

Appendix B: Lake Report Cards

Overall Strategy:

Improve Water Quality

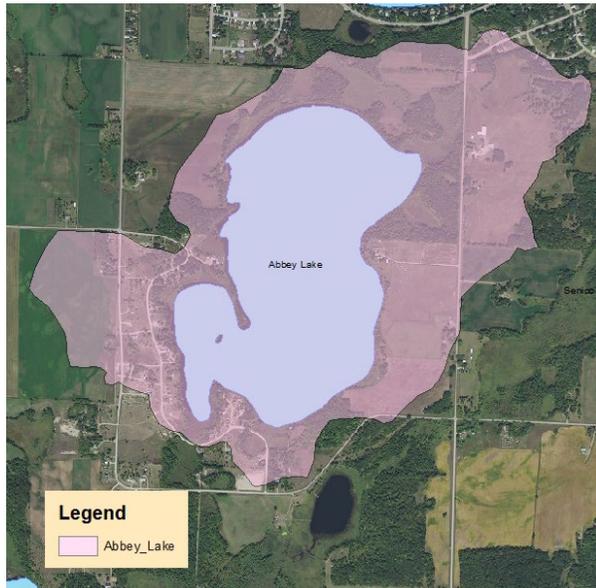
Impairment:

Not listed as impaired

Subwatershed

Lake Cover/Use:

- 35.9% Open Water
- 8.3% Developed
- 4.1% Wetlands
- 10.0% Cultivated Crops
- 18.2% Forest
- 23.4% Grassland



Basic Facts

DNR ID/ Becker No	MN03-0366-00 / 366
Township(s)	Lake View (Sec 14,23)
Lake Classification	Natural Environment
Lake Area	269 acres
Littoral Area	269 acres (100%)
Sub-watershed Area	772 acres
Shoreline Length	3.7 miles
Inlet(s)	None
Outlet(s)	Wetland Stream
Control Structures	None
Highest Recorded	1340.07 (09/20/2005)
Lowest Recorded	1340.07 (09/20/2005)
Ordinary High Water Level	1339.9 feet
Recorded Range	0
Maximum Depth	7 feet
Main Fish Species	N/A
Secondary Fish Species	N/A
MN DNR/ Private Fish Stocking	N/A
Aquatic Invasive Species (2015)	None listed
Public Access Sites	No Access
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County Zoning

Water Quality	10-Year Average 2008-2017	Previous 10-year average 1998-2007	Trend
Secchi (clarity)	5 ft.	4 ft.	Improving
Total Phosphorus	37 µg/L	50 µg/L	Improving
Orthophosphate	Insufficient Data	Insufficient Data	N/A
Chlorophyll-a	11 µg/L	22 µg/L	Improving

Short Term Goals - Year 2025

- Maintain a 5-year mean summer phosphorus concentration at or below 40 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 5 ft

Long Range Goals – Year 2035

- Maintain a 5-year mean summer phosphorus concentration at or below 40 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 5 ft

Overall Assessment

Abbey Lake is a 269 acre shallow, natural environment lake with a maximum depth of 7 feet which is listed as a priority shallow lake with the MN DNR. The entire lake is considered littoral with significant macrophyte growth throughout the lake. Abbey is considered mildly eutrophic with significant late season algal blooms and supports only warm fisheries. The lake's watershed has no surface water inlets and drains out of the wetland on the south shore of the lake and into Reeves Lake. The contributing watershed has a total area of 772 acres. There is heavy residential development on the southwest portion of the lake with limited development elsewhere.

Water quality has increased over the past 20 years and now remains stable. Comparing the last ten year period (2008-2017) to the previous ten year prior period (1998-2007), Abbey has increased in water clarity from 4 ft to 5 ft and decreased in total phosphorus concentration from 51 ppb to 46 ppb. Abbey is currently above the state standard for shallow lakes, which is 60 ppb phosphorus and 3.2-foot Secchi depth. There are no current water resource concerns.

Past Studies

None (2019)

Planned/Potential Projects:

- Lake Vegetation Survey
- Establish Load Allocation and Water Quality Goal

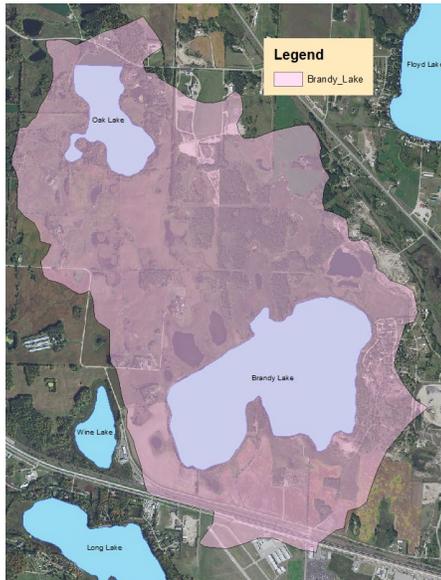
Ongoing Programs:

- Conduct routine Water Quality Monitoring
- Identify and address commercial, residential or agricultural runoff to lakes.
- Implement rules and permitting

Overall Strategy:
Improve Water Quality

Impairment:
Not listed as Impaired, Watch List

Subwatershed Lake Cover/Use:
24.0% Open Water
5.1% Developed
6.0% Wetlands
14.8% Cultivated Crops
30.2% Forest
20% Grassland



Water Quality	20-Year Average (1998-2017)	Trend
Secchi (clarity)	5 ft.	Increasing
Total Phosphorus	42 µg/L	Decreasing
Ortho Phosphate	Insufficient Data	N/A
Chlorophyll-a	8.2 µg/L	Decreasing
Water Quality	10-Year Average (2008-2017)	Trend
Secchi (clarity)	7.5 ft.	Increasing
Total Phosphorus	23 µg/L	Decreasing
Ortho Phosphate	Insufficient Data	N/A
Chlorophyll-a	4.8 µg/L	Decreasing

Short Term Goals - Year 2025

- Maintain a 5-year mean summer phosphorus concentration at or below 40 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 5 ft

Long Range Goals – Year 2035

- Maintain a 5-year mean summer phosphorus concentration at or below 40 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 5 ft

Basic Facts

DNR ID/ Becker No	MN03-0400-00 / 579
Township(s)	Detroit (Sec 20-21)
Lake Classification	Natural Environment
Lake Area	336 acres
Littoral Area	336 acres (100%)
Sub-watershed Area	1986 acres
Shoreline Length	3.75 miles
Inlet(s)	None
Outlet(s)	Wetland Stream
Control Structures	None
Highest Recorded	Not Recorded
Lowest Recorded	Not Recorded
Ordinary High Water Level	Not Recorded
Recorded Range	Not Recorded
Maximum Depth	Not Recorded
Main Fish Species	N/A
Secondary Fish Species	N/A
MN DNR/ Private Fish Stocking	N/A
Aquatic Invasive Species (2015)	None listed
Public Access Sites	None
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County

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Overall Assessment

Brandy Lake is a shallow 336-acre lake located just northwest of the City of Detroit Lakes. The lake is listed as a priority shallow lake with the MN DNR. The lake consists of 100% littoral area with extensive macrophyte growth throughout the lake. Water quality has been increasing over the past 20 years, with a summer mean water clarity of 7.5 feet and 23ppb phosphorus concentration (2008-2017). The prior ten years (1998-2007) exhibited lower water quality with 5-foot water clarity and 44ppb phosphorus concentration. This increase in water quality is primarily attributed to Becker County landfill groundwater remediation. The remediation efforts reduce polycyclic aromatic hydrocarbons (PAHs) by aerated contaminated groundwater prior to discharge to Brandy Lake.

There are only two residential homes that currently access the lake; however, one area on the southeast portion has been platted but not yet developed. A second-tier residential development is located on the east portion of the lake, which does not have individual lake access, but does contain a commons area for lake use. This commons area is in a natural condition, except for one unpaved boat access.

Past Studies

None (2019)

Planned/Potential Projects:

- Obtain baseline water quality data for Oak Lake.

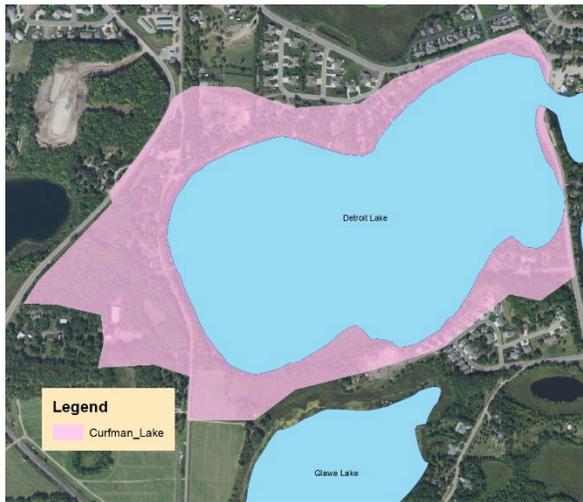
Ongoing Programs:

- Water quality monitoring

Overall Strategy:
Maintain Water Quality

Impairment:
Listed as impaired for mercury;

Shoreland Classification:
General Development



Catchment Area Land Cover:
56.3% open water, 8.7% wetlands,
5.1% grassland, 17.6% forest,
12.3% developed land

Water Quality	10-Year Average (2008-2017)	Trend
Secchi	10 ft.	Stable
Total Phosphorus	24 µg/L	Stable
Ortho Phosphate	5.2 µg/L	Stable
Chlorophyll-a	7.8 µg/L	Stable

Note: Zebra Mussel infested water listing in 2016

Short Term Goals - Year 2025

- Maintain a 5-year mean summer phosphorus concentration at or below 25 µg/L
- Maintain mean summer Secchi depth no less than 9 ft

Long Range Goals – Year 2035

- Achieve a 5-year mean summer phosphorus concentration at or below 25 µg/L
- Maintain mean summer Secchi depth no less than 9 ft

Overall Assessment

Curfman Lake is a small recreational development lake with heavily developed shorelines. While it is truly an embayment of Big Detroit, Curfman is considered a separate lake by the Minnesota Department of Natural Resources.

Curfman Lake is a 121-acre polymictic lake with a maximum depth of 21 feet and comprised of 85 acres (71%) of the littoral surface

Basic Facts

DNR ID /Becker No	MN03-0363-00 / 363
Township(s)	Lake View (Sec 9,10)
Classification	Recreational Development
Lake Area	121 acres
Littoral Area	85 acres (71%)
Sub-watershed Area	200 acres
Shoreline Length	1.7 miles / 9,239 feet
Inlet(s)	Detroit Lake
Outlet(s)	Detroit Lake
Control Structures	None
Highest Recorded	1335.78 feet (7/11/1998)
Lowest Recorded	1333.34 feet (9/13/1970)
Ordinary High Water Level	1334.3 feet
Recorded Range	2.44 feet
Maximum Depth	21 feet
Main Fish Species	Walleye, Muskellunge, Northern Pike, Largemouth Bass, Bluegill, Black Crappie
Secondary Fish Species	Hybrid Sunfish, Pumpkinseed, Yellow Perch, Lake Sturgeon, White Sucker, Black/Brown/Yellow Bullhead
MN DNR/ Private Fish Stocking	Walleye, Muskellunge, Lake Sturgeon
Aquatic Invasive Species	Flowering rush, Curly - leaf pondweed, Chinese mystery snail, Zebra Mussels
Public Access Sites	None
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County

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area. The southern shoreline is heavily vegetated with both submergent and emergent aquatic vegetation. This important vegetation population allows Curfman to provide excellent nursery and spawning habitat.

Curfman Lake is considered mesotrophic with relatively good water quality. Water quality has been stable for the last 10 years with mean phosphorus level ranging from 20ppb to 29ppb (24ppb average) and clarity levels ranging from 7.5 feet to 11 feet (average 10 feet), typically mirroring Big Detroit what quality. Late summer algal blooms have been observed, typically following large rain events.

Residential developmental pressures have increased along the southern shoreline with the conversion of forested land to the Golden Bay Shores planned unit development.

The aquatic invasive plants Flowering Rush and Curly-leaf pondweed are both present in the lake, along with invasive invertebrates Zebra Mussels and Chinese Mystery snail. The District recognizes the importance of managing nuisance invasive plant populations to promote a diverse native plant community; therefore both Flowering Rush and Curly-leaf Pondweed are assessed and management annually via herbicide applications.

Past Studies

- Ulteig Engineers Inc. 2009. North Side Stormwater Treatment Study
- K-V Associates Inc. 1980. Septic Leachate Survey, Detroit Lakes, MN
- Hecock, R. 1993. Diagnostic and Feasibility Study and Management Alternatives for Lake Sallie and Detroit Lake
- Larson Peterson and Associates. 1998. 1998 Quality Assurance Plan: Lakes Sallie and Detroit
- Larson, Peterson, and Ulteig. 2004. Wastewater Treatment Facility Effluent Discharge Feasibility Study; City of Detroit Lakes Preliminary Engineering Report
- Pelican River Watershed District and City of Detroit Lakes. 1971. The Effectiveness of Advanced Waste Treatment Methods and the Recovery Rate of an Enriched Lake following Nutrient Cut-Off
- A.W. Research Laboratories. 1996. Proposal for Locating Ground Water in the Wetland West of Detroit Lake
- McComas, Steve. Blue Water Science. 1999. Pelican River Watershed District Aquatic Plant Harvesting Program Evaluation
- McComas, Steve. Blue Water Science. Pelican River Watershed District Aquatic Plant Harvesting Program Evaluation
- Larson Peterson and Associates. 1987. 1987 Monitoring Plan: Lakes Sallie and Detroit
- Larson Peterson and Associates. 1990. Clean Lakes Study of Lakes Sallie and Detroit: 1988 and 1989 Data Collection Summary
- Larson Peterson and Associates. 1992. Diagnostic Feasibility Study: Management Alternatives for Lakes Sallie and Detroit
- Larson Peterson and Associates. 1998. 1998 Monitoring Plan: Lakes Sallie and Detroit
- Larson Peterson and Associates. 2001 Diagnostic Management Alternatives for Lake Sallie and Detroit Lake
- Iverson, Steven W. 1992. The Pelican River Navigation Restoration Project
- Larson Peterson and Associates. 2001. Stormwater Drainage Plan: Storm Sewer Drainage Districts, Detroit Lakes, MN

Planned/Potential Projects:

- Investigate untreated stormwater runoff from linear development

Ongoing Programs:

- Shoreline Surveys
- Lake Vegetation Surveys
- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Aquatic Plant Management (1C)
- Water Quality Monitoring

Overall Strategy:

Improve Water Quality

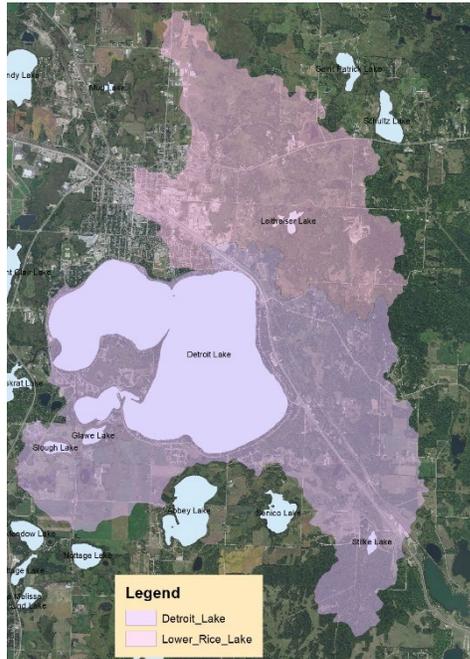
Impairment: Listed as impaired for mercury;

Shoreland

Classification: General Development

Catchment Area Land Cover:

33.6% open water, 5.5% wetlands, 3.1% cropland, 18.0% grassland, 27.8% forest, 12% developed land



Water Quality "Big Detroit"	10-Year Average (2008-2017)	Trend
Secchi	10.2 ft.	Stable
Total Phosphorus	25 µg/L	Slight Degrading
Ortho Phosphate	4.7 µg/L	Stable
Chlorophyll-a	8.4 µg/L	Stable

Water Quality "Little Detroit"	10-Year Average (2008-2017)	Trend
Secchi	12 ft.	Improving
Total Phosphorus	17 µg/L	Improving
Ortho Phosphate	5.0 µg/L	Stable
Chlorophyll-a	4.3 µg/L	Stable

Note: Zebra Mussel infested water listing in 2016

Short Term Goals - Year 2025

- Maintain a 5-year mean summer phosphorus concentration at or below 25 µg/L
- Maintain mean summer Secchi depth no less than 9 ft

Long Range Goals – Year 2035

- Achieve a 5-year mean summer phosphorus concentration at or below 20 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 10 ft

Basic Facts

DNR ID /Becker No	MN03-0381-00 / 381
Township(s)	Lake View (Sec 1-4, 9-15), Detroit (Sec 34-36)
Classification	General Development
Lake Area	3067.1 acres
Littoral Area	1895 acres (61.78%)
Sub-watershed Area	9769.6 acres
Shoreline Length	
Big Detroit	7.7 miles/40,900 ft.
Little Detroit	4.8 miles/ 25,295 ft.
Inlet(s)	Pelican River, Sucker Creek,
Outlet(s)	Pelican River
Control Structures	None
Highest Recorded	1335.78 feet (7/11/1998)
Lowest Recorded	1333.34 feet (9/13/1970)
Ordinary High Water Level	1334.3 feet
Recorded Range	2.44 feet
Maximum Depth	
Big Detroit	89 feet
Little Detroit	16 feet
Residence Time	
Big Detroit	2287 days
Little Detroit	487 days
Main Fish Species	Walleye, Muskellunge, Northern Pike, Largemouth Bass, Bluegill, Black Crappie
Secondary Fish Species	Hybrid Sunfish, Pumpkinseed, Yellow Perch, Lake Sturgeon, White Sucker, Black/Brown/Yellow Bullhead
MN DNR/ Private Fish Stocking	Walleye, Muskellunge, Lake Sturgeon
Aquatic Invasive Species	Flowering rush, Curly -leaf pondweed, Chinese mystery snail, Zebra Mussels
Public Access Sites	4 sites; SW Shore (DNR), NE Shore (City), N Shore "Little" Detroit" (City)
Marinas	J & K Marine, Long Bridge, Holiday Inn, Several Private
Public Beach	North Shore "Little" Detroit
References	DNR Lake Finder, Becker County

Overall Assessment

At 3,067 acres, Detroit Lake is the largest lake within the PRWD, and lies entirely within the City of Detroit Lakes municipal boundaries. As typical with urban lakes, its shoreline is extensively developed with residential homes, commercial businesses and some industrial buildings. The lakes are heavily used for game fishing, boating, and other summer and winter recreational activities. The drainage area of Detroit is 9770 acres in size, which is comprised primarily of Forest (42%), Grassland (27%), and Developed Land (18%).

Detroit Lake, locally known as Big Detroit and Little Detroit, has two distinct basins that are separated by a shallow gravel bar. The larger of the two basins, Big Detroit has a maximum depth of 82 feet (18.4-foot average) with 37.5 % of its surface within the littoral area (< 15 ft depth) and has 7.84 miles of shoreline. Little Detroit littoral area (< 15ft depth) encompasses the entire water basin, with a lake depth average of 8.5 feet and a maximum depth of 16 feet, with 4.9 miles of shoreline.

There are two public accesses on Big Detroit, located on the north and south sides. The north side access is owned by the City of Detroit Lakes, however, there are short term plans to construct a new access by the MN DNR, west of the Holiday Inn. The south public water access on Big Detroit is owned by the MN DNR and in 2016 was expanded and reconstructed to increase the parking area, providing stormwater management enhancements, and includes a designated area to clean and decontaminate water related equipment. There is one commercial marina on Big Detroit, operated by the Holiday Inn which is currently permitted for 26 slips.

Little Detroit has a City Park mile long public beach from Washington Avenue to Legion Road. Within the public beach area, the City of Detroit Lakes owns a public water access which is located at the intersection of Roosevelt Avenue and West Lake Drive. Little Detroit has two commercial marinas - J & K Marina and Long Bridge which have 102 and 36 slips respectively. There are 6 PUD's with water access totaling 82 slips.

Big Detroit and Little Detroit basins are separated by a shallow gravel bar with an area to the north which was last dredged in 1984 to provide watercraft passage at a cost of \$80,000.

The primary inlet and outlet for Detroit Lake is the Pelican River, flowing into the north side of Big Detroit and exiting the southwest side of Little Detroit. In addition to the Pelican River, Sucker Creek drains to the Lake along with two small wetland flowages, all on the southeast portion of Big Detroit. There are no water control structures, however, the lake level is controlled further downstream by the rock rapids located between Muskrat and Sallie lakes.

Big Detroit is a dimictic lake while Little Detroit is polymictic, however, both exhibit mesotrophic characteristics with moderately clear water and support all recreation/aesthetic uses. Occasionally, after large rain events or during hot summer months, the lake becomes borderline eutrophic with visible algal blooms. This is due, in part, to Rice Lake, an upstream degraded wetland

Planned/Potential Projects:

- Develop lake specific management plans including aquatic plant management
- Implement Rice Lake Wetland Nutrient Reduction Project.
- Retrofit existing and construct new stormwater management facilities
- Work with City of Detroit Lakes to enhance the street sweeping program
- Develop chloride assessment program
- Investigate internal phosphorus loading of Big Detroit Lake.
- Study potential regional BMP options for City of Detroit Lakes linear projects; develop credit system for linear redevelopment.
- Obtain baseline water quality data for Leitheiser, Patrick, Schultz lakes.

Ongoing Programs:

- Shoreline Surveys
- Lake Vegetation Surveys
- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Water Quality Monitoring
- Aquatic Plant Management (1C)
- Implement rules and permitting.
- Attend lake association meetings.

complex which releases phosphorous following large rain events. Urban and residential stormwater runoff are also contributors of nutrients to the lake.

The two waterbodies typically have consistently different water clarity and nutrient levels. Little Detroit generally has better water quality than the larger and deeper Big Detroit. Over the past 10 years, Little Detroit has shown a slight improvement in both clarity and total phosphorous. Big Detroit has exhibited stable water clarity with a slight increase in total phosphorous levels.

With the continued development of Detroit Lake, there has been an increase in lakeshore alteration activities including the removal of natural shoreline vegetation and installation of rock rip-rap. There has also been a noticeable increase in the removal of aquatic vegetation by both manual and mechanical means.

Aquatic invasive species have a large effect on lake health and in turn, lakeshore property value. Because of the high level of recreational use of Detroit Lake, this makes it very susceptible for invasive species introduction. The aquatic invasive plants Flowering Rush and Curly-leaf pondweed are both present in the lake, along with invasive invertebrates Zebra Mussels and Chinese Mystery snails. Both Flowering Rush and Curly-leaf Pondweed are assessed and managed annually via herbicide applications. The City of Detroit Lakes recognizes the economic value of the lake and assists the District in managing invasive plants.

The MN DNR is very active in the fisheries management of Detroit Lake. The lake supports a healthy game fish population including pan fish, Walleye, Bass, Northern Pike, and Muskellunge. MN DNR focuses fish stocking efforts in Detroit Lake for Walleye, Muskellunge, and Lake Sturgeon.

Past Studies

- Wenck Associates. 2019. Washington Square Mall Stormwater Feasibility Study. Detroit Lakes, MN
- Ulteig Engineers Inc. 2009. North Side Stormwater Treatment Study
- K-V Associates Inc. 1980. Septic Leachate Survey, Detroit Lakes, MN
- Hecock, R. 1993. Diagnostic and Feasibility Study and Management Alternatives for Lake Sallie and Detroit Lake
- Larson Peterson and Associates. 1998. 1998 Quality Assurance Plan: Lakes Sallie and Detroit
- Larson, Peterson, and Ulteig. 2004. Wastewater Treatment Facility Effluent Discharge Feasibility Study; City of Detroit Lakes Preliminary Engineering Report
- Pelican River Watershed District and City of Detroit Lakes. 1971. The Effectiveness of Advanced Waste Treatment Methods and the Recovery Rate of an Enriched Lake following Nutrient Cut-Off
- A.W. Research Laboratories. 1996. Proposal for Locating Ground Water in the Wetland West of Detroit Lake
- McComas, Steve. Blue Water Science. 1999. Pelican River Watershed District Aquatic Plant Harvesting Program Evaluation
- McComas, Steve. Blue Water Science. Pelican River Watershed District Aquatic Plant Harvesting Program Evaluation
- Larson Peterson and Associates. 1987. 1987 Monitoring Plan: Lakes Sallie and Detroit
- Larson Peterson and Associates. 1990. Clean Lakes Study of Lakes Sallie and Detroit: 1988 and 1989 Data Collection Summary
- Larson Peterson and Associates. 1992. Diagnostic Feasibility Study: Management Alternatives for Lakes Sallie and Detroit
- Larson Peterson and Associates. 1998. 1998 Monitoring Plan: Lakes Sallie and Detroit
- Larson Peterson and Associates. 2001 Diagnostic Management Alternatives for Lake Sallie and Detroit Lake
- Iverson, Steven W. 1992. The Pelican River Navigation Restoration Project
- Larson Peterson and Associates. 2001. Stormwater Drainage Plan: Storm Sewer Drainage Districts, Detroit Lakes, MN
- Elf, Brandy. 2006. Phosphorous in the Wetland Environment. Thesis
- Berryman, Erin, R. Venterea, J. Baker. 2005. Water Table Effects on Phosphorous Release and Trace Gas Flux in a Northwestern Minnesota Shallow Marsh.
- USDA Natural Resource Conservation Service. 2007. Upper Pelican River Watershed Plan and Environmental Assessment, Becker County Minnesota.

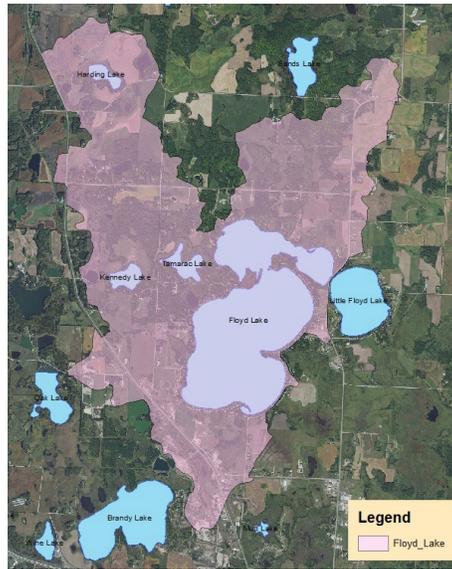
Overall Strategy:

Improve Water Quality (North Floyd); Maintain Water Quality (Big Floyd)

Impairment: Listed
Impaired for mercury

Drainage Area Land Cover:

21.7% open water
4.9 % wetlands,
15.5% cropland,
17.7% grassland,
31.4% forest,
8.7% developed



Water Quality Big Floyd	10-Year Average June - Sept (2008-2017)	Trend
Secchi (clarity)	12 ft.	Stable
Total Phosphorus	14 µg/L	Stable
Ortho Phosphate	3.0 µg/L	Stable
Chlorophyll-a	4.5 µg/L	Stable

Short Term Goals - 2025

- Maintain the 5- year mean summer phosphorus levels below 20µg/L
- Maintain mean (5yr) Secchi depth no less than 10 feet

Long-term Goals – Year 2035

- Achieve a 5-year mean summer phosphorus level below 15µg/L
- Maintain mean secchi (5yr) depth no less than 11 feet

Water Quality North Floyd	10-Year Average June - Sept (2008-2017)	Trend
Secchi (clarity)	8.5 ft.	Stable
Total Phosphorus	34 µg/L	Stable
Ortho Phosphate	5 µg/L	Stable
Chlorophyll-a	16 µg/L	Stable

Short Term Goals - 2025

- Maintain 5- year mean summer phosphorus levels below 35µg/L
- Maintain mean Secchi depths no less than 8 feet

Long-term Goals – Year 2035

- Achieve a 5-year mean summer phosphorus level below 30µg/L
- Maintain a 5-year mean Secchi depth no less than 9 feet

Basic Facts

DNR ID/Becker No	MN03-0387-00 / 387
Township(s)	Detroit (Sec 3, 4, 9, 10, 15, 16)
Lake Classification	General Development
Lake Area – Big	862 acres
North	298 acres
Littoral Area	861 acres (73.1 %)
Sub-watershed Area	6281.3 acres
Shoreline Length	
Big	5.5 miles/29,000 ft
North	3.6 miles/18,850 ft
Inlet(s)	Campbell Creek and Tamarac Lake flowage
Outlet(s)	Pelican River (Becker CSAH 21 culvert)
Control Structures	None (Level controlled by Little Floyd Lake Dam)
Highest Recorded	1356.5 feet (7/29/1993)
Lowest Recorded	1353.61 feet (10/23/1956)
Ordinary High Water Level	1354.8 feet
Recorded Range	2.89 feet
Maximum Depth	26 feet (“Big” Floyd), 34 feet (“North” Floyd)
Water Residence	271 days-North Floyd N/A- Big Floyd
Main Fish Species	Black Crappie, Bluegill, Pumpkinseed, Largemouth Bass, Rock Bass, Walleye
Secondary Fish Species	Bowfin, Hybrid Sunfish, Tullibee Black/Brown/Yellow Bullhead
Fish Stocking & Management	Walleye;
Aquatic Invasive Species (2018)	Zebra Mussel
Public Access Sites	Big Floyd SE Shore (DNR)
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County

Overall Assessment

Floyd Lake, a 1,178 acre, general development lake with heavily developed shoreline, is located north of the City of Detroit Lakes. The lake is divided into two distinct basins, known locally as Big Floyd and North Floyd. The lakes are heavily used for game fishing, boating, and other summer and winter recreational activities. The larger of the two basins, Big Floyd, is 862 acres in size, reaches a maximum depth of 25 feet, and has approximately 5.5 miles of shoreline. The littoral area (<15 ft) of the lake accounts for nearly 70% of the lake area and emergent aquatic plants are common. North Floyd is smaller, with 316 acres of surface area, 2.2 miles of shoreline, and a maximum depth of 34 feet. North Floyd littoral area (<15 ft) coverage is approximately 60%. There is one MN DNR owned public access located on the southeast side of Big Floyd. North Floyd Lake does not have a public access but is accessible via a channel between the two basins.

The major water source into North Floyd is Becker County Drainage Ditch 12/Campbell Creek along with two minor inlets located on the west side of North Floyd and on the southwest side of Big Floyd. Campbell Creek is an intermittent, high gradient stream and is the major nutrient source to North Floyd Lake. Sections of Campbell Creek were ditched and straightened in the early 1900s for agricultural benefit and included partially drawing down Campbell Lake and draining surrounding wetland areas. Becker County Ditch 11-12 discharges into Campbell Creek, a natural channel which drops almost 80 feet in 2 miles before reaching North Floyd. Through the lower reach, Campbell Creek flows through highly erodible soils, and carries a heavy sediment load to North Floyd. It appears that most of the time Big Floyd also contributes some flow to North Floyd, although it is thought the source of this water is mainly from groundwater. Other minor water sources include overland flows and groundwater seeps and springs. The outflow is located on the east side of North Floyd and connects to Little Floyd through a Becker CSAH21 road culvert.

Both lakes have undergone increased development pressure in the past 15 years. Big Floyd underwent conversions of seasonal cabins to permanent year-round residential homes and increased second-tier development. In 2017, the Ironman Golf Course, located between Big and Little Floyd Lakes was converted to residential lots. Big Floyd's shoreline is extensively developed with approximately 76% of 300 parcels exhibiting moderate to significant shoreline modification. In the mid-2000's, the north side of North Floyd was converted from agriculture pasture to residential lots. Since the conversion, approximately 12% of North Floyd's 67 parcels have moderate to significant shoreline modification. Utilization of rip-rap, vegetation/tree removal, sand blankets and retaining walls are prominent alteration practices.

Residential properties primarily use septic systems, with a few parcels using holding tanks. It is anticipated parts of Big Floyd may be annexed into the City of Detroit Lakes as it is an area identified in the "Future Utility Extension/Annexation Area" of the City of Detroit Lakes Comprehensive Plan. This area is also within the City of Detroit Lakes "extra territorial" 2-mile area, which means the City has influence on the specifics of new developments.

Both Big and North Floyd Lakes are dimictic lakes. Most of the time Big Floyd's water is clear, with moderate phosphorus and algae concentrations, good game fish populations, and moderate aquatic plant growth. Big Floyd exhibits above average water quality in comparison with other District Lakes and is considered mesotrophic with annual averages of 12.5 feet of water clarity and 18 ppb in-lake phosphorus concentrations. In comparison, North Floyd suffers from poor water clarity, high phosphorus and severe algal blooms as a result of almost of 100 years of elevated phosphorus and sediment loading from ditched Campbell Creek. In North Floyd, there is a phenomena occurring known as "internal phosphorus loading" which recycles and releases phosphorus back into the water column causing algae blooms. This is due to decades of legacy phosphorus that has accumulated in the lake sediment. In late summer, after water "turnover", North Floyd experiences occasional algae blooms caused by the release of phosphorus from the enriched lake sediments. North Floyd is considered borderline eutrophic as the annual average of in-lake phosphorus concentrations have remained in the 32-34 ppb range.

The District partnered with the Natural Resource Conservation Service (NRCS) to develop an Upper Pelican River Watershed Plan and Environmental Assessment (2007) to identify the major sources of nutrients and sediment loading in the Upper Pelican River reach including Campbell Creek and the Pelican River/Ditch 13 area from Little Floyd Lake to Detroit Lake. The plan recommended a strong non-degradation policy for Big Floyd; Campbell Creek short term reductions of 25% TP loading, 50% reductions long-term to North Floyd and to improve North Floyd water quality to 25ppb in-lake concentration to benefit downstream Little Floyd Lake water quality.

The District partnered with NRCS, Becker County Soil and Water Conservation Service, and landowners to prioritize and install over 25 agricultural BMPs in the upper Campbell Creek watershed in 2012 and 2013 including terrace/tile structures, stream bank buffers, and wetland restorations (cost share with Federal, State and local funding of over \$250,000). While these efforts resulted in reduction in farm field soil erosion, the lower portion of Campbell Creek's confined stream channel remains highly erodible. However, there has been some improvement in North Floyd annual water clarity in the past decade from 7.5 ft (1998-2007) to 8.5 ft (2008-2017), but no improvement in the phosphorus concentration. Campbell Creek and it's watershed, continues to be a source of nutrients and sediment to North Floyd Lake, especially during spring runoff and summertime high intensity rainfall events. The District will continue to assess and implement additional measures to reduce external and internal phosphorus inputs and sediment loading into North Floyd Lake. The non-degradation measures for Big Floyd include Stormwater management, shoreline enhancements, and septic treatment.

Past Studies

- Houston Engineering Inc. 1997. Proposal to Provide Engineering Services for Water and Sanitary Sewer Improvements along Big Floyd Lake to Detroit Township
- A.W. Research Laboratories. 1996. Proposal for the Septic/Point Source Detection Overflight Floyd and Little Floyd Lakes
- Wenck Associates Inc. 2008. Wastewater Treatment and Drinking Water Supply Alternative Analysis; Floyd Lake Chain of Lakes
- A.W. Research Laboratories. 1996. Proposal for the Aerial Lakeshore Analysis of Floyd Lake
- Widseth Smith Nolting. 1997. Water System Feasibility Study for Big Floyd Lake, Detroit Township, MN
- Widseth Smith Nolting. 1998. Wastewater Facility Plan for Big Floyd Lake, Detroit Township, MN
- 1998 Campbell Creek Comprehensive Plan
- Minnesota Pollution Control Agency, Water Quality Assessment of the Upper Pelican River Watershed, 2002, Clean Water Partnership Program
- NRCS. 2007. Upper Pelican River Watershed Plan and Environmental Assessment
- PRWD Shoreline Surveys 2004, 2009, 2016 (assessment of shoreline alteration and watercraft quantity/use)

Planned/Potential Projects

- Evaluate the potential for restoration of altered wetlands near Campbell Creek.
- Identify priority aquatic vegetation areas
- Conduct study to identify options for managing North Floyd phosphorus internal loading and implement most feasible options
- Work with the City of Detroit Lakes (Annexation areas)
- Establish Load Allocation and Water Quality Goal for North Floyd
- Develop and implement streambank stabilization plan for Campbell Creek
- Identify and Target Critical agricultural erosion and sediment transport areas.
- Monitoring existing agricultural BMPs for phosphorus removal
- Conduct lake sediment study to investigate internal loading.
- Sediment TMDL study in Campbell Creek
- Establish baseline data of zooplankton community composition

Ongoing Projects & Programs

- Water Quality Monitoring (levels and nutrients)
- Shoreline surveys
- Cost share program for shoreline enhancements including buffers and soft armor installations.
- Implement rules and permitting
- Lake vegetation survey
- Attend lake association meetings
- Encourage ongoing inspection of septic systems for compliance with Becker County Ordinance

Overall Strategy:

Maintain Water Quality

Impairment: Not listed as impaired

Shoreland Classification:
Recreational Development

Subwatershed Lake Cover/Use:

- 21.8% Open Water
- 7.4% Developed
- 3.0% Wetlands
- 9.3% Cultivated Crops
- 48.4% Forest
- 10.1% Grasslands



Water Quality	10-Year Average (2008-2017)	Trend
Secchi	14 ft.	Increasing
Total Phosphorus	12 µg/L	Stable
Ortho Phosphate	3 µg/L	Stable
Chlorophyll-a	4 µg/L	Stable

Short Term Goals - Year 2025

- Maintain a 5-year mean summer phosphorus concentration at or below 13 µg/L
- Maintain mean summer Secchi depth no less than 14 ft

Long Range Goals – Year 2030

- Achieve a 5-year mean summer phosphorus concentration at or below 13 µg/L
- Maintain mean summer Secchi depth no less than 14 ft

Basic Facts

DNR ID/ Becker No	MN03-0358-00 / 358
Township(s)	Lake View (Sec 1, 18)
Lake Classification	Recreational Development
Lake Area	143 acres
Littoral Area	86 acres (63.7%)
Sub-watershed Area	619 acres
Inlet(s)	None
Outlet(s)	Wetland Stream to Lake Sallie
Control Structures	None
Highest Recorded	1334.17 feet (7/7/1998)
Lowest Recorded	1333.26 feet (7/30/2003)
Ordinary High Water Level	1334 feet
Recorded Range	0.91 feet
Maximum Depth	24 feet
Main Fish Species	Black crappie, Bluegill, Largemouth bass, Northern pike, Pumpkinseed, Rock bass, Walleye
Secondary Fish Species	Black/Brown/Yellow bullhead, Hybrid sunfish, White sucker, Yellow perch
MN DNR/ Private Fish Stocking	Walleye
Aquatic Invasive Species (2015)	None listed
Public Access Sites	None
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County

Overall Assessment

Fox lake is a small, heavily-developed lake totaling 143 acres and reaching a depth of 24 feet. Approximately 60% (86 acres) of the lake is considered littoral and less than 15 feet. There is no surface water inlet and the lake receives water primarily from stormwater runoff and groundwater interactions. There is one outlet to the lake which flows south through a wetland to Lake Sallie.

The majority of residential lake development occurred between the 1960s and 1990 where the number of homes more than doubled from 24 to 55. The MN DNR owns a 3 acres tract of land that contains approximately 1300 feet of shoreline on the north side of the lake that remains protected.

Prior to 2004, a 40-acre parcel just north of the lake was used for ag purposes with turkey manure being applied to the land periodically. The lake showed signs of degradation with nuisance algal bloom and poor water clarity. The turkey manure application ceased in 2004. The lake responded with drastic and immediate increases in water clarity and reductions of in-lake phosphorus levels. Currently, water quality is good with an increasing trend of clarity, with an average of 14-foot over the last ten years and a stable phosphorus concentration of 12ppb.

Past Studies

None (2019)

Potential Projects:

- Investigate sediment and phosphorus loads.

Ongoing Programs:

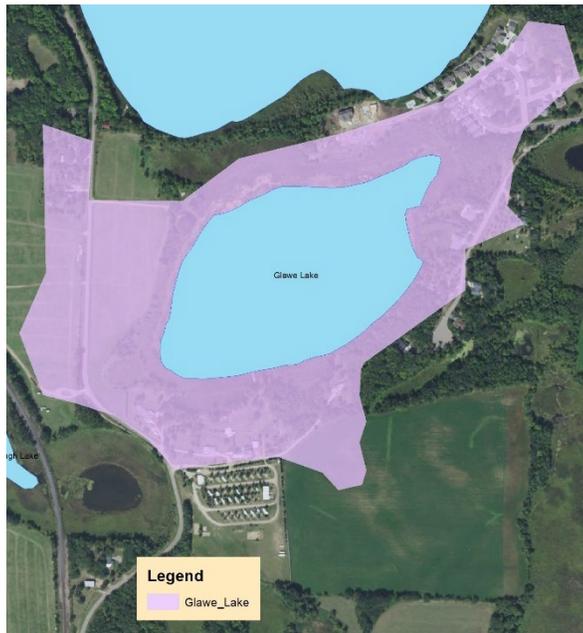
- Shoreline Surveys
- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Water Quality Monitoring
- Lake vegetation surveys
- Implement rules and permitting.
- Attend lake association meetings.

Overall Strategy:
Maintain Water Quality

Impairment:
None listed

Shoreland Classification:
Natural Environment

Catchment Area Land Cover:
31.8% open water, 9.5% wetlands, 1.2% cropland, 29.6% grassland, 15.7% forest, 12.2% developed land



Water Quality	10-Year Average (2008-2017)	Trend
Secchi	10.5 ft.	Stable
Total Phosphorus	22 µg/L	Stable
Ortho Phosphate	4.0 µg/L	Stable
Chlorophyll-a	4.5 µg/L	Stable

Short Term Goals - Year 2025

- Maintain a 5-year mean summer phosphorus concentration at or below 23 µg/L
- Maintain mean summer Secchi depth no less than 9 ft

Long Range Goals – Year 2035

- Achieve a 5-year mean summer phosphorus concentration at or below 23 µg/L
- Maintain mean summer Secchi depth no less than 9 ft

Basic Facts

DNR ID /Becker No	MN03-0364-00 / 364
Township(s)	Lake View (Sec 15)
Classification	Natural Environment
Lake Area	40.9 acres
Littoral Area	N/A
Sub-watershed Area	102.5 acres
Shoreline Length	1.1 miles
Inlet(s)	None
Outlet(s)	Wetland to Curfman
Control Structures	None
Highest Recorded	N/A
Lowest Recorded	N/A
Ordinary High Water Level	N/A
Recorded Range	N/A
Maximum Depth	20 feet
Main Fish Species	Unknown
Secondary Fish Species	Unknown
MN DNR/ Private Fish Stocking	None
Aquatic Invasive Species	None known
Public Access Sites	None
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County

Elevations NGVD 29

Overall Assessment

Glawe is a small natural environment lake totalling about 40 acres and reaching a depth of 20 feet. It is separated from Curfamn Lake by a 250 foot wide land bridge along its northern shoreline. Water quality on Lake Glawe has remained stable and the lake is classified as mesotrophic. There is significant macrophyte growth along the shoreline.

Development around the lake has increased in recent years with the construction of the Golden Bay Shores development along the NE shoreline. Stormwater from the development is treated via stormwater ponds on the north side of the lake prior to discharge to Glawe. A new single family residential development is also under construction on the east side of the lake. Shoreline vegetation removal from residential home construction should be minimized to avoid negative impacts to these small, sensitive lakes.

In addition to the residential development, there is a commercial campground located along the southern shoreline. The majority of the campground sites are outside of the drainage area, but do allow lake access for clients for non-motorized lake use (i.e. paddle boats). Currently there is no watercraft access and there is no motorized boat use.

Past Studies

None (2019)

Planned/Potential Projects:

Ongoing Programs:

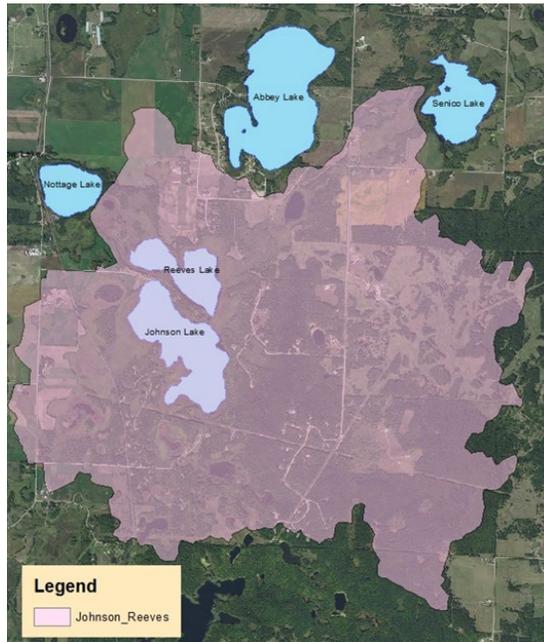
- Shoreline Surveys
- Lake Vegetation Surveys
- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Water Quality Monitoring
- Implement rules and permitting

Overall Strategy:
Maintain Water Quality

Impairment: Not listed as impaired

Subwatershed Lake Cover/Use:

- 7.3% Open Water
- 3.3% Developed
- 9.3% Wetlands
- 5.2% Cultivated Crops
- 49.4% Forest
- 25.5% Grassland



Johnson

Water Quality	20-Year Average June - Sept (1998-2017)	Trend
Secchi (clarity)	9 ft.	Stable
Total Phosphorus	26 µg/L	Stable
Ortho Phosphate	Insufficient Data	N/A
Chlorophyll-a	Insufficient Data	N/A

Reeves

Water Quality	20-Year Average June - Sept (1998-2017)	Trend
Secchi (clarity)	10 ft.	Stable
Total Phosphorus	27 µg/L	Stable
Ortho Phosphate	Insufficient Data	N/A
Chlorophyll-a	Insufficient Data	N/A

Short Term Goals - Year 2025

- Maintain a 5-year mean summer phosphorus concentration at or below 30 µg/L
- Maintain mean summer Secchi depth no less than 8 ft

Long Range Goals – Year 2035

- Maintain a 5-year mean summer phosphorus concentration at or below 40 µg/L
- Maintain mean summer Secchi depth no less than 5 ft

Basic Facts

DNR ID/ Becker No	MN03-0374-01&02 / 374
Township(s)	Lake View
Lake Classification	Natural Environment
Lake Area	219.6 acres (Johnson) 146.6 acres (Reeves)
Littoral Area	137.2 acres (Johnson) 88.8 acres (Reeves)
Sub-watershed Area	4576 acres
Shoreline Length	3.37 miles (Johnson) 3.44 miles (Reeves)
Inlet(s)	Wetland Stream from Abbey Lake
Outlet(s)	Wetland Stream to Lind/Nottage Lake
Control Structures	None
Highest Recorded	Not Recorded
Lowest Recorded	Not Recorded
Ordinary High Water Level	Not Recorded
Recorded Range	Not Recorded
Maximum Depth	30 feet (Johnson), 43 feet (Reeves)
Main Fish Species	Black crappie, Bluegill, Northern pike, Pumpkinseed, Walleye
Secondary Fish Species	Black/Brown/Yellow bullhead, Bowfin, Hybrid sunfish, White sucker, Yellow perch
MN DNR/ Private Fish Stocking	N/A
Aquatic Invasive Species (2015)	None
Public Access Sites	None
Public Beach	None
References	DNR Lake Finder, Becker County

Overall Assessment

Johnson and Reeves Lake are both moderately developed, natural environment lakes located south of the City of Detroit Lakes. The two lakes sit north and south relative to each other and are connected via a natural channel on their east side. A prominent wetland fringe surrounds both lakes, uprooted portions of wetland vegetation often detach and move around the lakes by wind and water currents. The channel between the two lakes sometimes becomes blocked by floating bogs, making watercraft passage between the two impossible. Johnson lake lies to the south and is larger in size than Reeves, totaling 219.6 acres in size and reaching a depth of 30 feet. Reeves is slightly smaller in size, 146.6 acres, and is 43 feet at its deepest point. Johnson and Reeves have similar littoral areas that are 63% and 61% of the lake surface area, respectively.

Water quality has remained stable over the last 20 year period with average clarity of 9 ft on Johnson Lake and 10 ft on Reeves Lake. Total phosphorus levels are also stable on the two lakes, averaging 26 ppb and 27 ppb. Both lakes are considered mesotrophic with moderately clear water. Both lakes do stratify in the summer months, developing an anoxic layer below 4-5 meters (13-16 feet).

The primary source of surface water input to the lake is stormwater runoff from the large drainage area of 4,576 acres. There is a small amount of water that travels via wetland stream from Abbey Lake to the north into Reeves. Reeves Lake also outlets via a wetland stream to Nottage Lake. Groundwater interactions also play a prominent role in the water budget.

Residential development is located on the peninsula which extends between the two lakes from the west. There is also a small campground located on that peninsula, which also contains the only boat access to the lake (private access). In recent years, there have been several residential homes constructed on the north and east side of Reeves Lake. Due to the extensive wetland fringe on the lake, only a few locations allow lake access from riparian properties. In some locations where the wetland fringe is not as prominent, access to the lake has been obtained by removing portions of the wetland vegetation.

Past Studies

None (2019)

Planned/Potential Projects:

Ongoing Programs:

- Shoreline Surveys
- Lake Vegetation Surveys
- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Water Quality Monitoring
- Implement rules and permitting.

Overall Strategy:

Improve Water Quality

Impairment: Not listed as impaired

Subwatershed Lake Cover/Use:

- 17.4% Open Water
- 7.5% Developed
- 11.7% Wetlands
- 17.2% Cultivated Crops
- 16.8% Forest
- 29.5% Grassland



Lind

Water Quality	10-Year Average June-Sept (2008-2017)	Trend
Secchi	9.6 ft.	Insufficient Data
Total Phosphorus	42 µg/L	Insufficient Data
Ortho Phosphate	9 µg/L	Insufficient Data
Chlorophyll-a	9 µg/L	Insufficient Data

Nottage

Water Quality	10-Year Average June - Sept (2008-2017)	Trend
Secchi	Not Tested	N/A
Total Phosphorus	Not Tested	N/A
Ortho Phosphate	Not Tested	N/A
Chlorophyll-a	Not Tested	N/A

Short Term Goals - Year 2020

- Achieve a 5-year mean summer phosphorus concentration at or below 40 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 8 ft

Long Range Goals – Year 2030

- Achieve a 5-year mean summer phosphorus concentration at or below 40 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 8 ft

Basic Facts

DNR ID/ Becker No	MN03-0374-01&02 / 374
Township(s)	Lake View
Lake Classification	Natural Environment
Lake Area	45 acres (Lind) 71 acres (Nottage)
Littoral Area	17 acres (Lind) N/A (Nottage)
Sub-watershed Area	599 acres
Inlet(s)	Wetland Stream from Reeves Lake
Outlet(s)	Stream to Lake Melissa
Control Structures	None
Highest Recorded	Not Recorded
Lowest Recorded	Not Recorded
Ordinary High Water Level	Not Recorded
Recorded Range	Not Recorded
Maximum Depth	51 feet (Lind), 25 feet (Nottage)
Main Fish Species	Black crappie, Bluegill, Northern pike, Pumpkinseed, Walleye
Secondary Fish Species	Black/Brown/Yellow bullhead, Bowfin, Hybrid sunfish, White sucker, Yellow perch
MN DNR/ Private Fish Stocking	N/A
Aquatic Invasive Species (2015)	Curly-leaf pondweed (Lind)
Public Access Sites	None
Public Beach	None
References	DNR Lake Finder, Becker County

**Elevations NGVD 29*

Overall Assessment

Lind and Nottage Lakes are both small natural environment lakes located in the drainage area between Johnson/Reeves Lake and Lake Melissa.

Nottage Lake is located in the northern portion of the drainage area with no residential development. There are no surface water inputs to the lake other than stormwater runoff from primarily cultivated cropland. A 100 foot forested buffer is located between agricultural uses. Because there is no residential development on the lake, and it is disconnected from major public watercourses, water quality sampling for the lake has never been conducted.

Lind Lake is a 45 acre natural environment lake located in the southern portion of the drainage area. Water flows into the north side of the lake via wetland stream from Reeves Lake. A small stream exits the lake to the south and flows to Lake Melissa. Lind is deep for its size and reaches a depth of 51 feet in the northern portion of the lake. There are currently four single family residential homes along the western shoreline and one commercial business on the south shore. Heavy agricultural use is present, including cattle grazing within 150 feet of the lake, and cattle using the input stream as a water source.

Water quality monitoring began in 2015 to obtain baseline data for Lind and investigate I nutrient loads to Melissa. The proximity of cattle to the lake and stream raised concerns about nutrients loads to the lake. Results from monitoring showed in-lake mean summer nutrient levels at 42ppb, put the lake in the mildly eutrophic category. Interestingly, phosphorus levels were at their highest in the spring and declined in the summer. Water clarity also increased in the summer as the lake stratified. Anoxia developed below 3 meters in June and remained throughout the year. Internal phosphorus loading is a major factor with bottom orthophosphate concentration approaching 1300 ppm in September. Monitoring of nutrient load from Lind to Melissa was minimal due to low stream flow.

Past Studies

None (2019)

Planned/Potential Projects:

- Establish Load Allocation and Water Quality Goal
- Investigate cattle watering and stream crossing

Ongoing Programs:

- Water Quality Monitoring
- Implement rules and permitting
- Lake vegetation survey

Overall Strategy:
Maintain Water Quality

Impairment: Listed as impaired for mercury

Subwatershed Lake Cover/Use:
62.4% Open Water,
2.6% Developed,
3.2% Wetlands,
5.6% Cultivated Crops,
7.5% Forest
18.7% Grassland



Water Quality	10-Year Average (2008-2017)	Trend
Secchi (clarity)	8.3 ft.	Stable
Total Phosphorus	25 µg/L	Stable
Ortho Phosphate	6.3 µg/L	Stable
Chlorophyll-a	11.0 µg/L	Stable

Short Term Goals - Year 2025

- Maintain the 5-year mean summer phosphorus concentration at or below 25 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 8 ft

Long Range Goals – Year 2035

- Maintain the 5-year mean summer phosphorus concentration at or below 25 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 8 ft

Basic Facts

DNR ID Becker No	MN03-0386-00 / 386
Township(s)	Detroit
Lake Classification	General Development
Lake Area	214.28 acres
Littoral Area (<15 ft)	95 acres (44.33%)
Sub-watershed Area	341 acres
Shoreline Length	2.2 miles/11,720 ft
Inlet(s)	Pelican River
Outlet(s)	Becker Drainage 13 and historic outlet
Outlet Elevation	N/A
Control Structures	Concrete Weir
Highest Recorded	1355.7 feet (4/22/1997)
Lowest Recorded	1353.5 feet (5/21/2014)
Ordinary High Water Level*	1354.8 feet
Recorded Range	2.2 ft.
Maximum Depth	32 feet
Water Residence	104 days
Main Fish Species	Black Crappie, Bluegill, Green Sunfish, Largemouth Bass, Northern Pike, Walleye
Secondary Fish Species	Bowfin, Hybrid Sunfish, Pumpkinseed, Tullibee, White Sucker, Black/Brown/Yellow Bullhead
MN DNR/ Private Fish Stocking	Walleye (2005-2014),
Aquatic Invasive Species (2018)	Zebra Mussel
Public Access Sites	SW Shore (DNR)
Marinas	None
Public Beach	None
References	DNR Lake Finder

Elevations NGVD 29

Overall Assessment

Little Floyd Lake is a 214-acre lake with a maximum depth of 34 ft. It has a moderately developed shoreline. Little Floyd sub-watershed area is approximately 342 acres including surface water area. Little Floyd receives most of its water from North Floyd, which outlets to Little Floyd through the Becker CSAH 21 road, though there are some small natural drainage ways that lead to the lake.

The littoral area (< 15ft depth) of the lake accounts for 95 acres (45%) with an extensive emergent (cattail and hardstem bulrush) vegetation area located on the northeast side. There is an abundant native plant community. There is one MN DNR public access on Little Floyd located on the south end.

Little Floyd Lake is classified as a mesotrophic lake based on the Tropic State Index average for phosphorous, chlorophyll-a, and water clarity. In-lake phosphorus concentrations can vary between 20ppb to 34ppb and are highly responsive to storm-events and heavy rainfall patterns. The 10-year (2008-2017) average is 25 ppb in-lake phosphorus concentration.

Little Floyd Lake has two outlets located on the south side. Historically, the lake had one outlet, located near the present day public access, however, a new outlet was constructed in 1919, when the Becker County Drainage System 13 was built to channelize the Pelican River between Little Floyd lake and Big Detroit lake. In 1936, the Civilian Conservation Corps (CCC) built a concrete weir dam on Becker Drainage System 13. This structure controls Little Floyd, as well as North and Big Floyd's water levels. The weir has a fixed crest which is set at a run out elevation of 1354.1 (NGVD 29) and is owned and operated by the MN DNR.

There are 86 parcels on Little Floyd, with high density areas which were platted and developed before statewide shoreland standards. There are 55 parcels (64%) having greatly to moderately altered shorelines and 31 parcels (36%) having little to no shoreline alteration. There are 11 parcels along the south shore with seawalls.

Over the past 20 years, on the south end of the lake, two resorts have been converted to individual ownership. In addition, many of the seasonal cottages are being rebuilt or converted to year-round homes.

In the mid-2000's on the west side, Little Floyd had increased second-tier development pressure when the Iron Man golf course (back 9 holes) was developed into residential housing. During this same time, the north end was converted from pasture grassland into residential housing. There is a permanent special protection area owned by the Pelican River Watershed District which preserves the bluff and emergent aquatic vegetation area along the north side of Little Floyd.

Planned/Potential Projects

- Identify priority aquatic vegetation areas
- Work with the City of Detroit Lakes (Annexation areas)
- Identify and Target Critical agricultural erosion and sediment transport areas.
- Establish baseline data of zooplankton community composition

Ongoing Projects & Programs

- Water Quality Monitoring
- Shoreline surveys
- Lake vegetation surveys
- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Implement rules and permitting
- Attend lake association meetings.

Past Studies

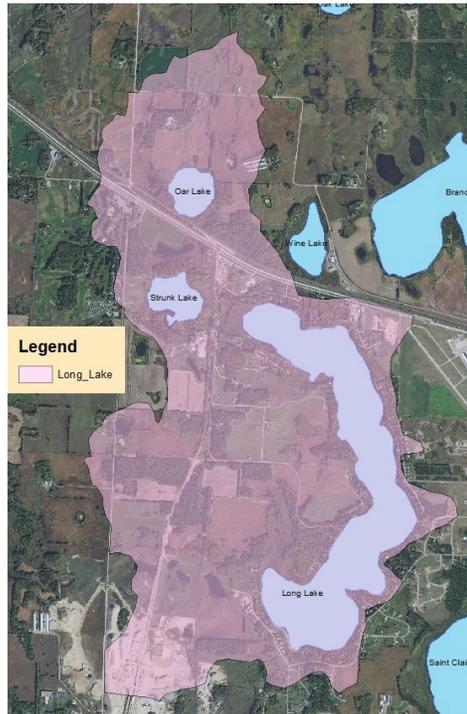
- Houston Engineering Inc. 1997. Proposal to Provide Engineering Services for Water and Sanitary Sewer Improvements along Big Floyd Lake to Detroit Township
- A.W. Research Laboratories. 1996. Proposal for the Septic/Point Source Detection Overflight Floyd and Little Floyd Lakes
- Wenck Associates Inc. 2008. Wastewater Treatment and Drinking Water Supply Alternative Analysis; Floyd Lake Chain of Lakes
- Minnesota Pollution Control Agency, Water Quality Assessment of the Upper Pelican River Watershed, 2002, Clean Water Partnership Program
- NRCS. 2007. Upper Pelican River Watershed Plan and Environmental Assessment
- PRWD Shoreline Surveys 2004, 2016

Overall Strategy:
Improve Water Quality

Impairment: Not listed as impaired

Subwatershed Lake Cover/Use:

- 62.4% Open Water
- 2.6% Developed
- 3.2% Wetlands
- 5.6% Cultivated Crops
- 7.5% Forest
- 18.7% Grassland



Water Quality	10-Year Average June - Sept (2008-2017)	Trend
Secchi	14.5 ft.	Improving
Total Phosphorus	12 µg/L	Improving
Ortho Phosphate	3.5 µg/L	Improving
Chlorophyll-a	4.2 µg/L	Stable

Short Term Goals - Year 2025

- Maintain a 5-year mean summer phosphorus concentration at or below 14 µg/L
- Maintain mean summer Secchi depth no less than 14 ft

Long Range Goals – Year 2035

- Maintain a 5-year mean summer phosphorus concentration at or below 14 µg/L
- Maintain mean summer Secchi depth no less than 14 ft

Basic Facts

DNR ID/ Becker No	MN03-0383-00 / 383
Township(s)	Lake View, Detroit (Sec 5, 29-32)
Lake Classification	Rural Development
Lake Area	408.73 acres
Littoral Area	152 acres (37.19%)
Sub-watershed Area	2761 acres
Shoreline Length	6.0 miles / 31,597 feet
Inlet(s)	Stream from wetland
Outlet(s)	Stream to St. Clair Lake
Control Structures	None
Highest Recorded*	1351.25 feet (7/25/1993)
Lowest Recorded*	1349.61 feet (11/11/1944)
Ordinary High Water Level*	1351.2 feet
Recorded Range*	1.64 feet
Maximum Depth	61 feet
Main Fish Species	Black Crappie, Bluegill, Largemouth Bass, Northern Pike, Rock Bass, Walleye
Secondary Fish Species	Bowfin, Hybrid Sunfish, Pumpkinseed, Tullibee, White Sucker, Yellow Perch, Brown/Yellow Bullhead
MN DNR/ Private Fish Stocking	Walleye
Aquatic Invasive Species (2015)	None listed
Public Access Sites	City Park on NE Shore (DNR)
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County

Overall Assessment

Long Lake is a 408-acre recreational development lake located at the head of its watershed area, with no surface water inputs, such as a river or a stream. Long Lake is fed primarily by stormwater runoff and groundwater interactions. It is a narrow, deep lake, with a maximum depth of 61 feet and with 37% of the lake surface area classified as littoral. Though a small lake relative to others which attract a large clientele, its elongated shape gives it a shoreline length that is exceeded in the District only by Big Detroit and Melissa.

Long Lake has good water quality with annual phosphorus levels ranging from 11 ppb to 16 ppb, and water clarity between 12 and 19 feet. 10-year summer mean for phosphorus and clarity is 12ppb and 14.5 feet, respectively.

Long Lake is known for its abundance of Northern Pike and Bluegill. The 2016 assessment showed Pike catches were higher than average and higher than other ecologically similar lakes. While there are no special regulations for Long Lake, anglers are encouraged to release Northern Pike over 24 inches. Since 2001, a Walleye stocking research study has been underway to attempt to determine the best stocking method for a given lake type, despite the efforts, Walleye abundance has continued to decline.

Long Lake outlets via Joy Creek to St. Clair Lake, a lake impaired for excessive nutrients.

Long is a deep lake, with nearly 37% (11,690 feet) of the shoreline sloping steeply toward the lake. The natural shoreline has been greatly modified, including installation of rip-rap, sand blankets, and vegetation removal. Of the 183 parcels surveyed in 2010, 30 contained a retaining wall within the shore impact zone. 96 parcels (52%) were recorded as having moderately to greatly altered shorelines, including 83 with rip-rap shorelines and 60 with beach sand blankets. 87 parcels (47%) of the parcels remained in a natural or minimally altered condition.

The City of Detroit Lakes annexation of Long Lake has provided water and sewer to the east and south sides of the lake with services on the north completed in 2019. It is still unknown when City utilities will be connected on the west side of the lake. It is likely that improved water quality will continue to be observed with the transition from individual lot septic system to City sanitary sewers.

In the past 20 years, several resorts have been converted to large residential

Planned/Potential Projects:

- Establish baseline data of zooplankton community composition

Ongoing Programs:

- Shoreline Surveys
- Lake Vegetation Surveys
- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Water Quality Monitoring
- Attend Lake Association Meetings

lots and all have been connected to City water and sewer. One RV campground still exists on the northwest side of the lake and it is likely that it too will be subdivided. The City of Detroit Lakes owns Long Lake Park which contains over 2,200 feet of shoreline, located on the east side of the lake that, except for the public access, will remain in its natural condition. Along the west side of the lake, another parcel, owned by Concordia College, will also remain in an unaltered condition that will protect over 2000 feet of shoreline.

There is an active gravel mine in the southern portion of the Long Lake watershed. In recent year, there has been interest by the company to expand to the north and west, closer to the lake. In 2018, Becker County denied a conditional use permit request to expand the mine, including gravel extraction below the water table.

In 2003, a water control structure was installed on a wetland outlet on the north side of the lake, allowing the wetland to serve as a water detention area significantly reducing nutrient loading from the wetland. This project drastically reduced localized nuisance algal blooms on the north side of the Lake and caused an increase in mean summer water clarity by nearly 2 feet.

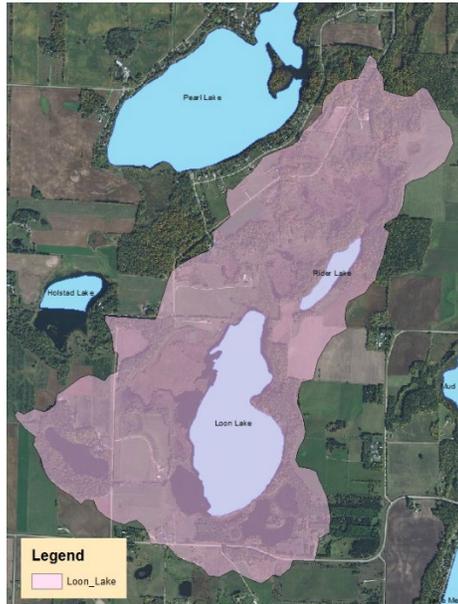
Past Studies

Overall Strategy:
Improve Water Quality

Impairment: Not listed as impaired

Subwatershed Lake Cover/Use:

- 20.9% Open Water
- 3.9% Developed
- 7.0% Wetlands
- 12.1% Cropland
- 33.4% Forests
- 22.6% Grassland



Water Quality	20-Year Average (1998-2017)	Trend
Secchi (clarity)	6.5 ft.	Insufficient Data
Total Phosphorus	29 µg/L	Insufficient Data
Ortho Phosphate	Insufficient Data	Insufficient Data
Chlorophyll-a	10.5 µg/L	Insufficient Data

Short Term Goals - Year 2025

- Achieve a 5-year mean summer phosphorus concentration at or below 30 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 6 ft

Long Range Goals – Year 2035

- Achieve a 5-year mean summer phosphorus concentration at or below 30 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 6 ft

Basic Facts

DNR ID/ Becker No	MN03-489-00 / 288
Township(s)	Erie, Holmesville (Sec 5, 32, 33)
Lake Classification	Natural Environment
Lake Area	264 acres
Littoral Area	Not Recorded
Sub-watershed Area	1275 acres
Inlet(s)	None
Outlet(s)	None
Control Structures	None
Highest Recorded Ordinary High Water Level	Not Recorded
Lowest Recorded Ordinary High Water Level	Not Recorded
Recorded Range	Not Recorded
Maximum Depth	Not Recorded
Main Fish Species	N/A
Secondary Fish Species	N/A
MN DNR/ Private Fish Stocking	N/A
Aquatic Invasive Species (2015)	None listed
Public Access Sites	None
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County

Elevations NGVD 29

Overall Assessment

Loon Lake is a shallow 264 acre natural environment lake. There is little residential development with 2 single family homes on the west side of the lake and one cattle grazing area on the south side of the lake. It is apparent that cattle grazing extends to the water edge and is potentially used as a water source. This certainly is a significant nutrient source to the lake. There is a prominent wetland fringe along the western and northern shoreline.

Water quality was monitored for a three year period from 2006-2008 with total phosphorus concentrations of 29 ppm and water clarity of 6.5 feet. This is well within the expected range for this ecoregion (23-50ppm phosphorus and 5-10.5 ft clarity) and well below the impairment limits for shallow lakes (60 ppm phosphorus and 3.2 ft clarity). Loon is a landlocked lake, meaning there is no surface water inlet or outlet, and is disconnected from all surface watercourses.

Past Studies

None (2019)

Planned/Potential Projects:

- Investigate agricultural BMPs

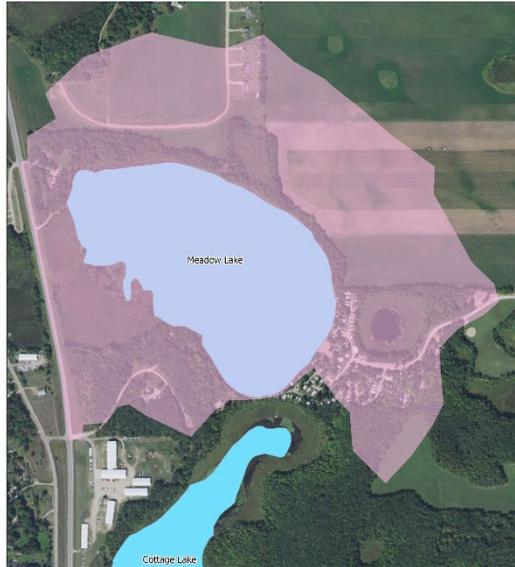
Ongoing Programs:

- Water Quality Monitoring
- Implement rules and permitting.

Overall Strategy:
Maintain Water Quality

Impairment: Listed as impaired for mercury

Subwatershed Lake Cover/Use:
26% Open Water
5.8% Developed
10.3% Wetlands
21.8% Cultivated Crops
18.3% Forest
17.8% Grassland



Water Quality	10-Year Average (2008-2017)	Trend
Secchi	16.5 ft.	Stable
Total Phosphorus	14 µg/L	Stable
Ortho Phosphate	5.5 µg/L	Stable
Chlorophyll-a	3.2 µg/L	Stable

Short Term Goals - Year 2025

- Maintain a 5-year mean summer phosphorus concentration at or below 17 µg/L
- Maintain mean summer Secchi depth no less than 15 ft

Long Range Goals – Year 2035

- Maintain a 5-year mean summer phosphorus concentration at or below 17 µg/L
- Maintain mean summer Secchi depth no less than 15 ft

Basic Facts

DNR ID/ Becker No	MN03-371-00 / 371
Township(s)	Lake View (Sec 28)
Lake Classification	General Development
Lake Area	71 acres
Littoral Area	30 acres (42.25%)
Sub-watershed Area	244 acres
Shoreline Length	1.32 miles / 6969.6 feet
Inlet(s)	None
Outlet(s)	None
Control Structures	None
Highest Recorded	N/A
Lowest Recorded	N/A
Ordinary High Water Level	N/A
Recorded Range*	N/A
Maximum Depth	72 feet
Water Residence	N/A
Main Fish Species	Black Crappie, Bluegill, Green Sunfish, Largemouth Bass, Northern Pike, Walleye
Secondary Fish Species	Hybrid Sunfish, Pumpkinseed, Tullibee, Rainbow Trout, Black/Brown/Yellow Bullhead
MN DNR/ Private Fish Stocking	None
Aquatic Invasive Species (2019)	None
Public Access Sites	W Shore off Hwy 59 (DNR)
Public Beach	None
Marinas	None
References	DNR Lake Finder, Becker County

Elevations NGVD 29

Overall Assessment

Meadow is a 71acre natural environment lake located approximately 4.5-miles SW of the City of Detroit Lakes. Despite its relatively small size, the lake is quite deep, reaching a maximum depth of 72 feet.

Located in the upper part of the Lake Melissa watershed, Meadow has no surface water inlet and is recharged primarily by groundwater interaction and some surface water runoff. There is no true outlet to the lake, however, there is a culvert below Highway 59 that connects Meadow to a wetland and another culvert below CSAH 17 that connects the wetland to Lake Melissa.

Attempts were made by the DNR between 1987 through 2009 to regularly stock Rainbow and Brown Trout, however this had limited success. The DNR also began stocking walleye in 2010, however, further study found that the lake best supports Largemouth Bass, Bluegill, Crappie, and Northern pike population, so stocking efforts ceased. Because the lake is deep enough to support both warm and cold fisheries, there is a small population remaining of Trout and Cisco (Tullibee).

There are three residential homes on the western shoreline and a campground located on southeast portion. There is some agricultural (row crop) activity to the north of the lake that is separated from the lake by a forested buffer, 150-300 feet wide. Emergent vegetation is present along most of the shoreline except for about 1000 feet near the campground area, which may have been removed for the installation of a sand beach and docking area. There is moderate macrophyte growth in the littoral area of the lake (<15 ft). Lake depths begin to drop sharply about 150-250 feet offshore, where plant growth becomes much more limited.

The District has monitored Meadow Lake since 1999 and the water quality has always been good. Currently the lake is sampled for both chemistry and clarity every three years. The water quality is stable with a 10-year average clarity of 16.5 and total phosphorus concentration of 14 ppb.

Past Studies

None (2019)

Planned/Potential Projects:

- Shoreline Surveys
- Lake Vegetation Surveys

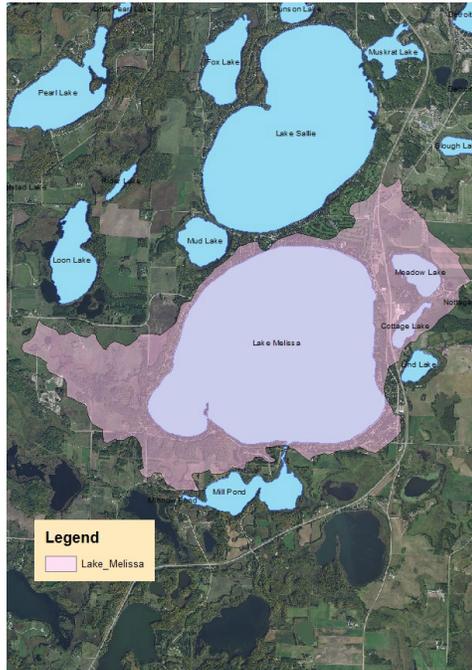
Ongoing Programs:

- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Water Quality Monitoring
- Implement Rules and Permitting.

Overall Strategy:
Maintain Water Quality

Impairment: Listed as impaired for mercury

Subwatershed Lake Cover/Use:
55.8% Open Water
9.4% Developed
3.9% Wetlands
7.7% Cultivated Crops
14.8 Forest
8.4% Grassland



Planned/Potential Projects:

- Study zebra mussel impacts on lake ecosystems, including impacts to walleye populations.

Ongoing Programs:

- Shoreline Surveys
- Lake Vegetation Surveys
- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Water Quality Monitoring
- Implement Rules and Permitting.
- Aquatic Plant Management (1B)
- Attend lake association meetings.

Water Quality	10-Year Average (2008-2017)	Trend
Secchi	11.5 ft.	Improving
Total Phosphorus	20 µg/L	Improving
Ortho Phosphate	5.5 µg/L	Improving
Chlorophyll-a	5.5 µg/L	Improving

Note: Zebra Mussel infested water listing in 2015

Short Term Goals - Year 2025

- Maintain a 5-year mean summer phosphorus concentration at or below 20 µg/L
- Maintain mean summer Secchi depth no less than 10 ft

Long Range Goals – Year 2035

- Maintain a 5-year mean summer phosphorus concentration at or below 20 µg/L
- Maintain mean summer Secchi depth no less than 12 ft

Lake Melissa is the second largest lake within the Pelican River Watershed District. It totals 1,850 acres and reaches a maximum depth of 37 feet, with about ½ of its surface area is considered littoral. Lake Melissa is classified as a mesotrophic lake with good water quality. The Pelican River passes through the lake, entering on the north end from Lake Sallie, outlet into on the south end to Mill Pond. Late summer algal blooms have been observed, typically caused by nutrient movement from the borderline eutrophic Lake Sallie through the Pelican River.

The invasive Zebra Mussel was observed in Lake Melissa in 2014. Since then there has been a significant increase in water clarity. Prior to the infestation, mean summer clarity ranged from 8 to 12 feet (9.5 feet average). Subsequent years after the infestation, clarity increased to 12.5 (2015), 14.5 (2016), and 16.5 (2017). There has also been a significant reduction in chlorophyll level, indicating a shift from free floating to benthic (bottom dwelling) algae, which is common with infested lakes.

Lake Melissa is also known to be infested with the invasive aquatic plant Flowering Rush and Curly-leaf Pondweed. The District actively surveys and chemically treats nuisance population annually to manage the plant density and minimize recreational and environment impacts.

The shoreline on Lake Melissa has been experiencing intense development in recent years to what was already a highly developed lake shore. There has also been a conversion from small, seasonal cottages, to larger, year-round homes. Residential lots are relatively small, which also contributes to the dense development and shoreline modifications.

Shoreline survey results comparing waterfront equipment between 2008 and 2017 showed a drastic increase in quantity of observed waterfront equipment present, which is consistent with the increased development. The amount of motorized watercraft present more than doubled from 225 (2008) to 433 (2017), which, with 399 parcels on the lake, accounts for more than one watercraft per parcel. Personal watercraft (PWC, jetskis) were classified separately for the study, where 172 were observed in 2017, a 300% increase from 2008. As to be expected with an increase on watercraft, there was also a significant increase in boat lifts, both covered and uncovered. Interestingly, the largest increase observed was with the non-motorized watercraft (including stand-up paddleboards, kayaks, paddle boats, etc.) which increase by 360% to a total of 276.

There are several water control structures in the Lake Melissa vicinity. The remnant of a lock and dam system is located approximately 100 feet upstream of Lake Melissa. This lock is no longer active and there are no water level manipulation abilities with the remnant structure, which does not inhibit fish passage. There is a bridge located at the outlet of lake Melissa that forms a slight hydraulic constriction. There are no other dam components, such as piers, stops, or concrete crest present. Approximately 300 feet downstream of the outlet is a large culvert below South Melissa Drive. There is a noticeable difference between the headwater and tailwater elevations at the culvert. Also, the velocity of flow in the channel from the lake to the culvert suggests that the headwater elevation at the culvert is slightly lower than the actual elevation of Lake Melissa.

Bucks Mill Dam is approximately 1.35 miles downstream of lake Melissa. Historically, a water wheel was utilized at the original dam for Buck's Mill, which is no longer present. At a later date, a second dam was constructed approximately 100 feet upstream of the original. The new dam is used to adjust water level in Mill Pond, and provide water to a downstream MN DNR Fisheries rearing pond. Due to the difference in water level, this dam has virtually no impact on Lake Melissa water levels.

Past Studies

- Rieke Carrol Muller and Associates Inc. 1984. Facility Plan Addendum Report, Lakeview Township Evaluation of Land Application by Spray Irrigation
- Wenck Associates Inc. 1998. Wastewater Treatment and Drinking Water Supply Alternatives; Lake Sallie and Melissa Chain of Lakes
- Widseth Smith Nolting. 1997. A Proposal to Detroit Township to Provide Engineering Services for a Wastewater Facility Plan and Water Feasibility Study
- A.W. Research Laboratories. 1995. Proposal for Mapping Sedimentation in Lake Sallie
- Larson Peterson and Associates. 1989. Clean Lakes Program: In Lake Monitoring Lake Sallie
- Lee, David R. 1971. Septic Tank Nutrients in Groundwater Entering Lake Sallie
- McComas, Steve, Hecock, R., Nustad, R., Wilson, B. 1996. An Updated Diagnostic and Feasibility Study for Lake Sallie, Detroit Lakes, MN
- McComas, Steve. Blue Water Science. 1997. Plant Harvesting and Zooplankton Dynamic in Muskrat Lake, Status Report
- McComas, Steve. Blue Water Science. 2001. Plant Harvest and Water Quality Dynamics in Muskrat lake for 2000
- Neel, Joe K. 1973. Weed Harvest and Lake Nutrient Dynamics
- Instrumental Research Inc. 1985. Nutrient Retention of Harvested Aquatic Vegetation from Lakes Sallie and Melissa
- Rieke Carrol Muller and Associates Inc. 1978. Water Pollution Control Facilities Report for Lakeview Township, Becker County, MN
- Rieke Carrol Muller and Associates Inc. 1981. Wastewater Treatment Facilities Plan Summary Report
- Wenck Associates Inc. 2010. Lakeview Township Community Assessment Report

Overall Strategy:
Maintain Water Quality

Impairment: Not listed as impaired

Subwatershed Lake Cover/Use:

- 29.4% Open Water
- 15.4% Developed
- 2.0% Wetlands
- 14.6% Cultivated Crops
- 23.0% Forest
- 27.9% Grassland



Water Quality	10-Year Average June - Sept (2007-2016)	Trend
Secchi (clarity)	7.5 ft.	Insufficient Data
Total Phosphorus	20 µg/L	Insufficient Data
Ortho Phosphate	N/A	Insufficient Data
Chlorophyll-a	10 µg/L	Insufficient Data

Short Term Goals - Year 2025

- Achieve a 5-year mean summer phosphorus concentration at or below 20 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 5 ft

Long Range Goals – Year 2035

- Achieve a 5-year mean summer phosphorus concentration at or below 20 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 5 ft

Basic Facts

DNR ID/ Becker No	MN03-0377-00 / 377
Township(s)	Lake View (Sec 31, 32)
Lake Classification	Natural Environment
Lake Area	185.6 acres
Littoral Area	185.6 acres (100%)
Sub-watershed Area	481 acres
Inlet(s)	Pelican River from Lake Melissa, Wetland Stream from East
Outlet(s)	Pelican River to Buck Lake
Control Structures	Dam (Buck's Mill)
Highest Recorded	1328.73 feet (5/27/1997)
Lowest Recorded	1327.93 feet (4/19/2012)
Ordinary High Water Level	1328.7 feet
Recorded Range	0.8 feet
Maximum Depth	10 feet
Main Fish Species	Black Crappie, Bluegill, Green sunfish, Largemouth bass, Northern pike, Pumpkinseed, Walleye
Secondary Fish Species	Black/Brown/Yellow bullhead, Bowfin, Hybrid sunfish, White sucker, Yellow perch
MN DNR/ Private Fish Stocking	N/A
Aquatic Invasive Species (2015)	Flowering rush, Zebra mussel
Public Access Sites	Pelican River from Melissa (DNR)
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County

Overall Assessment

Mill Pond is a shallow natural environment lake totaling 185 acres in size. Technically, Mill is a reservoir because of a downstream dam (Bucks Mill Dam) which maintains the water level about 6 feet above the natural lake elevation. The east half of the lake is dense vegetation except for the channel which the Pelican River flows through. The west basin contains open water and reaches a maximum depth of 10 feet.

Mill has no designated boat ramp, but the lake can be accessed via Lake Melissa with canoes, kayaks, or small watercraft. There is some residential development in the form of single family homes, primarily in the west basin.

Historically, a dam was located downstream from where the current dam exists. It was used to provide water power for the adjacent mill. This has been removed, however, the original dam embankments where the water wheel would have been remain intact. The current dam sits approximately 100 feet upstream from the historic location and is used to control water levels on Mill Pond, which is used as a MN DNR rearing pond.

In 2019, Becker County and the MN DNR began discussions of the possibility to remove the outlet structure and replace with a rock weir rapids. The District is concerned the removal of the dam will allow passage for common carp which are a nuisance species and will cause ecological harm.

Water quality was monitored for a three-year period from 2007-2009 where total phosphorus levels were 20ppm and water clarity was 7.5 ft. The nutrient levels were found to be very similar to Lake Mellissa, which drains through Mill Pond.

Due to its connection to Lake Melissa, the lake is also infested with Zebra Mussels and Flowering Rush. In past years, the Pelican Group of Lakes Improvement District (PGLID) has managed Flowering Rush in Mill Lake by chemical and hand removal in an attempt to minimize propagation to downstream lakes (Pelican Lake).

Planned/Potential Projects:

- Monitor Mill Pond water outlet structure redesign to ensure common carp are not introduced to District lakes.

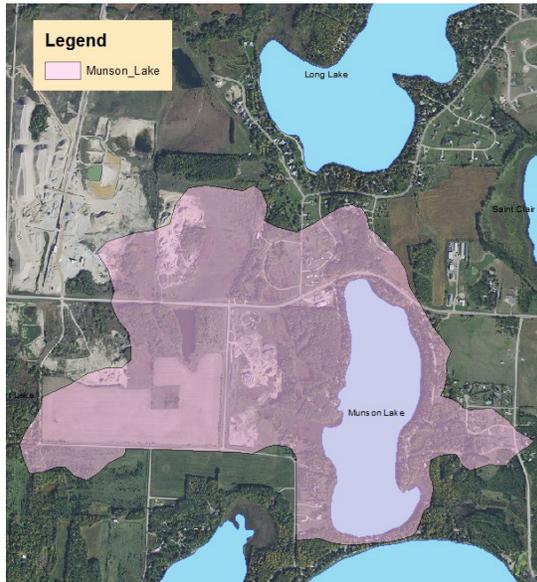
Ongoing Programs:

- Water Quality Monitoring
- Aquatic plant survey

Overall Strategy:
Maintain Water Quality

Impairment: Not listed
as impaired

**Subwatershed Lake
Cover/Use:**
17.9% Open Water
14.9% Developed
3.7% Wetlands
25.2% Cultivated Crops
25.6% Forest
12.8% Grassland



Water Quality	10-Year Average (2008-2017)	Trend
Secchi	10.8 ft.	Stable
Total Phosphorus	18 µg/L	Improving
Ortho Phosphate	4.2 µg/L	Stable
Chlorophyll-a	6.0 µg/L	Stable

Short Term Goals - Year 2025

- Achieve a 5-year mean summer phosphorus concentration at or below 20 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 10ft

Long Range Goals – Year 2035

- Achieve a 5-year mean summer phosphorus concentration at or below 20 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 10 ft

Basic Facts

DNR ID/ Becker No	03035700
Township(s)	Lake View (Sec 5,8)
Lake Classification	Rural Development
Lake Area	133.83 acres
Littoral Area	48 acres (35.87%)
Sub-watershed Area	748 acres
Shoreline Length	2.34 miles
Inlet(s)	None
Outlet(s)	1 (Wetland Stream to Lake Sallie)
Control Structures	None
Highest Recorded	1333.99 (04/02/2003)
Lowest Recorded	1333.99 (04/02/2003)
Ordinary High Water Level	1333.99 ft.
Recorded Range	Not Recorded
Maximum Depth	26 feet
Main Fish Species	Black crappie, Bluegill, Largemouth bass, Northern pike, Walleye
Secondary Fish Species	Brown/Yellow bullhead, Hybrid sunfish, Pumpkinseed, White sucker, Yellow perch
MN DNR/ Private Fish Stocking	Walleye
Aquatic Invasive Species (2015)	None listed
Public Access Sites	SE Shore off Twnshp Rd
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County

Elevations NGVD 29

Overall Assessment

Munson lake is a 134 acres recreational development lake with heavily developed shoreline. It is located just southeast of the City of Detroit Lakes, between Long Lake and Lake Sallie. Munson Lake has a maximum depth of 26 feet and has a littoral area of approximately 48 acres (36% of lake surface area). There are no surface water inlets and the lake receives water primarily from stormwater runoff and groundwater interaction. Water flows from the lake on the southeast corner through a series of historic MN DNR fisheries rearing ponds to Lake Sallie. A MN DNR public access constructed of gravel is located near the outlet.

The shoreline topography is predominantly steep slopes and bluffs draining toward the lake. During early development of these areas, wood retaining walls were used to alter the slope topography to allow building construction closer to the lake. In many locations, the wood walls have begun to fail and need to be removed and the slope stabilized with vegetation. In some cases, when removal is not feasible, the walls must be properly replaced. In a shoreline survey conducted in 2017, a total of 23 parcels containing retaining walls were counted.

Munson is classified as a mesotrophic lake with good water quality that supports a healthy fishery and allows many types of recreational uses. Munson is dimictic, mixing in the spring in the fall, and remains well mixed in the upper 5-6 meters (16.5-19.5 feet). Water quality on Munson has been stable for the last 10 years with the exception of total phosphorus level, which showed a 20% improvement from the previous ten-year period (1998-2007). Water clarity averages are nearly 11 feet with total phosphorus levels of 18ppb.

Because of Munson's elongated shape, it has a higher shoreline length to lake area ratio. This allows more residential development and increased developmental pressure than a lake similar to its size with a round shape. Developmental pressure was apparent during a survey of shoreline alteration where 52% of the parcels were found to be greatly or moderately altered. Only 24% of the parcels were in a natural condition.

Two gravel mining operations are located in the western portion of the drainage area.

Past Studies

None (2019)

Planned/Potential Projects:

- Promote conversation of retaining walls to natural vegetation.

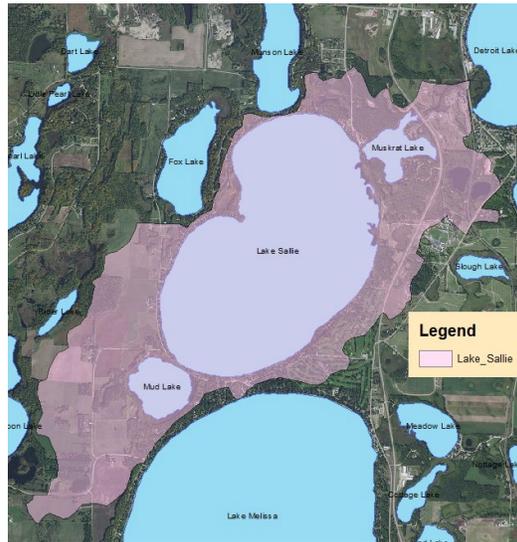
Ongoing Programs:

- Shoreline Surveys
- Lake Vegetation Surveys
- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Water Quality Monitoring
- Implement rules and permitting

Overall Strategy:
Maintain Water Quality

Impairment:
Listed as impaired for mercury

Subwatershed Lake Cover/Use (included in Lake Sallie Subwatershed)
46.2% Open Water
10.0% Developed
3.7% Wetlands
7.6% Cultivated Crops
18.0% Forest
14.4% Grassland



Planned/Potential Projects:

Ongoing Programs:

- Shoreline Surveys
- Lake Vegetation Surveys
- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Water Quality Monitoring
- Aquatic Plant Management (LMP-01)

Water Quality	10-Year Average (2008-2017)	Trend
Secchi	10 feet	Stable
Total Phosphorus	30 µg/L	Stable
Ortho Phosphate	9 µg/L	Stable
Chlorophyll-a	6 µg/L	Stable

Note: Zebra Mussel infested water listing in 2016

Short Term Goals – Year 2025

- Achieve a 5-year mean summer phosphorus concentration at or below 27 µg/L
- Achieve mean summer Secchi depth no less than 10 ft

Long Range Goals – Year 2035

- Achieve a 5-year mean summer phosphorus concentration at or below 27 µg/L
- Achieve a mean summer Secchi depth no less than 10 ft

Overall Assessment

Muskrat is a small lake totaling 69 acres in surface area with 64 of those classified as littoral (<15 feet deep). The maximum depth of the lake is 18 feet. Muskrat lake is actually located within the Lake Sallie drainage area with the Pelican River flowing through it. The river is navigable from Detroit Lake, which has influence increased development that what is typically observed on similar lakes in this area. A tram was construction to allow the movement of watercraft from Muskrat to Lake Sallie, which would otherwise not be possible due to a constructed rapid between the two lakes. The shallow lake is fertile with aquatic plants that grow to the surface in the deepest region of the lake.

A lock and dam system was removed in 2001 and replaced with a constructed rapid. The primary goal of the barrier removal was to allow for fish passage from Sallie to Muskrat (and Detroit via the Pelican River). The rapid has become a valuable asset for the MN DNR, which has a fisheries facility located in the area. Annual walleye netting is conducted for egg takes, which are grown and released back into area lakes which are not capable of sustaining a high enough rate of natural reproduction. The passage has also aided in the Muskie fishery by allowing the passage between the lakes.

Water quality in Muskrat Lake is variable and highly influence by the nutrient load from discharge from the Detroit Lake via the Pelican River and from St. Clair Lake (impaired for excessive nutrients) via Judicial Ditch 14. The lake is classified as mesotrophic; however, it tends to exhibit some eutrophic tendencies (lake wide algal blooms and dense macrophyte growth) during warmer summer months. It should be mentioned that beginning the 2018, the City of Detroit Lake began to upgrade the Wastewater Treatment Facility which discharges effluent wastewater into St. Clair Lake. While the water will be low in nutrients, the volume will increase by about 2 million gallons per day, which was previously land applied during summer months. This may increase the nutrient load discharge from the ditched wetland which Ditch 14 flows through.

Past Studies

- McComas, Steve and Stuckert, J. Blue Water Science. 1999. Plant Harvesting and Zooplankton Dynamics in Muskrat Lake for 1998
- Rieke Carrol Muller and Associates Inc. 1984. Facility Plan Addendum Report, Lakeview Township Evaluation of Land Application by Spray Irrigation
- Wenck Associates Inc. 1998. Wastewater Treatment and Drinking Water Supply Alternatives; Lake Sallie and Melissa Chain of Lakes
- Widseth Smith Nolting. 1997. A Proposal to Detroit Township to Provide Engineering Services for a Wastewater Facility Plan and Water Feasibility Study
- A.W. Research Laboratories. 1995. Proposal for Mapping Sedimentation in Lake Sallie
- Larson Peterson and Associates. 1989. Clean Lakes Program: In Lake Monitoring Lake Sallie
- Lee, David R. 1971. Septic Tank Nutrients in Groundwater Entering Lake Sallie
- McComas, Steve, Hecock, R., Nustad, R., Wilson, B. 1996. An Updated Diagnostic and Feasibility Study for Lake Sallie, Detroit Lakes, MN
- McComas, Steve. Blue Water Science. 1997. Plant Harvesting and Zooplankton Dynamic in Muskrat Lake, Status Report
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- Neel, Joe K. 1973. Weed Harvest and Lake Nutrient Dynamics
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- Larson Peterson and Associates. 1990. Clean Lakes Study of Lakes Sallie and Detroit: 1988 and 1989 Data Collection Summary
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- Iverson, Steven W. 1992. The Pelican River Navigation Restoration Project
- K-V Associates Inc. 1980. Septic Leachate Survey, Detroit Lakes, MN
- Hecock, R. 1993. Diagnostic and Feasibility Study and Management Alternatives for Lake Sallie and Detroit Lake
- Larson Peterson and Associates. 1998. 1998 Quality Assurance Plan: Lakes Sallie and Detroit

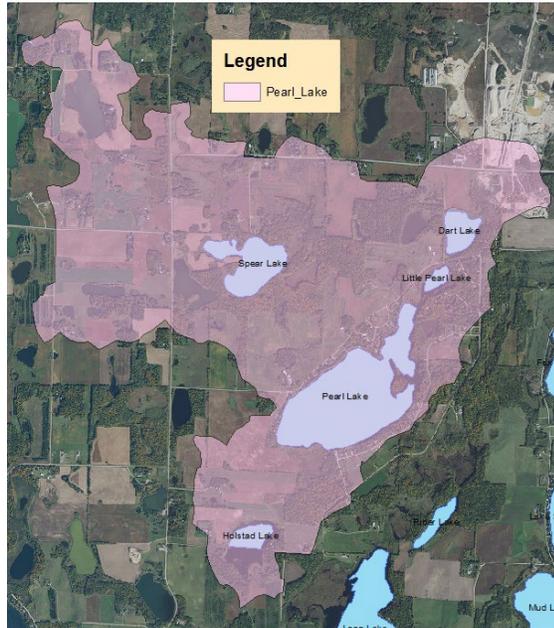
Overall Strategy:

Maintain Water Quality

Impairment: Not listed as impaired

Subwatershed Lake Cover/Use:

- 14.6% Open Water
- 5.8% Developed
- 2.6% Wetlands
- 22.0 Cultivated Crops
- 30.9% Forest
- 24.2% Grassland



Water Quality	10-Year Average (2008-2017)	Trend
Secchi	9 ft.	Stable
Total Phosphorus	28 µg/L	Stable
Ortho Phosphate	Insufficient Data	Insufficient Data
Chlorophyll-a	9.5 µg/L	Insufficient Data

Short Term Goals - Year 2025

- Achieve a 5-year mean summer phosphorus concentration between 25-29 µg/L
- Maintain mean summer Secchi depth no less than 9 ft

Long Range Goals – Year 2035

- Achieve a 5-year mean summer phosphorus concentration between 25-29 µg/L
- Maintain mean summer Secchi depth no less than 9 ft

Basic Facts

DNR ID/ Becker No	MN03-0486-00 / 486
Township(s)	Lake Eunice (Sec 11-14)
Lake Classification	Recreational Development
Lake Area	281 acres
Littoral Area	168.2 acres (59.8%)
Sub-watershed Area	3534 acres
Inlet(s)	None
Outlet(s)	Wetland Stream
Outlet Elevation	1356.5
Control Structures	None
Highest Recorded	1358.24 feet (7/8/2002)
Lowest Recorded	1354.83 feet (9/25/2012)
Ordinary High Water Level	1356.6 feet
Recorded Range	3.41 feet
Maximum Depth	54 feet
Main Fish Species	Black crappie, Bluegill, Largemouth bass, Northern pike, Walleye
Secondary Fish Species	Black/Brown bullhead, Hybrid sunfish, Pumpkinseed, White sucker, Yellow perch
MN DNR/ Private Fish Stocking	Walleye
Aquatic Invasive Species (2015)	Curly-leaf pondweed
Public Access Sites	S Shore just E of peninsula (DNR)
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County

Elevations NGVD 29

Overall Assessment

Pearl Lake is a 281 acres lake located along the western edge of the Pelican River Watershed District boundary. It reaches a depth of 54 feet with a littoral area (<15feet) accounting for 60% (168 acres) of its surface area. The drainage area of Pearl Lake includes several other small lakes and wetlands including Little Pearl, Dart, Bijou, and Holstad Lakes. Other than the lakes within its drainage area, Pearl is poorly connected to any downstream lake or other lakes within the watershed. Historically, Pearl Lake experiences large fluctuations in water levels, with a recorded range of 3.4 feet. A well defined outlet was constructed in the southwest corner of the lake and maintains water levels at more constant elevation.

The MN DNR maintains an asphalt public boat access ramp along the southern shoreline, allowing both public and private use of the lake. Curly leaf pondweed was first observed in a 0.20 acre area in 2010. A permit to chemically treat the plant was applied for at that time but was denied by the MN DNR. By 2011, populations were widespread and now are found in all portions of the lake.

There have been substantial increases in residential development in the past 20 years. In 1983 there were only two riparian residences. By 2003, that had grown to 32 and by 2013, there were a total of 57 riparian residences. The remaining undeveloped riparian properties are not suitable for development due to wetlands and poor drainage.

Water quality exhibits large year-to-year fluctuations with a 10 year average of 28 ppb phosphorus and clarity of 9.5 feet. A diagnostic study of Pearl Lake was completed in 2012, which determined that the primary source of in-lake phosphorus was from internal loading from nutrient rich sediments. The lake stratifies strongly between 4-6 meters and develops anoxia in the lower layer, further increasing release of phosphorus from lake bottom sediments in to the lower water layer.

There is cultivated cropland on both the east and west sides of the lake that drain via private ditch to Pearl Lake. Study work from 2010 and 2011 show that during dry periods, there is very limited input from those sources to the lake, but during wet periods, a significant amount of sediment loads are observed. Due to the flashy nature of the monitoring locations, annual loads from those sources could not be determined.

Past Studies

Pelican River Watershed District, Clean Water Partnership Diagnostic Study of Pearl Lake, 2012

Planned/Potential Projects:

- Investigate internal loading reduction opportunities.
- Investigate sediment and phosphorus load reductions from agricultural regions
- Obtain baseline data water quality data for Spear and Rider Lakes.

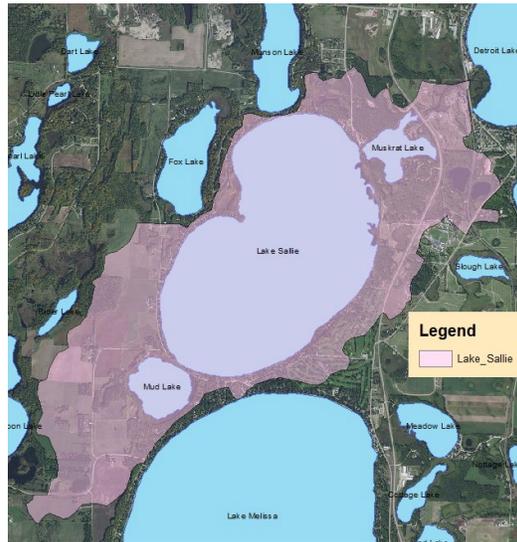
Ongoing Programs:

- Shoreline Surveys
- Lake Vegetation Surveys
- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Water Quality Monitoring
- Implement rules and permitting

Overall Strategy:
Improve Water Quality

Impairment:
Listed as impaired for mercury

Subwatershed Lake Cover/Use:
46.2% Open Water
10.0% Developed
3.7% Wetlands
7.6% Cultivated Crops
18.0% Forest
14.4% Grassland



Water Quality	10-Year Average (2008-2017)	Trend
Secchi	7.5 feet	Stable
Total Phosphorus	35 µg/L	Stable
Ortho Phosphate	7 µg/L	Stable
Chlorophyll-a	13 µg/L	Stable

Note: Zebra Mussel infested water listing in 2016

Short Term Goals – Year 2025

- Achieve a 5-year mean summer phosphorus concentration at or below 30 µg/L
- Achieve mean summer Secchi depth no less than 6 ft

Long Range Goals – Year 2035

- Achieve a 5-year mean summer phosphorus concentration at or below 27 µg/L
- Achieve a mean summer Secchi depth no less than 8 ft

Basic Facts

DNR ID/ Becker No	MN03-0359-00 / 359
Township	Lake View (Sec 7-9, 16-20)
Lake Classification	General Development
Lake Area	1272.9 acres
Littoral Area	577 (45%)
Sub-watershed Area	3159 acres
Shoreline Length	5.5 miles / 29,300 feet
Inlet(s)	4 (Pelican River from Muskrat Lake, Wetland Streams from Fox and Munson, Culvert from Mud)
Outlet(s)	Pelican River (to Lake Melissa)
Control Structures	Dunton Rapids (no longer controlled)
Highest Recorded	1331 feet (8/9/1993)
Lowest Recorded	1325.42 feet (7/25/1936)
Ordinary High Water Level	1330.3 feet
Recorded Range	5.58 feet
Maximum Depth	50 feet
Water Residence	271 days
Main Fish Species	Black crappie, Bluegill, Green sunfish, Largemouth bass, Muskellunge, Northern pike, Rock bass, Walleye
Secondary Fish Species	Bowfin, Hybrid sunfish, Pumpkinseed, Tullibee, White sucker, Yellow perch, Black/Brown/Yellow bullhead
MN DNR/ Private Fish Stocking	Walleye
Aquatic Invasive Species (2016)	Flowering rush, Curly-leaf pondweed, Zebra Mussel
Public Access Sites	NE Shore (DNR)
Marinas	None
Public Beach	None
Marinas	
References	DNR Lake Finder, Becker County

Overall Assessment

Lake Sallie is a 1,273-acre polymictic lake which reaches a maximum depth of 50 feet, with 45% of its surface area is considered littoral. Lake Sallie is classified as a borderline eutrophic lake vulnerable to nutrient impairment. The Pelican River passes through the lake, entering on the north end from Muskrat Lake, outlet into on the south end to Lake Melissa.

Historically, Lake Sallie has had poor water quality, partly due in part to the City of Detroit Lakes use the upstream St. Clair Lake as a discharge point for wastewater. Prior to the construction of the original wastewater treatment facility 1929, untreated wastewater was discharged in the Lake St. Clair, which resulted in phosphorus level in Lake Sallie to be approximately 54ppb, nearly 3 times that of nearby and similar lakes. In 1979, the facility was upgraded. Sallie responded with a decline in phosphorus levels ranging from 46 to 48ppb. The current facility, upgraded in 2002, further reduced load to Lake Sallie resulting in the current mean summer levels between 35 and 37ppb.

While it has greatly improved since the 1970's it continues to exhibit moderate to severe algal blooms are common, often continuous in July and August. These appear to be brought on in part by internal nutrient recycling, whereby nutrient rich water from the bottom layers are brought to the oxygen rich upper layers during lake mixing periods, often triggered by storm event and high winds.

Much of the nutrient load comes from upstream sources, specifically from nutrient rich water from partially drained Lake St. Clair via Becker County Ditch 14. An alum treatment in Lake St. Clair conducted in 1998 reduced internal loading to the lake, and in effect, reduced nutrient loading to the downstream Muskrat and Sallie Lakes. Stormwater Best Management Practices in the City of Detroit Lake has also aided in Lake Sallie improvements by reducing stormwater runoff loads to Little Detroit Lake, which outlets to Sallie.

In the fall of 2016, zebra mussels were located at the public access of the lake. By 2017, the infestation had spread lakewide. The District continues to monitor how the infestation impacts water quality. After only three years, the water clarity has increased to a record summer average of 13 ft. (compared to the previous 10 year average of 7 ft.).

A lock and dam system was installed during the depression era by a Civilian Conservation Corp (CCC) crew between Lake Sallie and Muskrat Lake. This structure was removed in 2001 and replaced with

Planned/Potential Projects:

- Monitor and investigate Ditch 14 phosphorus sources and implement feasible options for reduction.
- Monitor and assess wastewater treatment facility discharges to St. Clair Lake and Ditch 14.
- Investigate potential groundwater influences on Ditch 14.
- Study zebra mussel impacts on lake ecosystem.
- Obtain internal phosphorus loading data.
- Investigate stormwater practices for linear developments.

Ongoing Programs:

- Shoreline Surveys
- Lake Vegetation Surveys
- Cost Share Program for shoreline enhancements including buffers and soft armor installations.
- Water Quality Monitoring.
- Implement Rules and Permitting.
- Aquatic Plant Management (Project 1B)
- Attend lake association meetings.

a constructed rock rapids outfall at the historic water outlet elevation and no longer allows for any water level manipulation. The Pelican River flows out to Lake Melissa through a culvert under Becker CSAH 22 approximately 200 feet downstream of Lake Sallie. The velocity of flow between the outlet of Sallie and the culvert suggests that the headwater of the culvert may be slightly lower than the true water level in the Lake. There is also a slight hydraulic restriction that appears to control lake level.

Past Studies

- McComas, Steve and Stuckert, J. Blue Water Science. 1999. Plant Harvesting and Zooplankton Dynamics in Muskrate Lake for 1998
- Rieke Carrol Muller and Associates Inc. 1984. Facility Pland Addendum Report, Lakeview Township Evaluation of Land Application by Spray Irrigation
- Wenck Associates Inc. 1998. Wastewater Treatment and Drinking Water Supply Alternatives; Lake Sallie and Melissa Chain of Lakes
- Widseth Smith Nolting. 1997. A Proposal to Detroit Township to Provide Engineering Services for a Wastewater Facility Plan and Water Feasibility Study
- A.W. Research Laboratories. 1995. Proposal for Mapping Sedimentation in Lake Sallie
- Larson Peterson and Associates. 1989. Clean Lakes Program: In Lake Monitoring Lake Sallie
- Lee, David R. 1971. Septic Tank Nutrients in Groundwater Entering Lake Sallie
- McComas, Steve, Hecock, R., Nustad, R., Wilson, B. 1996. An Updated Diagnostic and Feasibility Study for Lake Sallie, Detroit Lakes, MN
- McComas, Steve. Blue Water Science. 1997. Plant Harvesting and Zooplankton Dynamic in Muskrat Lake, Status Report
- McComas, Steve. Blue Water Science. 2001. Plant Harvest and Water Quality Dynamics in Muskrat lake for 2000
- Neel, Joe K. 1973. Weed Harvest and Lake Nutrient Dynamics
- Instrumental Research Inc. 1985. Nutrient Retention of Harvested Aquatic Vegetation from Lakes Sallie and Melissa
- Rieke Carrol Muller and Associates Inc. 1978. Water Pollution Control Facilities Report for Lakeview Township, Becker County, MN
- Rieke Carrol Muller and Associates Inc. 1981. Wastewater Treatment Facilities Plan Summary Report
- Wenck Associates Inc. 2010. Lakeview Township Community Assessment Report
- McComas, Steve. Blue Water Science. 1999. Pelican River Watershed District Aquatic Plant Harvesting Program Evaluation
- McComas, Steve. Blue Water Science. Pelican River Watershed District Aquatic Plant Harvesting Program Evaluation
- Larson Peterson and Associates. 1987. 1987 Monitoring Plan: Lakes Sallie and Detroit
- Larson Peterson and Associates. 1990. Clean Lakes Study of Lakes Sallie and Detroit: 1988 and 1989 Data Collection Summary
- Larson Peterson and Associates. 1992. Diagnostic Feasibility Study: Management Alternatives for Lakes Sallie and Detroit
- Larson Peterson and Associates. 1998. 1998 Monitoring Plan: Lakes Sallie and Detroit
- Larson Peterson and Associates. 2001 Diagnostic Management Alternatives for Lake Sallie and Detroit Lake
- Iverson, Steven W. 1992. The Pelican River Navigation Restoration Project
- K-V Associates Inc. 1980. Septic Leachate Survey, Detroit Lakes, MN
- Hecock, R. 1993. Diagnostic and Feasibility Study and Management Alternatives for Lake Sallie and Detroit Lake
- Larson Peterson and Associates. 1998. 1998 Quality Assurance Plan: Lakes Sallie and Detroit

Overall Strategy:
Improve Water Quality

Impairment: Not listed as impaired

Subwatershed Lake Cover/Use:

- 17.4% Open Water
- 4.8% Developed
- 6.7% Wetlands
- 4.3% Cultivated Crops
- 51.2% Forest
- 15.5% Grassland



Water Quality	10-Year Average June - Sept (2006-2015)	Trend
Secchi (clarity)	9.5 ft.	Insufficient Data
Total Phosphorus	30 µg/L	Insufficient Data
Ortho Phosphate	Insufficient Data	Insufficient Data
Chlorophyll-a	7.8 µg/L	Insufficient Data

Short Term Goals - Year 2025

- Achieve a 5-year mean summer phosphorus concentration at or below 30 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 10 ft

Long Range Goals – Year 2035

- Achieve a 5-year mean summer phosphorus concentration at or below 30 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 10 ft

Basic Facts

DNR ID/ Becker No	MN03-0420-00 / 420
Township(s)	Richwood (Sec 27, 34)
Lake Classification	Natural Environment
Lake Area	104.7 acres
Littoral Area	104.7 acres (100%)
Sub-watershed Area	545 acres
Inlet(s)	None
Outlet(s)	None
Control Structures	None
Highest Recorded	Not Recorded
Lowest Recorded	Not Recorded
Ordinary High Water Level	Not Recorded
Recorded Range	Not Recorded
Maximum Depth	11 ft.
Main Fish Species	N/A
Secondary Fish Species	N/A
MN DNR/ Private Fish Stocking	N/A
Aquatic Invasive Species (2015)	None listed
Public Access Sites	None
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County

Elevations NGVD 29

Overall Assessment

Sand Lake is a 104-acre shallow natural environment lake located 1.5 miles north of Floyd Lake and about 6 miles north of the City of Detroit Lakes. There is very little residential development on the lake with only three residential single-family homes located in the very southern portion of the lake. Sands is a shallow lake that reaches a depth of 11 feet with a prominent wetland fringe along the edge of the lake. It is land locked with no significant surface water inlet or outlet. The lake is recharged by stormwater runoff and groundwater interactions.

Sand Lake was monitored for chemistry and clarity from 2006-2010 with average water clarity of 9.5 feet and mean summer total phosphorus levels of 30 ppb. Macrophyte growth is present throughout the lake, and is especially dense in water less than 5-feet.

Past Studies

Planned/Potential Projects:

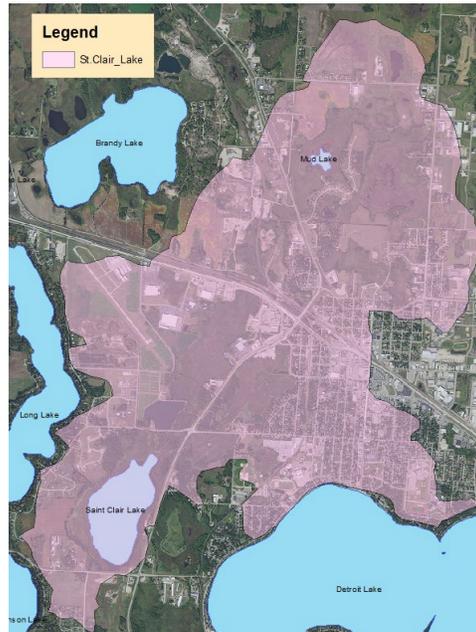
Ongoing Programs:

- Water Quality Monitoring

Overall Strategy:
Improve Water Quality

Impairment: Impaired for Nutrients

Subwatershed Lake Cover/Use:
4.7% Open Water
40.8% Developed
15.0% Wetlands
12.7% Cultivated Crops
11.9% Forest
14.9% Grassland



Water Quality	10-Year Average (2008-2017)	Trend
Secchi (clarity)	2.5 ft.	Degrading
Total Phosphorus	107 µg/L	Degrading
Ortho Phosphate	7.1 µg/L	Degrading
Chlorophyll-a	44 µg/L	Degrading

Not always suitable for swimming and wading due to low clarity and excessive algae caused by excess nutrients

Short Term Goals - Year 2025

- Achieve a 5-year mean summer phosphorus concentration at or below 60 µg/L
- Achieve mean summer Secchi depth no less than 3.5 ft

Long Range Goals – Year 2035

- Achieve a 5-year mean summer phosphorus concentration at or below 60 µg/L
- Achieve mean summer Secchi depth no less than 3.5 ft

Basic Facts

DNR ID/ Becker No	MN03-0382-00 / 382
Township(s)	Lake View, Detroit (Sec 4, 5, 32, 33)
Lake Classification	Natural Environment
Lake Area	142 acres
Littoral Area	Not Recorded
Sub-watershed Area	4430 acres
Shoreline Length	2.5 miles
Inlet(s)	Stream from Long Lake
Outlet(s)	Stream to Ditch 14
Control Structures	None
Highest Recorded	1338.11 feet (10/26/2004)
Lowest Recorded	1335.75 feet (9/12/2003)
Ordinary High Water Level	1337.5 feet
Recorded Range	2.36 feet
Water Residence	98 days
Maximum Depth	7.5 ft.
Main Fish Species	N/A
Secondary Fish Species	N/A
MN DNR/ Private Fish Stocking	N/A
Aquatic Invasive Species (2015)	None listed
Public Access Sites	None
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County, MPCA

Elevations NGVD 29

Overall Assessment

Lake St. Clair originally was a 591 acre lake located west of the Detroit Lakes. In about 1915 the lake was drained to its present size of 140 acres because of the “awful stench” it presented to the local residents. This was caused by more than seventy years of untreated sewage from the City of Detroit lakes. A modern sewage treatment plant was constructed in 1976 which reduced phosphorus loadings to St. Clair by approximately 90%. The City continues to discharge treated effluent wastewater on the north side of the lake.

St. Clair is prone to annual winterkill episodes and therefore does not support game fish populations. There is no public access on the lake. The lake is, however, heavily used by waterfowl.

Two ditches bring water to St. Clair, including much of the City of Detroit Lakes stormwater runoff. A natural outlet from Long Lake enters from the west, which contributes only minor amounts of water and nutrient load. St. Clair discharges to the southwest via Becker County Ditch 14 to the Pelican River, entering Muskrat and Sallie Lakes. Ditch 14 flows through a partially drained wetland which contributes additional phosphorus prior to outlet to the Pelican River.

Lake bottom sediments are up to 16 feet thick in portions of the lake and are thought to be caused by the lake’s history of receiving sewage prior to modern wastewater treatment.

The Pelican River Watershed District applied aluminum sulfate (ALUM) to Lake St. Clair in October 1998. This treatment was a phased approach intended to reduce the unacceptable phosphorus level in Lake Sallie. Following the ALUM treatment, in-lake phosphorus concentrations in St. Clair Lake were reduced by over 50% from 131ppb to 72ppb, with a similar reduction in orthophosphate. Phosphorus level began to trend upward beginning in the early 2010’s showing that the ALUM treatments effectiveness had begun to wear and that another dose will be required to maintain phosphorus level below 80ppb.

In 2016, the MPCA accepted the St. Clair lake Total Maximum Daily Load (TMDL) study. The study showed that the lake is capable of a daily loading capacity of 2.75 lbs. of phosphorus a day. This equates to a 24% reduction of the current load. The TMDL report allowed for an increase in nutrient load for the City of Detroit Lakes Wastewater Treatment Facility by 95 lbs/yr, a 28% increase to allow for population growth and annexation within the city. To meet the reduction goal, the total reduction of phosphorus in non-point sources (stormwater runoff from within the City of Detroit Lakes) is 277 lb/yr, and 49% decrease from the existing condition.

Planned/Potential Projects:

- Implement St. Clair Lake TMDL
- Monitor and investigate Ditch 14 phosphorus sources and feasible options for reduction.
- Identify stormwater inputs from City of Detroit Lakes and prioritize BMP’s to reduce phosphorus loads.
- Investigate groundwater influences.
- Linear redevelopment stormwater BMP’s.

Ongoing Programs:

- Shoreline Surveys
- Lake Vegetation Surveys
- Water Quality Monitoring

Past Studies

- Larson, Peterson, and Ulteig. 2004. Wastewater Treatment Facility Effluent Discharge Feasibility Study; City of Detroit Lakes Preliminary Engineering Report
- Pelican River Watershed District and City of Detroit Lakes. 1971. The Effectiveness of Advanced Waste Treatment Methods and the Recovery Rate of an Enriched Lake following Nutrient Cut-Off
- Instrumental Research Inc. 1984. Aeration Proposal to the Pelican River Watershed District
- Wenck Associates Inc. 2006. Ditch 14 Hydraulic and Water Quality Study
- Minnesota Pollution Control Agency. 2014. St. Clair Lake Total Maximum Daily Load (TMDL) Report

Overall Strategy:
Improve Water Quality

Impairment: Impaired for
Nutrients (phosphorus)

**Subwatershed Lake
Cover/Use:**
17.2% Open Water
15.4% Developed Land
2.0% Wetlands
14.6% Cultivated Crops
23.0% Forest
27.9% Grassland



Water Quality	10-Year Average (2008-2017)	Trend
Secchi	3 ft.	Insufficient Data
Total Phosphorus	87 µg/L	Insufficient Data
Ortho Phosphate	3 µg/L	Insufficient Data
Chlorophyll-a	23 µg/L	Insufficient Data

Short Term Goals - Year 2025

- Achieve a 5-year mean summer phosphorus concentration at or below 60 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 3.5 ft

Long Range Goals – Year 2035

- Achieve a 5-year mean summer phosphorus concentration at or below 60 µg/L ± 4%
- Maintain mean summer Secchi depth no less than 3.5 ft

Basic Facts

DNR ID/ Becker No	MN03-0398-00 / 398
Township(s)	Detroit (Sec 19, 20)
Lake Classification	Natural Environment
Lake Area	44.1 acres
Littoral Area	44.1 acres (100%)
Sub-watershed Area	219 acres
Inlet(s)	None
Outlet(s)	None
Control Structures	None
Highest Recorded	Not Recorded
Lowest Recorded	Not Recorded
Ordinary High Water Level	Not Recorded
Recorded Range	Not Recorded
Maximum Depth	Not Recorded
Main Fish Species	N/A
Secondary Fish Species	N/A
MN DNR/ Private Fish Stocking	N/A
Aquatic Invasive Species (2015)	None listed
Public Access Sites	None
Marinas	None
Public Beach	None
References	DNR Lake Finder, Becker County

Elevations NGVD 29

Overall Assessment

Wine Lake is small 44 acre natural environment lake located just north of the City of Detroit Lakes. There is one commercial business located on the east shoreline that uses the lake for watercraft testing. Wine lake is listed as a nutrient impaired lake with average summer phosphorus levels of 87ppm and water clarity of 3 feet, which exceeds the shallow lake standard of 60ppm and 1 meter (3.28ft) .

The lake was monitored for water quality for 3 years (2009-2011). The lake has no surface water inlet and is recharged by stormwater runoff and groundwater interaction. Wine Lake is a landlocked basin with no residential development, and therefore is low priority for water quality monitoring.

Past Studies

Implementation

Planned/Potential Projects:

- Develop and implement phosphorus TMDL

Ongoing Programs:

- Water Quality Monitoring