

**Big McDonald Lake  
Otter Tail County Ditch 25  
Water Quality Assessment**

**Phase 1 - Initial Data Review**

Prepared for  
**Big McDonald Lake Improvement District**

June 2021

Prepared by:  
Kevin Pederson, PE  
Chad Engels, PE  
Jeff Strom (Stantec)



I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.

Signature: Kevin D. Pederson

Typed or Printed Name: Kevin D. Pederson

Date: June 8, 2021 License Number: 49029

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.

Signature: Chad L. Engels

Typed or Printed Name: Chad L. Engels

Date: June 8, 2021 License Number: 47545

---

## Table of Contents

---

1. Purpose and Introduction .....	1
2. Existing Information Review .....	4
3. Timeline of Ditch 25 Activities .....	5
4. Ditch 25 Water Quality Data (2015-2020) .....	6
5. Ditch 25 Water Quality Discussion .....	12
6. Recommendations for Ditch 25 .....	13
6.1 Recommendation: Conduct Common Carp Assessment in Wendt Lake.....	13
6.2 Recommendation: Perform Standard Fisheries Survey in Wendt Lake.....	14
6.3 Recommendation: Continue Monitoring Water Quality in Wendt Lake and County Ditch 25 and potentially add a site in the wetland north of Big McDonald Lane .....	14
7. Conservation Partners Legacy Grant .....	15
8. References.....	15

## List of Figures

Figure 1 Location Map.....	1
Figure 2 Parcel Map.....	2
Figure 3 Ditch 25 Watershed .....	3
Figure 4 Sampling Location Map .....	8
Figure 5 TSS concentrations for each site from 2015-2017.....	9
Figure 6 TSS concentrations for each site from 2018-2020.....	9
Figure 7 TP concentrations for each site from 2015-2017.....	10
Figure 8 TP concentrations for each site from 2018-2020.....	10
Figure 9 E. coli concentrations for each site from 2015-2017.....	11
Figure 10 E. coli concentrations for each site from 2015-2017.....	11

## List of Tables

Table 1. Summary of Existing Information Review .....	4
Table 2. Ditch 25 timeline of activities (2014-2020).....	5
Table 3. Summary of 2015-2020 water quality monitoring data in and upstream of Ditch 25 .....	7
Table 4. Conservation Partners Legacy Grant Key Dates (Previously Cycle).....	15

## List of Appendices

Appendix A Estimated Costs (2021 Dollars)

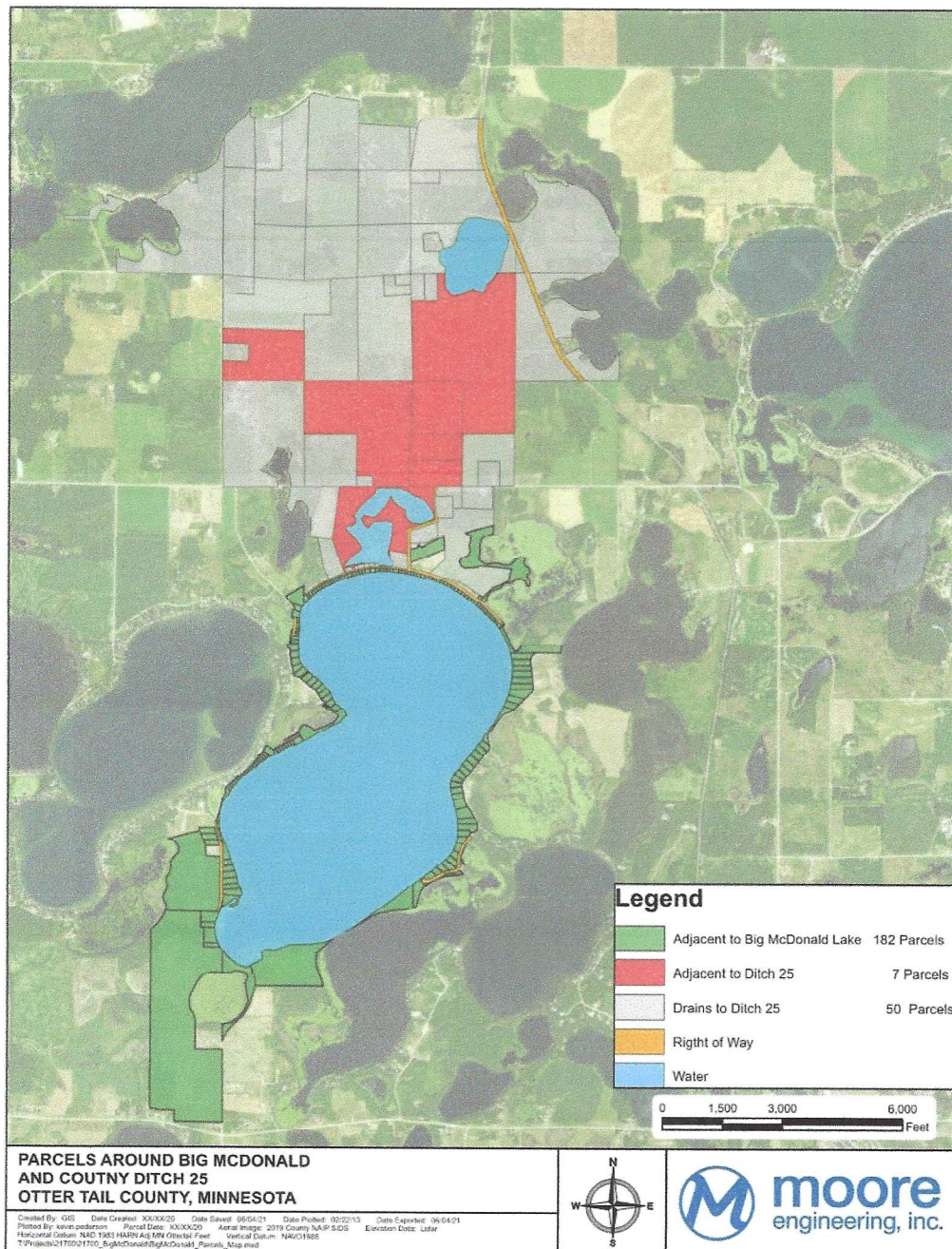
---



**Big McDonald Lake / OTC Ditch 25  
Water Quality Assessment – Data Review**

The first step of any water quality improvement project is to identify and evaluate the existing information. Once this information has been assessed, follow-up actions can be recommended to fill data gaps and advance a mitigation plan. Therefore, this study follows the traditional protocol and begins with an assessment of the available information and water quality data. This technical memorandum presents the results of this work which includes the following components:

- Overview of existing data and reports for Ditch 25
- Timeline of Ditch 25 Activities
- Ditch 25 water quality monitoring results
- Ditch 25 water quality discussion



**Figure 2 Parcel Map**

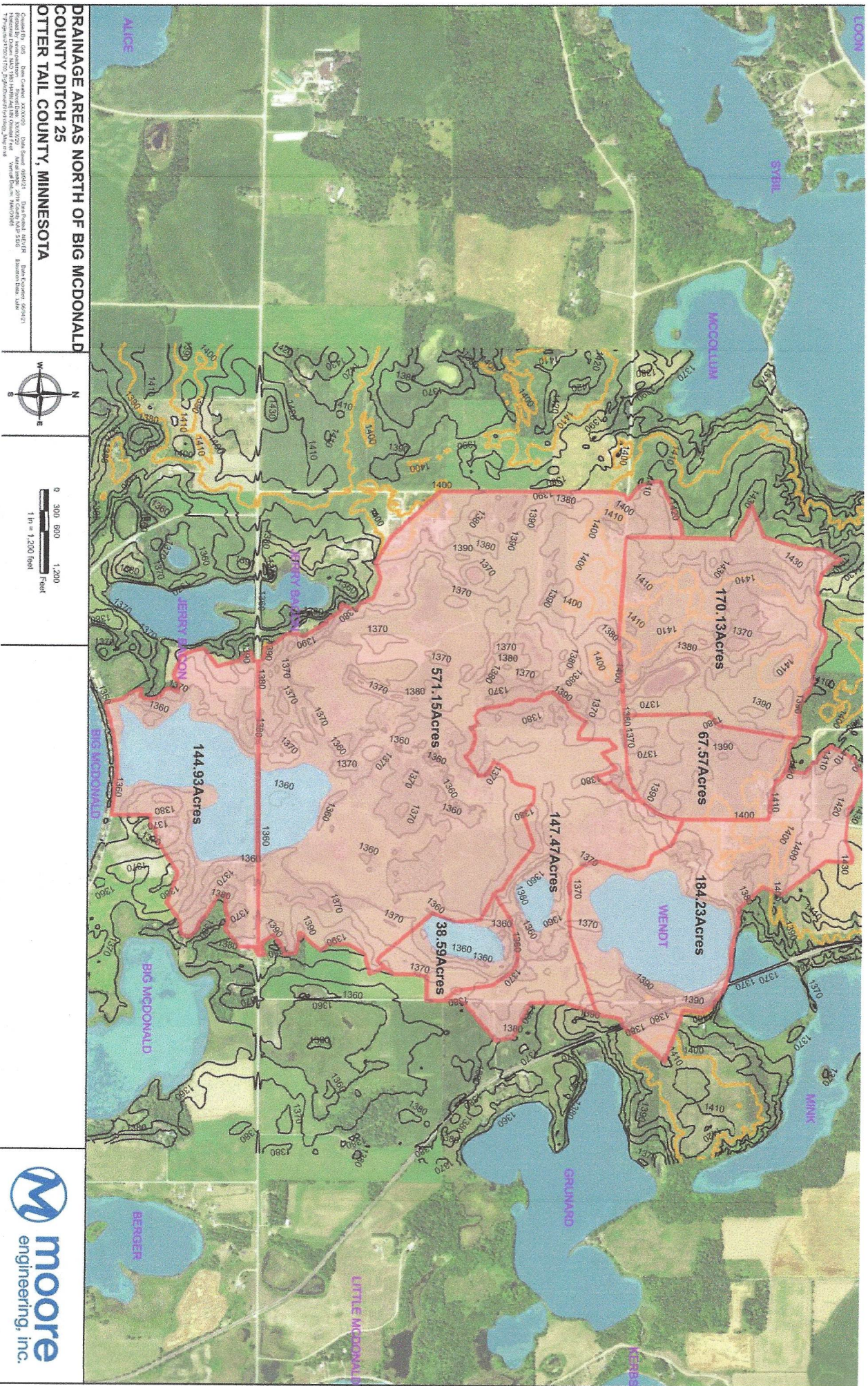


Figure 3 Ditch 25 Watershed

## 2. Existing Information Review

Table 1 summarizes the reports, studies, letters, and data that were compiled and reviewed. All information in Table 1 was supplied by the LID, RMB Environmental Laboratories (RMB), or County.

**Table 1.** Summary of Existing Information Review

Title/Description	Source/Author	Date
Ditch 25 Engineer’s Repair Report Phase 1	WSN	4/7/2014
Ditch 25 Engineer’s Repair Report	WSN	2015
Engineer’s Repair Report Recommendations	WSN	3/24/2015
Various documented notes and progress updates for Ditch 25 repairs	Ottertail County	8/11/2014, 5/15/2015, 8/20/2015, 10/19/2016, 11/8/2016, 6/13/2018 8/14/2018
Letter: “Re: Ditch 25 Reopening”	Craig Johnson, LID	7/31/2015
Letter: “Re: County Ditch #25 – Repair Request”	Donald Beck, LID	7/23/2018
Letter: “Re: notes on proposed Ottertail County Ditch #25 cleaning upstream of Big McDonald Lake	MPCA	8/27/2018
Big McDonald Lake Summary Report	RMB	2020
Ditch 25 Water Quality Data	LID, RMB	2015-2020

### 3. Timeline of Ditch 25 Activities

Table 2 presents a general timeline of activities that occurred in Ditch 25 from 2013 through 2020 based on the existing information review.

**Table 2.** Ditch 25 timeline of activities (2014-2020)

Year	Description of Activity	Source(s)
2013	<b>Re-determination of benefits is completed</b>	Ottertail County note
Spring 2015	<b>Survey work and Engineer’s Repair Report completed in March</b> County notes indicate ditch had not been cleaned/maintained since original construction Engineer report recommendations were to clean and excavate to original ditch grade Report indicated relatively minor change to flow characteristics would result from recommended cleanout/repairs Report indicated effect on water quality would be insignificant, however it did identify carp access as a potential concern for cleanout/repairs	Ottertail County notes and WSN (2015)
Summer 2015	<b>Ditch 25 Cleanout from CSAH 35 (Hwy 35) to outlet of Wendt Lake</b> Cleanout was completed by DM Enterprises between July 9-13 and August 8 Contractor encountered a ditch crossing at the outlet of Wendt Lake, the pipe (6”) could not be located and therefore was assumed to be buried and nonfunctional. Water had been overtopping the crossing earlier in the year and washout was noted LID voices concern during cleanout in letter to County dated July 31, 2015 that the project would increase nutrient inputs to the lake and create a better passageway for carp	Ottertail County notes and letter from LID (2015)
	<b>LID begins water quality monitoring at 3 locations in and upstream of Ditch 25 (Figure 4):</b> Wendt Lake near Heart Lake Road Ditch 25 at Hwy 35 Ditch 25 at Big McDonald Lake Rd First samples collected by LID on August 26, 2015 LID has continued monitoring every summer from 2015 through 2020	Data provided by RMB & LID
Fall 2016	<b>Pipe replaced at crossing near outlet of Wendt Lake</b> The plugged/buried 6-inch pipe was removed and replaced with a 20-foot long, 12-inch diameter corrugated metal pipe (CMP) New pipe installed at the same elevation as the previous pipe	Ottertail County notes

#### 4. Ditch 25 Water Quality Data (2015-2020)

---

Water quality was monitored by the LID from 2015 through 2020 at Wendt Lake and two locations along Ditch 25 (Table 3 and Figure 4). In general, 2-4 water quality samples were collected each year by the LID between June and October. All samples were analyzed by RMB Laboratories in Detroit Lakes, Minnesota. Water quality analyses included total suspended solids (TSS), total phosphorus (TP), and *Escherichia coli* (*E. coli*). Laboratory results for each site were reviewed by the Moore team and basic statistical analyses were performed (Table 3 and Figure 5 through Figure 10). It was noted during our initial review of the data that there appeared to be a shift (i.e. increase) in concentrations for each water quality parameter beginning in 2018. This shift occurred at each sampling station, however it was most notable at the Wendt Lake and Hwy 35 sites. Thus, we first performed statistical analyses on the entire dataset (2015-2020), and then conducted individual analyses on the 2015-2017 and 2018-2020 data subsets. Below is a brief discussion of the water quality analysis results.

TSS concentrations are generally highest at the Hwy 35 site compared to Wendt Lake and the Big McDonald Lake Rd (aka Big McDonald Lane) site. TSS at Big McDonald Lake Rd is consistently lower than Hwy 35 and Wendt Lake, likely due to settling in the large wetland complex downstream of Hwy 35. Mean TSS concentrations at all three sites were higher from 2018-2020 compared to 2015-2017. Wendt Lake showed the largest relative increase (approx. 7.5 times higher) in TSS concentrations between 2015-2017 and 2018-2020. However, Hwy 35 and Big McDonald Lake Rd also displayed significant increases (both approx. 4 times higher in 2018-2020). Ditch 25 is located within the Central River Nutrient Region for which the State's river/stream TSS concentration standard is 30 mg/L. A stream is considered impaired for TSS if more than 10% of the samples exceed the 30 mg/L standard or at least three individual measurements exceed the standard. TSS concentrations exceeded the 30 mg/L standard on 6 occasions (38%) in Wendt Lake, 9 occasions (56%) at Hwy 35, and 2 occasions (12%) at Big McDonald Lake Rd between 2015 and 2020. At all three sites, a majority of the TSS standard exceedances occurred between 2018 and 2020.

TP concentrations were highest at the Hwy 35 and Wendt Lake sites. TP concentrations at Big McDonald Lake Rd were lower than the other sites likely due to settling and biological uptake in the wetland complex downstream of Hwy 35. Similar to TSS, mean TP concentrations at all three sites were higher from 2018-2020 compared to 2015-2017. Wendt Lake showed the largest increase in mean TP going from 59 µg/L in 2015-2017 to 379 µg/L in 2018-2020. Mean TP concentrations at Hwy 35 increased from 109 µg/L in 2015-2017 to 421 µg/L in 2018-2020, while mean TP at Big McDonald Lake Rd site went from 93 µg/L in 2015-2017 to 138 µg/L in 2018-2020. In a letter to the Minnesota DNR in 2018 (Table 1), the MPCA indicated that the TP standard for County Ditch 25 is 65 µg/L. A stream is considered impaired for TP if summer growing season mean concentration exceeds this standard. Mean TP data from 2018-2020 suggest that the Hwy 35 site is approximately seven times greater than the 65 µg/L standard and the Big McDonald Lake Rd site exceeds the standard by a factor of two.

Based on our review of the State of Minnesota's online database, no previous water quality monitoring or DNR surveys have been conducted for Wendt Lake. Information provided by Minnesota DNR Fisheries suggests Wendt Lake is a small (~55 acres), shallow (max depth ~6 feet), and has a relatively small drainage area (~181 acres). The summer growing season (i.e. June through September) mean TP concentration standard for shallow lakes in the North Central Hardwood Forest Ecoregion is 60 µg/L. Thus, TP concentrations in Wendt Lake have gone from close to the 60 µg/L standard in 2015-2017, to more than six times the standard from 2018-2020.

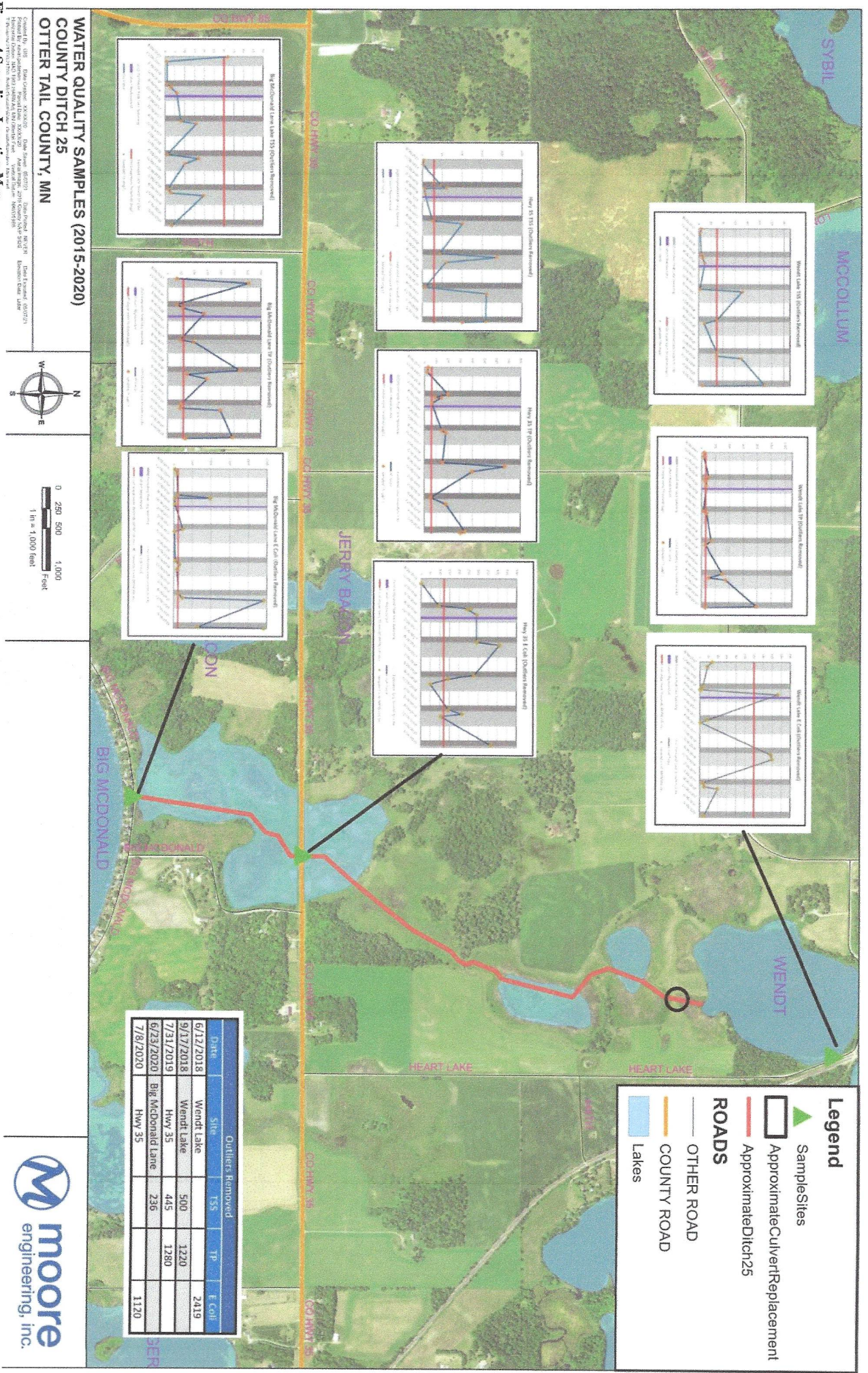


**Big McDonald Lake / OTC Ditch 25  
Water Quality Assessment – Data Review**

The state chronic and acute standards for *E. coli* in streams/rivers is 126 organisms/100 ml and 1,260 organisms/100 ml, respectively. A stream is considered impaired for *E. coli* if the geometric mean (geomean) of all samples within any calendar month exceed the chronic standard, and/or 10% of all samples taken during any calendar exceed the acute standard. The monitoring results for County Ditch 25 suggest *E. coli* concentrations generally increase from upstream to downstream (Table 1; Figures 5 and 6). Concentrations in Wendt Lake are high at times, however only one sample (6%) has exceeded the acute standard and the geomean concentration during the entire period of record (2015-2020; 29 organisms/ml) is well below the chronic standard. However, *E. coli* geomean has increased since 2018. Geomean *E. coli* concentrations at Hwy 35 and Big McDonald Lake Rd have exceeded the chronic standard for the entire period of record (2015-2020). The *E. coli* geomean at Big McDonald Lake Rd has shown significant increases from 2018-2020, while the geomean at Hwy 35 has shown a modest increase. There have been two exceedances (12%) of the acute standard at Big McDonald Lake Rd, both of which occurred from 2018-2020. There have been no exceedances of the acute standard at the Hwy 35 site.

**Table 3. Summary of 2015-2020 water quality monitoring data in and upstream of Ditch 25**

Site	Count			Mean			Min			Max		
	All Data	2015-2017	2018-2020	All Data	2015-2017	2018-2020	All Data	2015-2017	2018-2020	All Data	2015-2017	2018-2020
<b>TSS (mg/L)</b>												
Wendt Lake	16	8	8	56	13	98	2	2	7	>500	72	>500
Hwy 35	16	8	8	88	31	145	2	2	8	445	101	445
Big McDonald Lake Rd	17	9	8	22	9	36	1	1	1	236	32	236
<b>TP (µg/L)</b>												
Wendt Lake	16	8	8	219	59	379	31	31	60	1,220	104	1,220
Hwy 35	16	8	8	265	109	421	25	25	55	1,280	193	1,280
Big McDonald Lake Rd	17	9	8	114	93	138	35	35	47	304	304	270
<b><i>E. coli</i> (MPN/100 mL)</b>												
Wendt Lake	16	8	8	29	9	68	1	1	7	2,419	172	2,419
Hwy 35	16	8	8	130	140	200	1	1	50	1,120	727	1,120
Big McDonald Lake Rd	17	9	8	167	107	296	20	20	38	2,419	980	2,419



**WATER QUALITY SAMPLES (2015-2020)  
COUNTY DITCH 25  
OTTER TAIL COUNTY, MN**

Created by: MTR  
 Prepared by: MTR  
 Approved by: MTR  
 Date: 10/20/2020



**Legend**

- Sample Sites
- Approximate Culvert Replacement

**ROADS**

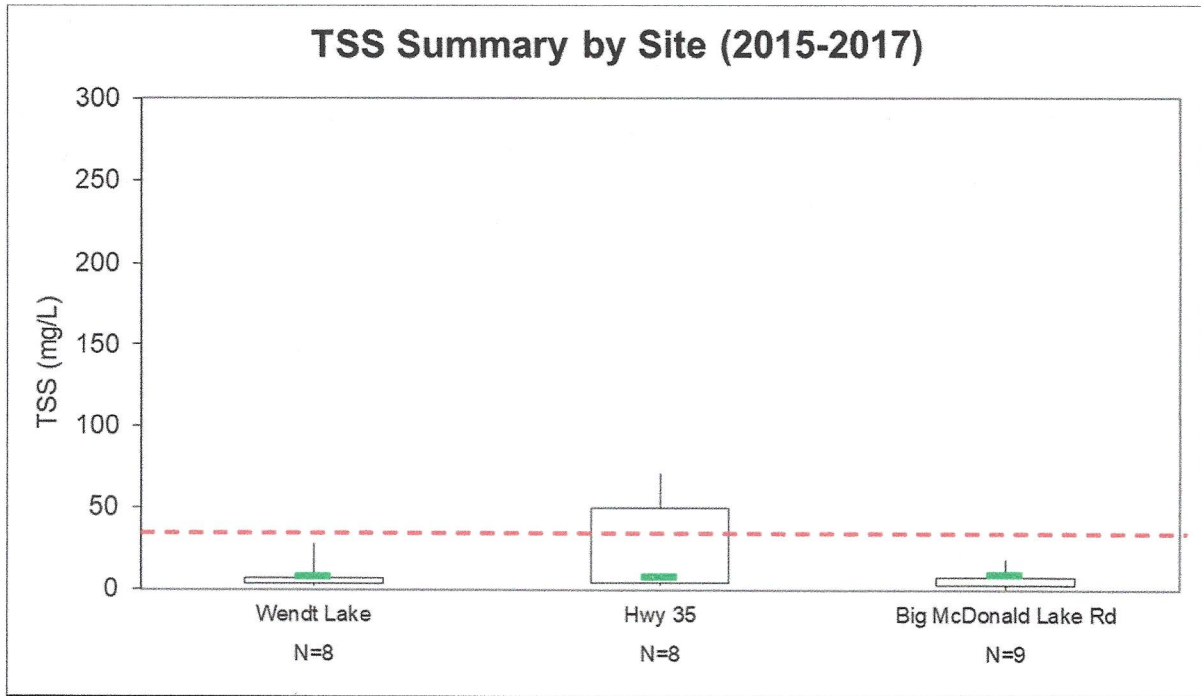
- OTHER ROAD
- COUNTY ROAD

Lakes

Date	Site	TSS	TP	E Coli
6/12/2018	Wendt Lake	500	1220	2419
7/31/2018	Hwy 35	445	1280	
6/23/2020	Big McDonald Lane	236		
7/8/2020	Hwy 35			1120

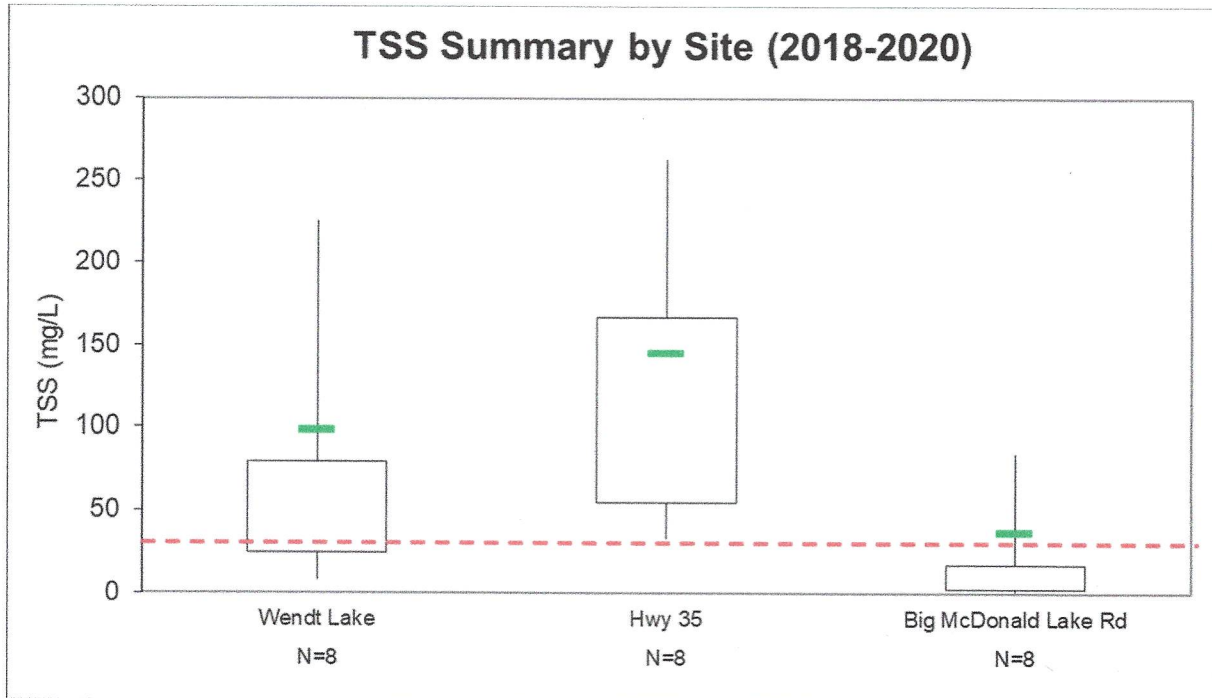


**Figure 4 Sampling Location Map**



**Figure 5 TSS concentrations for each site from 2015-2017.**

The upper and lower edge of each box represent the 75th and 25th percentile of the data range for each site. Error bars above and below each box represent the 95th and 5th percentile of the dataset. The green dash is the average concentration of all data collected. The dashed red line represents the Central River Region TSS Standard (30 mg/L).



**Figure 6 TSS concentrations for each site from 2018-2020.**

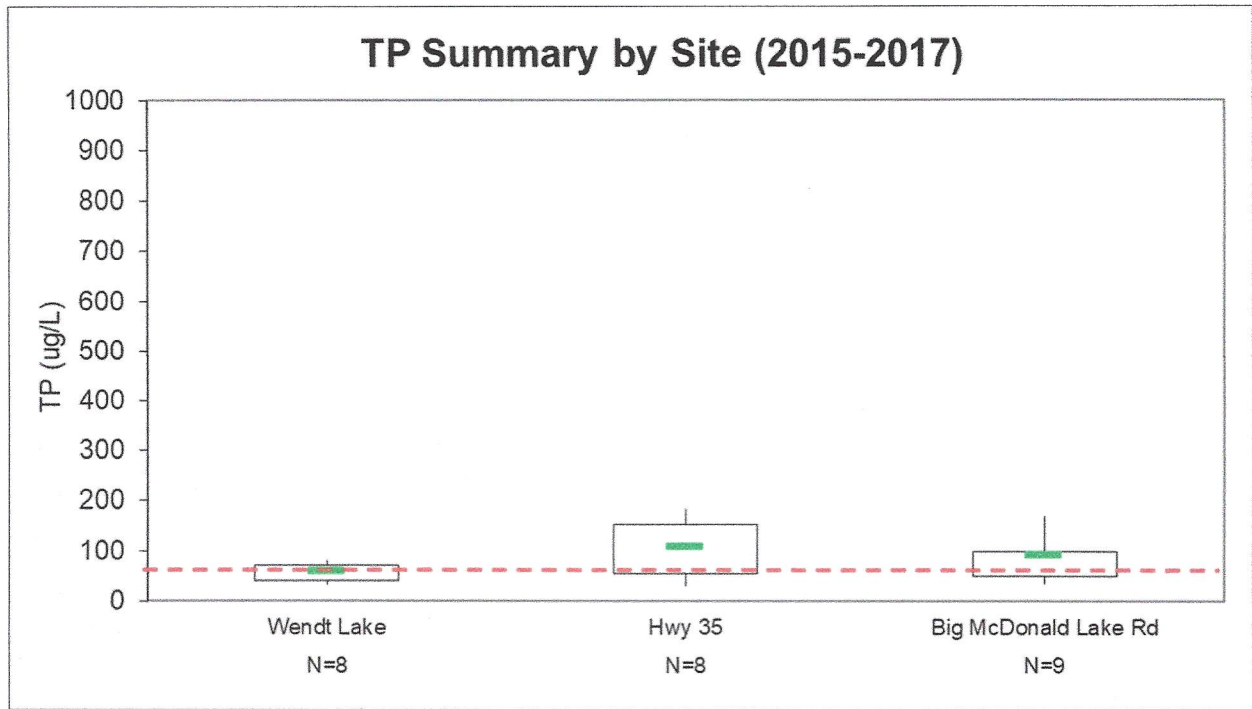


Figure 7 TP concentrations for each site from 2015-2017.

The dashed red line represents the TP Standard for Ditch 25 (65  $\mu\text{g/L}$ ).

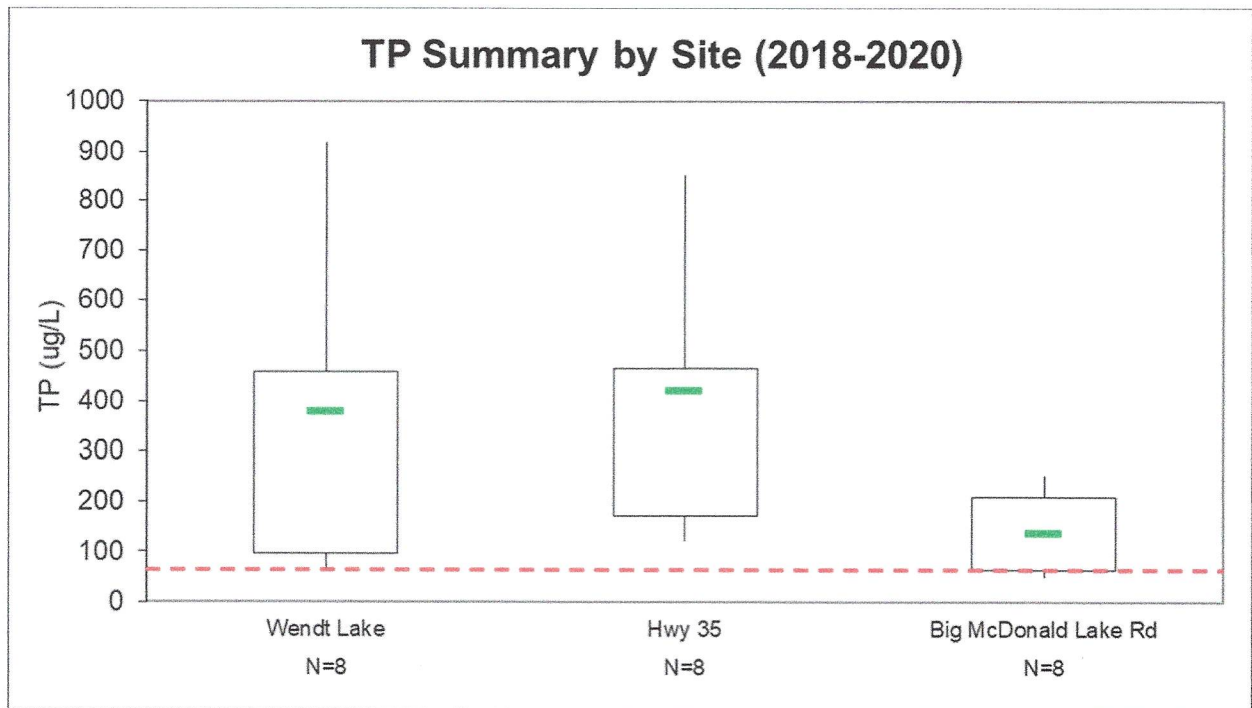
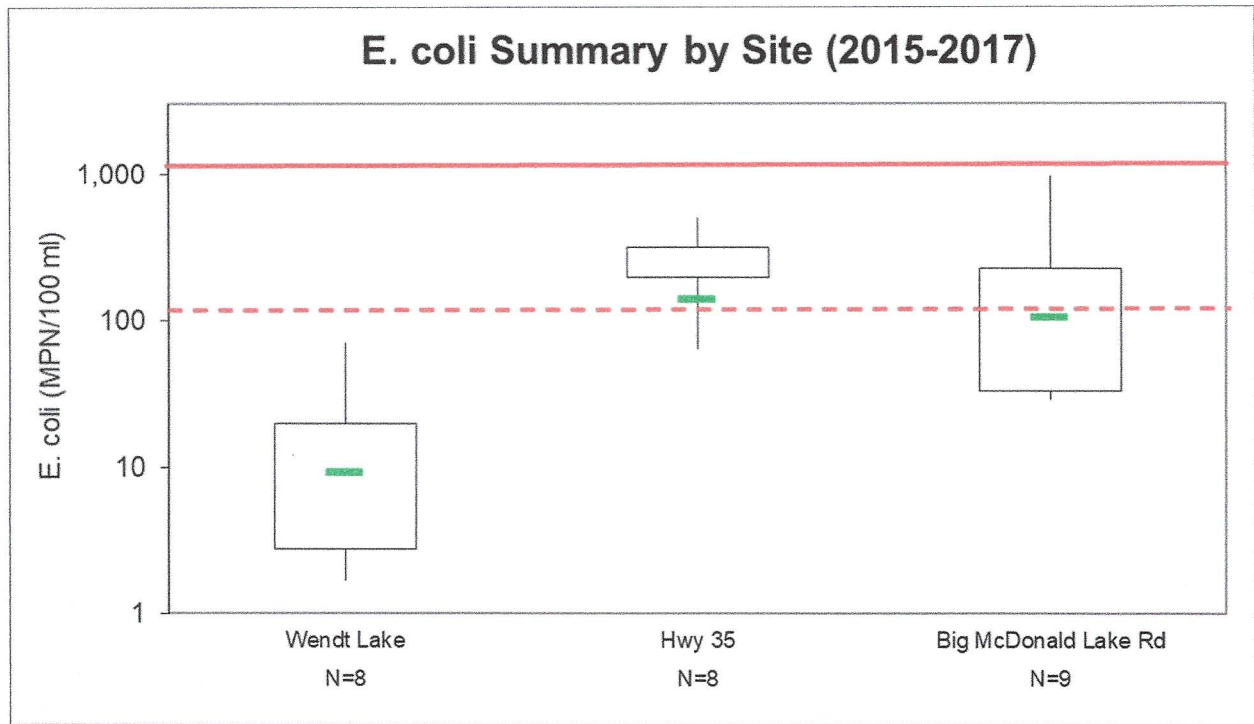
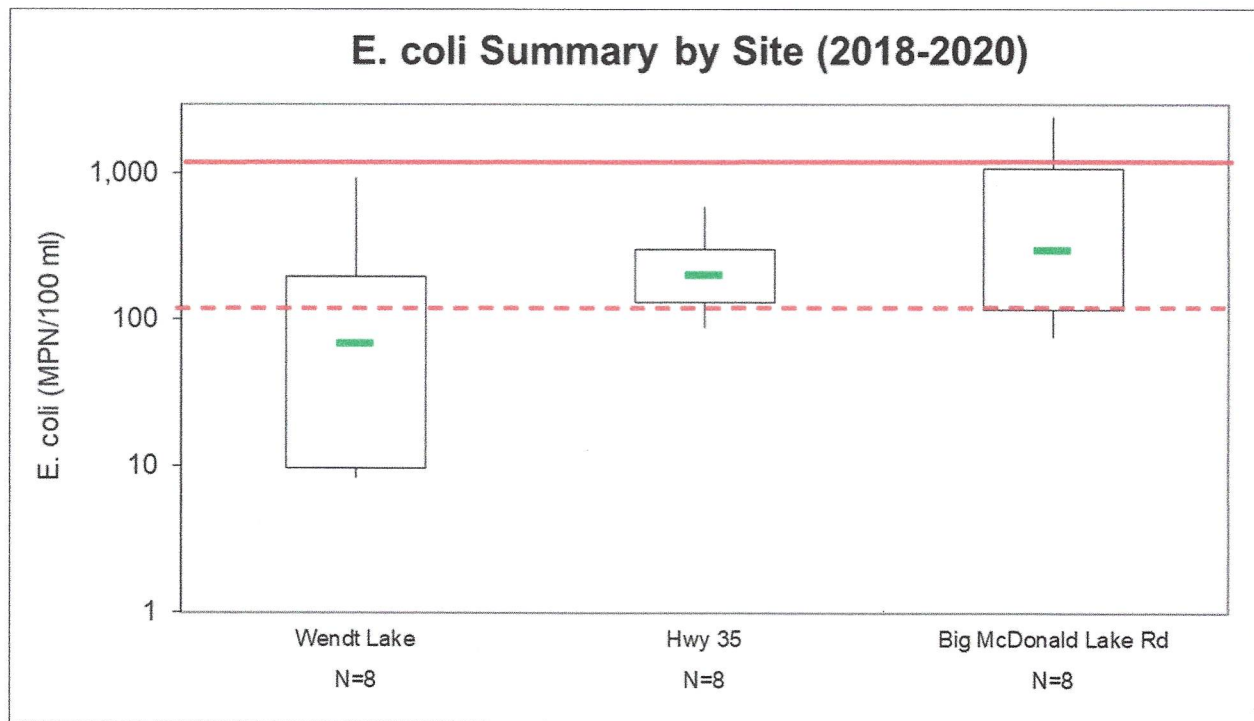


Figure 8 TP concentrations for each site from 2018-2020.



**Figure 9 E. coli concentrations for each site from 2015-2017.**

The green dash is the geomean concentration of all data collected. The dashed red line represents the chronic standard for E. coli in streams/ rivers (126 organisms/100 ml) and the solid red line represents the acute standard (1,260 organisms/100 ml)



**Figure 10 E. coli concentrations for each site from 2018-2020.**

The dashed red line represents the chronic standard for E. coli in streams/ rivers (126 MPN/100 ml)

## 5. Ditch 25 Water Quality Discussion

---

We are not aware of any existing water quality data collected in County Ditch 25 prior to the 2015 ditch cleanout. Water quality sampling by the LID began when the ditch cleanout work was being performed in 2015, and therefore we are unable to evaluate if this work had any impact on water quality conditions in Ditch 25. The Ditch 25 data collected from 2015-2020 shows that TSS, TP, and E. coli concentrations were higher in 2018-2020 compared to 2015-2017. Further, the 2018-2020 data indicate that concentrations of all three parameters are elevated and often exceed state water quality standards.

Wendt Lake is a major driver of downstream water quality in Ditch 25 since it represents the headwaters of the ditch system. The Ditch 25 cleanout work was performed in 2015 and the lake demonstrated relatively low TSS and TP concentrations as levels were at or below state water quality standards for three years (2015-2017) following the cleanout. Beginning around 2018, Wendt Lake flipped to a turbid water state (i.e. high nutrients, poor water clarity) within a relatively short time period. We are not aware of any significant changes in land cover/use or land management practices within Wendt Lake's drainage area around this time. One event that did occur was the replacement of the Ditch 25 crossing pipe downstream of Wendt Lake in the fall of 2016. The crossing pipe serves as the primary outlet control for Wendt Lake and it was noted by the contractor doing the ditch cleanout that the pipe was plugged/buried and the crossing had previous signs of water flowing over the top. This suggests that, prior to 2017, the plugged pipe presented a complete or nearly complete barrier to fish migration between Ditch 25 and Wendt Lake. The previously plugged 6-inch was removed and replaced with a 12-inch diameter CMP, thus restoring a hydrologic connection between Ditch 25 and Wendt Lake.

Migration of common carp from Big McDonald Lake to Wendt Lake via Ditch 25 is one possible explanation for the shift in water quality observed in Wendt Lake beginning around 2018. We are not aware of any current or historic information or local knowledge of the Wendt Lake fishery. Two common carp were sampled during the most recent DNR fisheries survey for Big McDonald Lake in 2017. The average weight of these fish was approximately 10 pounds which suggests that there is a resident population of adult common carp in Big McDonald Lake and the greater McDonald Chain of Lakes. It is likely that some adult carp began migrating into Wendt Lake to spawn in the spring of 2017 following restoration of the crossing pipe in 2016.

Common carp are one of the most widely introduced and invasive species of fish and can dominate the fish biomass of many shallow lakes and wetlands in Minnesota. Adult carp do not protect their eggs after they have been released and fertilized, and therefore carp prefer to migrate and spawn in shallow wetlands and lakes devoid of egg and larval predator fish (e.g. bluegills). The eggs develop and hatch within a week of fertilization and juvenile carp typically stay in or near their nursery habitat for 6-12 months to avoid predation. Female carp can produce several hundred offspring per year and juvenile growth rates are high (~6 inches per year) so they have the potential to become superabundant and impact the ecology of a lake shortly after successful recruitment. High densities of common carp have been shown to reduce native vegetation coverage which can lead to increased turbidity, sediment resuspension, algae, and lower waterfowl populations. Research suggests that these impacts begin to occur at common carp densities of ~100 kg of carp biomass/hectare (89 pounds/acre) (Bajer et al. 2009).

If conditions in Wendt Lake were prime for recruitment (i.e. low abundance bluegills), it would only take a few adult carp to migrate, spawn, and quickly push Wendt Lake's carp population over the impairment threshold. It is recommended that more fisheries information be collected in Wendt Lake to determine if common carp levels currently exceed the impairment threshold and what other fish species are present in the lake.

The water quality monitoring results also suggest that the wetland complex between Hwy 35 and Big McDonald Lake Rd treats a significant amount sediment and phosphorus in County Ditch 25 before it discharges to Big McDonald Lake. Although flow and load measurements have not been collected, mean TSS and TP concentrations (2018-2020) decrease by 75% and 67%, respectively, between Hwy 35 and Big McDonald Lake Rd. These reductions suggest that the wetland complex is providing relatively good treatment of pollutants before discharging to Big McDonald Lake. However, if elevated concentrations and loads continue upstream of Hwy 35, the wetland complex could become overloaded with sediment and phosphorus which can lead to reduced capacity and/or the release of soluble phosphorus from accumulated sediment. Improving water quality upstream of Hwy 35 is the best course of action to ensure that the wetland complex continues to provide good treatment and does not become overloaded.

## **6. Recommendations for Ditch 25**

---

Based on our review of available information/data for Ditch 25, we recommend that the restoration of Wendt Lake be the primary focus for improving water quality conditions in Ditch 25. Protecting the wetland complex between Hwy 35 and Big McDonald Lake Rd should also be a priority for protecting water quality in Big McDonald Lake. Until upstream water quality is restored (i.e. restoration of Wendt Lake), we discourage any hydraulic alterations within the wetland complex (e.g. channelization/cleanout) as this would create a more direct conduit of sediment and nutrient loads from Wendt Lake and Ditch 25 to Big McDonald Lake.

At this time, we recommend that the LID take the following next steps:

- 1) Conduct a common carp assessment in Wendt Lake
- 2) Perform a standard fisheries survey in Wendt Lake
- 3) Continue monitoring water quality in Wendt Lake and Ditch 25 and potentially add a site in the wetland north of Big McDonald Lane.

Each of these recommendations is described below in more detail.

### **6.1 Recommendation: Conduct Common Carp Assessment in Wendt Lake**

---

We recommend conducting a common carp electrofishing assessment per methods of Bajer et al. 2012 to determine whether common carp are contributing to degraded water quality conditions in Wendt Lake. These methods call for at least three individual common carp survey events (i.e. different days) consisting of multiple (three or more) 20-minute electrofishing transects. Each survey event will require a MnDNR permit and follow-up data analysis of the survey results. A general cost estimate for these surveys is provided in Appendix A. If common carp densities in Wendt Lake exceed the impairment threshold (89 pounds/acre), then management of the carp population could be evaluated as a future phase/task. Options to manage carp in Wendt Lake could include, but are not limited to:

- Common carp removals (e.g. seining/netting, rotenone, full or partial lake drawdown)
- Stocking of bluegills and/or other egg and larval predator fish
- Installation of fish barriers at the lake's outlet or other points along Ditch 25
- Modifications to Wendt Lake's outlet structure

6.2 Recommendation: Perform Standard Fisheries Survey in Wendt Lake

It is also recommended that other fish species be assessed in Wendt Lake to determine the presence/absence of egg and larval predator fish as well as other rough fish (e.g. bullheads, fathead minnows) that could negatively impact water quality. To do this, we recommend performing a standard fishery trap and gill net survey according to Minnesota DNR protocols (MnDNR 2017). Due to its small size and shallow depth, a trap net only survey may be the best approach for Wendt Lake as use of gill nets could result in excessive mortality of top predator species if they are present in the system. Survey methods would need to be discussed and worked out with the area DNR fisheries office. A general cost estimate for a standard fisheries survey for Wendt Lake would be is provided in Appendix A.

6.3 Recommendation: Continue Monitoring Water Quality in Wendt Lake and County Ditch 25 and potentially add a site in the wetland north of Big McDonald Lane

We recommend the following changes and additions to the LID's current water quality monitoring activities for Wendt Lake and Ditch 25:

- Increase monitoring frequency at each location to two times per month between May 1 and September 30 (~10 samples total), targeting a mix of high and low flow events. Sampling at this frequency and range of flow conditions will allow for pollutant load estimates and a better understanding of seasonal and weather-driven changes in water quality.
- Move Wendt Lake monitoring location to the middle of the lake (canoe, kayak, or boat) and add ortho-phosphorus, chlorophyll-a, Secchi depth, temperature, dissolved oxygen, pH, GPS coordinates, and lake level (using surveyed benchmark) to the list of monitoring parameters for Wendt Lake. Adding these water quality parameters will help us assess eutrophication in Wendt Lake compared to State water quality standards. Moving the sampling location to the middle of the lake provides a better representation of whole-lake water quality conditions and reduces the chance of sample contamination.
- Add ortho-phosphorus, temperature, dissolved oxygen, pH, water level (using surveyed benchmark), and gauged flow measurements to the list of monitoring parameters for the Hwy 35 and Big McDonald Lake Road Sites. Adding these water quality parameters will allow us to evaluate nutrient cycling in the Ditch 25 wetland complex and whether it is a source or sink of phosphorus from upstream to downstream. Collecting water level and gauged flow measurements will allow us to calculate Ditch 25 pollutant loads for each monitored parameter which are critical inputs for constructing and calibrating watershed and receiving water hydrology and water quality models. They are also critical inputs for evaluating engineering feasibility and design of potential BMPs.
- In order to address some concern expressed with close sample proximity to culverts (potential to experience some sediment mixing due to sampling) an additional site could be added in the wetland between HWY and Big McDonald Lane. Any additional sample locations should be accessed by canoe/kayak or similar to avoid disturbing sediment.
- Flows should be estimated at the time of sampling at the Highway 35 and Big McDonald Lane/Road crossings. It is assumed the LID could collect velocity and depth readings which could be converted to flow by the Moore team.



## 7. Conservation Partners Legacy Grant

Assuming the additional data corresponds to the hypothesis presented herein, the conservation partners legacy grant may be a reasonable approach to compete for project funding. The additional data acquired in this effort will be used to verify the assumption of a carp infestation and if confirmed, provide documentation for the grant application.

In order to apply for this grant several criteria have to be met which include, but are not limited to substantially complete construction plans, environmental review including NHIS documentation, and must show the ability to acquire right-of-way. It may be possible that the County could provide the project right-of-way via the ditch and road corridors, this would need to be determined. The grant has a minimum 10% match required from non-State funds.

As of the date of this report the 2022 cycle had not opened yet so the 2021 dates are being used for estimating schedule as shown below:

**Table 4. Conservation Partners Legacy Grant Key Dates (Previously Cycle)**

Key Event	Date
First day of application acceptance*:	August 1, 2020
End of application acceptance:	September 21, 2020 at 3:00 PM, CST
Selection Deadline 1:	December 14, 2020
<b>IF</b> there were remaining funding	
First day of application acceptance*:	December 14, 2020
End of application acceptance:	February 1, 2021 at 3:00 PM, CST
Selection Deadline 2:	April 16, 2021

\*The CPL staff can do a brief administrative review to ensure the application is complete and eligible for funding if they receive it at least 1 week before the application deadline.

For more grant information on the Conservation Partners Legacy Grant Program refer to <https://www.dnr.state.mn.us/grants/habitat/cpl/index.html>

## 8. References

Bajer, P.G, G. Sullivan, and P.W. Sorensen. 2009. Effects of a rapidly increasing population of common carp on vegetative cover and waterfowl in a recently restored Midwestern shallow lake. *Hydrobiologia* 632: 235-245.

Bajer, P.G. and P.W. Sorensen. 2012. Using Boat Electrofishing to Estimate the Abundance of Invasive Common Carp in Small Midwestern Lakes. *North American Journal of Fisheries Management* 32: 817-822.

Minnesota Department of Natural Resources (MnDNR). 2017. Manual of Instructions for Lake Survey. Fish and Wildlife Division Section of Fisheries Special Publication No. 180. [https://files.dnr.state.mn.us/publications/fisheries/special\\_reports/180.pdf](https://files.dnr.state.mn.us/publications/fisheries/special_reports/180.pdf)

**Big McDonald Lake / OTC Ditch 25  
Water Quality Assessment – Data Review**

**Appendix A Estimated Costs (2021 Dollars)**

Fish Surveys				
Description	Unit	Unit Price	Quantity	Total Price
Standard & Electrofishing Survey and Reporting	Trip	\$10,000	1	\$10,000
<b>Total Fish Survey</b>				<b>\$10,000</b>

Standard Fishery Survey include MnDNR permit application, prep and travel time, equipment costs, net setting/retrieval, fish processing, and reporting for one two-day survey. If additional follow-up assessments are determined to be needed the LID will be contacted regarding the recommendation for additional effort.

Data Review and Pre-Grant Implementation Phase				
Description	Unit	Unit Price	Quantity	Total Price
Administration, and Reporting	Lump Sum	\$1,500	1	\$1,500
2-man Survey Crew	Hour	\$235	8	\$1,880
Agency Coordination (DNR and County)	Lump Sum	\$4,480	1	\$4,480
Evaluation of Implementation Alternatives	Lump Sum	\$6,000	1	6,000
Geotechnical <i>SOILS ENGR BARRIERS</i>	Lump Sum	\$6,500	1	\$6,500
Plans and Report	Lump Sum	\$19,475	1	\$19,475
Summary Meetings and Related Updates	Lump Sum	\$4,040	1	\$4,040
Conservation Partners Legacy Grant Application	Lump Sum	\$5,000	1	\$5,000
<b>Total Pre-Grant Implementation</b>				<b>\$48,875</b>

*2- CARP BARRIERS:  
UPSTREAM  
@ WENDT LAKE  
AND  
1 @ BIG MAC LAKE*

Assumes project will consist of fish barriers and Wendt Lake current carp population mitigation

**Proposed Agreement Subtotal Total \$58,875**

Water Samples				
Description	Unit	Unit Price	Quantity	Total Price
DO/PH Meter	Each	\$1,000	1	\$1,000
TSS	Sample	\$13	40	\$520
TP	Sample	\$15	40	\$600
Ortho-P	Sample	\$15	40	\$600
E Coli	Sample	\$20	40	\$800
Chlorophyll-a	Sample	\$32	10	\$320
Cooler Shipping and handling	Round Trip	\$175	10	\$1,750
<b>Total Water Quality Sampling</b>				<b>\$5,590</b>

Assumes the LID will provide the necessary equipment and labor (assumed \$1,000). Water quality samples will be contracted directly between the LID and 3<sup>rd</sup> party. Additional costs outside of this agreement..

**Estimated Cost to LID \$68,875**