Environment and Natural Resources Trust Fund (ENRTF)
M.L. 2018 ENRTF Work Plan Final Report (Main Document)

Today's Date: March 1, 2024

Date of Next Status Update Report: Final Report

Date of Work Plan Approval: 9/13/2018

Project Completion Date: On or before June 30, 2024

PROJECT TITLE: Adaptive Lake Management Plan—Lake Winona and Lake Agnes

Project Managers: Scott Gilbertson

Organization: Alexandria Lake Area Sanitary District (ALASD)

College/Department/Division:

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Location: This project will impact the Alexandria Lake Area in Douglas County, Minnesota. Specifically, the project is designed to benefit water quality in Lake Winona, Lake Agnes and other down-stream lakes in the Alexandria chain of lakes.

Total Project Budget: $600,000

Amount Spent: $600,000

Balance: $0

Legal Citation: M.L. 2018, chapter 214, article 4, section 2, subd. 04l as extended by M.L. 2020, First Special Session, Chp. 4, Sec. 2 as extended by M.L. 2021 First Special Session, Chp. 6, Art. 5, Sec. 3, Sub 19c [to June 30, 2024]

Appropriation Language:

"$600,000 the second year is to the Board of Water and Soil Resources for a grant to the Alexandria Lake Area Sanitary District for lake management activities, including, but not limited to, alum treatment in Lake Agnes, carp removal in Lake Winona, and related management and reassessment measures that are intended to achieve and maintain compliance with water quality standards for phosphorus and the total maximum daily load for Lake Winona."

M.L. 2020 - Sec. 2. ENVIRONMENT AND NATURAL RESOURCES TRUST FUND; EXTENSIONS. [to June 30, 2021]

I. PROJECT STATEMENT:

The goal of the project is to achieve attainment of state water quality standards in Lake Winona, Lake Agnes and other downstream lakes and facilitate implementation of the Lake Winona Phosphorus Total Maximum Daily Load (TMDL) in a cost-effective manner prioritizing the use of best practices for lake management.

ALASD is presently facing an estimated $14 million cost to upgrade its wastewater treatment infrastructure in order to achieve compliance with a very stringent phosphorus limitation contained in its wastewater permit that is based on the water quality standards for Lake Winona and the Lake Winona Phosphorus TMDL. The District has pioneered several wastewater treatment optimization techniques and has nearly achieved compliance with the phosphorus limit with its existing technology; yet, to achieve perfect compliance the District would be required to perform the costly infrastructure upgrade to its facility. The $14 million-dollar infrastructure upgrade would be eligible for up to $7 million dollars of state grant funds and the additional $7 million-dollar cost would be passed on to the District's customers in Alexandria and the surrounding communities.

However, the most recent water quality data and lake management science demonstrates that even if ALASD makes the costly investment in infrastructure, it will not achieve the desired water quality outcome because of the existing carp infestation in Lake Winona. Because the District was concerned about spending limited state and local resources on infrastructure upgrades that would fail to achieve the water quality objectives established by the state, ALASD hired a top lake scientist to study alternatives that could achieve standards in Lake Winona and Lake Agnes—without performing costly infrastructure upgrades. The District's scientist developed a lake management plan that if implemented successfully will very likely achieve water quality standards in Lake Winona, Lake Agnes and potentially Lake Henry and other downstream lakes—without additional infrastructure upgrades from the District.

To address water quality in Lake Agnes which receives discharge from Lake Winona, the District intends to complete an alum treatment to reduce phosphorus loading from lake sediments. For deep lakes like Lake Agnes, the primary restoration approach is to reduce phosphorus load which in turn reduces algal growth and increases water clarity. One of the major sources of phosphorus to lakes is often from lake sediments known as internal phosphorus loading. Monitoring data suggests that internal phosphorus loading provides as much as 1,400 pounds of phosphorus to Lake Agnes annually, approximately 35% of the annual phosphorus load to the lake. Reducing the internal phosphorus load will result in Lake Agnes meeting state water quality standards.

Restoring shallow lakes is more complex, because water quality is impacted by biological conditions as well as phosphorus loading. Shallow lakes exist in either a clear, plant dominated state or a turbid, algae dominated state. Lake Winona currently exists in the turbid, algae dominated state with minimal aquatic plants. Carp are one of the major drivers of turbid water quality and must be managed before aquatic plants and the clear water state can be established. Therefore, this project focuses on carp management and plant establishment in Lake Winona to maximize the impacts of reducing phosphorus loading. To our knowledge, no carp infested lake has been restored through nutrient reductions alone. Rather, shallow lake managers such as Ducks Unlimited and the Minnesota DNR focus primarily on driving the lake to the clear state though invasive carp management and whole lake drawdown to establish plan communities.

The $600,000 appropriation to the District will go to fund implementation of the District's adaptive lake management plan. If the plan is successful it will save the state and local community millions of dollars, lead to attainment of water quality standards in Lake Winona, Lake Agnes, and Lake Henry, while facilitating implementation of the Lake Winona TMDL. Further, this project serves as a model for flexible and cost-effective approaches to addressing compliance with state and federal water quality regulations.

II. OVERALL PROJECT STATUS UPDATES:

Updates will be provided every 6 months (July 1 and January 1) commencing July 1, 2019. A final report will be submitted within 6 months of completion of the project.

First Update July 1, 2019

The project moved along smoothly in the first period of the grant with sediment coring and fish population assessment planning being the primary focus of this period. Sediment cores were collected from South Pond, North Pond, and Lake Agnes to determine the appropriate alum dose for the lake and ponds. Planning for the fish surveys included ordering equipment, determining monitoring locations, requesting permits, and scheduling field data collection activities. The District also help a public meeting to describe the project and get public input at the start of the project. The District has also been working closely with the City of Alexandria on the project.

Amendment request July 1, 2019
We request an amendment to extend the completion dates of outcomes 4-8 in Activity 1 by one year to allow the alum treatment additional time to work.

Amendment request approved by LCCMR on September 16, 2019.

Second Update January 1, 2020

The primary activities during the second period of the grant focused primarily on the common carp assessment of the Winona-Agnes-Henry chain of lakes. Several field work tasks were completed during the 2019 open water season, focusing on collecting pre-treatment quantitative data on the current state of aquatic vegetation and Common Carp populations within the Winona/Agnes/Henry chain of lakes. Study of Common Carp movements was also initiated. MNDNR standard sampling protocols were employed to survey aquatic vegetation in Lakes Winona, Henry, and Agnes. Focused assessment of the abundance and biomass density of common carp with a modern electrofishing-based method developed at the University of Minnesota was conducted for Lake Winona and Lakes Agnes/Henry. In addition, two types of fish tags were implanted in Common Carp that were then released to gather data relevant to the management decision making process. Activities related to the active and passive tracking of these tags was conducted.

Draft plans and specifications for the alum treatment on Lake Agnes were also developed to procure a contractor tor the alum application. Plans and specifications will ensure a competitive bid process and a qualified contractor to complete the application in Fall of 2020. A bid request is planned for Spring of 2020.

Update June 18, 2020

Project extended to June 30, 2021 by LCCMR 6/18/20 as a result of M.L. 2020, First Special Session, Chp. 4, Sec. 2, legislative extension criteria being met.

Third Update July 1, 2020

The final alum dosing recommendation and application area was finalized from its draft form utilizing the sediment chemistry data from the sediment cores collected in the first update. The Plans and Specifications for the competitive bid process for the Lake Agnes alum treatment which were being drafted during the second update were finalized. The finalized bid package was published for Request for bids in July of 2020 for a Fall 2020

application. The request for bids was published online and in the local newspaper. After a contractor is selected from the competitive bid process the alum application will take place in Fall 2020.

Amendment Request - September 2, 2020
We request an amendment to change the project manager from Joe Bischof to Anne Wilkinson.
Amendment Approved by LCCMR 10/29/2020

Fourth Update January 1, 2021

The alum application contractor was selected from the request for bids. The initial half dose was applied to Lake Agnes the week of September 14, 2020 according the specifications in the bid request.

A physical barrier is proposed that will consist of a pivoting grate inside a precast box culvert section. The barrier is designed to optimize the combination of a.) allowing some level of native fish passage while blocking mature carp passage, b.) maintaining public access to shore fishing, c.) maintaining lake hydraulics, and d.) providing a structure that is relatively low maintenance. The plans and specifications are 90% complete. USACE permit has been obtained. DNR permit has been applied for, and in final negotiation phase of special conditions. The barrier is expected construction is quarter one of 2021.

Amended February 5, 2021
LCCMR have amended the work plan to align with previously approved covid extension and pending legislative action to extend appropriation end date to 2024. To align project management with LCCMR practice (one project manager from organization receiving funds) and in an effort to be consistent across projects, the project manager has been changed to Scott Gilbertson (original project manager).

June 30, 2021 Legislative Amendment

The original work plan approval to extend the appropriation end date to June 30, 2024 and subsequent legislation extension has been passed by the legislature on June 26, 2021 and signed into law on June 29, 2021.

Amendment approved by legislature and governor 6/29/21

Fifth Update July 1, 2021

The carp barrier was installed just downstream of the culvert that connects Lakes Winona and Agnes in April 2021. The carp barrier consists of a 4-foot by 8-foot precast concrete channel with a fabricated metal grate. Riprap berms block the rest of the channel from fish passage. To date, significant maintenance has not been required, and numerous carp have been observed blocked by the barrier, attempting to swim upstream into Lake Winona.

Next quarter, an updated population estimate of lake Winona following the installation of the carp barrier will be conducted via a carp catch per unit effort. In addition, a radio telemetry survey will be conducted to determine if any of the preexisting radio tags are still located in Lake Winona. In the event that there are not enough radio tags in lake Winona up to ten additional carp with radio tags will be surgically implanted. The purpose of the radio tag insertions is to aid the commercial fishermen in location carp aggregations to maximize catch rates. This method is also known as the “judas method”. Periodic radio telemetry surveys will be conducted leading up to the proposed commercial seining event to located and determine where carp aggregations exist.

Sixth Update January 1, 2022

Once the barrier was installed, the next phase of the management plan is attempting carp removals in an effort to reduce the carp biomass in Lake Winona to the management goal density of less than 133 lbs/ac. Using the CMR model and extrapolating the data following the commercial seining removal event the biomass density within Lake Winona was reduced from a population estimation of 550 lbs/acre to about 404 lbs/acre for a reduction of 146 lbs/acre. To meet the goals of the ALMP for biomass reduction (i.e.150 kg/ha or 133 lbs/ac), a further 271 lbs/ac need to be removed.

Stantec staff took follow up sediment cores within the application area. The data from these cores will be used to prescribe the second alum dose later this spring.

Seventh Update July 1, 2022

The second and final dose of is scheduled for the fall of 2022. Stantec staff took sediment cores last fall and the data was analyzed. The sediment cores should an average % decrease of internal P load of 64% after the first dose.

Carp surveys in support of the carp barrier and compliance with public waters permit will be completed by August 31, 2022. A second and final carp removal event will take place in the fall or winter of 2022/2023.

Eighth Update January 1, 2023

The second and final alum dose was applied to Lake Agnes on September 20-22, 2022.

The final carp removal was completed from Lake Winona in November 2022.

Amendment request January 1, 2023

We are requesting funds be shifted from the University of Wisconsin-Stout budget line to Alum applicators budget line.

- University of Wisconsin-Stout budget would be reduced by $11,267 to a revised budget of $38,733.
- Alum applicators budget would increase by $11,267 to a revised budget of $301,267. These changes are being requested because the alum application estimate was lower than the application cost. Budget from the University of Wisconsin Stout can be reduced because the results of the first sediment analysis provided an application area. Thus, follow up cores are only taken in the application area which requires less cores than was originally estimated. There is enough budget in the University of Wisconsin Stout budget line to cover the remaining sediment cores.

We are requesting funds be shifted from the Commercial fisherman budget line to Professional/Technical/ Service Contract budget line.

- Commercial Fisherman budget would be reduced by $7,382 to a revised budget of $42,618.
- to Professional/Technical/ Service Contract budget would increase by $7,382 to a revised budget of $207,882.

These changes are being requested because the carp removal activities are completed and more budgeted is needed for the post management activities and adaptive management summary.

Amendment Approved by LCCMR 1/18/2023.

Ninth Update June 30, 2023

This update includes the results and discussion from the Winona Chain of Lakes Adaptive Management Progress Report, split into the specific activity sections and summarized in the Table below.

Activity	Date	Results
Alum Treatments in Lake Agnes		
Alum Treatment 1	September 2020	Approximately 61% reduction in internal P loading compared to pre-treatment conditions (based on laboratory incubation of sediment cores)
Alum Treatment 2	September 2022	Second half dose applied. Sediment cores will be collected in 2023 to assess the overall reduction in internal P loads.
Carp Management in Lake Winona		
Barrier Installation	April 2021	Post-construction common carp population surveys showed that the existing population in Lake Winona is comprised of mature individuals with no evidence of successful recruitment since installation. May 30-31, 2022. During extremely high-water levels due to late spring and intense rainfall, some carp were observed migrating over the rip-rap adjacent to the barrier. Additional rip-rap will be added in spring 2023 to raise elevation to prevent future migration during high-water levels.
Commercial Seining Event 1	October 2021	4,918 individual carp removed (~31,131 lbs)
Carp population survey and biomass estimation	August 2022	Carp population surveys were conducted in Lakes Winona, Agnes and Henry as a requirement of the Public Waters Permit. See Carp Population Management discussion below for details.
Commercial Seining Event 2	October 2022	1,611 individual carp moved (~ 8,460 lbs)

Additionally, the Winona Chain of Lakes Adaptive Management Progress Report summarized the progress to attainment of the management plan goals, summarized below.

Requirements and Goals	Activities	Progress	Outstanding Tasks
Adaptive Lake Management Plan			
Attain water quality standards (WQS) in Lakes Winona, Agnes and Henry	Multiple activities described throughout this memo.	Lake Winona is not meeting WQS Lakes Agnes and Henry are meeting WQS	Continue Plan implementation to achieve WQ compliance in Lake Winona
90% reduction of internal P load in Lake Agnes	Lake Agnes alum treatment – full application completed.	61% reduction of internal P load after first half treatment	Collect sediment cores from Lake Agnes in 2023 to estimate internal P load reduction after both alum applications
Achieve carp population biomass of 133 lbs/ac (150 kg/ha) in Agnes, Henry, and Winona	Carp tracking, design and installation of carp barrier and conducted two commercial seining events	39,630 lbs of carp removed in two events; CPUE and CMR surveys estimate that the current carp density in Lake Winona is 550-1165 lbs/ac 2022 population surveys estimate biomass in Lakes Agnes and Henry approximate 165 lbs/ac	Continue Plan implementation to goal attainment. Add additional rip-rap to carp barrier to prevent migrations during high water level
Improved SAV	Reduce carp density to target goal	SAV have not yet been surveyed following two carp removal events	SAV survey to be conducted in 2023

ALASD has invested significant effort into the improvement of the Winona chain of lakes through implementation of the Adaptive Lake Management Plan. Several Plan activities have been implemented since 2020 including carp tracking and surveys, installation of a carp barrier between Lakes Winona and Agnes, implementation of the carp barrier operations and maintenance plan, two commercial seining events, two alum applications in Lake Agnes, and ongoing water quality monitoring. A summary of the outcomes and recommendations is provided below.

- A full alum treatment has been completed in Lake Agnes with a half-dose application in 2020 and the remaining half-dose in 2022. Post-treatment sediment cores collected in 2021 showed an estimated 61% reduction in potential internal P loading in Lake Agnes sediments. Sediment cores will be collected in 2023 to evaluate total load reductions following the second application.
- The carp barrier has been functioning as intended with the only known exception of the observed migration during high-water levels on May 30-31, 2022. Stantec, ALASD and MnDNR determined that the appropriate mitigation step is to add additional rock to the carp barrier berm to raise the elevation slightly but still comply with the approved design elevation. This will be completed in Spring 2023.
- Despite two carp removal events in Lake Winona, carp population density remains above the target biomass threshold of 133 lbs/ac. The second removal event resulted in a much lower amount of biomass removed compared to the first event. The commercial fisherman and WSB, the carp removal subcontractor, do not expect that the commercial seining technique will result in any more significant biomass removal due to challenges with the seine snagging large woody debris on the bottom and carp potential exhibiting gear avoidance.

- The 2019 SAV survey indicated extremely low plant density and diversity. Sago pondweed was the only species found in four locations (including one location in the south pond). Stantec will complete another SAV survey in 2023 and compare to 2019 conditions.
- Water quality has not changed in Lake Winona in recent years, but Lakes Agnes and Henry appear to be meeting water quality standards and may be considered for delisting in the near future.

Tenth Update January 1, 2024

All project tasks have now been completed. Since the last update in July 2023, the following activities have been completed.

- Stantec completed a submerged aquatic vegetation (SAV) survey in Lake Winona. No SAV taxa were observed in Lake Winona.
- Stantec completed three carp surveys in support of the Public Waters Permit for the carp barrier. While the surveys were not included in the work plan for this grant, we have included the data as it pertains to the overall project results. Common carp density is still well above the target threshold.

Overall Project Outcome and Results

Lake Winona is a shallow lake in Alexandria, MN that receives discharge from a wastewater treatment facility operated by the Alexandria Lakes Area Sanitary District (ALASD) as well as stormwater from the City of Alexandria. Lakes Winona, Agnes and Henry are known collectively as the Winona Chain of Lakes which ultimately flow into Lake Le Homme Dieu. The lakes have been negatively impacted by excess nutrients and high densities of common carp (carp), which contribute to poor water quality conditions.

Reducing nutrient loads from multiple sources and reducing common carp density in Lake Winona is necessary to meet water quality standards in the Winona Chain of Lakes. In 2018, ALASD was awarded a Legislative-Citizen Commission on Minnesota Resources (LCCMR) grant to implement an adaptive lake management plan (Plan) for the Winona Chain of Lakes. The primary goals and activity of the grant work plan includes the following:

1. Alum treatment in Lake Agnes to reduce the internal phosphorus load by 90%.
2. Reduce carp density in Lake Winona to sustainable levels to prevent adverse impacts on water quality and aquatic vegetation.

Several management actions have been implemented to-date through the LCCMR grant, which included two applications of alum to Lake Agnes, tracking carp movement among the lake chain, installation of a carp barrier between Lakes Winona and Agnes, and two carp removal events that removed over 6500 individuals from Lake Winona. The alum treatment successfully reduced internal phosphorus loading by over 90%. In combination with ALASD's efforts to keep phosphorus levels below their permit limit in the discharge, Lakes Agnes and Henry are currently meeting water quality goals. Unfortunately, common carp density in Lake Winona remains high. Nutrients and carp are common problems in many Minnesota lakes, which require significant effort and resources to reduce for water quality improvement.

III. PROJECT ACTIVITIES AND OUTCOMES:

The overarching goal is to reduce and manage common carp in Lake Winona chain of lakes to reestablish submersed aquatic vegetation and improve water clarity and achieve water quality standards in Lake Winona, Lake Agnes and Lake Henry. The three principal project activities are as follows:

1. Alum treatment in Lake Agnes.
2. Control carp in Lake Winona to prevent adverse impacts on water quality and submersed aquatic vegetation.
3. Switch lake Winona from the turbid water, algae dominated state to the clear, plant dominated stated and achieve state water quality standards.

Please note that the completion dates listed for the outcomes are subject to final approval from the Minnesota Pollution Control Agency (MPCA) and some of the completion dates and project activity timelines may be adjusted based on MPCA's input and development of the District's National Pollutant Discharge Elimination System (NPDES) permit.

PHASE 1: Alum Treatment in Lake Agnes

Description: There are several steps for completing an alum treatment starting with collecting sediment cores to identify mobile phosphorus concentrations in the sediment, followed by dose determination, plans and specifications and application management. Table 1 outlines a preliminary schedule for each of the steps. To determine the appropriate areas and amounts of alum to be applied in Lake Agnes and two upstream ponds, intact sediment cores will be collected to determine vertical profiles of mobile phosphorus for alum dosage cost estimates. Sediment cores will be collected from three points in Lake Agnes and one each in the North and South Ponds. Once the appropriate amount of alum and application areas are determined, a forma bidding process will be initiated that includes the development of plans and specifications, bidding, and contract management. Additionally, contractor management is necessary to ensure that the alum treatment is completed according to the specifications. The alum treatment will be completed in two applications with half of the dose applied in the first application and the remaining dose in the second application to ensure peak binding efficiency of the aluminum and mobile phosphorus. Sediment cores will be collected to determine if the sediment goal of 90% reduction in mobile phosphorus is accomplished. Sediment monitoring between applications allows for an adaptive approach where adjustments to the application can occur to ensure effectiveness.

ACTIVITY 1 ENRTF BUDGET: $ 405,000

Outcome	Completion Date
1. Collection of analysis of lake sediment cores (3 locations in Lake Agnes, 1 in North Pond, 1 in South Pond) to determine sediment phosphorus release, quantify the mass of mobile phosphorus in the sediment, and determine the area contributing to internal phosphorus loading.	May, 2019
2. Dose determination: the results sediment analysis will be used to determine the amount of alum needed and application areas	July, 2019
3. Plans specifications, bid and award: Once the application approach is determined, plans and specifications will be developed and the project will be competitively bid.	August, 2019
4. Initial Application: Half of the alum prescribed will be applied by the selected contractor with oversight from the designing engineer. Field management includes ensuring that alum quantities and purity is as specified, application occurs as prescribed, and pH is managed to protect aquatic life.	September/October 2020

5. Follow-up sediment monitoring: Sediment cores will be collected from the same sites as the initial analysis to determine if sediment targets (90% reduction in mobile P) are achieved. The second application will be adjusted if necessary.	September 2021
6. Second Application: Half of the alum prescribed will be applied by the selected contractor with oversight from the designing engineer. Field management includes ensuring that alum quantities and purity is as specified, application occurs as prescribed, and pH is managed to protect aquatic life.	September/October 2022
7. Follow-up sediment monitoring. Sediment cores will be collected from the same sites as the initial analysis to determine if sediment targets (90% reduction in mobile P) are achieved. Results will be used to determine if future applications are necessary.	September 2023
8. Completion of the project will result in a 90% reduction in internal loading in Lake Agnes which results in a 1,260 pound reduction in phosphorus loading to Lake Agnes.	December 2023

Project updates inclusive of each relevant activity will be made consistent with section II.

First Update July 1, 2019

Sediment cores were collected from Lake Agnes, North Pond, and South Pond on February 11, 2019. Cores were delivered to the University of Wisconsin-Stout and analyzed for sediment phosphorus release and sediment chemistry. The results were used to determine that and alum dose of 144,354 gallons of alum in depths greater than 15 feet is required to stop sediment phosphorus release in the lake. The District held a public hearing on June 18, 2019 to order the alum treatment and direct the development of plans and specifications. However, results suggested that a one-year delay from the original plan in the application to allow carp management will help the alum treatment last longer.

Second Update January 1, 2020

Draft plans and specifications were developed during this grant period to procure a contractor for the alum application. Plans and specifications include two applications (Fall 2020 and Fall 2022) applying half of the dose in each application. Plans and specifications are currently under review and a request for bids is planned for Spring 2020.

Third Update July 1, 2020

The final alum dosing recommendation and application area was finalized from its draft form utilizing the sediment chemistry data from the sediment cores collected in the first update. The Plans and Specifications for the competitive bid process for the Lake Agnes alum treatment which were being drafted during the second update were finalized. The finalized bid package was published for Request for bids in July of 2020 for a Fall 2020 application. The request for bids was published online and in the local newspaper. After a contractor is selected from the competitive bid process the alum application will take place in Fall 2020. Outcome 3 has been completed.

Fourth Update January 1, 2021

A qualifying contractor was selected from the request for bids. The initial half dose for the alum prescribed was be applied by the selected contractor the week of September 14, 2020 with oversight from the design engineer. Field management included ensuring that alum quantities and purity is as specified, application occurs as prescribed, and pH is managed to protect aquatic life. The application was completed according to the specifications in the bid. Objective 4 has been completed.


HAB
AquaticSolutions
Lake Henry
Lake Agnes
Central Lakes Trail
2nd Ave W
3rd Ave E
4th Ave W
4th Ave E
Google Earth
©2020 Google
Lake Agnes
Application Coverage Map
Aluminum Sulfate applied at 996 gallons/acre
September 15-17, 2020

Fifth Update July 1, 2021

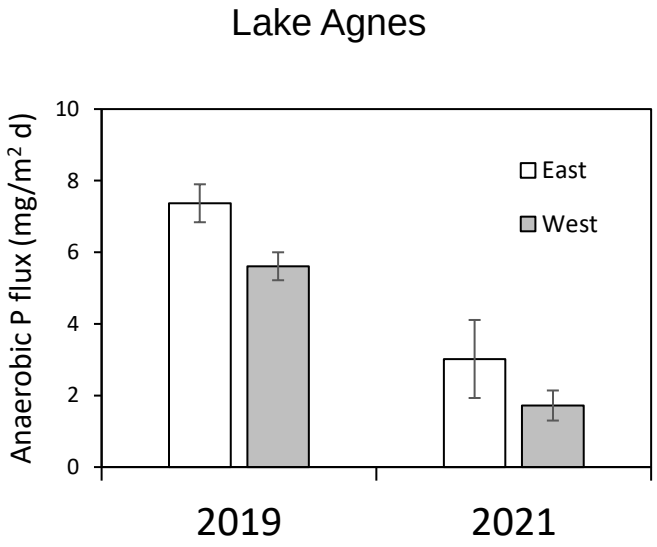
No tasks were completed for this activity. Follow up sediment cores will be taken in Fall 2021 to prescribe the dose for the second alum application for the fall of 2022.

Sixth Update January 1, 2022

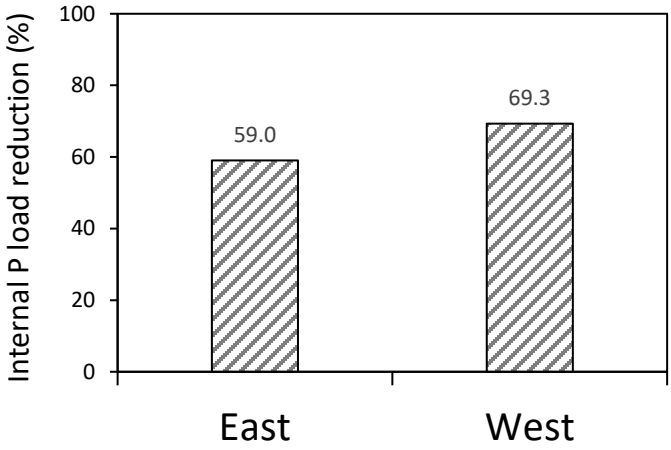
In anticipation of the second alum treatment, Stantec staff took follow up sediment cores within the application area and delivered them to be analyzed by UW-Stout for sediment chemistry and release rate. We collected 10 sediment cores from two locations within the application area. The data from these cores will be used to prescribe the second dose of alum treatment to come this spring.

Seventh Update July 1, 2022

The second and final dose of is scheduled for the fall of 2022. Stantec staff took sediment cores last fall and the data was analyzed.



The anaerobic P flux was significantly reduced from the pre-treatment samples. This metric illustrates the potential P -release from the sediments in anaerobic conditions and it a proxy for internal loading when applied of the anoxic zone and the anoxic period of Agnes lake. The sediment cores should an average % decrease of internal P load of 64% after the first dose.



Because of the positive response in internal load reduction, the second dose will remain the same as the first dose. The alum application is under contract and will completed fall of 2022.

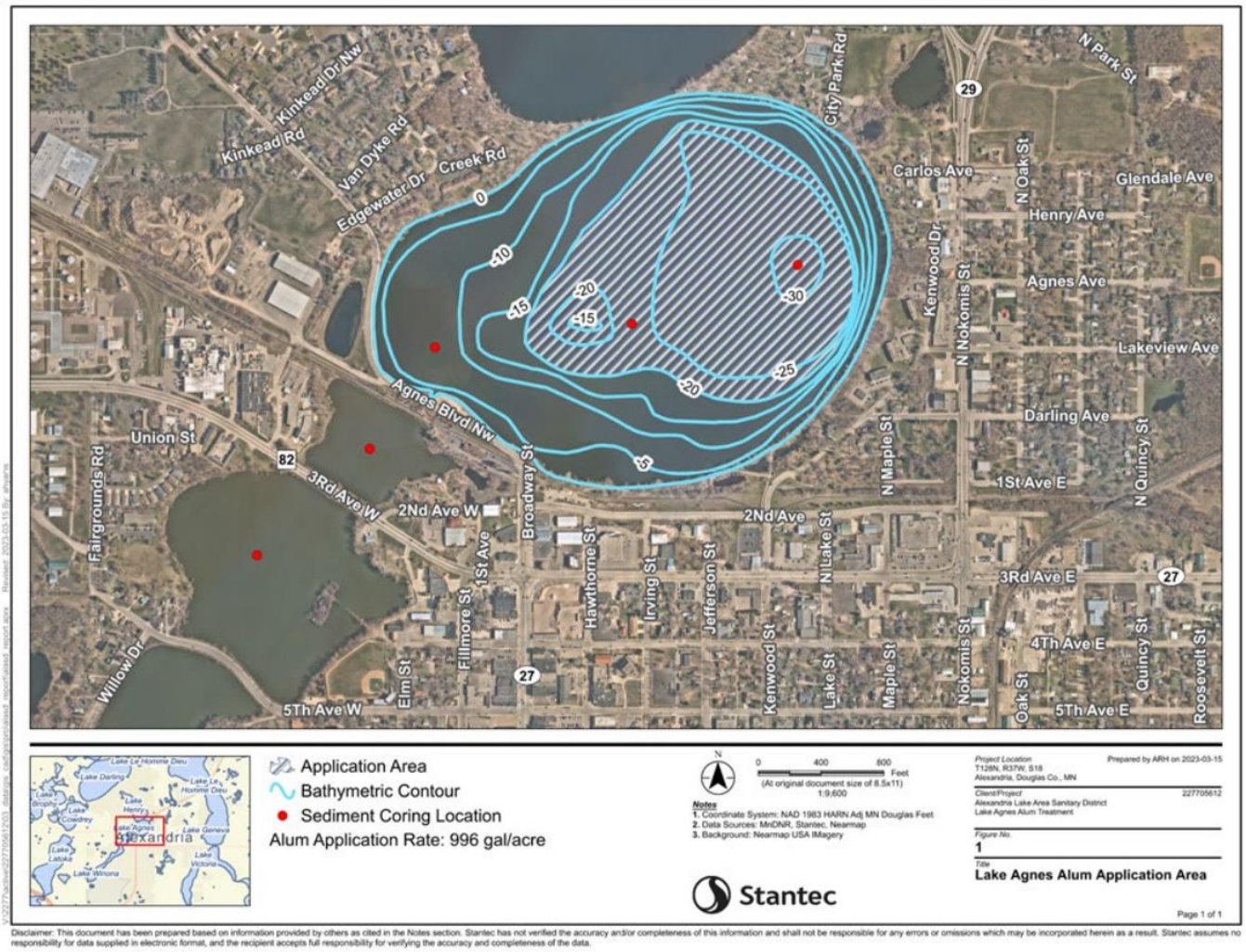
Eighth Update January 1, 2023

A qualifying contractor was selected from the request for bids. The final half dose for the alum prescribed was be applied by the selected contractor of September 20-22, 2022 with oversight from the design engineer. Field management included ensuring that alum quantities and purity is as specified, application occurs as prescribed, and pH is managed to protect aquatic life. The application was completed according to the specifications in the bid. Objective 7 has been completed.

Ninth Update June 30, 2023

The following paragraphs are an excerpt from the Winona Chain of Lakes Adaptive Management Progress Report and summarize the activity 1 results to date.

Sediment cores were collected in 2019 from shallow, mid-depth and deep zones within Lake Agnes as well as the North and South Ponds that exist between Lakes Winona and Agnes (Figure 4-1). Sediment core results are briefly described below.



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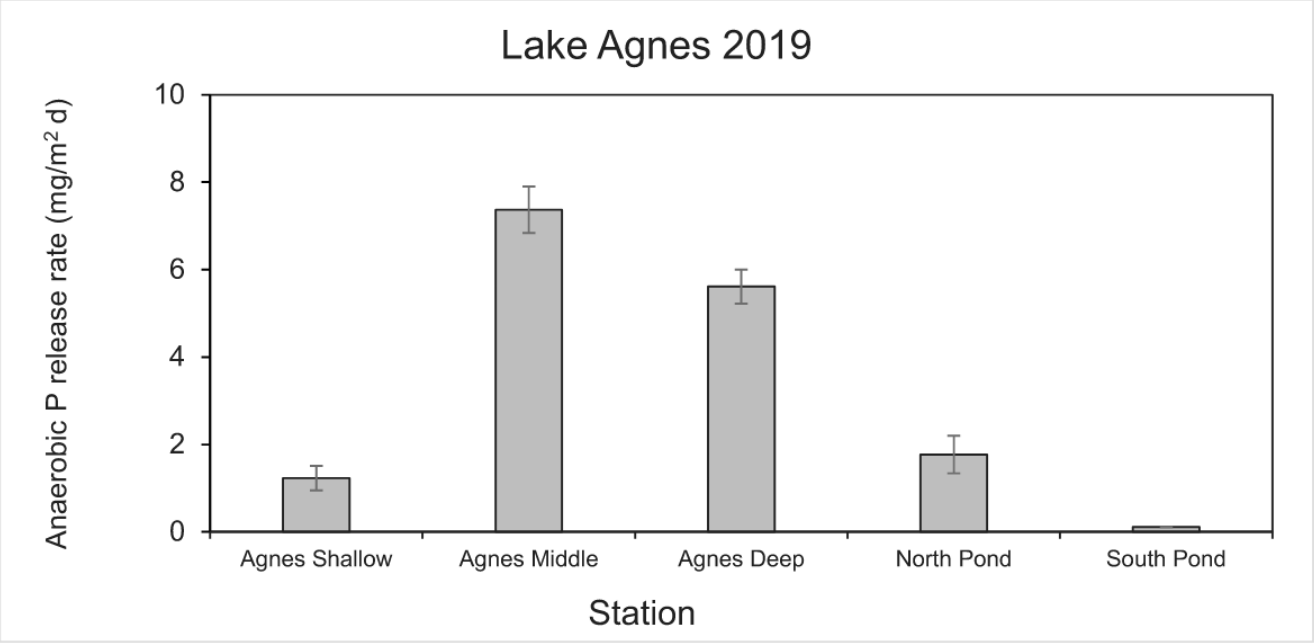
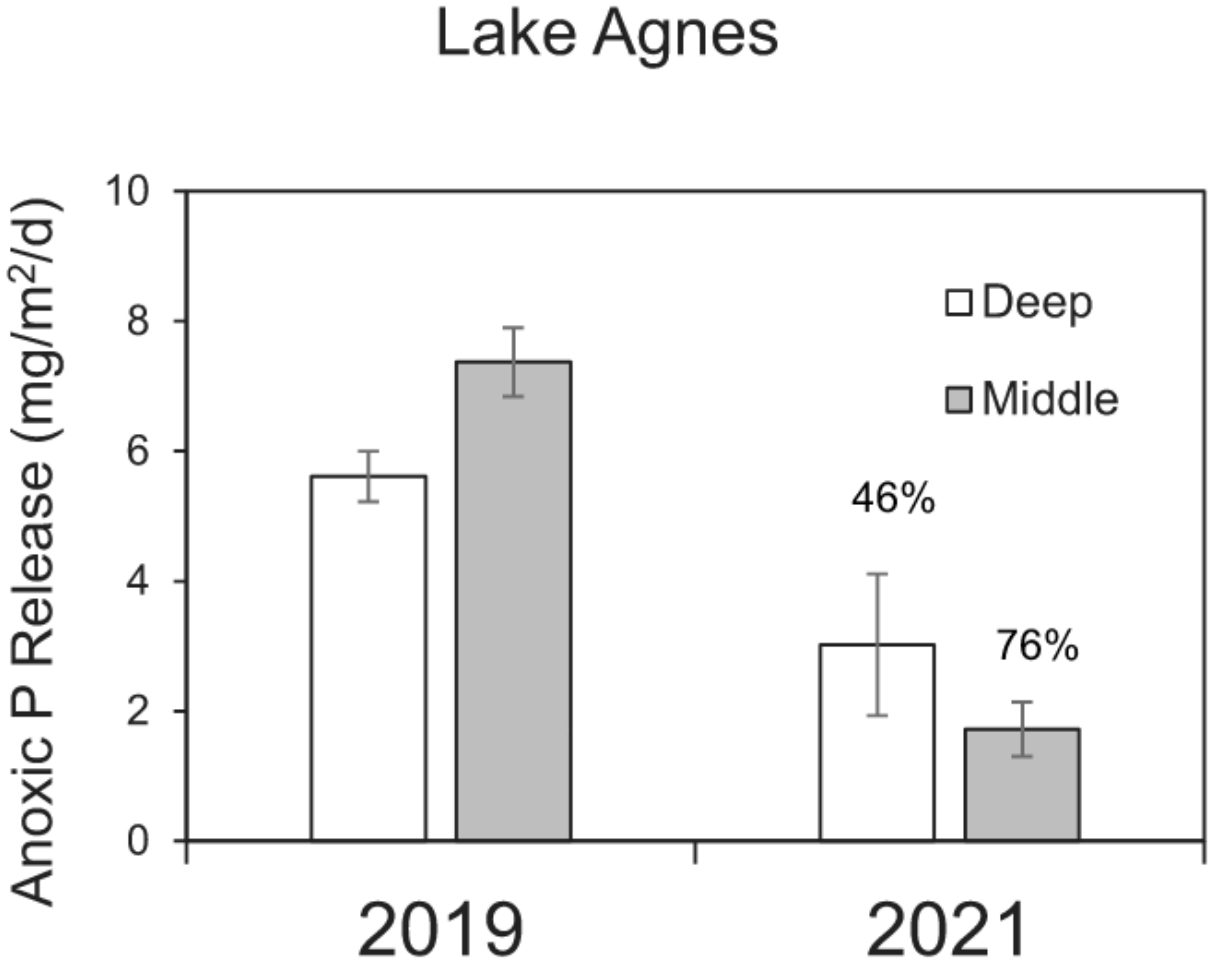
Sediment cores were analyzed at the University of Wisconsin – Stout for determination of sediment P release rates under anoxic conditions and quantification of the fraction of sediment P pools that are considered mobile and likely to be released from sediments. The sediment release rates are used to determine treatment area while the P fractionation is used to determine the alum dose. The analyses determined that the highest rates of P release were in the mid-depth (20 ft), and deep (30 ft) zones of Lake Agnes with lower rates observed in the shallow zone (5 ft) and North and South Ponds. Therefore, the strategy determined most appropriate for Lake Agnes was to apply alum to the mid-depth and deep zones which correspond to the treatment area delineated in the Figure above. In addition, the application strategy recommended that the alum dose be split into two applications.



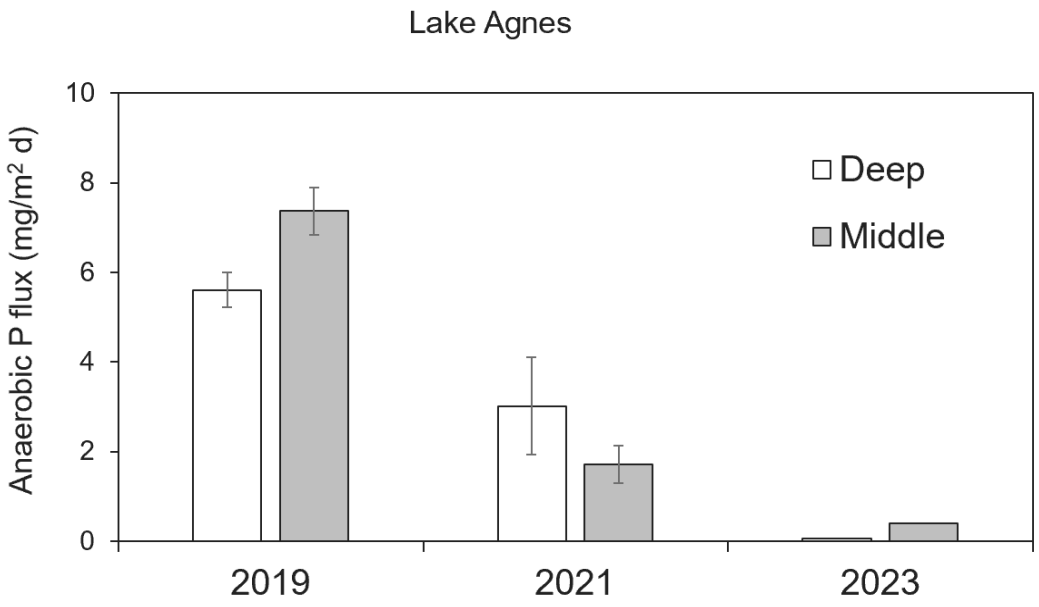
The recommended alum dose for Lake Agnes was 129,424 gallons to be applied over 65 acres, split evenly into two applications. The first application was initiated the week of September 14, 2020, where 64,712 gal of alum was applied to the target area shown in (Figure 4-1) which included areas ≥ 20 feet water depth.

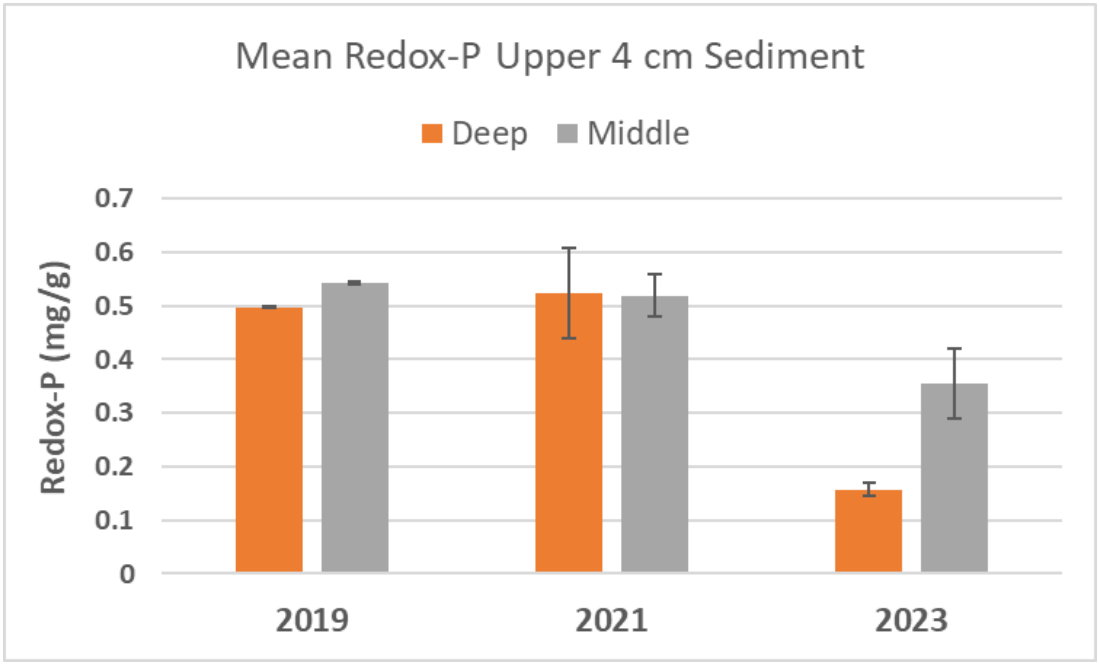
Approximately one year following the first application, Stantec collected follow up sediment cores in fall 2021 for post-application sediment chemistry and release rate analyses. The follow-up sediment cores were collected from the alum treatment area only, which includes the middle and deep sites. The data from these cores was used to track alum treatment effectiveness for reducing internal loading and evaluate if any adjustments to the original alum dose were warranted.
The results from the follow up cores after the first initial alum treatment showed a substantial reduction in internal loading. The post-treatment sediment cores from the middle and deep stations showed a 76% and 46% reduction in P release rates for an average 61% reduction in internal P loading. Because of the positive response in internal P load reduction, the second dose remained the same as the first dose. The final half dose of 64,712 gallons for the alum prescribed was applied to the same treatment area on September 20-22, 2022. Post-treatment sediment cores will be collected in July 2023 to evaluate the total load reduction observed from both alum applications.



Tenth Update January 1, 2024

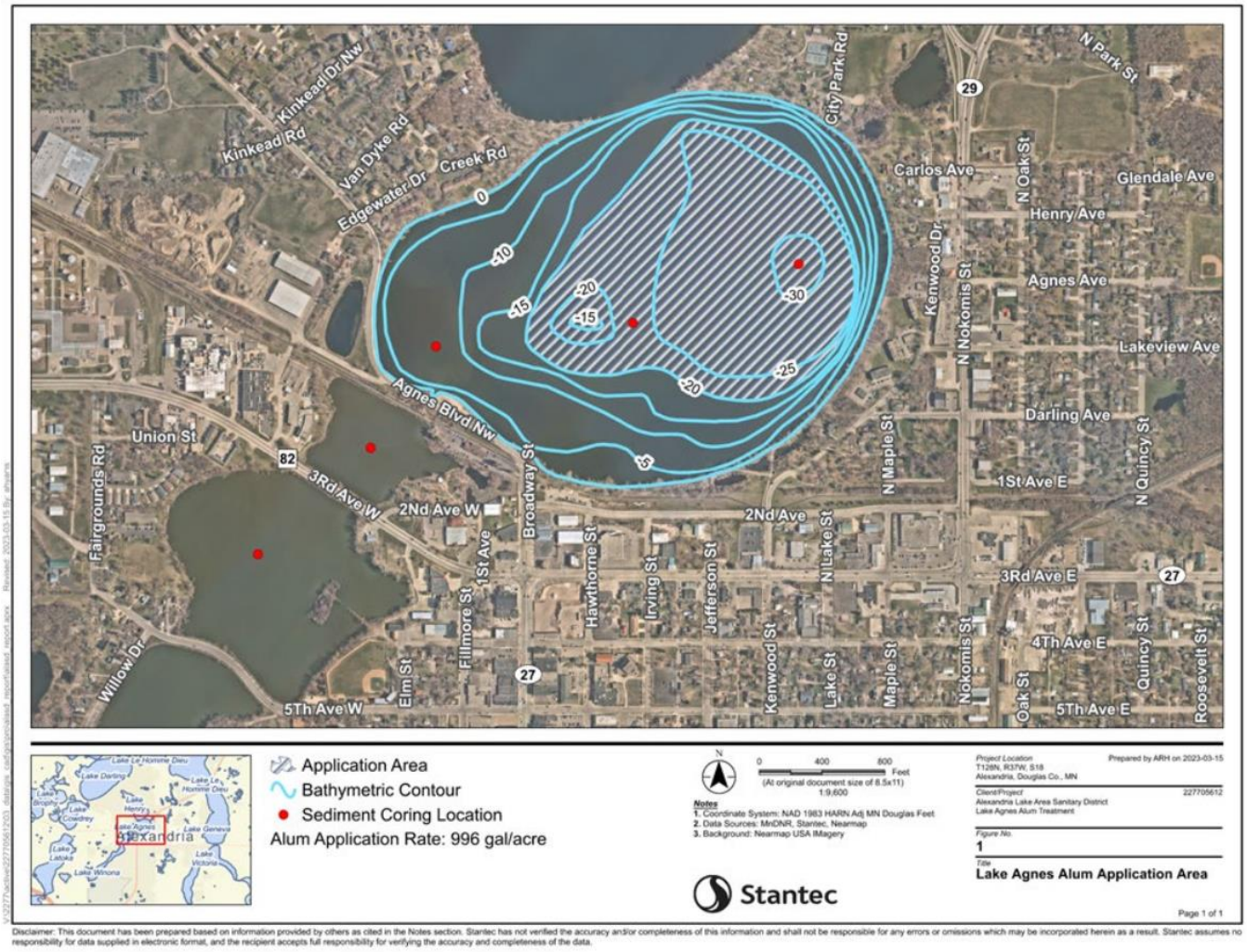
Sediment cores were collected from Lake Agnes on July 19, 2023. Follow-up sediment cores were collected from the alum treatment area only. Duplicate cores were collected from the deep and middle depth stations as previously conducted. On average, the 2021 sediment cores showed a total 61% reduction in anaerobic sediment phosphorus release compared to the pre-treatment conditions in 2019. The follow-up cores collected in 2023 showed an even greater reduction of 96% compared to pre-treatment conditions. Consequently, the goal for reduction of internal phosphorus loading in Lake Agnes by 90% has been attained. In addition, the form of phosphorus known as redox-P (i.e., iron-bound P plus loosely-bound P), which serves as the basis for alum dose calculations, was also reduced compared to pre-treatment conditions. No real change in redox-P was observed between 2021 and pre-treatment conditions.


Lake Agnes
Anaerobic P flux (mg/m2 d)
10
8
6
4
2
0
Deep
Middle
2019
2021
2023

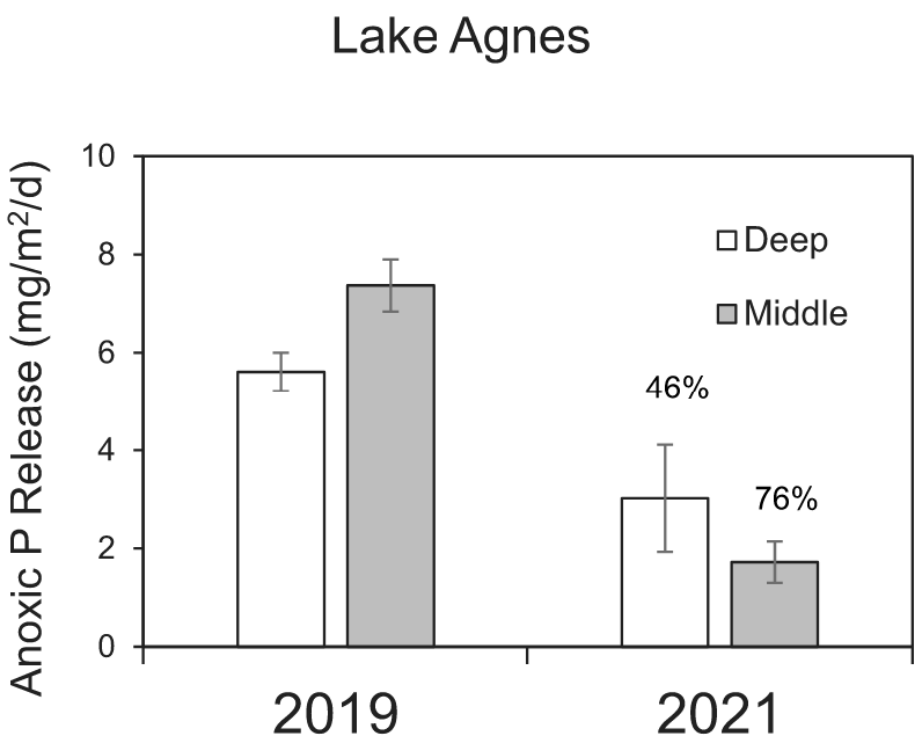

Mean Redox-P Upper 4 cm Sediment
Deep
Middle
Redox-P (mg/g)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2019
2021
2023

Final Report Summary

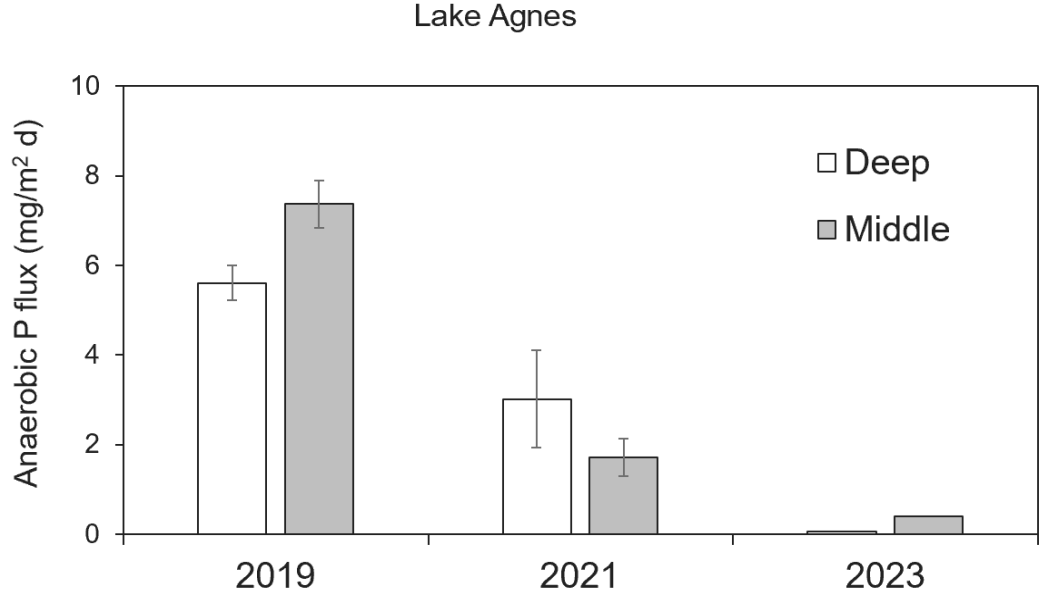
In 2019, sediment cores were collected from Lake Agnes, North Pond, and South Pond on February 11, 2019. Cores were delivered to the University of Wisconsin-Stout and analyzed for sediment phosphorus release and sediment chemistry. The results were used to determine an alum dose required to mitigate sediment phosphorus release in the lake. In 2020, plans and specifications were developed for the bidding process to find a qualified alum applicator. HAB Aquatics (now SOLitude Lake Management) was selected. The recommended alum dose for Lake Agnes was 129,424 gallons to be applied over 65 acres, split evenly into two applications. The first application was initiated the week of September 14, 2020, where 64,712 gal of alum was applied to the target area shown in the figure below which included areas ≥ 20 feet water depth.



Sediment cores collected approximately one year after the initial application indicated an average 64% reduction in sediment phosphorus release rates compared to pre-treatment conditions.



The remaining alum was applied in 2022. Post-treatment sediment cores collected in 2023 showed an estimated 96% reduction in potential internal P loading in Lake Agnes sediments, which indicated the goal for Activity 1 has been achieved.



ACTIVITY 2: Integrated Carp Management Plan and Implementation in Lake Winona

Description: To restore Lake Winona, the first step is to assess and reduce the carp population to allow establishment of submerged aquatic vegetation and the clear lake, plant dominated state. The goal of this step is to determine the impact of carp on lake water quality, identify management opportunities for long term control of the carp population, and to reduce carp density to sustainable levels such that submerged aquatic vegetation can thrive in Lake Winona.

Using the Integrated Pest Management approach established by University of Minnesota researchers, there are a number of steps to evaluate the carp population to develop an understanding of their impact on the lake and to determine appropriate control strategies. The focus of activity 2 is to control the size of the carp population in Lake Winona to prevent adverse impacts on water quality and submersed aquatic vegetation by:

1. ***Quantifying the number and biomass of common carp in the lake system.*** This task includes populations estimates through electrofishing surveys to determine carp densities and their impact on lake water quality. University of Minnesota research suggest carp population densities should be less than 190 kg/ha for plants to establish.
2. ***Quantifying immigration/migration in the lake system, spawning areas, and overwintering habits.*** During the initial population evaluation using electrofishing, 50 radio tags will be surgically implanted into carp so their movements can be tracked and documented. This will allow us to determine where fish removals may be most effective, and where carp may be moving in and out of the system. Further, this approach allows us to determine spawning areas for future control. These data will be used to determine if carp barriers are necessary, where they are needed and where carp are spawning. ***Reducing the numbers and biomass of common carp in the lake***. Once the carp population dynamics are understood so that future recruitment and immigration can be controlled, carp removal will occur using seining by local commercial fisherman or other techniques as appropriate. The goal is to reduce the carp population below 150 kg/ha to allow for aquatic plant establishment.
3. ***Preventing or limiting future reproduction of common carp in the lake system.*** As the carp population is reduced, ALASD is committed to limiting carp reproduction and immigration through the use of carp barriers, aeration, or other techniques necessary. Carp barriers may include grates, velocity barriers, permeable berms, or drop structures. Because the extent and design of these projects is not known, the District is committed to implementing these projects using their own funds as needed. The City of Alexandria is committed to taking over long-term management of carp once this project is complete.
4. ***Measure impacts of carp management on water quality and submersed aquatic vegetation***. The final step is to determine the water quality benefits of the carp management efforts through aquatic plant surveys and water quality monitoring. The District will monitor total phosphorus, chlorophyll-a and Secchi depth. Plant surveys will be completed using Minnesota DNR point intercept methods.

ACTIVITY 2 ENRTF BUDGET: $175,000 – 200,000

Outcome	Completion Date
1. Carp Population Estimates and Tracking; The goal of this step is to determine the current carp density in Lake Winona, Lake Agnes and Lake Henry to estimate impacts to water quality. In shallow lakes, carp densities greater than 190 kg/ha can limit submerged aquatic vegetation.	Dec. 2021
2. Quantifying immigration/migration in the lake system, spawning areas, and overwintering habits. The goal of this step is to determine spawning areas, locations and	Dec. 2021

preliminary designs for carp barriers, determine and install control methods to control carp recruitment, and determine the best methods for removal to reduce carp density.	
3. Reducing the numbers and biomass of common carp in the lake. Carp removal will be conducted using the most appropriate method including seining by commercial fisherman, trapping, or other methods. The goal of this step is to reduce carp populations in Lake Winona, Lake Agnes, and Lake Henry to less than 150 kg/ha.	March 2023
4. Measure impacts of carp management on water quality and submersed aquatic vegetation The ultimate goal is to sustainably reduce carp densities in Lake Winona, Lake Agnes, and Lake Henry below 150 kg/ha, prevent spawning and recruitment by limiting access to spawning areas and preventing carp from immigrating into the system using barriers or other technologies, and provide a long term carp management plan for the City of Alexandria to implement using the Integrated Pest Management approach developed by University of Minnesota Researchers. The project should result in greater that 80% of the lake covered in submerged or emergent aquatic vegetation.	June 30, 2024

Project updates inclusive of each relevant activity will be made consistent with section II.

First Update July 1, 2019

Planning for the carp population density estimate and radio tagging has begun. Tags, surgery supplies and tracking equipment were ordered for the scheduled fish survey. Stationary tracking equipment was also ordered. The first scheduled electrofishing survey is currently scheduled for late July. A permit application was submitted, and we are working with MNDNR staff to complete the permit process. Maps were also developed to identify potential carp spawning areas and to identify carp tracking locations.

Second Update January 1, 2020

<u>Common Carp Population Surveys</u>

Surveys of Common Carp abundance and biomass density were performed following established electrofishing-based methods developed at the University of Minnesota. Lakes Agnes and Henry were combined into a single management unit. Data from these surveys indicates hyperabundance of Common Carp within Winona and Agnes/Henry Lakes: mean catch per unit effort indicated that current carp biomass densities are above 100kg/ha impairment threshold with 95% confidence (figure 1). The length frequency of the Common Carp sample from lake Winona contains multiple clusters of similar sized individuals that may correspond to major year classes (figure 2). Study of age frequency within this population will refine our understanding the population structure further (see section Common Carp ageing below).

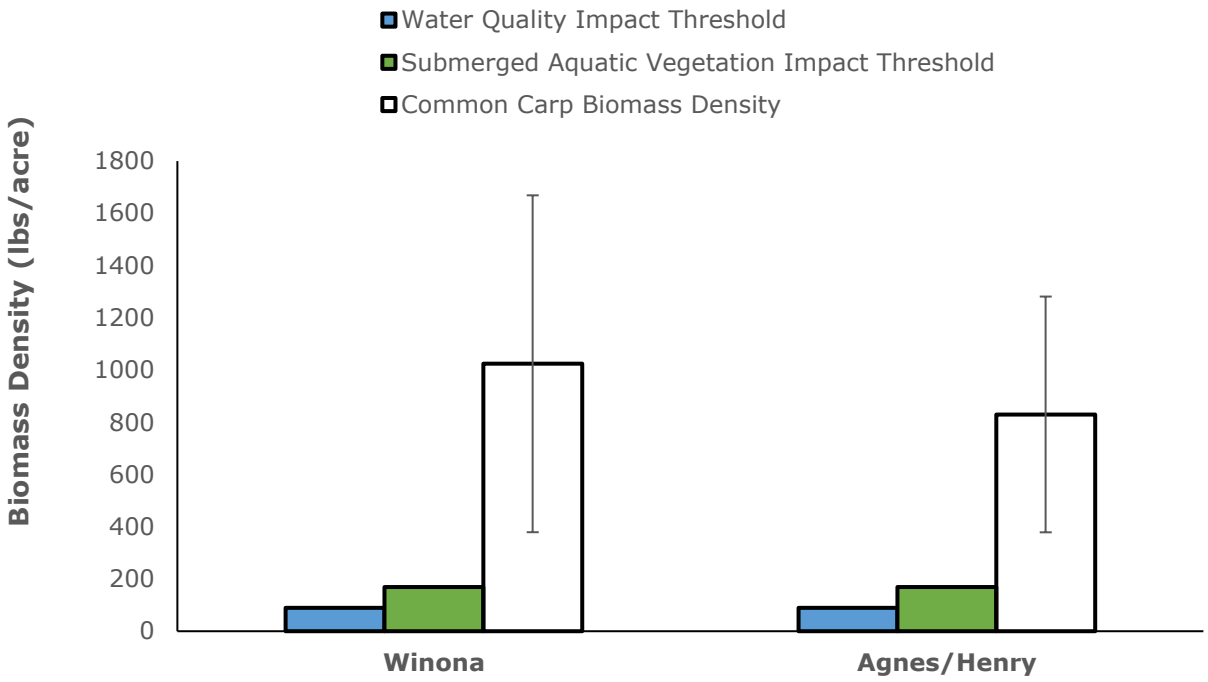


Figure 1. Results of 2019 season Common Carp biomass density surveys compared to established impairment thresholds. Error bars represent the 95% confidence interval around the estimate.

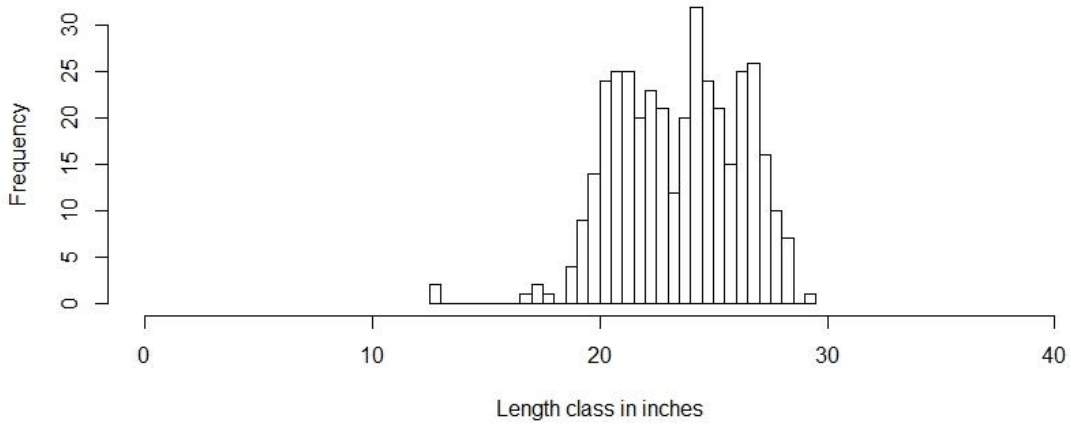


Figure 2. Length frequency of the Common Carp sample captured during electrofishing survey of Lake Winona.

Submerged Aquatic Vegetation

Surveys of aquatic vegetation taxonomic diversity, spatial occurrence, and relative density via point-intercept and hydroacoustic methods were conducted on each lake following guidelines established by the MNDNR's division of ecological and water resources. These lake plant surveys robustly quantified the current state of low diversity and occurrence of submerged aquatic vegetation within lakes Winona, Agnes, and Henry (Lake Winona vegetation density heatmap shown in figure 3). Identical post-treatment surveys will be performed to quantify changes that are predicted to occur after reduction of the Common Carp population.

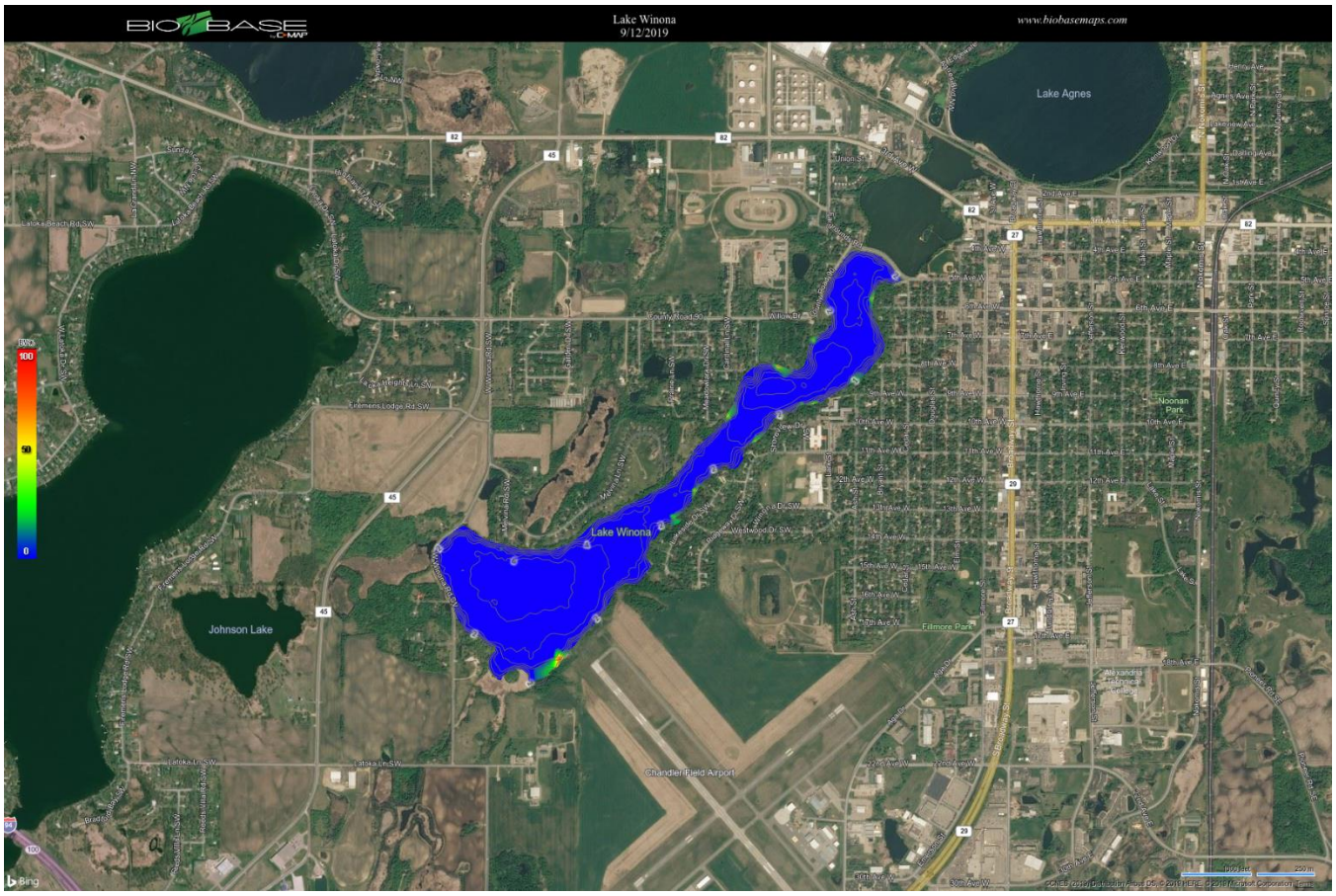


Figure 3. Submerged aquatic vegetation heatmap from September 2019 survey of Lake Winona.

<u>Common Carp Movement</u>

Two methods for tracking Common Carp movement within the system were implemented. 21 radio frequency tags (RFT) were implanted into Common Carp captured from Lakes Winona, Agnes, and Henry to monitor the location and density of seasonal aggregations that will be targeted for mass removals via commercial seining. 489 Common Carp were implanted with passive integrated transponder (PIT) tags to 1.) monitor timing and magnitude of movements between Lake Winona and downstream habitats using stationary antenna arrays and 2.) facilitate capture-mark-recapture abundance estimation in conjunction with removal effort.


Figure 4. Implantation of radio frequency tags (RFT, left panel) and passive integrated transponder tags (PIT, right panel) into Common Carp that were then released.

To date two tracking events have been conducted to document the location of RFT tagged Common Carp (figures 5 and 6). At these two points in time the majority of tags have been located near the main inlet to Lake Winona (ALASD effluent). The consistency and density of this aggregation is a favorable sign for fall open water or winter through-ice removals. Evaluation of this site for commercial seining will be conducted to prepare for 2020/2021 removal season.

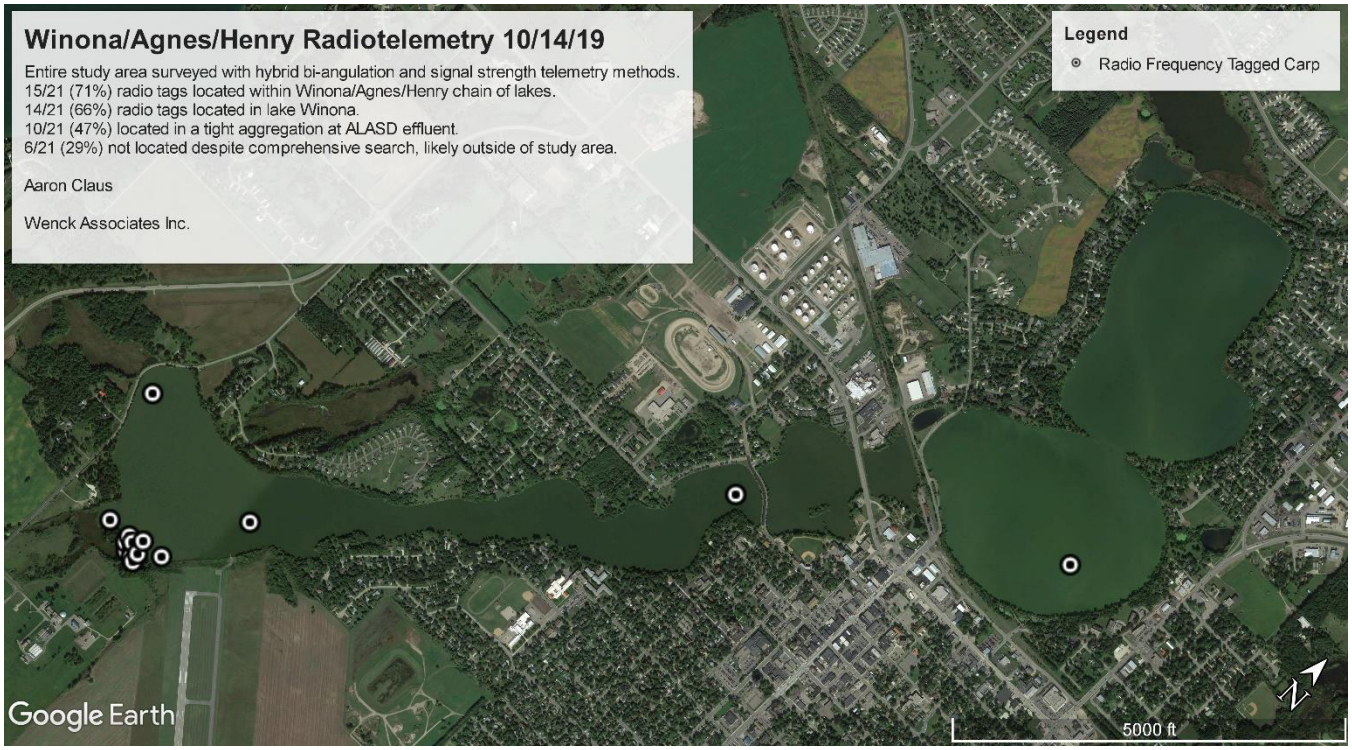


Figure 5. October 2019 radiotelemetry survey of tagged Common Carp within lakes Winona, Agnes, and Henry revealing an aggregation located near the ALASD outflow.

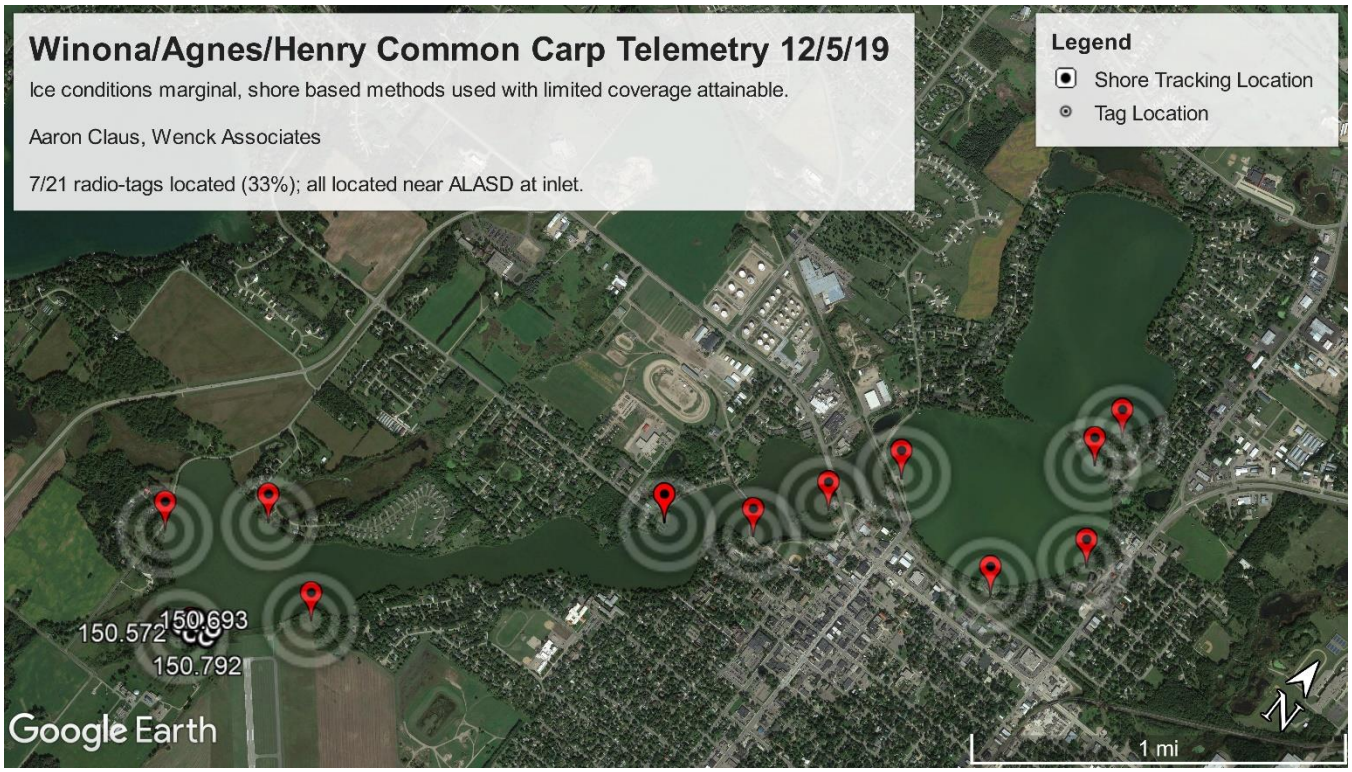


Figure 6. December 2019 radiotelemetry survey of tagged Common Carp within lakes Winona, Agnes, and Henry showing that the aggregation observed in the first tracking event is still located in the same location at the ALASD outflow.

A short interval of data was collected from stationary PIT tag antennas installed between Lake Winona and Agnes (figure 7) before equipment was stolen in October. The data from this interval documented high rates of movement (~10% of population moved through this connection). Directionality was roughly skewed slightly towards upstream movement during the period where data was collected, mirroring RFT tag data. While the theft was unfortunate, these data establish that movement rates of Common Carp are significant through this connection.

Figure 7. Stationary passive integrated transponder tag passage detection system at the Lake Agnes inlet.

Common Carp Ageing

A sample of 50 Common Carp were euthanized and their astercii otolith's extracted for the purpose of conducting an analysis of the Common Carp population's age frequency. This ageing study will be completed with assistance from an experienced expert in the field in early 2020. The carp age dataset will facilitate the calculation of average annual mortality rate of the population and provide insight into the recruitment history within it.

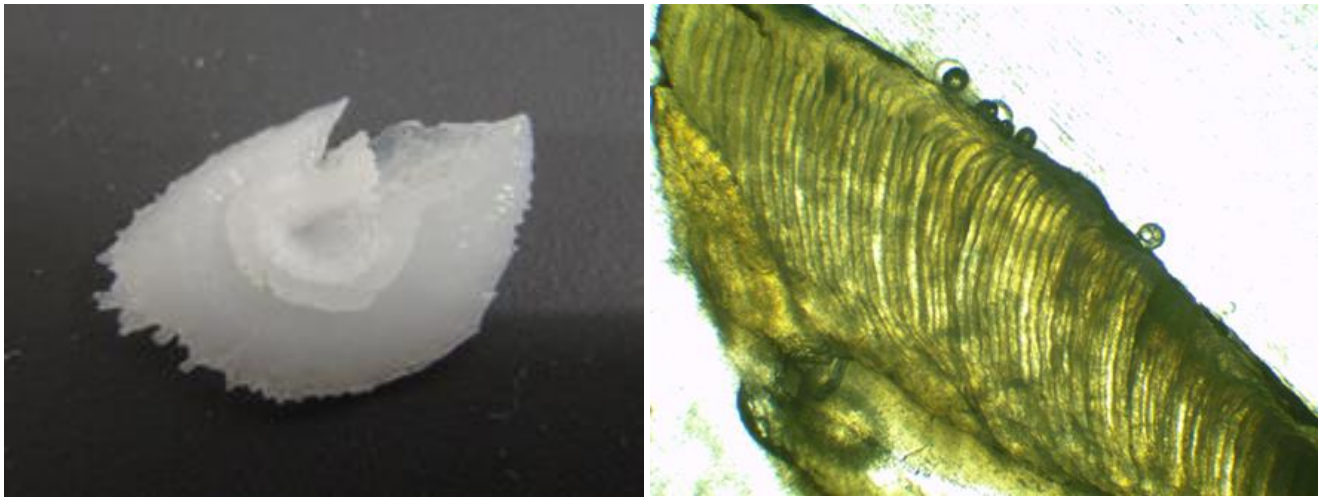


Figure 8. An otolith extracted from a Common Carp captured from Lake Winona (left panel) that will be sectioned like the example otolith (right panel) so that its age can be determined from annual growth rings.

Third Update July 1, 2020

In the first half of 2020, additional carp tracking events were completed to develop an understanding of carp movement in and out of the Lake Winona (Figures 9 and 10). In February 2020, 10 of the tagged carp were in found in Lake Winona suggesting that the carp move freely between lakes in the Winter. Six were still there in May 2020 and by late June 2020, only 2 remained in Lake Winona. There did not appear to be a strong carp spawning run this year and no areas were identified as potential spawning areas by congregating carp. It appears that carp may reproduce in Lake Winona itself.

Figure 9. Location of radio tagged carp during January 2020 survey.

Figure 10. Location of radio tagged carp during February 2020 survey.

Otoliths were extracted from carp captured during electrofishing surveys to determine carp age classes and elucidate trends in the reproductive dynamics of the carp population (frequency of reproductive success). A random subset of 50 Common Carp were taken from the sample collected during the electrofishing population survey, their asteriscii Otoliths extracted, and their age determined using established techniques by an experienced local contractor (Przemek Bajer of Carp Solutions LLC). Twenty-five Carp were taken from Lake Winona and the other 25 carp were taken from Lake Agnes or Henry. Due to prevalence of movements within the two waterbodies, ageing

data were aggregated for Lake Agnes and Lake henry. These age data were transformed and plotted relative to the aggregate length frequency for the entire survey (Figure 3). The youngest carp sampled was 6 years of age and the oldest carp sampled were 18 years of age. The most prevalent age class was age 14, which made up 44% of the sample (spawned in 2005). Age 14 carp ranged from 500-750mm in total length, indicating high variance in growth rates. Recruitment frequency was estimated over a 20-year time interval (1999-2019) by dividing by the number of year classes that accounted for 10% or more of the population (3 year classes: spawned in 2002,2005,2011). The frequency of significant recruitment events determined via this method was approximately one event every 7 years. Recruitment occurred in additional years, but those year classes did not contribute to 10% or more of the current population.

Based on these results, it appears that the Lake Winona carp population is primarily composed of fish from 3 reproduction events and have not had a significant recruitment event since 2011. It appears that carp reproduction is declining which is likely a result of the high density of carp that thrive in the three lakes. While it is not possible to assign a spatial designation to where these recruitment events occurred (nursery habitats), there is some evidence that recruitment may be occurring within Lake Winona.

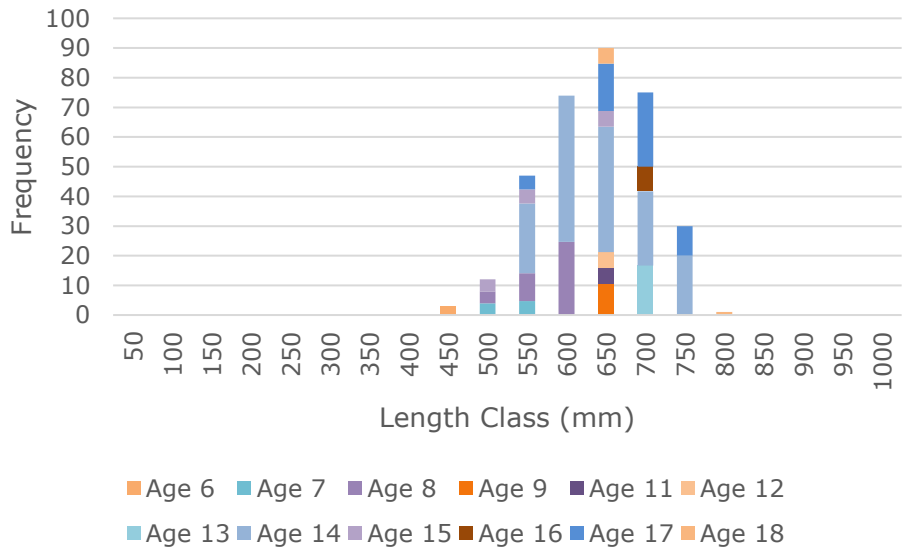


Figure 11. September 2019 Lake Winona/Agnes/Henry Common Carp age structure (Age-0=spawned 2019)

Fourth Update January 1, 2021

A physical barrier is proposed that will consist of a pivoting grate inside a precast box culvert section. The barrier is designed to optimize the combination of a.) allowing some level of native fish passage while blocking mature carp passage, b.) maintaining public access to shore fishing, c.) maintaining lake hydraulics, and d.) providing a structure that is relatively low maintenance. The plans and specifications are 90% complete. USACE permit has been obtained. DNR permit has been applied for, and in final negotiation phase of special conditions. The barrier is expected construction is quarter one of 2021. After the barrier is in place. A commercial fisherman will be brought in to remove carp that have been confined to the spawning area.

Fifth Update July 1, 2021

The carp barrier was installed just downstream of the culvert that connects Lakes Winona and Agnes in April 2021. The carp barrier consists of a 4-foot by 8-foot precast concrete channel with a fabricated metal grate. Riprap berms block the rest of the channel from fish passage. To date, significant maintenance has not been required, and numerous carp have been observed blocked by the barrier, attempting to swim upstream into Lake Winona.

Next quarter, an updated population estimate of lake Winona following the installation of the carp barrier will be conducted via a carp catch per unit effort. In addition, a radio telemetry survey will be conducted to determine if any of the preexisting radio tags are still located in Lake Winona. In the event that there are not enough radio tags in lake Winona up to ten additional carp with radio tags will be surgically implanted. The purpose of the radio tag insertions is to aid the commercial fishermen in location carp aggregations to maximize catch rates. This method is also known as the "judas method". Periodic radio telemetry surveys will be conducted leading up to the proposed commercial seining event to located and determine where carp aggregations exist.

Sixth Update January 1, 2022

Once the barrier was installed, the next phase of the management is attempting carp removals in an effort to reduce the carp biomass in Lake Winona to the management goal density of less than 133 lbs/ac. This update describes the use of modified unified method (MUM) and subsequent commercial netting in Winona Lake as well as pre-netting telemetry efforts. This event was conducted on October 18, 2021 on Winona Lake using underwater speaker systems, radiotelemetry, and a commercial netting crew to capture common carp in areas previously identified via electrofishing surveys and our reconnaissance day

<u>WINONA LAKE PRE-NETTING TELEMETRY</u>

Using an ATS R410 receiver and Yagi antenna, WSB staff conducted lake-wide high frequency radiotelemetry surveys to develop an understanding of carp distribution in Winona Lake and the movement patterns preceding the netting effort. Surveys were conducted on three occasions (October 11th, 15th, and 17th). Each survey consisted of methodical, thorough transects with a trolling motor examining signals received from individual transmitters in different areas of the lake. Each frequency was scanned initially in the early parts of the survey. Once a signal was detected, directionality of the signal was determined, and location of the carp was determined when signal was strongest. The entire shoreline was examined initially and was followed by multiple transects farther from shore. Results In general, there appeared to be little movement around the lake during the week-long telemetry survey period. Locations spanned the entire lake with a consistent group in the northeast portion of the lake, a group near the wastewater treatment plant (WWTP) outlet at the southern end of the lake, and several radiotagged carp spread throughout the main southern basin as well as along the "arm" of the lake (see Figures 1-3). Anecdotally, it was clear that many carp were still spread throughout the arm and to the north as evidenced by several carp near the surface of the water (notably on the east shore) in groups numbering between 5-15 individuals. The groups did not break up and submerge until the tracking vessel came within approximately 20 feet. Some radiotagged carp were periodically not able to be located. Locations of radiotagged carp seemed to match what was observed during side scan sonar surveys during the reconnaissance event. With no less than five tagged carp identified within the main southern basin, we decided to move forward with netting in the main basin

Figure 1: Map of radiotagged carp on October 11,2021.

Figure 2: Map of radiotagged carp on October 15,2021..

Figure 3: Map of radiotagged carp on October 17,2021.

SPEAKER HERDING/MUM

Prior to commercial crews beginning their net deployment, WSB conducted an abbreviated MUM session. We used two boats equipped with underwater speakers connected to amplified mp3 players able to emit a shuffle of pre-recorded sounds (as seen in Figure 4). We began by locating one radiotag (151.172) along the arm of the lake northeast of the basin as seen in Figure 5. We then began speaker herding transects “behind” the tag and began navigating slow passes from one shoreline to the opposite side. Figure 4: Representation of speaker mounted to boat on left with amplification and sound control on right. Results Each pass moved approximately 50-100 feet closer to the basin that was planned to be netted as seen in Figure 5. As passes progressed, radiotelemetry of carp 151.172 continued to determine the effectiveness of the herding. The carp appeared to be moving away from the speaker sound passes in the desired direction. As the passes approached the netting area, another tag (carp 150.572) was detected ahead of the MUM passes and appeared to be close to the edge of the anticipated path of the seine net deployment. At this time, the commercial netting crew was signaled to commence net deployment before the herded carp would have a chance to bypass the MUM front and return to the norther n areas of the lake.

Each pass moved approximately 50-100 feet closer to the basin that was planned to be netted as seen in Figure 5. As passes progressed, radiotelemetry of carp 151.172 continued to determine the effectiveness of the herding. The carp appeared to be moving away from the speaker sound passes in the desired direction. As the passes approached the netting area, another tag (carp 150.572) was detected ahead of the MUM passes and appeared to be close to the edge of the anticipated path of the seine net deployment. At this time, the

commercial netting crew was signaled to commence net deployment before the herded carp would have a chance to bypass the MUM front and return to the northern areas of the lake.

Figure 4: Representation of speaker mounted to boat on left with amplification and sound control on right.

Figure 5: Map of operations day of netting, October 18, 2021.

SEINE DEPLOYMENT AND CARP CAPTURE

Over 5,000 linear feet of netting was deployed in the southwestern basin (path the net followed is shown in Figure 6 above). The depth of the net was 23 feet maximum and mesh size was 5-inch stretch. Both vessels with speaker systems moved along the shore in front of the net as it was being deployed to move carp that were on the edge of the net toward the middle of the basin. Extra effort was given to the area around the effluence in the far southern area of the lake to move the group of tags there into the netting area. However, abundant cattails and shallow areas made it difficult to move them. It is also possible that some of the tags in this group are dead carp or are tags that were shed from the originally tagged carp since the locations had not changed over the October 2021 telemetry.

Figure 6: Beginning of seine net deployment by commercial fishing crew.

Figure 7: Gas powered winch pulling the seine net slowly toward shore.

Once all the net was deployed into the basin, a gas-powered winch was used to pull in the net toward shore (as seen in Figure 7) and the net was slowly restacked in the boat. Minor snags were encountered in the netting area in the form of medium-sized branches and stumps that required the net to be lifted temporarily and moved past the obstacle. These were likely partially or entirely submerged in the lake bottom and were not detected on the recon day. As the final portions of the net were being pulled in, a group of carp was accumulating near the pen. The last ~200 feet of net were corralled by hand by the crew and the group of carp was moved into the pen to await the haul out efforts. Once all the carp were penned up, we determined that there were three radiotags in the haul; one of which was 151.172 which we moved from its original position to within the netting area.

HAUL OUT AND DATA COLLECTION

Crew members removed carp from the pen by hand while WSB and Stantec staff counted every individual carp and scanned it for the presence of a PIT tag (as seen in Figure 9). All personnel were instructed to be extra vigilant for the three radiotagged carp. When a PIT tag was detected, its identifying code was called out and recorded for mark recapture estimation. Carp were loaded into metal boxes and transferred to the FisH20 truck for transport

Figure 8:Carp entering pen on let and a view of the carp just before being loaded into fish boxes on the boat.

Figure 9: Checking each carp for radiotags and PIT tags as well as keeping a total count in each fish box.

Figure 10: Fish20 truck preloaded with water and oxygen to keep carp alive in travel. On right, each fish box was dumped into one of the 10 tanks on the semi.

Figure 11: All three radiotagged carp that were captured in the seine net were identified and released back to the lake.

In total, 4,918 carp totaling approximately 31,131 pounds were removed from the lake. Using the capture, mark, and recapture population and biomass estimates from the seining, this is approximately 26.6% of the total population. Using average size of carp in the lake, that means there is still around 86,000 pounds of carp left in Lake Winona. Of the 4,918 total carp captured, 20 were detected with PIT tags from the marking day on September 30th and three individuals were previously implanted with radiotags. All three radiotaged carp were successfully recovered and released back to the lake (as seen in Figure 11).

Final Carp Population Estimates

Pre-carp removal due diligence was recommended following the installation of the carp barrier, which included the following actions:

- Updated carp electrofishing catch per unit effort (CPUE) population estimation numbers to account for the change in environment caused by the carp barrier installation.
- A radio telemetry survey to determine if any remaining RFT tagged carp from the 2019 tagging effort remained in Lake Winona. In the event that fewer than 10 RFT fish were located during radio telemetry surveys, Stantec would implant up to 10 additional RFT tags to aid in locating aggregations of carp during the removal effort.
- Lastly, PIT tag implants into all captured carp during the post barrier installation electrofishing CPUE survey. The data collected from these PIT tag implants will be used in a capture mark recapture (CMR) population estimation method to provide further data on the carp population dynamics in Lake Winona

In total, 88 carp were captured during the three electrofishing transects. Carp captured during all three transects had an average total length of 23.4 inches and weight of 6.3 pounds (Table 1). CPUE methods estimate 36,043 individual carp in Lake Winona. Average biomass density is estimated at 1070 lbs/ac, compared to the water quality impairment threshold of 89 lbs/ac and the management plan goal of 133 lbs/ac in Lake Winona by March 31, 2023 (Table 1). Surveys did not detect any young-of-year carp. The smallest individual carp captured was about two and a half pounds and 15 inches long. Carp age cannot be determined from the results of this survey; however, the size of the carp surveyed suggest the lake is dominated by mature carp and no successful carp recruitment within Lake Winona since the carp barrier was installed on April 13th, 2021. Carp recruitment success varies on multiple factors such as egg and larval predation by bluegill and other planktivorous species, and winterkill hypoxia (Bajer & Sorenson 2009).

Table 1. Common Carp Electrofishing Survey Results for Lake Winona

Lake	Lake Winona Pre Seine	Lake Winona Post Removal (Estimated)
Size (acre)	213	
Sample Date	9/30/2021	
# Sampled	78	4,918 individuals removed
# Transects	3	
E-fish Time (hour)	1	
Average Length (in)	23.4	
Average Weight (lb)	6.33	Estimated 31,130 pounds removed
CPUE Transect 1 (carp/hr)	78	
CPUE Transect 2 (carp/hr)	84	
CPUE Transect 3 (carp/hr)	102	
Average Catch Per Unit Effort (carp/hr)	88	
CPUE 95% Confidence (+/-)	25	
Estimated Density (carp/acre)	169	146
Estimated Population Size (N)	36,043	31,125
Biomass Present (lbs)	228,140	197,011
Average Biomass Density (lbs/acre)	1070	924
March 30, 2021 Removal Goal (lbs/acre)	133	133
Critical WQ Threshold (lbs/acre)	89	89

The CMR results are shown in Table 2. Twenty of the total 78 fish marked with PIT tags during the September 30, 2021, electrofishing CPUE survey were recaptured in the October 18, 2021 commercial seining event. Results of the CMR estimate total population of carp in Lake Winona to be 18,505 individuals and an estimated biomass density of 550 pounds per acre.

Table 2. Pre-Removal Capture-mark-recapture (CMR) Results in Lake Winona 2021.

Number of Carp Marked (M)	Total Number of Carp Recaptured (C)	# of Recaptured Carp Previously PIT Tagged (R)	Population Estimation (N)	Estimated Pounds of Carp In Winona	Estimated Pounds of Carp per Acre
78	4918	20	18,505	117,135	550

According to the CMR and CPUE population estimates, the estimated biomass of common carp in Lake Winona prior to carp removal efforts ranges from 550 lbs/ac to 1070 lbs/ac, respectively. The CMR and CPUE population estimation methods suggest that carp biomass exceeds the management removal goal of 133 lbs/ac and the water quality impairment threshold of 89 lbs/ac for common carp density to negatively impact water quality and ecology (Bajer 2009). The CPUE survey is used to guide carp management in lakes and provides a relative population estimation that is low in intensity and effort compared to other population estimation methods. It is easily replicable and can be used to monitor change over time and following lake management activities. The CMR methodology can be labor intensive, so Bajer and Sorensen (2012) developed an empirical method for estimating common carp density based on the CPUE electrofishing techniques. Because the CPUE methodology is predictive relationship based on other lakes, it is subject to over- or under-predicting population density more than the CMR method. Consequently, we believe that the CMR results are more reflective of the actual population in Lake Winona whereas the CPUE method appears to be overestimating the actual common carp population in Lake Winona.

Radio Telemetry and Radio Frequency Tag Implanting

The radio telemetry surveys conducted on September 30th, 2021 located a total of eight previously radio tagged carp in Lake Winona. To ensure success on the commercial seine, we determined that an additional 10 carp would need to be surgically implanted with radio tags. Therefore, ten additional carp were captured, implanted with radio tags, and re-released into Lake Winona. As of September 30th, 2021 there are 18 radio tagged carp in Lake Winona. Additional radio telemetry surveys were conducted leading up to the commercial seining removal efforts and are detailed in Appendix A.

Conclusions

Overall, more than 30,000 pounds of carp were removed from Lake Winona during the commercial seining event in fall 2021. The background coordination and reconnaissance resulted in a successful removal operation and provides a template for future removal operations. Pre removal due diligence steps that were taken beforehand including implanting additional RFT and PIT tags, radio telemetry surveys, and pre removal reconnaissance improved the chance of seine capture success. The intense pre- removal activities such as radio and PIT tagging that occurred in 2021 in Lake Winona will not need to be conducted again for the next three to four years. The radio tags implanted have an active lifespan of up to four years and therefore, increased tagging efforts will not need to be conducted to aid in removal efforts during that time span. Any follow up removal events in this time span will not require these two pre removal steps and therefore will be less costly and labor intensive compared to the first removal event.

Pre-removal carp population estimates differed between CMR and CPUE methods (550 lbs/ac vs 1,070 lbs/ac, respectively). The CPUE method developed by Bajer and Sorensen (2012) applies to small, shallow midwestern lakes using electrofishing methods so this methodology should apply well to Lake Winona. However, the approach is a predictive approach to estimating population density which is based on other lakes, and it may not be well-suited for Lake Winona. Furthermore, carp are known to exhibit learned gear avoidance. This means that when a fish is either shocked or netted multiple times it can learn how to avoid situations where it may encounter a net or shock device to protect itself. Additional investigation and sampling data would be needed to refine the population estimates between the CMR and CPUE methods. However, although the two carp population estimation methods vary, both methods indicate the carp population present in Lake Winona is still above the ALMP removal goal of 133 lbs/ac and the water quality impairment threshold of 89 lbs/ac.

Using the CMR model and extrapolating the data following the commercial seining removal event the biomass density within Lake Winona was reduced from a population estimation of 550 lbs/acre to about 404 lbs/acre for a reduction of 146 lbs/acre. To meet the goals of the ALMP for biomass reduction (i.e.150 kg/ha or 133 lbs/ac), a further 271 lbs/ac need to be removed.

Furthermore, only one relatively small carp (<15 inches) was captured in the seining effort and electrofishing CPUE. The size of the carp captured was dominated by mature carp and indicated no successful carp recruitment within Lake Winona since the carp barrier was installed on April 13th, 2021.

Seventh Update July 1, 2022

Carp surveys in support of the carp barrier and compliance with public waters permit will be completed by August 31, 2022. A second and final carp removal event will take place in the fall or winter of 2022/2023.

Eighth Update January 1, 2023

The final carp removal was completed from Lake Winona in November 2022. Objective 3 is complete. The final estimate for the carp removal will be included in the next report when the analysis is complete.

Ninth Update June 30, 2023

The following paragraphs are an excerpt from the Winona Chain of Lakes Adaptive Management Progress Report and summarize the activity 2 results to date.

In 2019, carp population surveys indicated that the density of carp in the Winona Chain of Lakes exceeded the density thresholds for impacts on water quality and native vegetation. Bajer (2009) defined a threshold of 89 lbs/ac for negative water quality impacts in Minnesota lakes. Bajer et al. (2015) reported that carp population density above 100 kg/ha is likely to negatively impact aquatic vegetation. In the fall of 2019 Lake Winona, contained an estimated 36,412 individual carp for a lake wide biomass density of 1024 lbs/acre (+/- 644.9 lbs/acre). Surveys were conducted at the same time in Lakes Agnes and Henry showed a combined lake estimate of 27,771 individual carp with an estimated biomass density of 830 lbs/acre (+/- 451.3 lbs/acre).

One of the first implementation activities for carp management in the Plan was to design and install a carp barrier between Lake Winona and Lake Agnes to stop both the emigration and immigration, reduce the potential for successful carp recruitment, and manage a more controlled population of carp between Lake Winona and the rest of the chain of lakes. On April 13, 2021, a carp barrier was installed between Lake Winona and Lake Agnes to prevent more carp from entering Lake Winona from downstream and create a more manageable condition for removal efforts. The Minnesota Department of Natural Resources (MnDNR) issued a Public Waters Work Permit (Permit Number 2020-2857) to ALASD for the carp barrier which includes a requirement that carp electrofishing surveys be conducted in 2022, 2023, 2026 and 2027.

Stantec has conducted three carp population surveys using boat electrofishing techniques in the Winona-Agnes-Henry chain of lakes as part of the Plan implementation, which are summarized below.

1. Prior to the installation of the carp barrier, carp population surveys were conducted in 2019 on Lakes Winona, Agnes and Henry to establish pre-management baseline population estimates.
2. On September 30, 2021, carp surveys were conducted in Lake Winona for pre-sampling community reconnaissance to help guide the fall 2021 carp removal efforts which occurred on October 18, 2021.
3. Carp were surveyed on August 16, 2022.

Carp populations density has been estimated using boat electrofishing techniques and two separate population estimation methods, the capture-mark-recapture (CMR) method and the catch-per-unit-effort CPUE method.

- The CMR methodology relies on two different capture events to generate a population estimate. First, carp must be captured in an initial capture event and marked with passive integrated transponder tags (PIT) tags, which covers both the capture and mark portion of the CMR methodology. The second capture event (the “recapture” portion) can occur through a variety of methods that where carp are counted and scanned for PIT tags, which is used in an established equation to arrive at a population estimation.
- The electrofishing CPUE method is used to estimate Common Carp abundance and biomass density. The Bajer and Sorensen method was developed to provide a simpler, lower effort way to estimate population density since the CMR method requires substantial effort. The Bajer and Sorensen method was based on a regression equation between electrofishing CPUE and carp density from several small Midwestern lakes. Thus, the Bajer and Sorensen CPUE method provides a means for predicting population density in way that is less labor intensive compared to traditional CMR methods. However, the technique is most effective for low and moderate population densities and is likely to over- or under-estimate population biomass when carp density is very high.

The carp population surveys in 2021 were conducted to estimate population density in Lake Winona following the construction of the carp barrier and prior to the first carp removal event. The CPUE surveys were conducted on September 30, 2021. During that survey, Stantec inserted PIT tags into captured carp so that population density could be calculated using the CMR method following the first removal event in October 2021. The table below shows the results of the carp population estimates from 2019, 2021 and 2022 based on the electrofishing CPUE method and the 2021 population estimates based on the CMR method.

Metric	Oct 2019	Sept 2021 CPUE	Sept 2021 CMR	Aug 2022 CPUE
Average Length of Common Carp (in)	23.5	23.4		23.2
Average Weight of Common Carp (lbs)	6.00	6.33		5.90
Estimated Density (carp/acre)	171	169		198
Estimated Population Size (abundance)	36,412	36,043	18,505	42,141
Estimated Biomass (lbs)	218,466	228,140	117,135	248,567
Average Biomass Density (lbs/acre)	1024	1070	550	1165

According to the CMR and CPUE population estimates, the estimated biomass of common carp in Lake Winona prior to carp removal efforts ranged from 550 lbs/ac to 1070 lbs/ac, respectively. The CPUE survey is used to guide carp management in lakes and provides a relative population estimation that is low in intensity and effort compared to other population estimation methods. The CMR methodology can be labor intensive, so Bajer and Sorensen developed an empirical method for estimating common carp density based on the CPUE electrofishing techniques. Because the CPUE methodology is a predictive relationship based on other lakes, it is subject to over- or under-predicting population density more than the CMR method. The CMR methodology is broadly accepted to provide a more reliable population estimate. Consequently, we believe that the CMR results are more reflective of the actual population in Lake Winona whereas the CPUE method appears to be overestimating the actual common carp population in Lake Winona.

In Lakes Agnes and Henry, the average biomass density was considerably higher in 2019 (830 lb/acre) compared to 2022 (165 lbs/acre) which represents an 80% decrease. At this time, it is unclear why the estimated population density changed so dramatically for these lakes. Lakes Agnes and Henry were treated as one waterbody for the purposes of the survey given the high degree of hydrological connectivity between the two lakes. The differences could be due to sampling gear avoidance, the carp were located in areas of the lake not sampled, migration to a downstream waterbody and/or the limitations of the CPUE survey methodology for those lakes.

Measurement	2019	2022
Average Length of Common Carp (in)	25.6	26.9
Average Weight of Common Carp (lbs)	8.65	15.37
Estimated Density (carp/acre)	96	11
Estimated Population Size (abundance)	27,771	3,121
Estimated Biomass (lbs)	240,224	47,971
Average Biomass Density (lbs/acre)	830	165

CARP REMOVAL EVENTS

Two carp removal events have been conducted in Lake Winona using commercial seining techniques. The first event occurred on October 18, 2021, and the second event occurred on October 24, 2022. Stantec subcontracted with WSB to conduct the pre-removal telemetry surveys and coordination with the local area commercial fisherman to conduct the seining. Captured carp from both events were provided to FisH20 for distribution on the local market. The results of the removal events are briefly summarized here:

- 2021: 4,918 individual carp were removed (~ 31,130 pounds)
- 2022: 1,611 individual carp were removed (~ 8,500 pounds)

The 2021 pre-removal population density based the CMR method indicated a population biomass of 550 lbs/acre. After the first removal event, we estimated that the population size was reduced to 403 lbs/acre. Following the second removal event in 2022, WSB estimated that the carp population density was reduced to 356 lbs/acre. The carp density goal established in the Plan is 133 lbs/ac, which means that an additional 223 lbs/acre needs to be removed from Lake Winona in order to meet the goal.

Despite two carp removal events in Lake Winona, carp population density remains above the target biomass threshold of 133 lbs/ac. The second removal event resulted in a much lower amount of biomass removed compared to the first event. The commercial fisherman and WSB, the carp removal subcontractor, do not expect that the commercial seining technique will result in any more significant biomass removal due to challenges with the seine snagging large woody debris on the bottom and carp potential exhibiting gear avoidance. Depending on the results of the SAV, the next steps will be outlined in the next update.

Tenth Update January 1, 2024

While not required as part of this project, we collected common carp population data in 2023 in support of the Public Waters Research Permit (Permit Number 2020-2857). The results are relevant to the overall research project and consistent with reporting for permit requirements. Common carp surveys were on Lakes Winona, Agnes and Henry on September 21, October 10 and October 24, 2023 using an electrofishing boat following the Bajer and Sorensen (2012) protocols as followed and described in previous grant updates.

A total of 133 carp were sampled in Lake Winona during all three surveys in 2023. The average length of

carp was 23.1 inches (587 mm) and ranged from 14 to 28 inches (350-704 mm). The average size of carp in Lake Winona was similar in 2023 to that of surveys from 2019-2022.

Two population estimates (PE) were generated for the 2023 Lake Winona surveys due to variations in CPUE between the first survey and the second and third surveys. CPUE dropped significantly between the first and second survey in Lake Winona. At this time, it is possible that carp were beginning to move to their deeper winter habitat reducing catchability. New research suggests that temperature variations, even within the summer or fall seasons, can affect common carp catchability (Simonson et al. 2022). One PE was calculated for the September survey alone and one PE was calculated for all three 2023 surveys combined (see table below). The CPUE and subsequent PE for the survey conducted in September of 2023 is similar to those calculated in 2019, 2021, and 2022, whereas the PE calculated from all three 2023 surveys is lower.

Carp density was calculated using the linear regression equation developed by Bajer and Sorensen (2012).

Carp density per hectare = 4.71 * CPUE + 3.04

The CPUE and the resulting PE was lower during the September 2023 survey than the 2022 survey estimates but higher than in 2019 and 2021. The PE for September 2023 was 38,889 carp (982 lbs/acre). Combining all three 2023 surveys resulted in a PE of 18,288 (490 lbs/acre), which is a much lower estimate than we've seen in past years.

	2019	2021	2022	9/21/23	10/10/23	10/24/23	2023 all surveys
Number of Transects	11	3	3	3	3	3	9
Electrofishing Time (hr)	3.67	1.0	1.0	1.0	1.0	1.0	3
Number of individuals sampled	326	88	103	95	24	14	133
Average Length of Common Carp (mm)	596	593	589	581	596	614	587
Average Length of Common Carp (in)	23.5	23.4	23.2	22.9	23.4	24.2	23.1
Average Weight of Common Carp (kg)	2.7	2.9	2.7	2.4	2.9	3.1	2.6
Average Weight of Common Carp (lbs)	6.0	6.3	5.9	5.4	6.3	6.9	5.7
Average Catch Per Unit Effort (carp/hr)	88.9	88.0	103.0	95.0	24.0	14.0	44.3
Estimated Density (carp/ha)	421.92	417.52	488.17	450.49	-	-	211.85
Estimated Density (carp/acre)	171	169	198	182	-	-	86
Estimated Population Size (abundance)	36,412	36,043	42,141	38,889	-	-	18,288
Estimated Biomass (kg)	99,094	103,465	112,729	95,002	-	-	47,403
Estimated Biomass (lbs)	218,466	228,140	248,567	209,479	-	-	104,524
Average Biomass Density (lbs/acre)	1024	1070	1165	982	-	-	490
Average Biomass Density (kg/ha)	1,148.3	1198.5	1305.9	1100.5	-	-	549.1

Seven carp were sampled in Lakes Agnes and Henry during all three surveys in 2023. The average length of carp was 25.2 inches (639 mm) and ranged from 7.9 to 29.1 inches (201 to 739 mm). Unlike the Lake Winona surveys, CPUE remained constant between the first and second surveys and increased during the third survey for Lakes Agnes and Henry; however, due to the low catch rate this increase was only one fish. CPUE was less than the 2022 survey resulting in a PE of 405 carp and biomass density of 94 lbs/acre (105.3 kg/ha). Over the past few surveys, the carp PE has steadily decreased in Lakes Agnes and

Henry (see summary table below).

	2019	2022	2023
Number of Transects	9	3	9
Electrofishing Time (hr)	3.00	1.0	3.0
Average Length of Common Carp (mm)	651	683	639
Average Length of Common Carp (in)	25.6	26.9	25.2
Average Weight of Common Carp (kg)	3.92	6.97	5.2
Average Weight of Common Carp (lbs)	8.65	15.37	11.5
Average Catch Per Unit Effort (carp/hr)	49.7	5.0	2.3
Estimated Density (carp/ha)	960.9	26.59	14.03
Estimated Density (carp/acre)	96	11	6
Estimated Population Size (abundance)	27,771	3,121	405
Estimated Biomass (kg)	108,963	21,756	3,038
Estimated Biomass (lbs)	240,224	47,971	6,699
Average Biomass Density (lbs/acre)	830	165	94
Average Biomass Density (kg/ha)	3,770.3	185.4	105.3

Final Report Summary

Following radio telemetry to track movement of carp among the Winona Lake Chain, a carp barrier was constructed between Lakes Winona and Agnes in 2019. Post-construction common carp population surveys showed that the existing population in Lake Winona is comprised of mature individuals with no evidence of successful recruitment since installation.

Two removal events have occurred in Lake Winona using commercial seining techniques. The first event was in fall 2021 which removed 4,918 individual carp (approximately 31, 130 lbs). The second event was in fall 2022 which removed 1,611 individuals (approximately 8,500 lbs). The seine snagged large woody debris on the bottom of Lake Winona at times during the removal event, which impacted removal success. Given that the baseline population survey indicated well over 30,000 individuals, it will take significant effort to remove that dense of a population. Stantec conducted several population surveys in the last few years using the Bajer and Sorensen (2012) methodology. This methodology is less labor intensive than traditional population estimation methods of capture-mark-recapture, but the tradeoff is that there can be a large range of uncertainty around the population estimate. Bajer and Sorensen (2012) acknowledge that the uncertainty range is likely to be higher in lakes with high density of carp, which is the case in Lake Winona.

While not required as part of this project, we collected common carp population data in 2023 in support of the Public Waters Research Permit (Permit Number 2020-2857). The results are relevant to the overall research project and consistent with reporting for permit requirements. Common carp surveys were on Lakes Winona, Agnes and Henry on September 21, October 10 and October 24, 2023 using an electrofishing boat following the Bajer and Sorensen (2012) protocols as followed and described in previous grant updates. A total of 133 carp were sampled in Lake Winona during all three surveys in 2023. The average length of carp was 23.1 inches (587 mm) and ranged from 14 to 28 inches (350-704 mm). The average size of carp in Lake Winona was similar in 2023 to that of surveys from 2019-2022.

Two population estimates (PE) were generated for the 2023 Lake Winona surveys due to variations in CPUE between the first survey and the second and third surveys. CPUE dropped significantly between the first and second survey in Lake Winona. At this time, it is possible that carp were beginning to move to their

deeper winter habitat reducing catchability. New research suggests that temperature variations, even within the summer or fall seasons, can affect common carp catchability (Simonson et al. 2022). One PE was calculated for the September survey alone and one PE was calculated for all three 2023 surveys combined (see table below). The CPUE and subsequent PE for the survey conducted in September of 2023 is similar to those calculated in 2019, 2021, and 2022, whereas the PE calculated from all three 2023 surveys is lower.

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$$\text{Carp density per hectare} = 4.71 * \text{CPUE} + 3.04$$

The CPUE and the resulting PE was lower during the September 2023 survey than the 2022 survey estimates but higher than in 2019 and 2021. The PE for September 2023 was 38,889 carp (982 lbs/acre). Combining all three 2023 surveys resulted in a PE of 18,288 (490 lbs/acre), which is a much lower estimate than we've seen in past years.

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Average Biomass Density (lbs/acre)	830	165	94
Average Biomass Density (kg/ha)	3,770.3	185.4	105.3

Unfortunately, the goal for Activity 2 was not met. The density of carp in Lake Winona is extraordinarily high compared to other MN lakes. It will take significant effort and resources to eradicate the carp population in Lake Winona.

ACTIVITY 3: Establishment of Clear Lake State and Submerged Aquatic Vegetation through Whole Lake Drawdown (if necessary) [Note: If the Whole Lake Drawdown is necessary it would be self-funded by ALASD].

Description: The goal of the project is to establish submerged aquatic vegetation in Lake Winona and flip the lake the clear lake state. Recent work by the University of Minnesota suggest that this can be accomplished through carp management. However, if carp management (activity 2) fails to result in the plant dominated state and achievement of water quality standards, the next step in the lake management sequence is to pursue a whole-lake drawdown. Ducks Unlimited and the Minnesota DNR routinely conduct whole lake drawdowns in Minnesota to establish submerged aquatic vegetation and most of the examples for shallow lake restoration in the Upper Midwest include combined management techniques of carp removal and whole-lake drawdown. These projects have demonstrated good success in invigorating the existing seed bed resulting in plant establishment without any need for transplanting. While we are confident that carp removal will result in plant establishment in Lake Winona, additional efforts may be needed to switch the lake into the clear lake state. In the case of Lake Winona, drawdown will be extremely expensive and is a more onerous process that requires approval by 75% of riparian landowners.

ACTIVITY 3 TOTAL BUDGET: $500,000 – $750,000
Estimated ENRTF Budget: $0
If this phase of the project is necessary the cost will be borne by the District.

Outcome	Completion Date
1. Evaluate feasibility of Whole Lake Drawdown (perform landowner survey). The District will conduct a landowner survey to gauge support for the drawdown. The District will also conduct a hydrologic analysis to determine the methods and feasibility of conducting a drawdown on Lake Winona.	Dec. 2023

2. Conduct Drawdown, if feasible. If feasible and necessary, the District will lower water levels in Lake Winona exposing as much of the sediment surface as possible in late summer and early fall. The outcome of the project will be to expose sediment of Lake Winona for 2 to 3 months.	Oct. 2026
3. Water Quality and Vegetation Monitoring. Result of the project will result in greater than 80% coverage in submerged aquatic vegetation and water quality (chlorophyll-a and Secchi depth) meeting water quality standards.	Oct. 2028

Project updates inclusive of each relevant activity will be made consistent with section II.

First Update July 1, 2019

No activities were completed for this activity.

Second Update January 1, 2020

No tasks were completed for this activity.

Third Update July 1, 2020

No tasks were completed for this activity.

Fourth Update January 1, 2021
No tasks were completed for this activity.

Fifth Update July 1, 2021
No tasks were completed for this activity.

Sixth Update January 1, 2022

No tasks were completed for this activity.

Seventh Update July 1, 2022

No tasks were completed for this activity.

Eighth Update January 1, 2023

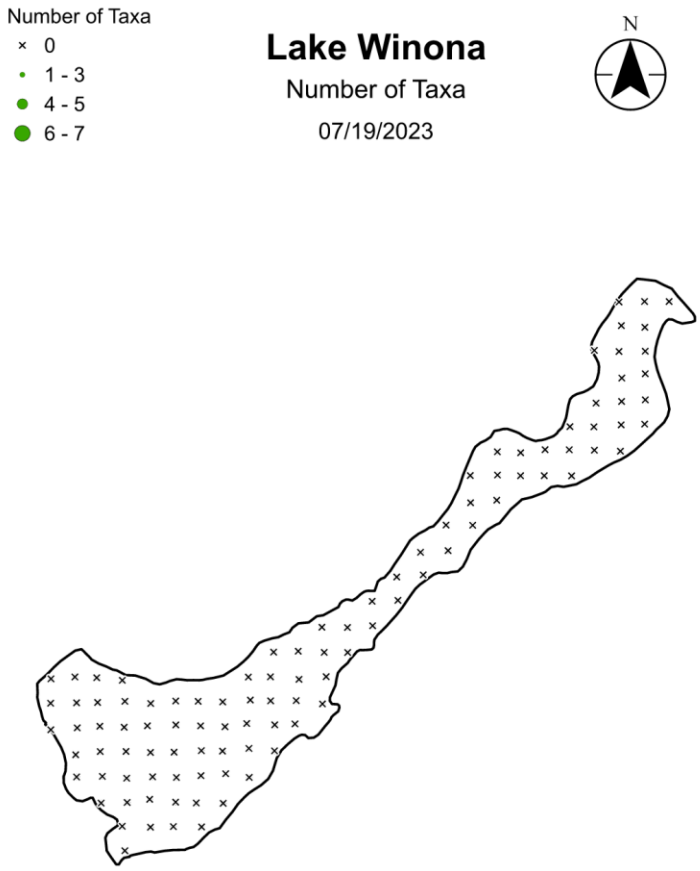
No tasks were completed for this activity.

Ninth Update June 30, 2023

Pending the results of the vegetation survey being collected this July, the feasibility for a lake drawdown will be evaluated according to the schedule and an update will be included in the next update**.**

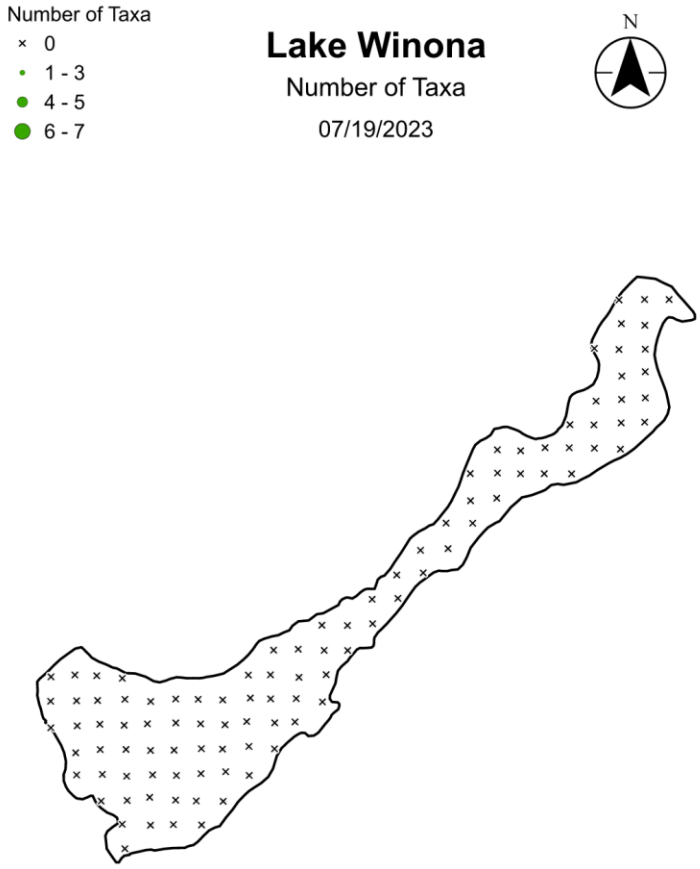
Tenth Update January 1, 2024

The final vegetation survey in Lake Winona was conducted on July 19, 2023. No taxa were observed in any of the survey points (noted by "x" in the figure below). Given that the density of carp is still so high in Lake Winona, we do not expect establishment of the submerged aquatic vegetation community until carp density is reduced to the goal.



Final Report Summary

The final vegetation survey in Lake Winona was conducted on July 19, 2023. No taxa were observed in any of the survey points (noted by “x” in the figure below). Given that the density of carp is still so high in Lake Winona, we do not expect establishment of the submerged aquatic vegetation community until carp density is reduced to the goal.



IV. DISSEMINATION:

Description: ALASD's website will be the principal vehicle for dissemination of information and results related to the project, including status updates. However, the City of Alexandria will be an active participant in the project and will also use their communication department to disseminate information regarding the project. ALASD will also likely hold at least one additional public meeting associated with the project and engage in additional efforts to keep the media informed about the project. ALASD will adhere to the ENRTF Acknowledgment Guidelines.

Relevant project updates regarding dissemination will be made consistent with section II.

First Update July 1, 2019

A public hearing was conducted at the Douglas County Public Works facility on June 18, 2019 to present the results of the sediment coring and alum dosing as well as introduce the carp assessment project. Numerous residents, ALASD Board members, City of Alexandria Council members and staff, and County staff attended the meeting. ALASD is also working on flyers for the alum treatment and carp management project to make available to the residents and to post on their website.

Second Update January 1, 2020

A presentation was made to the ALASD Board on October 9, 2019. No other tasks were completed for this activity.

Third Update July 1, 2020

A presentation was made to the ALASD Board on May 13, 2020. No other tasks were completed for this activity.

Fourth Update January 1, 2021

A presentation was given to the Alexandria Rotary Club on October 14, 2020. No other tasks were completed for this activity.

Fifth Update July 1, 2021

No other tasks were completed for this activity.

Sixth Update January 1, 2022

No other tasks were completed for this activity.

Seventh Update July 1, 2022

No tasks were completed for this activity.

Eighth Update January 1, 2023

No tasks were completed for this activity.

Ninth Update June 30, 2023

An Adaptive Management Progress Report was included on the ALASD website (Executive Summary - Alexandria Lake Area Sanitary District (alasdistrict.org)). A presentation was made to the ALASD Board on May 10, 2023.

Tenth Update January 1, 2024

No tasks were completed for this activity.

Final Report by June 30, 2024

An Adaptive Management Progress Report was included on the ALASD website (Executive Summary - Alexandria Lake Area Sanitary District (alasdistrict.org))

V. ADDITIONAL BUDGET INFORMATION:

A. Personnel and Capital Expenditures

Explanation of Capital Expenditures Greater Than $5,000: The District anticipates purchasing a stationary carp tracking device to place at the outlet of the Lake Henry to track carp immigration and emigration. The stationary carp tracking device will be installed and operated throughout the 5 year implementation period, at which time the equipment will be past its useable life.

Explanation of Use of Classified Staff: The appropriation will not be used to pay any classified staff.

Total Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: N/A

Enter Total Estimated Personnel Hours: N/A	Divide by 2,080 = TOTAL FTE: N/A

Total Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: The technical analysis will require about 1,400 hours over the course of the project; Subcontractors are estimated to contribute about 300 hours.

Enter Total Estimated Personnel Hours: 1,700	Divide by 2,080 = TOTAL FTE: 0.82

B. Other Funds:

SOURCE OF AND USE OF OTHER FUNDS	Amount Proposed	Amount Spent	Status and Timeframe
Other Non-State $ To Be Applied To Project During Project Period:			
The District may need to use its cash resources to fund all or a portion of activity 3 of the project, if said activity is necessary. The District may also fund additional alum if the final calculated dose requires more than budgeted.	$ 500,000-$750,000	$	TBD
Other State $ To Be Applied To Project During Project Period:			
N/A	$ N/A	$	
In-kind Services To Be Applied To Project During Project Period:			
N/A	$	$	
Past and Current ENRTF Appropriation:			
N/A	$	$	
Other Funding History:			
	$	$	

VI. PROJECT PARTNERS:

A. Partners outside of project manager's organization receiving ENRTF funding

The District's Executive Director, Scott Gilbertson, will act as the Project Manager. ~~Wenck Associates, Inc. will be the primary technical consutant. Joe Bischoff, a Principal in the firm, will act as project manager for the technical pieces.~~ Wenck Associates was acquired by Stantec Consulting Services, Inc during the course of this project. Joe Bischoff left Wenck Associates in 2020 and Anne Wilkinson became acting project manager until her departure in September 2023. Dendy Lofton, a Senior Associate in Stantec, acted as the technical lead beginning in July 2021 and project manager in September 2023.

B. Partners outside of project manager's organization NOT receiving ENRTF funding

City of Alexandria

VII. LONG-TERM- IMPLEMENTATION AND FUNDING:

Because completion of several components of the project will be required pursuant to the District's NPDES permit, the District will be responsible to fund efforts not covered by the ENRTF related to the project. It is also anticipated that ongoing efforts will be addressed and funded through the Lake Winona TMDL implementation group of which ALASD is a member and the City of Alexandria is the lead local government agency.

VIII. REPORTING REQUIREMENTS:

- The project that includes ENRTF funding is for 5 years, beginning on or before Sept. 1 2019 and ending on or before June 30, 2024. The overall restoration may need to extend to 2028, but does not require ENRTF funds.
- Periodic project status update reports will be submitted every six months consistent with section II.
- A final report and associated products will be submitted on or before June 30 2024.

IX. SEE ADDITIONAL WORK PLAN COMPONENTS:

A. Budget Spreadsheet
B. Visual Component or Map
C. Parcel List Spreadsheet
D. Acquisition, Easements, and Restoration Requirements
E. Research Addendum