MINNEHAHA CREEK
WATERSHED DISTRICT
QUALITY OF WATER, QUALITY OF LIFE

Meeting: Board of Managers
Meeting date: 1/11/2023
Agenda Item #: 11.2
Request for Board Action

Title:	Authorization to Execute a Contract with the University of Minnesota to Evaluate the Effectiveness of Carp Management as a Watershed Management Strategy
Resolution number:	24-006
Prepared by:	Name: Jill Sweet Phone: 952-930-1976 Email: jsweet@minnehahacreek.org
Reviewed by:	Name/Title: Brian Beck, R&M Program Manager Name/Title: Chuck Holtman, Legal Counsel
Recommended action:	Adopt Resolution 24-006 - Authorization to Execute a Contract with the University of Minnesota to Evaluate the Effectiveness of Carp Management as a Watershed Management Strategy
Schedule:	Initiate Project: Q1 2024 Data Analysis: Q2 & Q3 2024 Final Report & Presentation of Findings: Q4 2024
Budget considerations:	Fund name and code: Contract Services – 5-5001-4320 Fund budget: $163,730 Requested amount of funding: $64,947.43

Past Board action:	Res # 17-036	Title: Authorization to request funding from the Lessard Sams Outdoor Heritage Council
	Res # 23-070	Title: Authorization to Execute a Memorandum of Understanding (MOU) to Evaluate the Effectiveness of Carp Management as a Watershed Management Strategy in Partnership with the MPCA and DNR

Summary:

Background

In September of 2017, the Lessard Sams Outdoor Heritage Council (LSOHC) recommended the Six-Mile Creek-Halsted Bay (SMCHB) Habitat Restoration Project for $567,000 to the Minnesota State Legislature. The funding bill was approved, and the grant period began on July 1, 2018.

The project took a comprehensive approach to managing common carp in the SMCHB Subwatershed, based on the University of Minnesota's SMCHB carp assessment (2014-2017). This assessment developed a carp population census for each waterbody, identified migration patterns, and located reproduction areas. To address the carp population, the university researchers collaborated with District staff to develop a management approach consisting of three primary strategies:

1. Adult biomass removal.
2. Aeration of shallow lakes to prevent successful carp reproduction.
3. Barriers to prevent carp movement between waterbodies and assist with removal.

MCWD successfully executed the LSOHC grant between 2018 and 2022 by implementing a three-pronged strategy in the SMCHB Subwatershed. Looking ahead, the project will focus on the following steps:

1. Assessing water quality and vegetation response to carp management through field data collection.
2. Maintaining infrastructure and continuing to control carp biomass to ensure continued success.
3. Communicating MCWD's carp story with project partners and other interested public agencies.

In November of 2023, MCWD staff engaged with the Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Natural Resources (DNR) since they also have a role in carp management. These discussions have highlighted the need to better understand the variables that may affect carp management effectiveness and the impact of carp management on vegetation conditions and water quality since no comprehensive assessment has been conducted on the numerous carp management projects that have been implemented throughout the State of Minnesota over the past 10 years. The District, DNR, and MPCA staff have discussed each agency's interest in evaluating MCWD's carp management data set, along with other statewide data, to continue to refine their understanding of:

1. The response of water quality to common carp management.
2. The response of vegetation to common carp management.
3. The influence lake morphometry (size, deep vs shallow lakes) has on carp management outcomes.
4. The influence of hydrology and watershed characteristics (size, watershed to lake area ratio, landcover, waterbody connectivity) on carp management outcomes.
5. The effect of pre-removal lake conditions on carp management outcomes.

This partnership has been memorialized in a memorandum of understanding that outlines a systematic approach where each agency will bring its unique perspective and data to evaluate MCWD's carp management dataset. The District has allocated $75,000 in 2023 of its levied funds to analyze the outcomes of its carp management program. This collaboration is designed to enhance the capability of each agency to integrate carp management insights into their respective roles effectively.

University of Minnesota Analysis: Evaluating the Effectiveness of Common Carp Management in Minnesota

After engaging in discussions with our partners, the MCWD staff has concluded that the University of Minnesota (UMn) is the most suitable research organization to undertake this project. This decision is based on their prominent position as leaders in Aquatic Invasive Species (AIS) research within the state, along with the expertise of researchers like Dan Larkin and Jake Walsh, who have a background and prior experience in the specific subject of ecological response to lake management. Consequently, MCWD staff opted for a direct approach with UMn rather than opting for a competitive request for proposals.

The UMn has prepared a scope of work to conduct a multiscale analysis of existing carp management and ecological monitoring data to better understand the underlying factors that contribute to carp management effectiveness, and the impact of carp management on water quality and aquatic vegetation. The project will look at three tiers of analysis: statewide, Six-Mile Creek-Halsted Bay, and Wassermann Lake, to make use of MCWD's rich data collection at a local scale while also expanding to a larger geography to broaden the pertinence of the results.

The project is slated to be initiated in Q1 of 2024, with data discovery and compilation, analysis, report preparation, and outreach activities planned sequentially. Each partner agency reviewed the scope of work to ensure alignment with the shared goals and individual agency objectives. The partners will examine the findings at project milestones to ensure the final deliverable addresses the goals of all agencies, allowing for their endorsement. The UMn's final report will be published in a journal with practitioner readership and presented at relevant conferences with the aim to effectively communicate MCWD's carp story to our project partners and help shape the direction for future carp management initiatives.

The contract with the University of Minnesota for the performance of the study is in a lump sum amount of $64,947, with quarterly payments over the course of calendar year 2024. The study would use public data, and the study results would be public. The University of Minnesota researchers would have the ability to further present and publish work related to the study, with proper acknowledgement of the District's funding and partnership.

Supporting documents (list attachments):

- University of Minnesota Analysis Scope

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RESOLUTION

Resolution number: 24-006

Title: Authorization to Execute a Contract with the University of Minnesota to Evaluate the Effectiveness of Carp Management as a Watershed Management Strategy

WHEREAS, The field of water resources has long hypothesized that benthivores, including common carp, negatively impact aquatic vegetation communities in lakes, drive sediment resuspension, and degrade water quality;

WHEREAS, New research in the early 2010's provided a more quantitative relationship between common carp and aquatic vegetation health, establishing strategies for carp management with 100kg/ha as a critical threshold for carp biomass management targets;

WHEREAS, Working in partnership with Dr. Peter Sorenson and other leading University of Minnesota researchers, the District conducted a carp diagnostic study between 2014 and 2017 to quantify carp populations and clarify migratory patterns within the Six Mile Creek-Halsted Bay (SMCHB) Subwatershed – a 27-square mile, 14-lake, focal geography for watershed restoration tributary to Lake Minnetonka;

WHEREAS, Using the diagnostic data and management strategy developed by the University's Minnesota Aquatic Invasive Species Research Center (MAISRC), the District secured $567,000 in legislative funding through the Lessard Sams Outdoor Heritage Council in 2018 to implement a systems-scale carp management program within the SMCHB subwatershed from 2018 to 2023. At the time of implementation, this was one of Minnesota's largest carp management efforts;

WHEREAS, With this work concluding, and many of the management targets for carp population having been met, the District is interested in evaluating the efficacy of this effort, to bring increased focus to where and when it, and other watershed managers, may best apply carp management, and to better understand its impact on water quality and aquatic vegetation;

WHEREAS, In 2023, the District has allocated $75,000 of its levied funds to analyze the outcomes of its carp management program;

WHEREAS, The Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Natural Resources (DNR) both have an interest and a role in understanding the ecosystem response to carp management, and therefore the District has entered into an MOU with these agencies to outline opportunities to collaboratively study the impact of common carp management on lake ecology to inform how each organization approaches carp management in the future;

WHEREAS, The University of Minnesota (UMn) has developed a study scope and cost to analyze the effectiveness of carp management as a watershed management strategy to meet the shared objectives of the District, MPCA, and DNR;

WHEREAS, The UMn has proposed to incorporate into study cost an indirect cost component unrelated to the expenditure of time and resources of the UMn research team, however it is the position of the Board that the payment of such costs not incurred in the performance of the work is not within the District's authority and cannot be a component of study cost;

WHEREAS, adopted Board policy directs the District Administrator is to use a competitive method to retain professional services in excess of $25,000, however, the Board finds that the UMn is a leader in AIS research in the State, and that the research team possesses particular knowledge with respect to the subject matter, and therefore that the UMn is uniquely qualified to perform this work and a competitive procurement would not serve a useful purpose.

NOW, THEREFORE, BE IT RESOLVED that the District Board of Managers hereby authorizes the Administrator, on advice of counsel, to execute a contract with the University of Minnesota to evaluate the effectiveness of carp management as a watershed management strategy, in an amount not to exceed $64,947.43.

BE IT FURTHER RESOLVED that the contract will not include an indirect cost component.

Resolution Number 24-006 was moved by Manager _____, seconded by Manager _____. Motion to adopt the resolution ___ ayes, ___ nays, ___abstentions. Date: 1/11/2024

_____ Date: _____

Secretary

Evaluating the effectiveness of common carp management in Minnesota

Project Team

Minnehaha Creek Watershed District (MCWD): Brian Beck, Jill Sweet
University of Minnesota-Twin Cities (UMN): Jake Walsh, Dan Larkin
Minnesota Pollution Control Agency Lakes Lateral Team (MPCA): Jeff Strom, Amy Timm, Scott MacLean, Jesse Anderson
Minnesota Department of Natural Resources (MNDNR): Brian Nerbonne

Background

Common carp are known to disturb lake sediments and dislodge aquatic plants, which can alter the ecological makeup of lakes and adversely affect water quality. Common carp management can be an effective tool to improve water quality, but benefits are variable (Figure 1), are dependent on more than just carp response, and have been most often evaluated in shallow, unstratified lakes for which results may not be generalizable (Bajer and Sorensen 2015). An understanding of outcomes across a wider range of lakes could be used to more reliably prioritize lakes for carp management efforts.

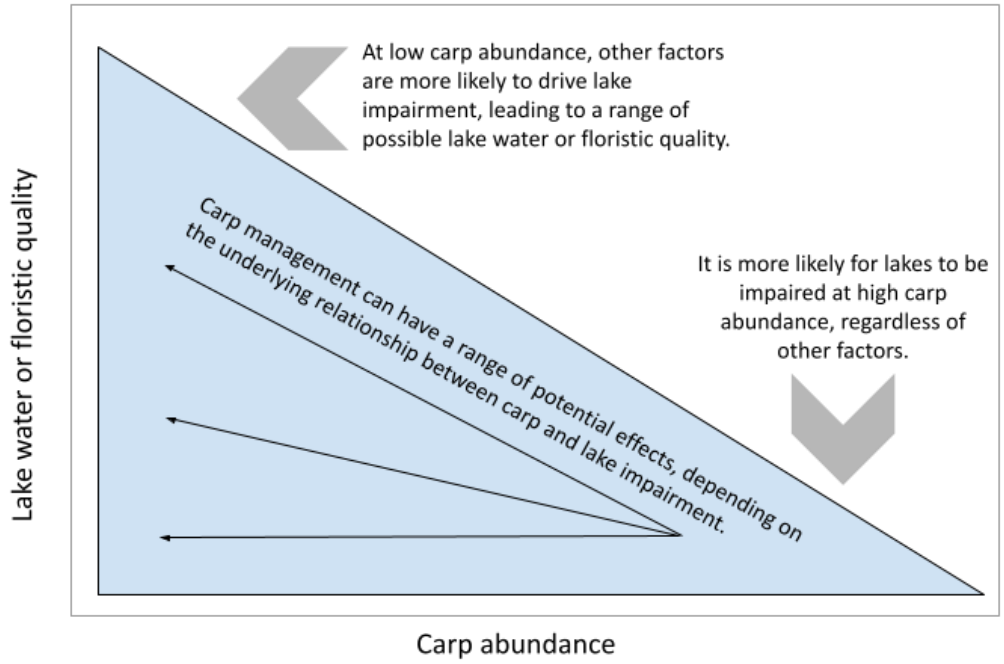

Figure 1 - Lake responses to carp management (black arrows) are likely to be variable and context-dependent (text and grey arrows), which can be represented by a wedge-shaped relationship.

Evaluating the effects of carp management in impaired lakes is complex and confounded by other, concurrent management efforts (Figure 2). Reducing biomass is often the focus of carp management and its evaluation, whereby success is defined as reducing the population below a threshold (e.g., < 100 kg/ha; Bajer et al. 2009). However, successfully reaching a threshold does not necessarily lead to a positive lake response, which is also dependent on context-specific interactions between lake processes, common carp, watershed characteristics, and other management.

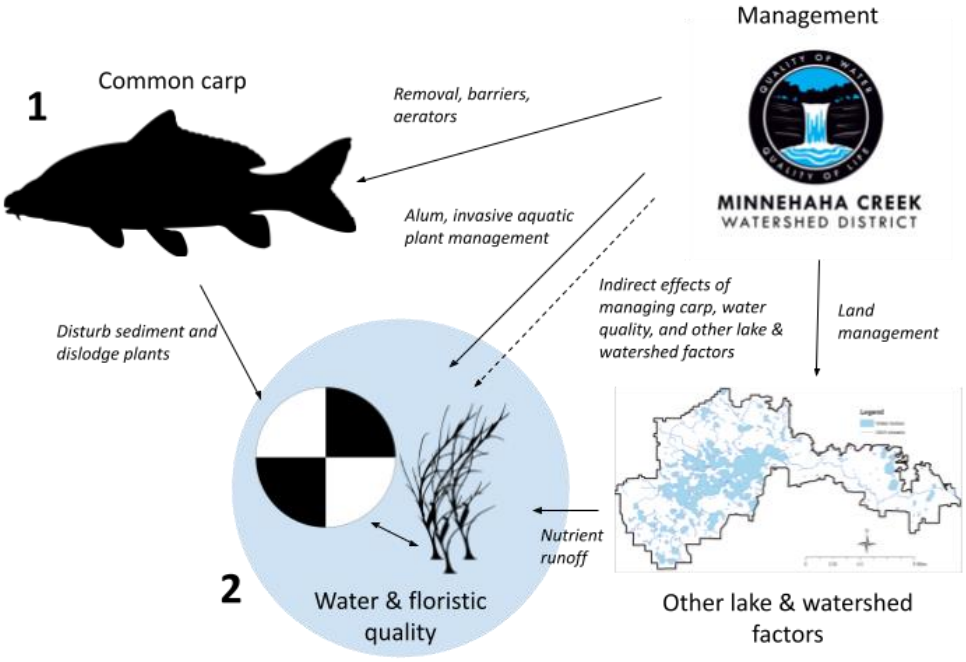

Figure 2 – The case of lake management in the Minnehaha Creek Watershed district highlights the complexity of managing water and floristic quality. Arrows represent example interactions. Effectiveness measures 1 and 2 are explained in more detail below. (Watershed map from Zhang and Mueller 2013.)

Objective. UMN proposes a multiscale analysis of existing carp management and ecological monitoring data to better understand the underlying factors that contribute to carp management effectiveness (Table 1). Results will be compiled into a final product by UMN with input from the project team, which will be reviewed by the project team and prepared for publication in a journal with a practitioner readership (e.g., Lake and Reservoir Management).

Table 1. Data inventorying for a multi-scale approach to evaluate carp management effectiveness in Minnesota.

Scale	Data available	Data needs
Tier 1: Statewide	**Water quality.** MPCA will share data related to water quality such as Secchi depth, nutrient concentrations, chlorophyll-a, and lake morphology. Water quality datasets will be supplemented with UMN remote-sensing of water clarity. **Macrophytes.** MAISRC and the Larkin Lab have compiled a dataset of ~3,000 aquatic plant community point-intercept surveys in MN.	**Carp biomass and management.** MCWD will contact watershed district and contractor connections to share carp standing biomass and removal estimates, as well as other water quality management efforts such as barrier construction, alum treatments, and summarized watershed practices. **Derived measure of lake connections to potential carp nursery habitat.** Waterbody connectivity has been

		estimated for existing programs/research (MNDNR WHAF, MAISRC AIS Explorer Tool, LAGOS-NE). UMN will explore these tools to compile the necessary data to derive connectivity metrics relevant to management.
Tier 2: Six Mile Creek- Halsted Bay	MCWD has collected carp management and ecological monitoring data: electrofishing carp CPUE, fish community data on nursery lakes, spring and summer aquatic plant surveys, and water quality.	Similar datasets could exist for other watershed districts in the metro area, MCWD staff will contact districts to gauge interest in contributing data.
Tier 3: Wasserman Lake	MCWD has collected intensive, longer-term carp management and ecological monitoring data: electrofishing carp CPUE, monthly aquatic plant surveys, twice monthly water quality, and buoy monitoring data.	***

Measuring management effectiveness

Data collation and analysis will be led by UMN, who will coordinate monthly team meetings. In these meetings, UMN will ensure that data are used appropriately and that analytical products can be relevant and applicable for lake and carp management frameworks at MCWD, MPCA, and MNDNR. As such, response variables and covariates will be further refined in these meetings. Analyses will focus on two aspects of effectiveness for each study scale:

1) Carp biomass responses. (Figure 2-1) UMN will compile and quantify carp management efforts as a covariate for evaluating carp and lake responses to management across the state, subwatershed, and Wasserman Lake. Management effort and context will likely need to be qualitatively grouped where data are not comparable across sources (e.g., lakes with/without connections to nursery habitat, with/without connections suitable for a barrier, lakes with/without high bluegill densities). Reduction in carp biomass could be related to covariates such as lake area, littoral area (or proportion of littoral area), and shoreline development factor. UMN will also derive a metric of lake connections to potential carp nursery habitat, where nursery habitat is classified by stream width—as some streams are too wide for barriers to be a feasible management option.

2) Water quality responses. (Figure 2-2) UMN will evaluate the effects of carp management on water quality (e.g., Secchi depth or chl-a concentrations) and aquatic plant communities. UMN will investigate species responses, floristic quality responses, and community responses using structural equation modeling ("SEM"; Arhonditsis et al. 2006). Covariates will include lake depth, nutrient concentrations, pre-management water clarity, lake morphological characteristics derived in 1, TMDL estimates where

available, relevant management history (e.g., alum treatments), and watershed characteristics (e.g., size, watershed to lake area ratio, and land cover).

Six Mile Creek-Halsted Bay Subwatershed projects. The Minnehaha Creek Watershed District (MCWD) has managed common carp in 14 interconnected lakes in the subwatershed (2018 – 2022, funded by the Lessard Sams Outdoor Heritage Council). Management efforts have included removing 300,000 carp, constructing four barriers and one weir to interrupt carp spawning, and installing three aeration sites to promote bluegill overwintering and predation on carp eggs. Lake responses to carp management have appeared to be variable and context-dependent (e.g., Figure 1). Our analysis will investigate the factors that have contributed to successful carp reductions and improvements to water and floristic quality.

Wasserman Lake. MCWD has collected higher resolution data on Wasserman Lake, which had an abundant carp population that has been substantially reduced with management. After carp management, water clarity and curly-leaf pondweed abundance increased in spring, but there have been limited improvements in mid-late summer after curly-leaf pondweed senescence. To manage summer water quality, MCWD treated the lake with alum in 2022. Wasserman Lake will provide an opportunity for more in-depth, longitudinal analysis of carp removal effectiveness, especially concerning seasonal patterns and pairing carp removals with additional water quality management strategies.

Timeline

Q1 2024	Work with team to gather relevant data and metadata and co-develop an analytical framework that would yield results directly relevant to management Monthly meeting goals: Confirm frequency and format of ongoing project discussions and identify the most useful final products.
Q2 2024	Summarize data and conduct analysis **Deliverable:** Progress report (data inventory and summary of preliminary results)
Q3 2024	Monthly meeting goals**:** Present results to MCWD, MNDNR, and MPCA; discuss implications for management; refine goals for final products; outline publication
Q4 2024	Prepare final products and share draft report with project team for comment and consultation Monthly meeting goals**:** Discuss next steps, lingering questions, and research uncertainty **Deliverable:** Final project report

Budget. The research co-development including data cleaning, analysis, and writing would require 0.5 FTE for Dr. Walsh ($47,979.52), 0.06 FTE for Dr. Larkin ($12,167.92), 320 hours for an undergraduate technician ($4,800) and 0% indirect ($0). Total: $64,947.43.

Personnel	Total
Q1	
Project Manager (Jake Walsh)	$11,994.88
Senior Project Manager (Dan Larkin)	$3,041.98
Technician (Undergraduate student)	$0.00
Quarter Total	*$15,036.86*
Q2	
Project Manager	$11,994.88
Senior Project Manager	$3,041.98
Technician	$2,400.00
Quarter Total	*$17,436.86*
Q3	
Project Manager	$11,994.88
Senior Project Manager	$3,041.98
Technician	$2,400.00
Quarter Total	*$17,436.86*
Q4	
Project Manager	$11,994.88
Senior Project Manager	$3,041.98
Technician	$0.00
Quarter Total	*$15,036.86*
Total	
Project Manager	$47,979.52
Senior Project Manager	$12,167.92
Technician	$4,800.00
Total	**$64,947.43**

References

Arhonditsis, G. B., C. A. Stow, L. J. Steinberg, M. A. Kenney, R. C. Lathrop, S. J. McBride, and K. H. Reckhow. 2006. Exploring ecological patterns with structural equation modeling and Bayesian analysis. Ecol. Model. **192**: 385–409. doi:10.1016/j.ecolmodel.2005.07.028

Bajer, P. G., and P. W. Sorensen. 2015. Effects of common carp on phosphorus concentrations, water clarity, and vegetation density: a whole system experiment in a thermally stratified lake. Hydrobiologia **746**: 303–311. doi:10.1007/s10750-014-1937-y

Bajer, P. G., G. Sullivan, and P. W. Sorensen. 2009. Effects of a rapidly increasing population of common carp on vegetative cover and waterfowl in a recently restored Midwestern shallow lake. Hydrobiologia **632**: 235–245. doi:10.1007/s10750-009-9844-3