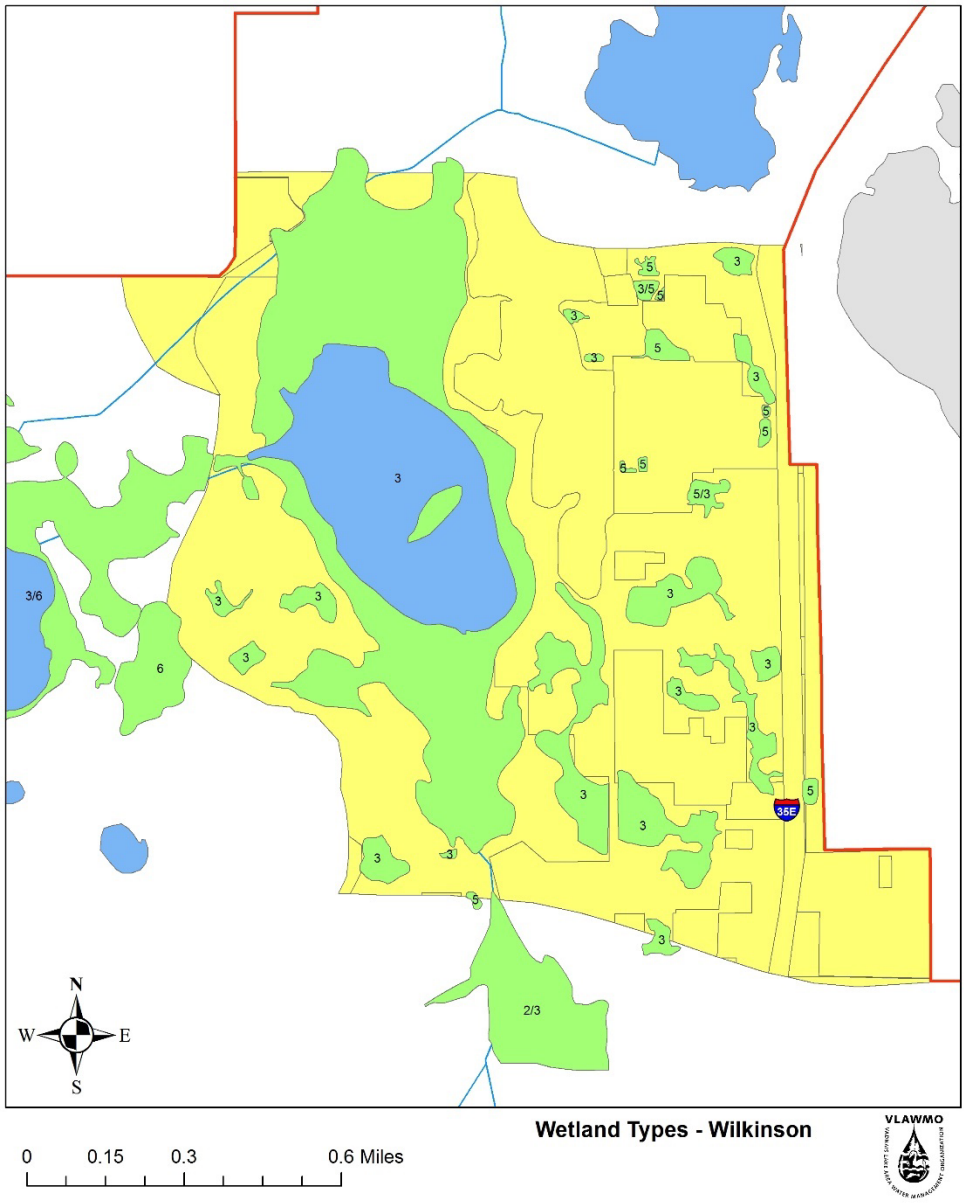
Figure 10: Wilkinson Lake area soils



2.4 WILKINSON LAKE WETLANDS AND WILDLIFE OBSERVATIONS

Wilkinson is located within a Type 3 Wetland US Fish & Wildlife Circular 39 classification system – Shallow Marsh. The soil is generally waterlogged early in the growing season and is often covered in 6 inches or more of water.

Figure 11: National Wetland Inventory (2015) wetland areas in and around Wilkinson Lake, Circular 39 Classification System



Wildlife Observations (from 2011 SLMP)

Skip Mott, a resident on Wilkinson Lake submitted wildlife observations (2007-2010). Trumpeter swans return to the lake each year and have babies (cygnets). In 2009 & 2010, none of the babies survived. Mortality is unknown but it is guessed that they were preyed upon by mink or other predators. In March 2010, 40 bald eagles were spotted on the ice of the lake, feeding on dead fish. The lake has diving ducks that use the lake in the fall as a stopover on their way south. Species noted include: Common Goldeneye, Bufflehead, Hooded Merganser, Northern Shoveler, Gadwall, and Mallard. Additionally, an osprey nest is located on the northwestern side of the lake. When VLAWMO staff did a lake depth study in May 2010, we noted the presence of 2 Trumpeter Swans, 2 Loons, 1 Painted Turtle, a Wood Duck, several Canada Geese and hundreds of dragonflies. Additionally, beavers have been spotted in a pond just south of the lake. Sandhill Cranes have been observed but have not nested on the lake. Black Tern have been observed feeding at the lake. In November, it has been observed that hundreds of diving birds and ducks use the lake.

Wildlife monitoring (2018-2020)

Wildlife monitoring has been conducted in the Wilkinson Subwatershed through:

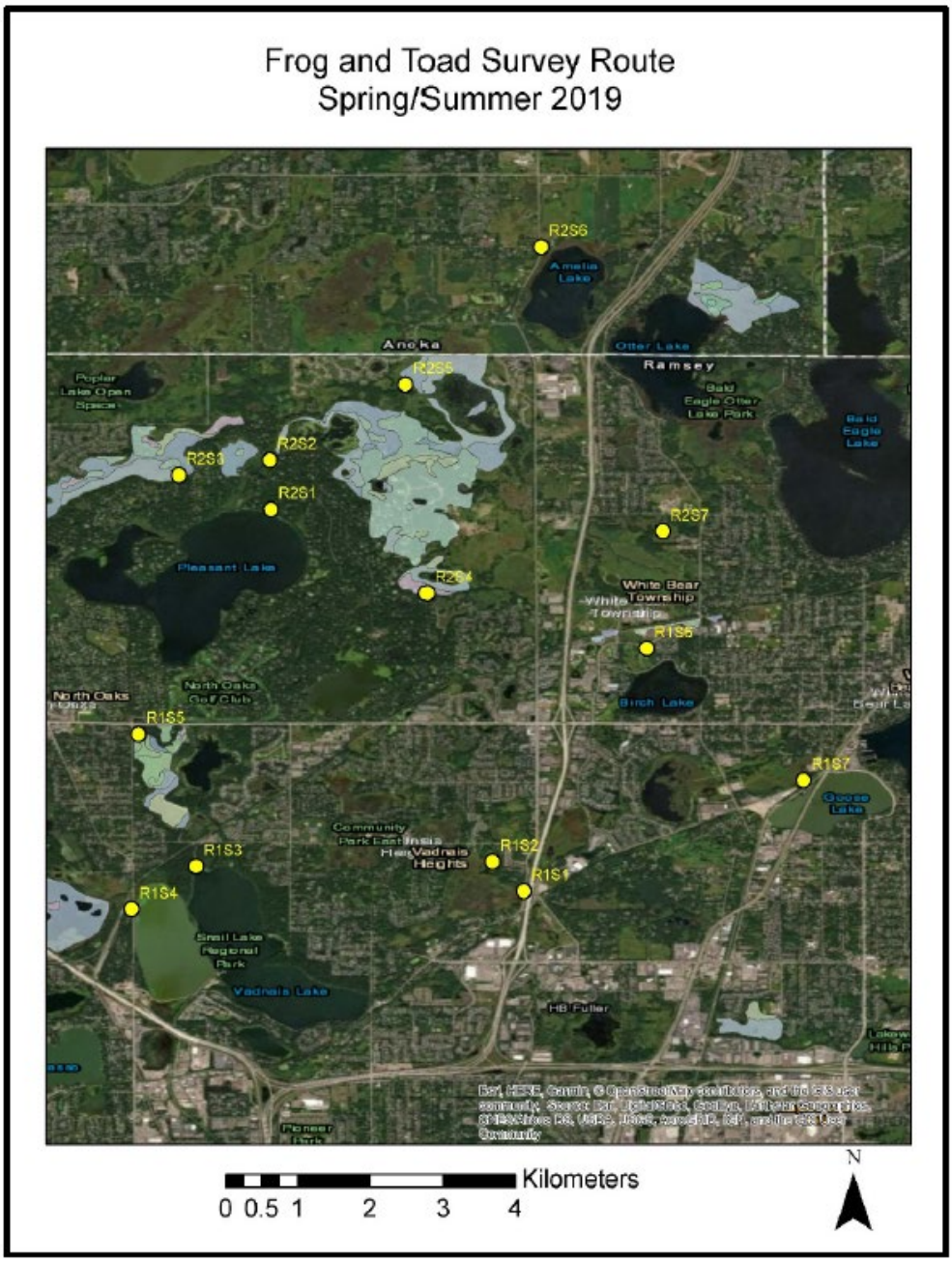
1. Frog and toad call surveys
2. Remote-camera monitoring

These techniques and relevant results within the subwatershed are described in this section. Full information and reports are available that include more detailed information on the VLAWMO website and through the MN DNR LakeFinder online tool.

1. Frog and Toad Call Surveys

During 2019-2020, VLAWMO conducted frog and toad call surveys in representative locations throughout the watershed. A survey location was near Wilkinson Lake was located on Crescent Lane. This is a mitigation wetland that is supporting a high diversity of frogs and toads. A barred owl was also heard at this site, which caused the chorus to quiet until the owl flew away. Northern leopard and Green frogs were not detected in 2019. Green frogs were detected in 2020. Cope's gray treefrogs were not detected in 2020. Spring peeper choruses were especially strong at this site on both the first and second run. This mitigation wetland may be especially important in providing habitat to this species that has been declining in the Twin Cities metro area.; 7 species were detected at this site. Species included: Wood frogs, Boreal chorus frogs, Spring peepers, American toads, Gray tree frogs, Cope's gray tree frogs, and Green frogs. A full report from these surveys is available on the VLAWMO website and as a StoryMap.

Figure 12: Frog and Toad Call Sampling Locations Watershed-wide



2. Remote-camera Monitoring

During 2018-2020, VLAWMO conducted remote-camera monitoring in representative locations throughout the watershed. North Oaks includes large wetland complexes and a 620-acre conservation easement with Minnesota Land Trust. The trail system is owned and management by the North Oaks Home Owners' Association (NOHOA). This large network of natural habitat is home to many mammal species. During the first monitoring session in Jan.-Feb. 2019, the coldest part of winter hit with deep snow and frigid temperatures. Mammal diversity at the cameras was low. We only saw: White-tailed deer, Coyotes, Short-tailed weasel, and Domestic dog. Coyote behavior was very interesting. In an area with fairly low human disturbance, coyotes appear curious and actively investigated the camera sites, even rolling in the snow and blowing it out of the way with their noses. Because diversity at the camera sites was lower than expected, we came back during fall 2019 with two University of Minnesota Service-Learning students. They each set up their own camera site, and let it run for ~5 weeks. With only these 2 cameras, we 9 mammal species including fascinating behavior of diurnal and nocturnal squirrels actively caching food for the winter in the same log. Mice feed on the cached food when the squirrels aren't around. A weasel came by looking for mice and investigated the very place where they had been only moments earlier. A pair of flying squirrels visited the site together and, of course, curious coyotes had their noses checking things out everywhere. There was a total of 11 mammal species among locations at this site. **Mammals included: White-tailed deer, Coyote, Raccoon, Short-tailed weasel/Weasel spp., Virginia opossum, Eastern cottontail, Gray squirrel, Red squirrel, Northern flying squirrel, Peromyscus (White-footed or Deer mouse), and Domestic dog.**

The full remote-camera monitoring report is available on the VLAWMO website. The remote camera StoryMap and Otter Spotter StoryMap are also available on the website. A traveling photo exhibit was also developed and displayed at the City of White Bear Lake library, RCSWCD park headquarters, and other locations. Local press covered the exhibits, and photos from the exhibit were featured in Press Publications articles.

Table 1: An excerpt from a summary table in the remote-camera monitoring report that shows monitoring in Vadnais-Sucker Lake Regional Park

Site	Locations	Total cameras	Dates	Weeks	Trapnights
North Oaks Conservation Area	7	5 2	Feb. 5-March 8, 2019 Oct. 3-Nov. 8, 2019	~10	227

Figure 13: Remote-camera Monitoring Locations Watershed-wide

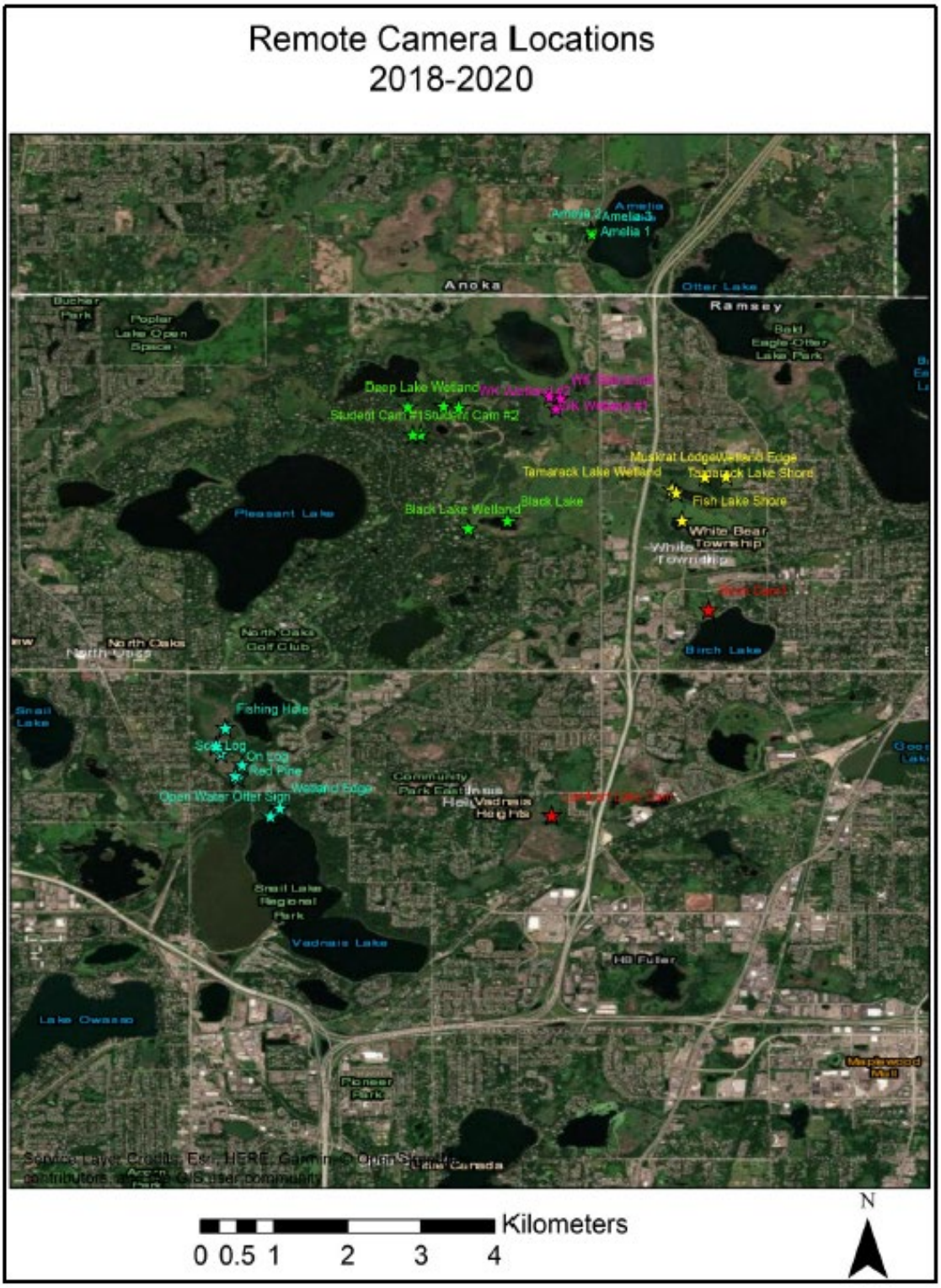


Figure 14: Photos excerpted from the full remote-camera monitoring report with highlights from the North Oaks Conservation Area

Wildlife Observations (2023-2024)

As part of the Wilkinson deep-water wetland project that was constructed during fall 2023, VLAWMO placed a remote camera, with the assistance of University of Minnesota Community-engaged Learning students, at the project site (pre, during, post monitoring). VLAWMO also placed a remote camera in the wetland area that is being investigated for a potential meander project during Jan.-March 2024.

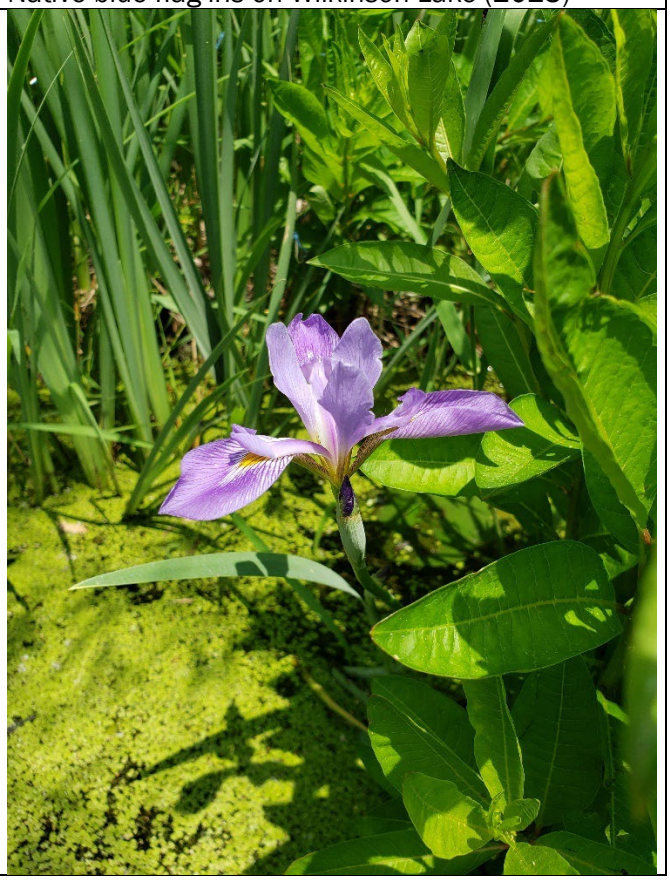
River otters were frequently observed, and multiple latrine sites were located. Additionally observed were: raccoon, muskrat, White-tailed deer, and coyotes. Bird observations included Sandhill cranes, Bald eagles, Blue-winged teal ducks, Mallards, and Wood ducks.

Trumpeter swans continue to nest at Wilkinson Lake, and an active otter latrine is located on the board walk on the southern edge of Wilkinson Lake. The Water willow (aka Swamp loosestrife, *Decodon verticillatus*) is also abundant on the shoreline areas of the lake.

Figure 15: Wildlife observations, selected photos (2023-2024)

Trumpeter swan nest on Wilkinson Lake (2023)	3 River otters observed on channel to the south of Wilkinson Lake (2023)
	

Remote camera photos: River otter, Sandhill crane, immature bald eagles, raccoon

Water willow on Wilkinson Lake (2023)	Native blue flag iris on Wilkinson Lake (2023)
	

3 LAKE FEATURES

LAKE FEATURES

The land surrounding Wilkinson Lake is under a conservation easement and therefore no development directly abuts the lake. There is multi-family housing and commercial to the east of the lake, agriculture and residential to the north, and residential to the west and south. Much of the water that runs off into Wilkinson goes through ponds or drainage areas so direct runoff is low.

3.1 LAKE DEPTH, BOTTOM HARDNESS, AND SEDIMENT ANALYSIS

On April 5, 2017, a survey was done by RC SWCD to determine the depth of Wilkinson. The deepest location was 5.7 feet. While that point was not measured with the rod, some areas were confirmed at 4.8 ft depth with the measuring rod. As BioBase's Quality Control technician noted, the transducer did generate some false depths, which impact the contour lines. The survey showed a water volume of 451.00 acre-feet.

The majority of the lake is 2-3 feet deep. This means the lake most likely freezes completely in the winter.

Bottom hardness was also surveyed on April 5, 2017.

Figure 16: Depth of Wilkinson Lake with 1-ft contours. Note: BioBase technicians noted that false depth readings were generated due to vegetation. On average, rod measurements showed water depths almost 2 feet deeper than the transducer's original readings, which were re-processed and interpolated to correct for this difference. The shallow island in the east was entered manually into GIS since the boat was not able to pass over it to gather data.

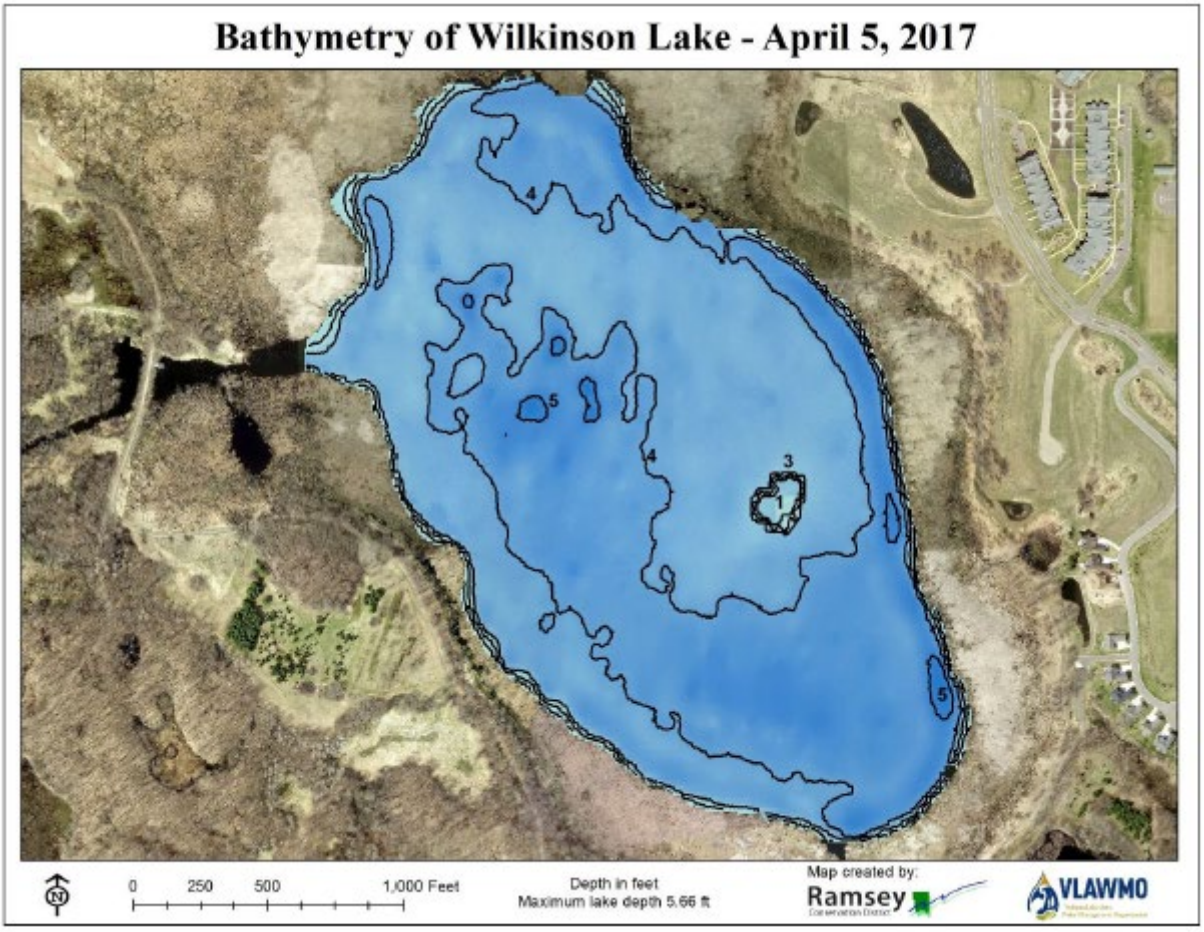
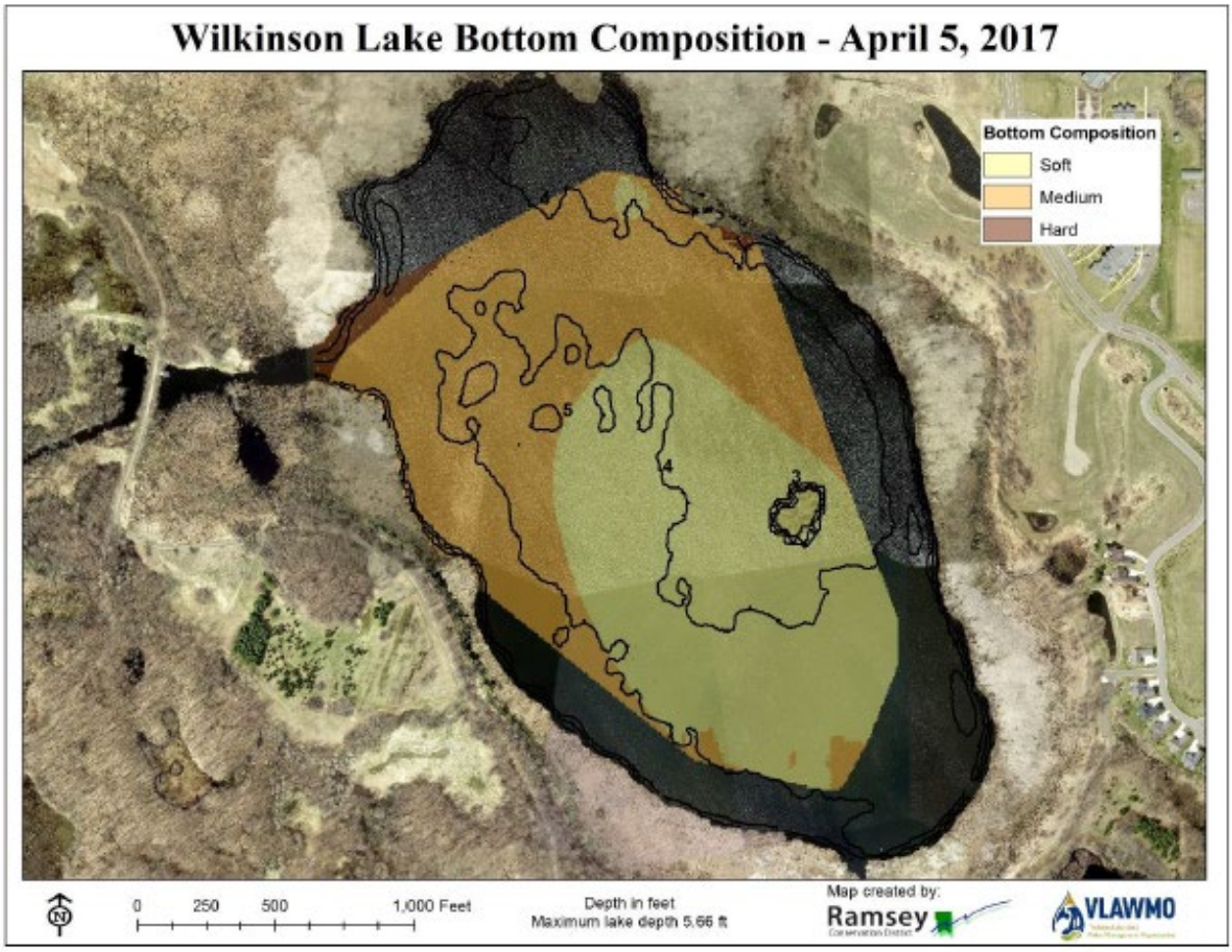


Figure 17: Hardness of Wilkinson Lake bottom with 1-ft contours. Note: The transducer was unable to collect a good distribution of data points due to the shallowness of the lake. This map is interpolated from points covering only about 20% of the lake.



Sediment Analysis

A survey was conducted by VLAWMO staff on February 25, 2010 and the samples were submitted to the University of Minnesota Soils Lab for analysis. There is nothing to indicate any major issues with the sediments of Wilkinson Lake. A more intensive analysis could be done in the future that would look at whether there is internal loading of phosphorus in the lake and whether the particle size of the sediments make the lake water more susceptible to being cloudy and murky.

Figure 18: Sediment collection locations

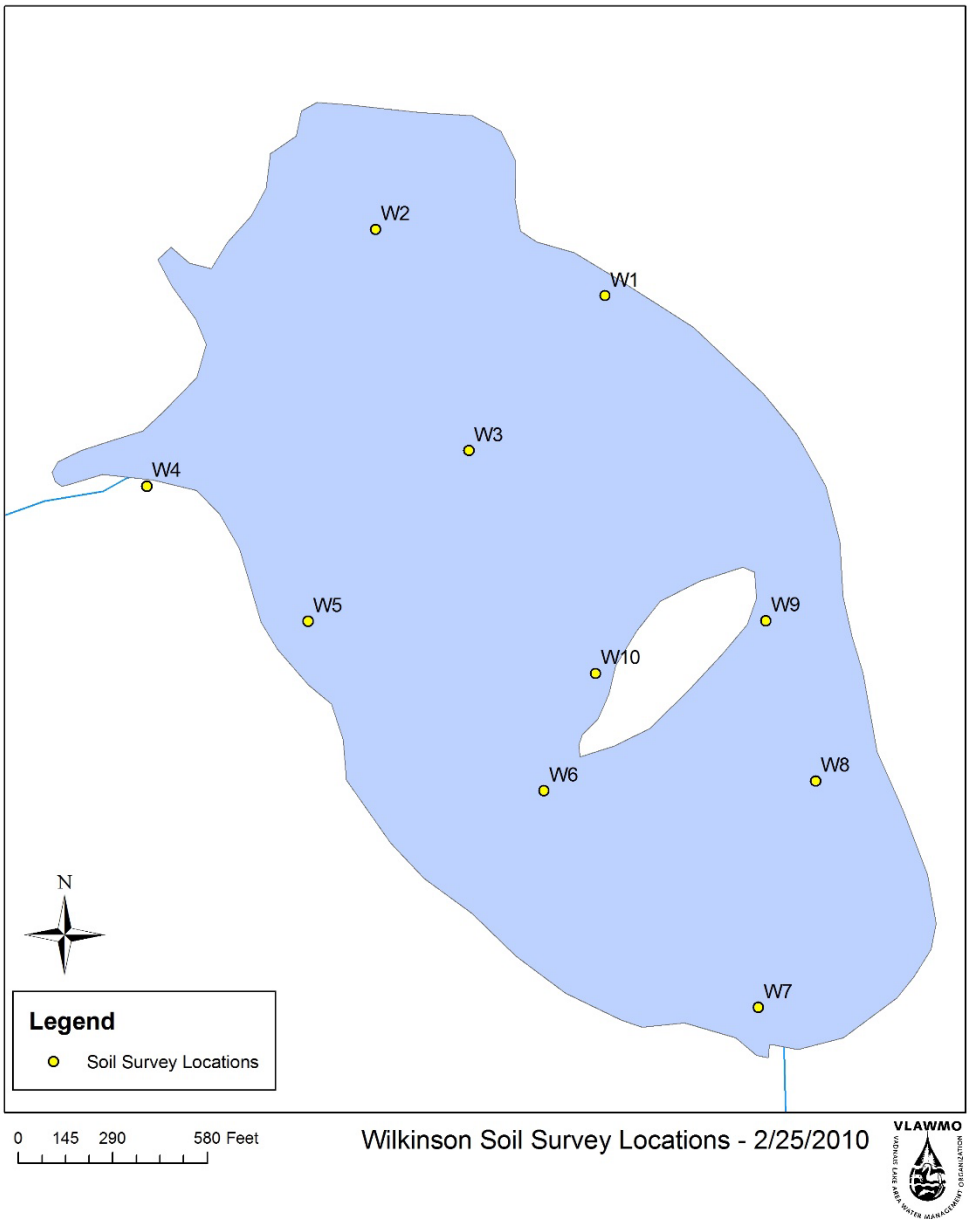


Table 2: Wilkinson Soil Sample Results

Wilkinson Soil Sample Results							
location	Organic Matter %	soluble salts mmhos/cm	pH	Nitrate ppm	Phosphorus ppm P	Potassium ppm K	Copper ppm Cu
W1	49.4	2.08	7.4	<1.1	4	47	0.5
W2	55.3	2.6	7.3	1.9	4	87	1.6
W3	54.3	2.79	7.2	<1.1	5	78	1.7
W4	56.9	2.26	7.3	<1.1	5	73	1.7
W5	66.3	1.48	6.2	<1.1	15	44	1.6
W6	14.6	2.16	7.4	<1.1	5	39	0.6
W7	51.5	2.27	7.1	<1.1	16	68	1.1
W8	57	2.78	7.2	<1.1	5	73	1.3
W9	56.6	2.23	7	<1.1	7	65	0.8
W10	33.2	1.92	7.6	1.3	4	37	0.6

Table 3: Summary of Soil Sample Results

pH	pH was at optimum-acceptable levels for all samples.
Soluble Salts	Samples appear to be acceptable but salt levels should be monitored. A few samples were approaching the possible problem level suggesting contamination, possibly coming from salted streets, parking lots, and sidewalks.
Nitrate	This is an essential plant nutrient. Most northern lakes have concentrations of less than 4ppm. Levels within Wilkinson are acceptable.
Potassium	Since natural levels of sodium and potassium ions in soil and water are very low, their presence may indicate lake pollution caused by human activities. Sodium is often associated with chloride. It finds its way into lakes from road salt, fertilizers, and human and animal waste. Potassium is the key component of commonly used potash fertilizer and is abundant in animal waste. Soils retain sodium and potassium to a greater degree than chloride or nitrate, therefore sodium and potassium are not as useful as pollution indicators. Increasing sodium and potassium values over time can mean there are long term effects caused by pollution. Although no normally toxic themselves, these compounds strongly indicate possible contamination from more damaging compounds. Wilkinson ranges from 37-87ppm which is low to medium levels of potassium.
Phosphorus	Phosphorus is the key nutrient affecting algae and weed growth. Phosphorus originates from a variety of sources, many of which are related to human activities. Major sources include human and animal wastes, soil erosion, detergents, septic systems and runoff from farmland or lawns. Wilkinson ranges between 4-16ppm, which is a low to medium range.
Copper	Copper is a relatively common metal in the environment. Average copper concentration in lakes is 15-30ppm. Copper is applied on many lakes to control algae and weeds and over time can accumulate in lake sediment to levels that can become toxic to fish and other organisms. Wilkinson ranges from 0.5-1.7ppm which is very low but indicative of the fact that there haven't been any copper treatments done to the lake.

3.2 BIOVOLUME AND AQUATIC VEGETATION

A Biovolume and aquatic vegetation survey was completed on August 11, 2017. The point intercept method incorporating aerial photography and a Lowrance HDS-5TM Global Positioning System (GPS) was used to assess the aquatic macrophyte community on Wilkinson Lake. Samples were taken at 60 evenly spaced (80 m) geo-referenced points. Data on depth, plant species, and abundance rank was recorded. A secchi disk measurement was also taken in the center of the lake on the shady side of the boat.

Aquatic macrophytes were found at all 60 points surveyed. Canada Waterweed (*Elodea canadensis*) and White Water Lily (*Nymphaea odorata*) were the most prominent species present, found at most of the survey points. Flat-stem pondweed (*Potamogeton zosteriformis*), Filamentous Algae (*Spirogyra/Cladophora* sp.), and Coontail (*Ceratophyllum demersum*) were the next most common species. Found in fewer than 15% of the survey points were the following species: Curly-Leaf Pondweed (*Potamogeton crispus*), (invasive); Greater Duckweed (*Spirodela polyriza*); Sago Pondweed (*Potamogeton pectinatus*); Yellow Water Lily (*Nuphar lutea*), Slender Waternymph (*Najas gracillima*); Muskgrass (*Chara spp.*) and Stonewort (*Nitella spp.*). Although the specific species of stonewort was not determined, there was no indication that the plant detected was the invasive starry stonewort – no white bulbils were seen. The secchi disk reading was 0.9m (2.95 ft).

Figure 15: Aquatic Vegetation Survey Locations. Green dots indicate vegetation present.

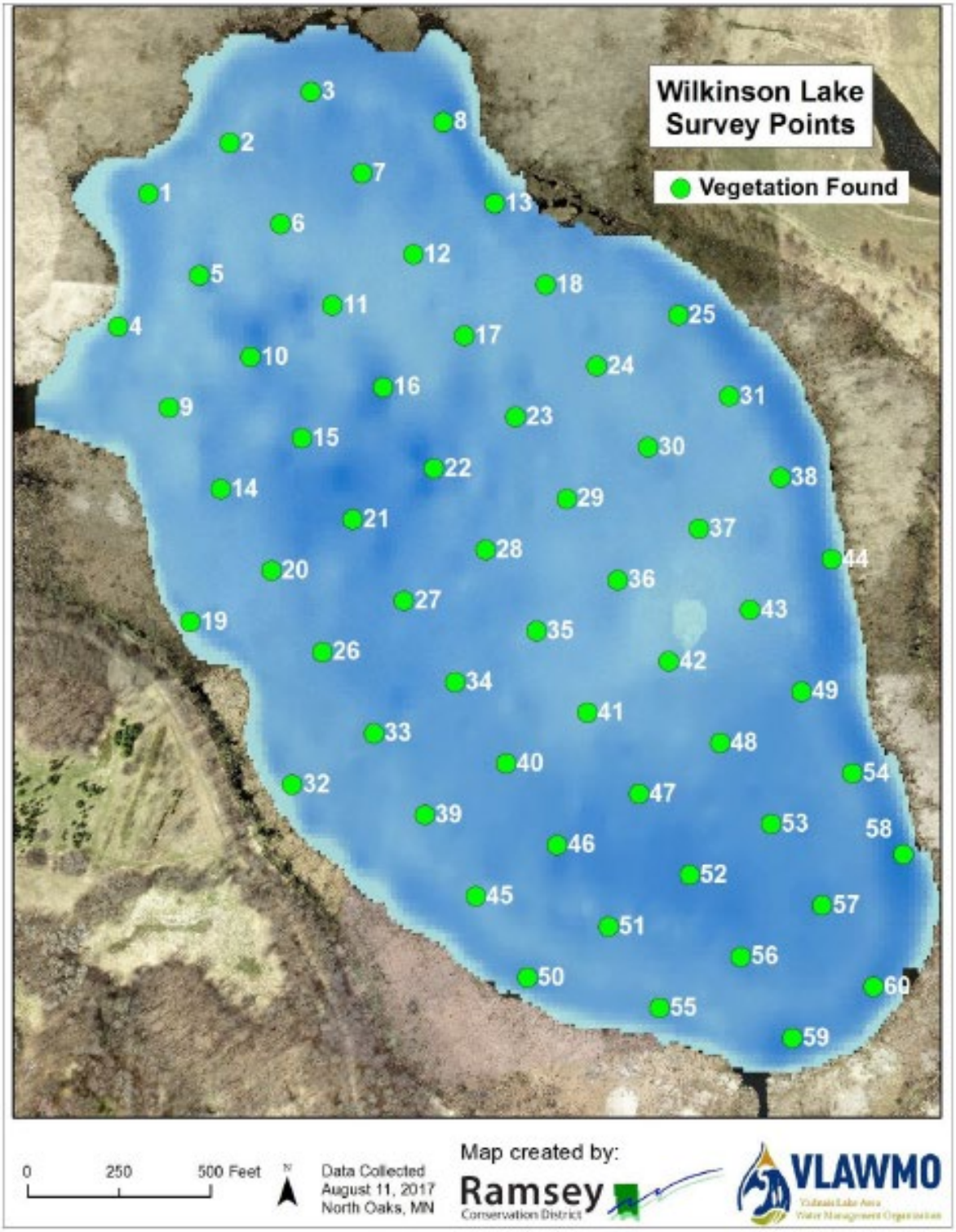
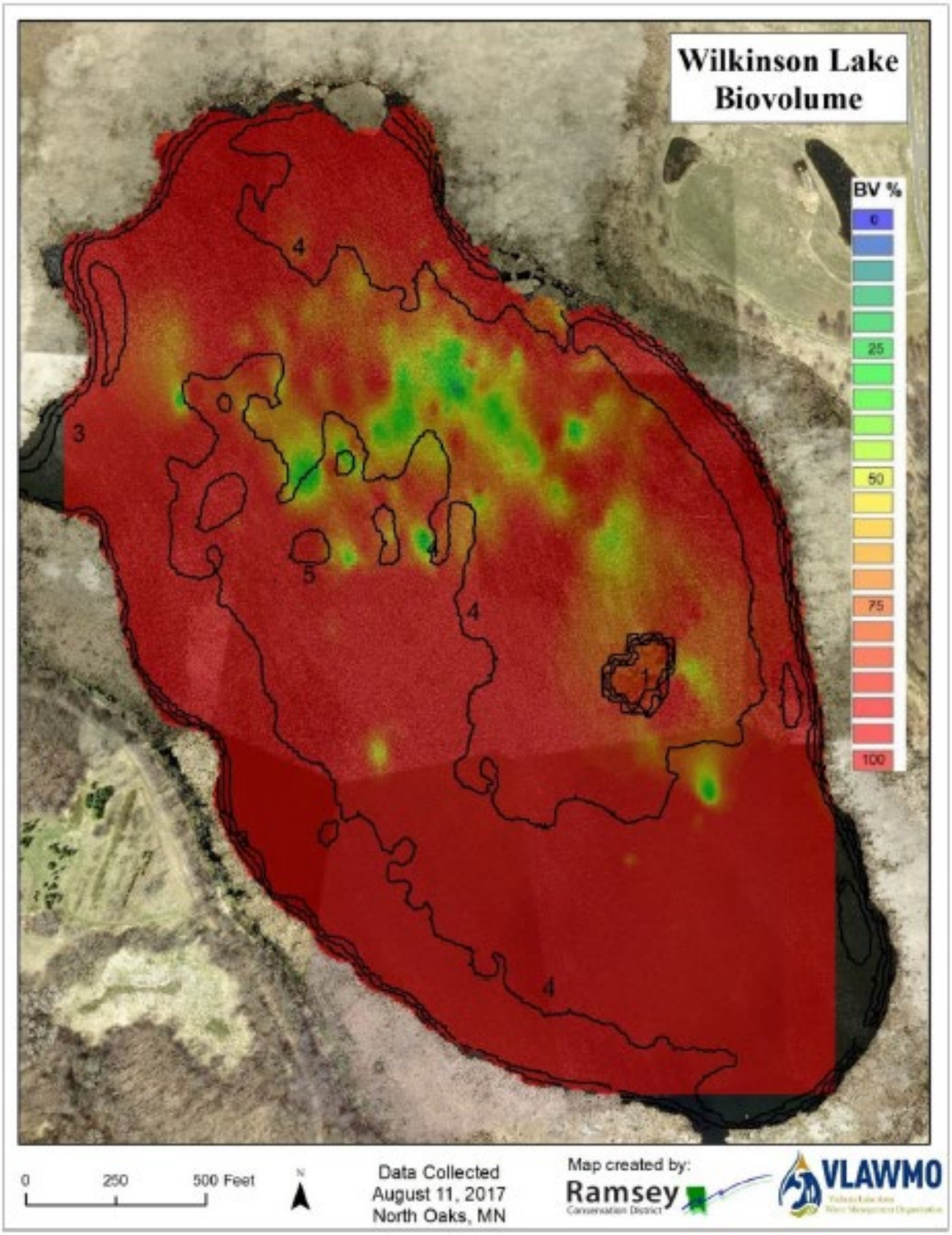


Figure 16: Wilkinson Lake vegetation biovolume with 1ft contours. Blue = 0% and Red = 100%



3.3 FISH SURVEY (2017)

Blue Water Science was hired to conduct a fish survey in September 2017. The survey found that the fish community of Wilkinson Lake (105 acres, average depth 2 feet) was dominated by small black bullheads. Green sunfish and pumpkinseed sunfish were abundant and yellow perch were common. Largemouth bass were sampled, but all 7 fish were less than 5-inches long. The presence of minnows and the absence of large predators such as largemouth bass indicates the potential for frequent winterkills in Wilkinson Lake. Fish re-introductions from Deep Lake as well as Pleasant Lake which are connected to Wilkinson Lake are likely.

Recommendations and future considerations include the following:

- It appears Wilkinson Lake has the potential to winterkill almost annually.
- Natural winterkill should keep the Wilkinson Lake fish community somewhat managed through "boom and bust" cycles.
- The fish barrier at the outlet should prevent carp migration into Wilkinson Lake. Carp are present in Deep Lake as well as Pleasant Lake.
- At this point, the best management approach for Wilkinson Lake is to let natural conditions impact the Wilkinson Lake fish community.

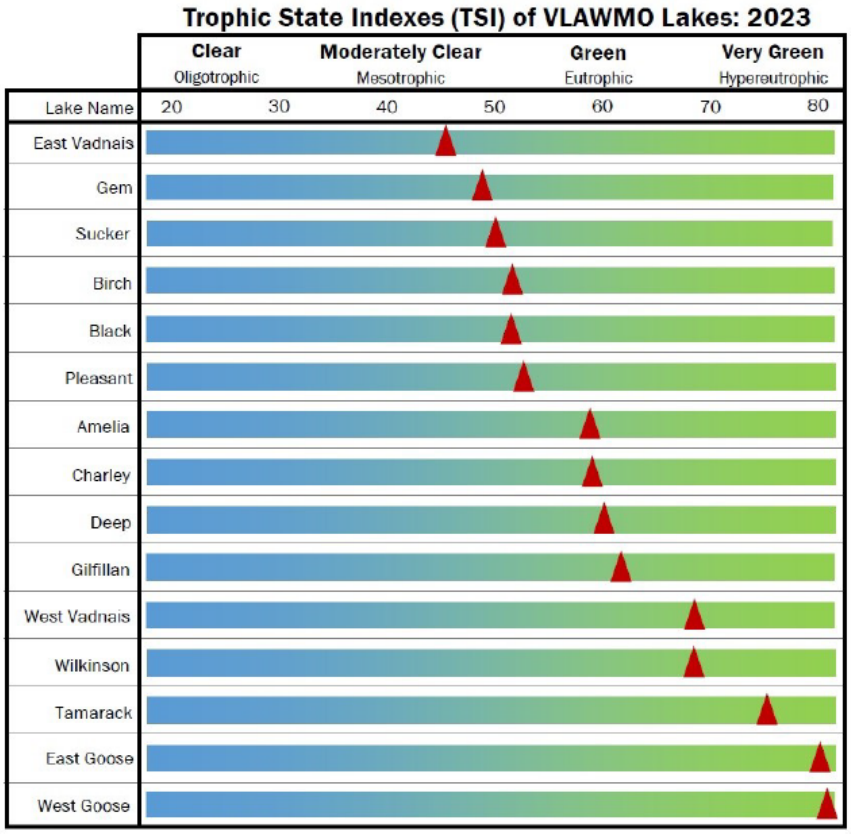
Table 4: Fish survey results for September 2017

	Fish/Net Sept 7-8, 2017 (n=8)	Typical Range (MnDNR)
Black bullhead	3.4	0.7 - 26
Black bullhead < 3.5 inches	341	*NA*
Black crappies	4.0	1.8 - 21
Bluegills	2.1	7.5 - 63
Bluegills < 3 inches	*21*	*NA*
Golden shiner	2.5	0.4 - 3.9
Green sunfish	31	0.4 - 3.8
Hybrid sunfish	1.3	NA
Largemouth bass	0.9	0.2 - 0.8
Pumpkinseed	34	0.7 - 4.2
Yellow perch	4.8	0.4 - 3.5
Minnow - fathead	25	NA
Minnows - mud	0.8	NA
Minnow - shiner	1.4	NA
Minnow - stickleback	0.4	NA
Painted turtle	1.3	--
Number of fish species	13	
TOTAL FISH PER NET	473	--

3.4 WATER QUALITY SUMMARY

Wilkinson Lake is shallow and falls between the green/eutrophic to very green/hypereutrophic classifications on the Trophic State Index (TSI) (shown below using the Carlson scale, MPCA). Wilkinson Lake had a score of 64 (2022) and 66 (2023).

Figure 17: TSI scores for VLAWMO lakes



Water quality data has been collected on Wilkinson since 1998. VLAWMO staff collects WQ data and water samples biweekly, May-September, for water clarity (secchi disk), nutrients (TP, Chl-a, SRP, nitrogen), and chemistry (temperature, conductivity, dissolved oxygen, and potential hydrogen [pH]). Total Phosphorus (TP) and Chlorophyll A (Chl-a) analyses are conducted by a contracted lab.

- TP is the primary cause of excessive plant and algae growth in lake systems. Phosphorus originates from a variety of sources, many of which are human related. Major sources include human and animal waste, soil erosion, detergents, septic systems, and stormwater runoff. Internal loading can also be present in a lake. Internal loading can result from P becoming resuspended into the water column from the sediment. High amounts of P in sediments may occur as a result of historical land uses including, but not limited to, waste disposal into the lake.

- Chl-a is a green pigment in algae. Measuring Chl-a concentration gives an indication of algae abundance.

- The MN Pollution Control Agency (MPCA) has impairment standards for the levels of TP and Chl-a. For shallow lakes in Minnesota, the impaired water quality standard levels are: <60µg/L for TP, <20µg/L for Chl-a, and <230 mg/L for Chloride.

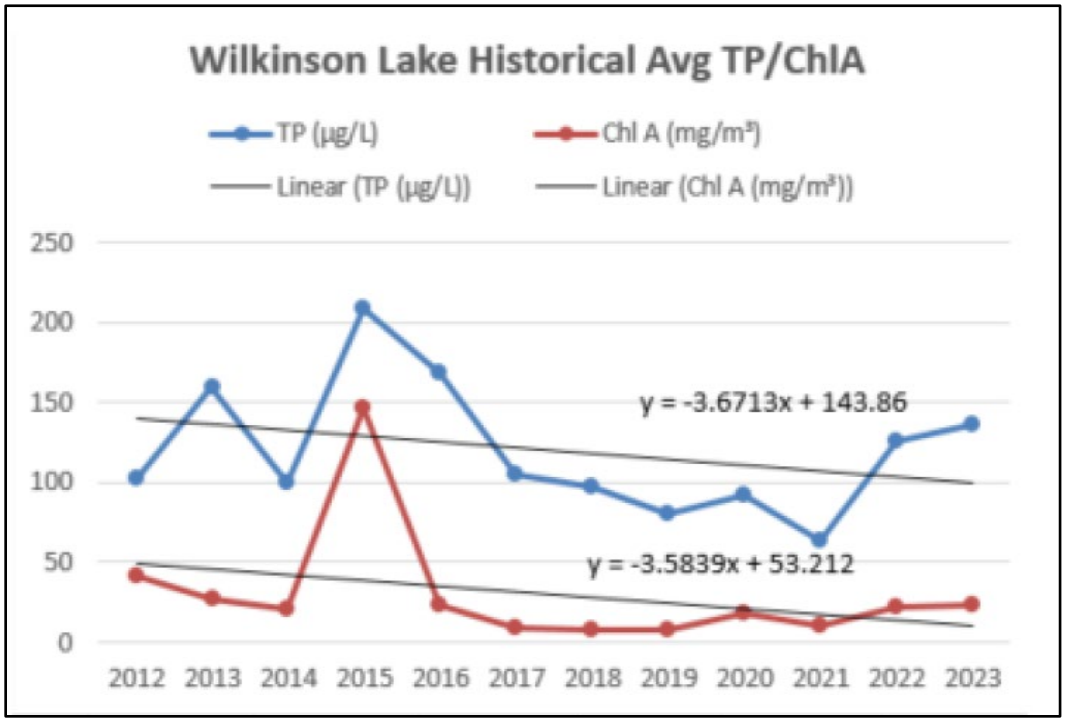
- Red numbers indicate values that exceed MN State Standards.

Table 5: Wilkinson Lake monitoring data 1998-2023

.

Wilkinson Lake Historical Avg TP/Chl A/ SDT			
Year	TP (µg/L)	Chl A (µg/L)	Secchi (m)
1998	48	26	1.1
1999	62	8	0
2000	38	34	0
2001	299	99	0.2
2002	107	40	0
2003	130	18	0
2004	72	0	0
2005	183	52	0
2006	96	10	0
2007	104	18	0.9
2008	64	8	0.3
2009	125	17	1
2010	140	31	0.8
2011	80	14	1
2012	103	42	0.9
2013	159	27	0.9
2014	100	21	0.9
2015	209	147	0.5
2016	169	24	1.1
2017	105	9	1.2
2018	97	8	1.2
2019	81	8	1.1
2020	92	18	1.1
2021	63	10	1.1
2022	126	22	1.1
2023	136	23	0.9

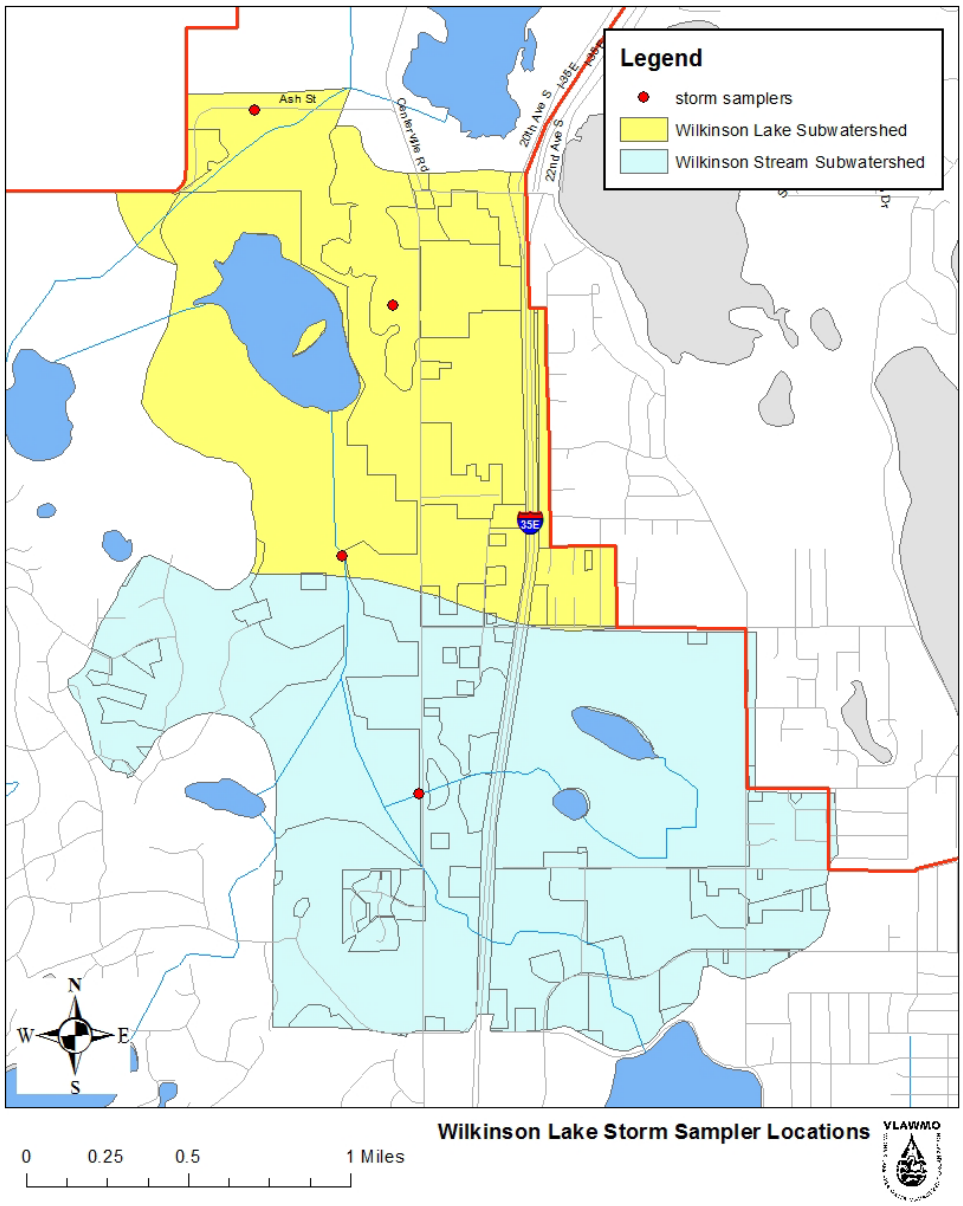
Figure 18: Water quality trends in Wilkinson Lake



Storm sampling

In 2010, 3 storm samplers were installed within the drainage area to study the level of pollutants and nutrients as water enters the Wilkinson watershed. One was placed north of the lake off of County Road J; one was place south of the lake in a stream within the Hill Farm; and the last one was placed at a storm sewer east of the lake near Waverly Gardens. In 2011, 4 samplers were placed; 3 in the same areas as in 2010, as well as one south of the immediate subwatershed, which will collect water coming from the Tamarack Nature Center area and the industrial area on the east side of Centerville Road. The averages for 2010 and 2011 are shown below. The storm samples were tested for the following: TP, Total Kjehdahl Nitrogen (TKN), Nitrates (NO3), Ammonia (NH3), and Total Suspended Solids (TSS).

Figure 19: Storm sampler locations



TKN is the sum of organic nitrogen and Ammonia (NH3) . High measurements of TKN typically results from sewage and manure discharges to water bodies. The average TKN for a lake in this ecoregion is 600-1200 ug/L. High NO3 levels are often caused by over application of fertilizers that leach into waterbodies. Unused NO3 turns into NO2 which is poisonous to fish (75ug/L will stress fish; over 500 ug/L can be toxic). Typical levels of NO3 in this ecoregion less than 100 ug/L. NH3 is a form of nitrogen contained in fertilizers, septic system effluent and animal waste. It is also a product of bacterial decomposition of organic matter. Typical levels of NH3 could not be found for this report. However, high levels of unionized NH3 can be toxic to aquatic organisms. TSS indicates the presence of very small particles in the water column. TSS interferes with light penetration, buildup of sediment, and the solids could carry nutrients that cause algal blooms and other toxic pollutants that are harmful to fish. Typical TSS in this ecoregion is 2-6 mg/L.

Table 6: Wilkinson Lake Storm Sampler Averages (2010-2011)

	2010	2011
TP (ug/L)		
Co Road J	612	625
Hill Farm	370	421
Storm Sewer	193	162
Centerville		137
TKN (ug/L)		
Co Road J	6277	2772
Hill Farm	2341	2584
Storm Sewer	1257	1420
Centerville		2164
NO3 (ug/L)		
Co Road J	1558	648
Hill Farm	136	409
Storm Sewer	169	234
Centerville		49
NH3 (ug/L)		
Co Road J	3436	385
Hill Farm	205	242
Storm Sewer	87	200
Centerville		77
TSS (mg/L)		
Co Road J	32.5	130.3
Hill Farm	23.7	87.7
Storm Sewer	5.21	7.48
Centerville		53.4

In 2010, VLAWMO staff collected 3-7 samples from the locations. In 2011, VLAWMO staff collected 5 samples from each location. Based on these limited results, it can be assumed that the runoff coming from the culvert at County Road J has the highest amount of pollutants in it. These results are not conclusive but offer some insight into sources of pollutant loading.

As the water moves to Wilkinson, the runoff is dispersed and filtered in wetland areas and spreads out within the water body. Samples taken from the lake water and tested for TP, TKN, NO3 and NH3 showed the following:

Table 7 : Samples from Wilkinson tested for runoff pollutants. As the summer season progresses, TP and TKN rise to levels that are over the typical levels for lakes in this region.

Date	TP (ug/L)	TKN (ug/L)	NO3 (ug/L)	NH3 (ug/L)
5/3/2010	61	1210	20	10
6/7/2010	103	1450	20	17
7/12/2010	142	1990	20	10
8/9/2010	211	2240	20	10
9/14/2010	208	2760	20	10
Avg	145	1930	20	11

4 MANAGEMENT ACTIONS

4.1 RETROFIT REPORT

Retrofit Report (2012)

In 2012, the Ramsey Conservation District (RCD), now RCSWCD, completed a Retrofit Report for Wilkinson Lake. This was part of a larger effort to assess the full watershed and subwatershed scales and identify optimal locations for BMPs.

In the Wilkinson Lake Subwatershed area, over half of the catchment, mainly the west side, consisted of open space. The eastern portion of the catchment along the 35E and Centerville Road corridor consisted of low-density residential single-family housing, commercial and light industrial land use. A series of wetlands, ditches and stormwater ponds contributed runoff to Wilkinson Lake. The soils within the area where retrofit opportunities were identified consist of Zimmerman and Soderville loamy fine sand which would allow for simple bioretention if found to not be compacted or polluted.

RETROFIT RECOMMENDATION

During the reconnaissance process, it was found that the commercial/industrial area and townhomes located in the north east corner of the catchment were receiving adequate treatment before draining in to Wilkinson Lake. In addition, according to VLAWMO staff a storm sampler collecting water quality samples that drain from this area have also shown that the runoff is receiving treatment upstream before entering Wilkinson Lake. A neighborhood in the south east corner of the catchment was identified as a potential location for a cluster of six simple bioretention cells. This neighborhood receives little treatment before it drains in to a ditch system connected to the south east corner of the wetland complex attached to Wilkinson Lake. If all six bioretention cells are installed at around 250 square feet each it is calculated that 5.3 lbs of TP would be removed from the catchment resulting in a 1.2% decrease from the base load. Possible pollutant-load reductions were fairly low. Additional feasibility investigation was completed to increase possible opportunities for BMPs.

Figure 20: Wilkinson Lake Subwatershed: 3 subcatchments focused upon for recommended retrofits

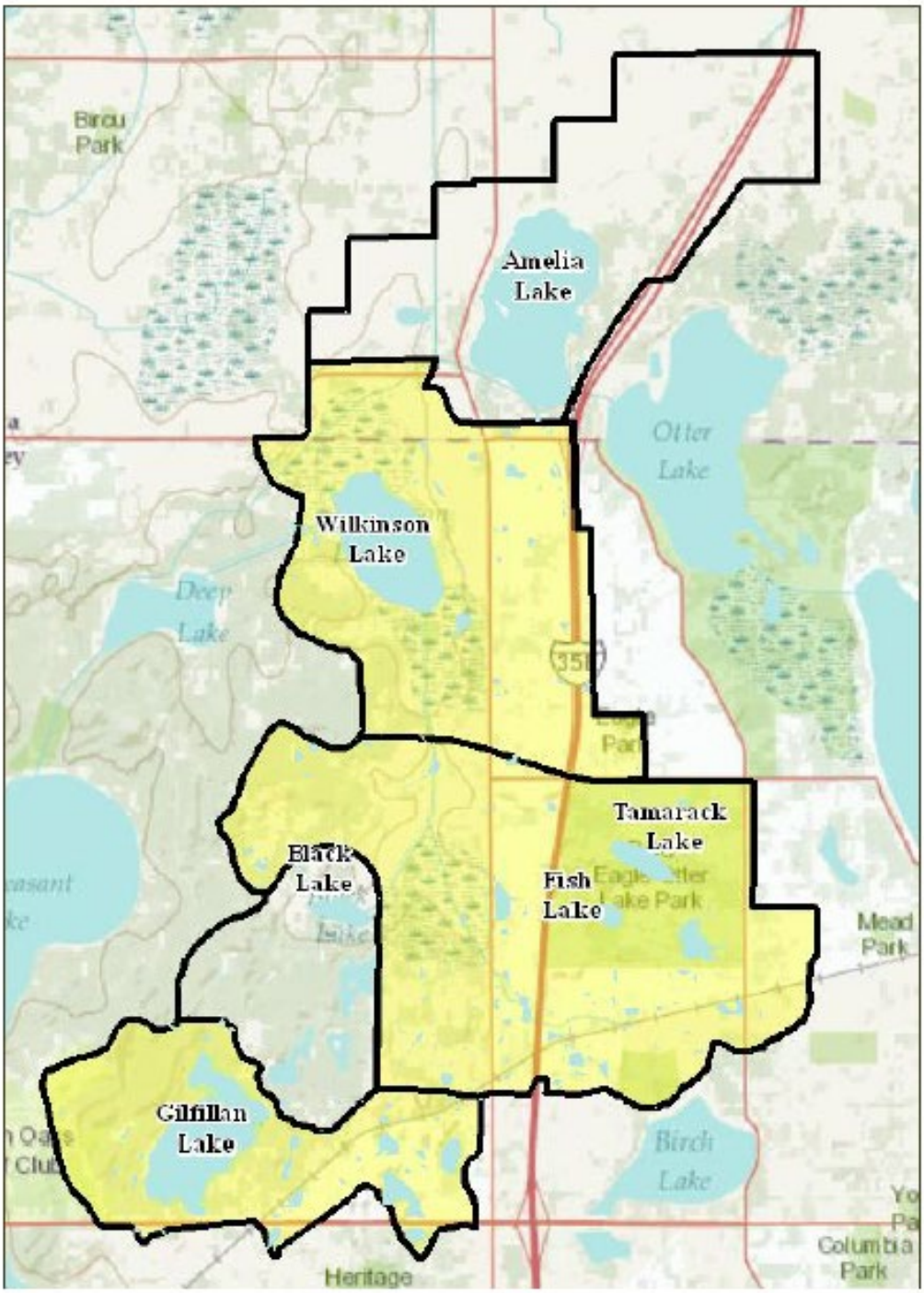
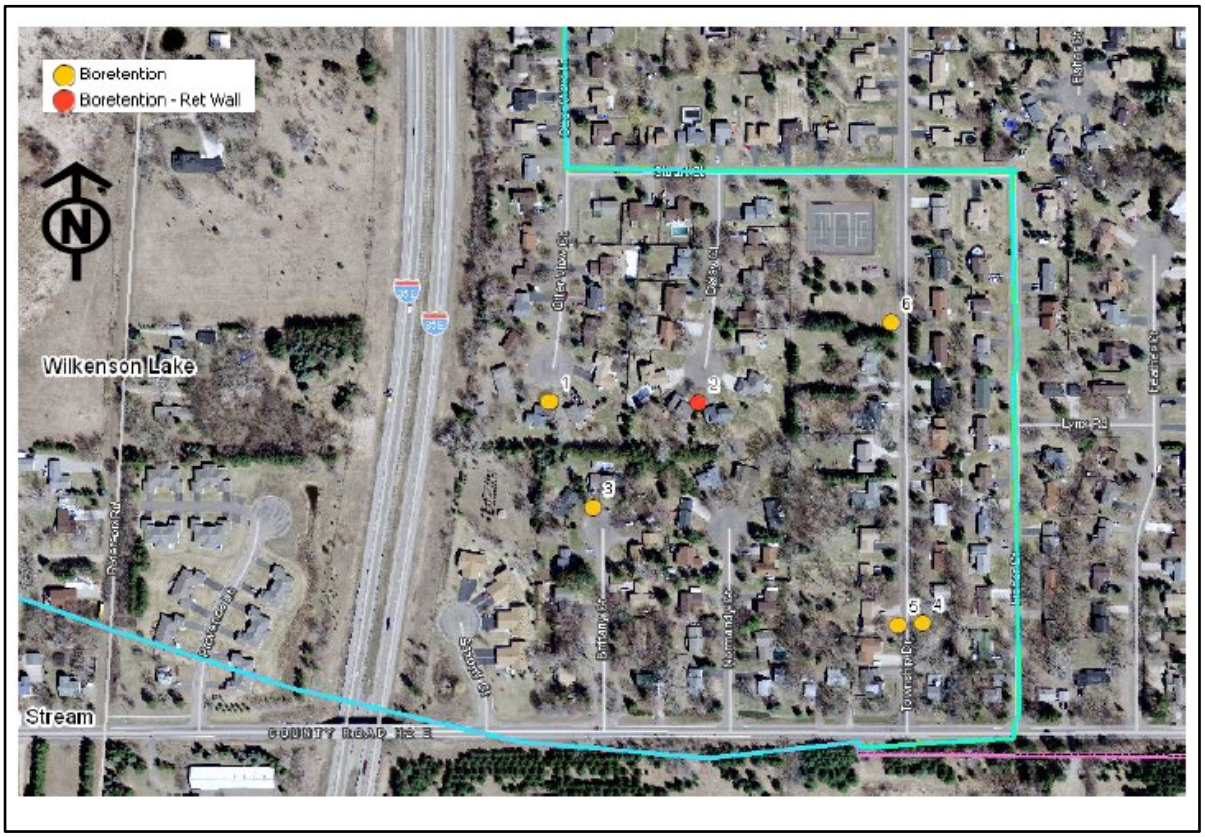


Figure 21: Locations recommended for possible retrofit BMPs.



Retrofit Report (2020)

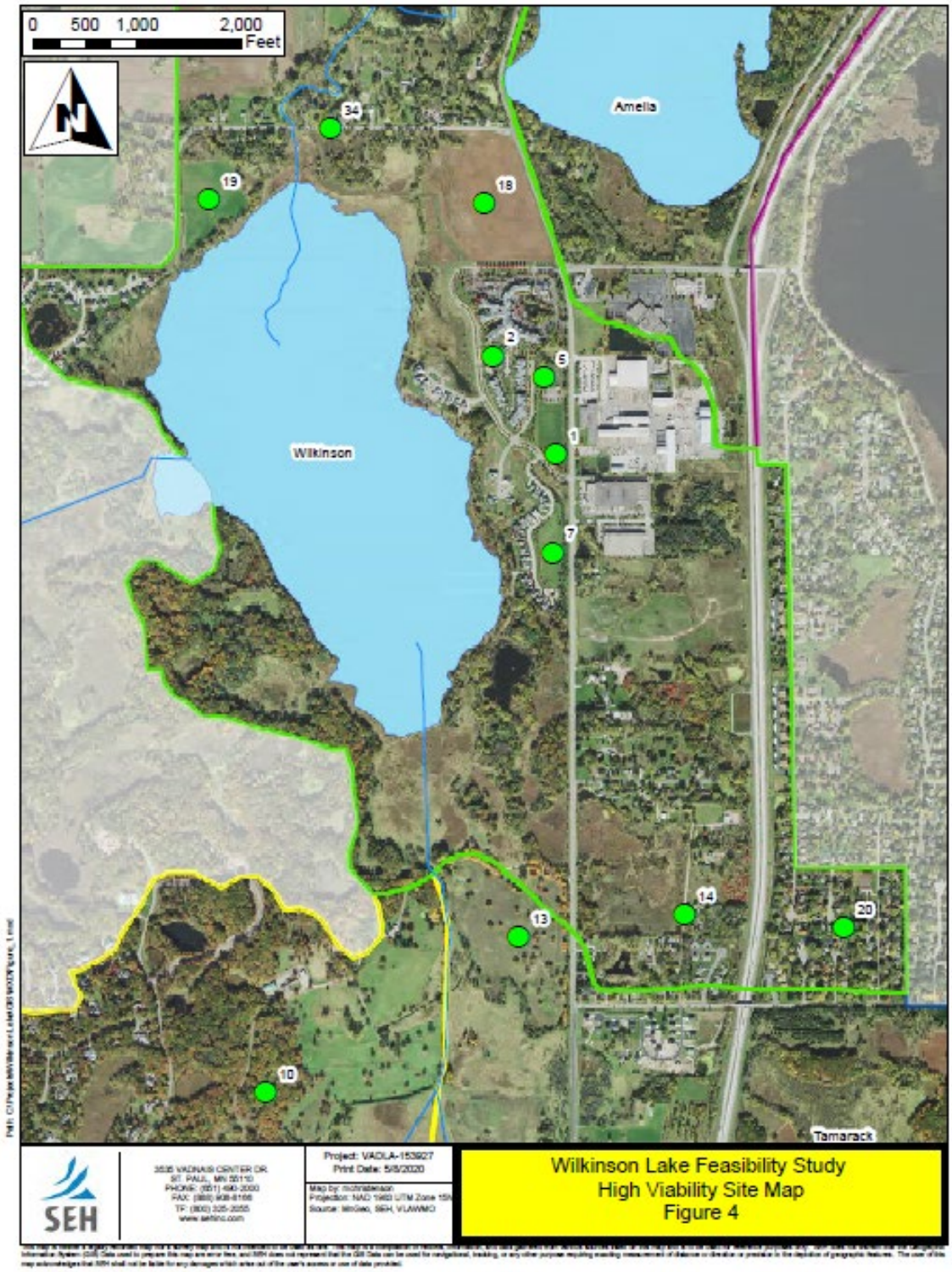
VLAWMO and RC SWCD worked with NOC and SEH Engineering in 2020 to conduct an additional feasibility investigation with SEH Engineering in 2020. Additional possible locations were identified as part of that effort.

Sites included:

Table 8: High Viability sites identified through feasibility study

Site	Description
1	General Area: Presbyterian Homes Waverly Garden Campus, Villas of Gem Lake, NOHOA Park Area, Potential BMP Enhancements
2	General Area: Presbyterian Homes Waverly Garden Campus, Villas of Gem Lake, NOHOA Park Area, Potential BMP Enhancements
5	General Area: Presbyterian Homes Waverly Garden Campus, Villas of Gem Lake, NOHOA Park Area, Potential BMP Enhancements
7	General Area: Presbyterian Homes Waverly Garden Campus, Villas of Gem Lake, NOHOA Park Area, Potential BMP Enhancements
10	Future Red Forest Way South Development, North Oaks Company Property
13	Future Gatehill Development, North Oaks Company
14	Peterson Road, White Bear Township
18	Future Development northeast of Wilkinson Lake, North Oaks Company
19	Future Development, northwest of Wilkinson Lake, North Oaks Company
20	Residential area in the southeast corner of the Wilkinson direct watershed, previously identified in the 2012 retrofit analysis
34	Ash Street Crossing, North Oaks Company, Lino Lakes, Ramsey County, Anoka County

Figure 22: Map of locations corresponding to high-viability sites



4.2 COMPLETED BMPS AND PROJECT PARTNERSHIPS IN THE SUBWATERSHED

Best Management Practices (BMPs) are implemented to improve and protect water quality. Common small-scale examples of BMPs include raingardens, infiltration basins, shoreline restorations, rain barrels, and native restorations and plantings. Larger BMPs include stormwater retention basins, iron-enhanced sand filters, weirs and stormwater conveyance retrofits, and in-lake treatments such an alum treatment, rough fish management, or aquatic vegetation management.

Completed BMPs for Wilkinson Lake include:

- NOC construction of permanent fish barrier in 1994, follow-up drawdowns to remove invasive common carp, and ongoing maintenance of the barrier
- Invasive common carp removal with VLAWMO and Carp Solutions (2019-present) with collaboration from NOC as the landowner where temporary barriers and removal is conducted
- Construction of a deep-water wetland to the south of Wilkinson Lake (fall 2023), in partnership with NOC, MLT, RC SWCD, SPRWS, Houston Engineering as part of VLAWMO's participation in the small, priority watershed grant program which is administered by the MPCA and funded by the EPA. Site enhancement and monitoring are currently underway (2024)

Possible upcoming projects include:

- Potential meander to the north of the deep-water wetland restoration area, as a possible second-round project in the small, priority watershed program
- Alum treatment as investigated in in-lake studies for Wilkinson Lake

Figure 24: Photos of major BMPs toward improvement of Wilkinson Lake

1994 NOC Fish barrier construction	Carp attempting to get into Wilkinson Lake to spawn but trapped below the new barrier
	
Antenna placement as part of VLAWMO/Carp Solutions carp removal effort (2020)	Carp removal by VLAWMO/Carp Solutions
	
Wilkinson deep-water wetland construction (fall 2023)	Wilkinson deep-water wetland following vegetation establishment (summer 2024)
	

Residential Grant Projects

As one of VLAWMO's core program areas, VLAWMO's grant programs work to implement in-ground BMPs within VLAWMO's boundaries, for the improvement and preservation of water quality. For more information, visit www.vlawmo.org/grants/. Within the Wilkinson Lake subwatershed…

Figure 24: Wilkinson Lake subwatershed implemented projects and BMPs.