

**Environment and Natural Resources Trust Fund
2019 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 106-BH

Citizen-Aided Carp Management: Overcoming Roadblocks to Lake Restoration

Category: H. Proposals seeking \$200,000 or less in funding

Sub-Category: B. Water Resources

Total Project Budget: \$ 106,151

Proposed Project Time Period for the Funding Requested: June 30, 2021 (2 yrs)

Summary:

Citizens will be enlisted to field-test a new method of managing carp to restore an impaired lake. Water quality & cost-effectiveness will be quantified to inform statewide implementation.

Name: Andrew Dickhart

Sponsoring Organization: Carver County Water Management Organization (CCWMO)

Title: AIS Coordinator

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Location

Region: Metro

County Name: Carver

City / Township: Cologne

Alternate Text for Visual:

Map of Benton Lake with proposed box net sites and a photo of nets. Also, visual representation of box net technique vs. other methods.

| | | | | | | | |
|--|--------------------|--------------------------|-------------------|--------------------------|-----------------------|--------------------------|----------------------------|
| <input type="checkbox"/> | Funding Priorities | <input type="checkbox"/> | Multiple Benefits | <input type="checkbox"/> | Outcomes | <input type="checkbox"/> | Knowledge Base |
| <input type="checkbox"/> | Extent of Impact | <input type="checkbox"/> | Innovation | <input type="checkbox"/> | Scientific/Tech Basis | <input type="checkbox"/> | Urgency |
| <input type="checkbox"/> | Capacity Readiness | <input type="checkbox"/> | Leverage | <input type="checkbox"/> | | TOTAL | <input type="checkbox"/> % |
| <input type="checkbox"/> If under \$200,000, waive presentation? | | | | | | | |



PROJECT TITLE: Citizen-aided carp management: overcoming roadblocks to lake restoration

I. PROJECT STATEMENT

The goal of this project is to demonstrate a new method of managing invasive common carp that can be implemented by citizen groups and LGUs to improve water quality by reducing in-lake nutrient loading. This new approach would overcome current roadblocks to successful carp management. Although research shows that lakes can be restored by managing common carp, widespread implementation of carp management has been severely hindered by lack of effective removal methods. Traditional methods such as lake drawdowns, poisoning, and commercial seining are often ineffective, harmful to native species, cost-prohibitive, and/or rely on a few specialized contractors that are difficult to secure. We propose to address these challenges by enlisting local citizens to field-test a simple, innovative method of removing carp via baiting and trapping using corn and custom “box nets”. This new approach was developed by the U of MN startup company, Carp Solutions, and is consistent with research findings that common carp can be trained to feed in specific locations of a lake using corn as bait. The chief advantage of box nets, which are stationary, is that carp can be lured into them and removed even in lakes with debris or where carp do not form natural aggregations. Further, baiting is simple enough that citizens can be trained to administer it, increasing the scalability and affordability of this strategy. Carp Solutions conducted proof-of-concept experiments in 4 lakes in 2017 which showed that 20-50% of carp were removed from each lake using only 1-4 nets, with no non-target impacts. This promising method could easily be scaled up by enlisting citizen groups to provide volunteer labor.

We request funding for a full-scale demonstration of carp removal using baited box nets in Benton Lake, a small lake in Carver County impaired for excess nutrients, which would serve as a model for other systems. The Carver County Watershed Management Organization (CCWMO) will partner with Carp Solutions and local citizens to test this new method. Effectiveness will be evaluated by quantifying carp removal efficiency and associated water quality improvements. This information will be used to guide implementation of this method in carp-infested lakes impaired for excess nutrients across the state. Our findings will also fill in important gaps in the scientific understanding of the impacts of carp and carp removal on annual nutrient dynamics.

Benton Lake is an ideal site for this test because there is detailed information on the existing carp population, a fish barrier at the outlet to prevent recolonization during removal efforts, an extensive water quality monitoring record, and local partners who are willing to participate in lake restoration activities by providing in-kind support. Specifically, in 2017, the CCWMO contracted Carp Solutions to conduct a carp assessment which showed that carp biomass was very high (~400 kg/ha) and typical of shallow lakes in Minnesota. Furthermore, phosphorus modeling revealed that Benton Lake requires a 97% reduction in internal phosphorus loading to meet State water quality standards and support recreation. The proposed project will make much-needed progress towards improving the water quality in this severely degraded lake and its findings will be broadly applicable to restoring similarly impaired waters.

II. PROJECT ACTIVITIES AND OUTCOMES

ACTIVITY 1: Demonstration of the new baited box net method

We will use multiple (≥ 5) baited box nets to aggressively remove carp from Benton Lake. The nets will be placed along the shoreline in mid-summer and baited using corn to condition the carp to aggregate at the bait site at night. Baiting will be conducted by citizens/partners who will be trained to administer the appropriate amount of bait and monitor its consumption by carp. The carp will be conditioned for 5-10 days and then the sides of the nets will be lifted to enclose the carp for counting and removal. The proportion of the carp population removed will be calculated by examining previously marked fish. This effort will be repeated at least four times per year; the goal is to achieve at least a 50% reduction in abundance in year 1. This effort will be conducted for two years in an attempt to reduce carp biomass from approximately 400 kg/ha to below 100 kg/ha (management threshold) and examine how quickly the goal can be achieved and whether effectiveness decreases as carp abundance declines. Overall removal efficiency (% population removed) will be calculated and plotted against time (number of net lifts and carp abundance). Labor and costs will also be calculated, including in-kind contributions, to enable calculations of cost per lb phosphorus (See Activity 3).

ENRTF BUDGET: \$ 80,776 (\$26,780 of additional in-kind support)

| Outcomes | Completion Date |
|--|------------------------|
| <i>1. Capture, marking, & release of ≥ 200 carp to enable tracking of removal progress</i> | <i>July 31, 2019</i> |
| <i>2. Nets installed, citizens/partners trained</i> | <i>Aug 31, 2019</i> |
| <i>3. Reduction of carp abundance by $\geq 50\%$; Season 1</i> | <i>Dec 31, 2019</i> |
| <i>5. Nets re-installed after winter, citizen/partner refresher workshop</i> | <i>June 30, 2020</i> |
| <i>6. Reduction of carp abundance $\geq 75\%$; Season 2</i> | <i>Dec 31, 2020</i> |



**Environment and Natural Resources Trust Fund (ENRTF)
2019 Main Proposal**

ACTIVITY 2: Monitoring of lake response to carp removal activities

We will collect detailed data to monitor improvements in Benton Lake resulting from carp removal to fill in key data gaps in the scientific literature. Specifically, lake restoration efforts via carp management typically focus only on total phosphorus (TP) and only during the growing season (May-September). We will measure in-lake concentrations of TP and total Kjeldahl nitrogen (TKN) year-round as well as select response variables including Secchi transparency, total suspended solids, chlorophyll-a, cyanobacteria abundance, and presence of cyanotoxins. We will also measure aquatic vegetation richness and cover, native fish community structure, waterfowl use, and recreational use. Furthermore, we will measure stream flow and nutrients at the outlet to calculate changes in nutrient export to downstream waters. All monitoring will be conducted annually for two years.

ENRTF BUDGET: \$22,600 (\$19,400 of additional in-kind support)

| Outcome | Completion Date |
|---|------------------------|
| 1. <i>Water quality, vegetation, fish, and waterfowl surveys – year 1 summer and fall</i> | <i>Dec 31, 2019</i> |
| 2. <i>Water quality monitoring– year 1 winter and spring</i> | <i>June 30, 2020</i> |
| 3. <i>Water quality, vegetation, fish and waterfowl surveys – year 2 summer and fall</i> | <i>Dec 31, 2020</i> |
| 4. <i>Water quality monitoring– year 2 winter and spring</i> | <i>June 30, 2021</i> |

ACTIVITY 3: Summarizing results and reporting findings

This task involves analyzing the carp removal and water quality data to quantify removal efficiency and lake response. The cost efficiency of reducing nutrients (\$ per lb of P and N) via carp management will be calculated for TP and TKN based on the mass of carp removed, measured in-lake nutrient concentrations, and annual discharge. Before and after comparisons of clarity, chlorophyll-a, plants, fish, waterfowl, and recreation will be also reported. Findings will be formally presented at the annual MN Water Resources Conference which brings together natural resource managers from across the state. CCWMO will also conduct educational outreach at pop-up stations onsite during carp removal efforts and at their annual city-wide festival.

ENRTF BUDGET: \$ 2,775(\$6,900 of additional in-kind support)

| Outcome | Completion Date |
|--|------------------------|
| 2. <i>Cost effectiveness and lake response report – year 1</i> | <i>June 30, 2020</i> |
| 4. <i>Final report on cost effectiveness and lake response</i> | <i>June 30, 2021</i> |

III. PROJECT PARTNERS:

A. Partners receiving ENRTF funding

| Name | Affiliation | Role |
|---------------------|--------------------|--|
| Carp Solutions, LLC | Consultant | Provides technical expertise and equipment for carp removal and fish surveys |

IV. LONG-TERM- IMPLEMENTATION AND FUNDING:

In addition to providing in-kind support for this project, CCWMO has invested in assessments and infrastructure to plan for long-term carp management in this system. In 2013, CCWMO installed a carp barrier at the outlet of Benton Lake, to protect this system from downstream sources of carp. In 2017, CCWMO contracted Carp Solutions to estimate carp abundance which showed that carp biomass was very high (661 kg/ha) and that carp were most likely responsible for poor water quality. In 2017, CCWMO also conducted a preliminary assessment of the box net technology, which showed that 21% of the population (5,105 carp) were removed with just 2 nets. In 2018, CCWMO is committed to investing in studies of carp recruitment, seasonal migrations, and overwintering sites. CCWMO is also examining the need for a winter aeration system to strengthen native fishes (bluegills) to reduce future carp reproductive success. Implementation of these activities is funded by local dollars through annual budgetary processes including the Carver County Capital Improvement Plan. Overall, the vision of CCWMO is to implement an integrated pest management strategy for carp in a shallow lake system that could be used as a model for other locations across Minnesota.

V. TIME LINE REQUIREMENTS:

Carp removal and lake response monitoring will be conducted for 2 full years starting in July 2019 and ending in June 2021. Data analysis and final reporting will be completed by June 30, 2021.

2019 Proposal Budget Spreadsheet

Project Title: Citizen-aided carp management: overcoming roadblocks to lake restoration

IV. TOTAL ENRTF REQUEST BUDGET 2 years

| BUDGET ITEM | AMOUNT |
|--|-------------------|
| Personnel: all CCWMO staff time will be included as in-kind contribution | N/A |
| Professional/Technical/Service Contracts: | |
| Subcontract Carp Solutions LLC, to provide technical expertise and specialty equipment for: Electrofishing to catch, mark, & release carp for progress tracking (\$3,840) Training citizens & local partners to bait/monitor nets, oversight (\$3,600) Seasonal deployment & management of box nets, removal & disposal of carp (\$70,336) Native fish community surveys following DNR protocols (\$4,000) Data analysis and report preparation (\$2,400) | \$ 84,176 |
| Subcontract laboratory for water quality analyses: In-lake monitoring for TP, TKN, TSS, Chl-a; biweekly; year-round; 2 years (\$6,250) In-lake monitoring for cyanobacteria/cyanotoxins, monthly; July-sept; 2 years (\$6,100) Outlet monitoring for TP, TKN; year-round; 2 years (\$2,950) Courier for sample pick-up; 2 years (\$1,400) | \$ 16,700 |
| Equipment/Tools/Supplies: | |
| Continuous water level logger for outlet stream | \$ 1,400 |
| Trail cameras for waterfowl monitoring (2 * \$250) | \$ 500 |
| Corn for baiting 6 nets; 4 attempts per year; 2 years | \$ 3,000 |
| Acquisition (Fee Title or Permanent Easements): | N/A |
| Travel: all travel will be provided as in-kind support | N/A |
| Additional Budget Items: Registration fee for presenter at UMN Water Resources Conference | \$ 375 |
| TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST = | \$ 106,151 |

V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

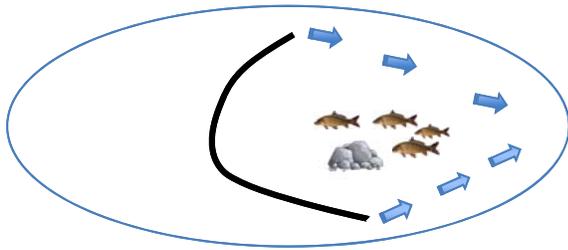
| SOURCE OF FUNDS | AMOUNT | Status |
|--|-----------|----------------|
| Other Non-State \$ To Be Applied To Project During Project Period: | N/A | |
| Other State \$ To Be Applied To Project During Project Period | N/A | |
| In-kind Services To Be Applied To Project During Project Period: | | |
| Citizen baiting & monitoring of box nets | \$ 22,280 | <i>Secured</i> |
| CCWMO staff time for water quality monitoring, community outreach, & data analysis | \$ 30,800 | <i>Secured</i> |
| Past and Current ENRTF Appropriation: N/A | N/A | |
| Other Funding History: 2017 CCWMO-funded carp assessment to collect baseline data | \$ 37,000 | <i>Secured</i> |

Citizen-aided carp management: overcoming roadblocks to lake restoration

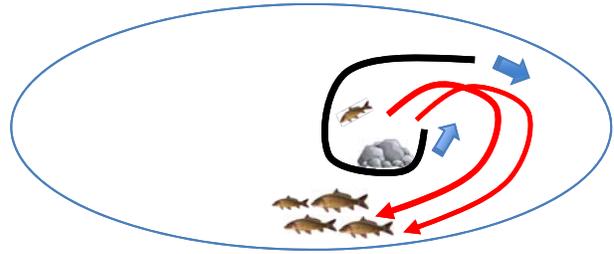
Lake restoration via carp management has been unable to progress from science to implementation because effective removal methods are lacking. This can be solved by a new citizen-aided method.

Winter seining: Leading current carp removal method that is often ineffective

1. Commercial seine net is deployed under the ice and pulled across the lake towards a landing site near shore to capture an aggregation of carp

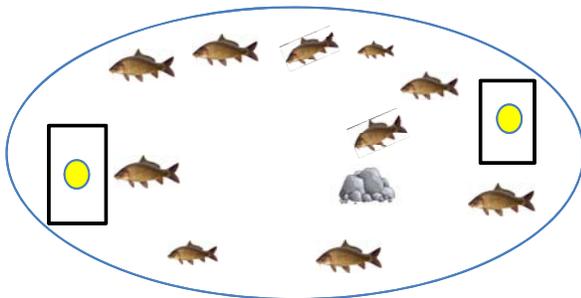


2. The nets often snag on natural debris on the bottom of the lake (e.g. rock piles, vegetation). Carp may escape, learn to avoid the net, and become very difficult to catch.

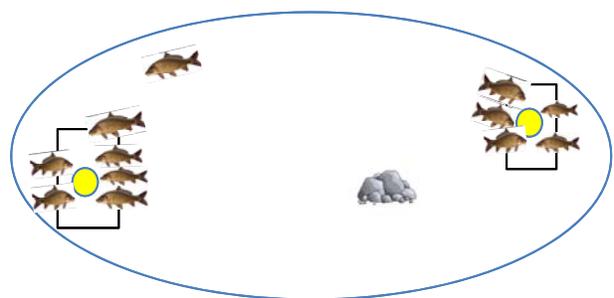


Baited Box Nets: New citizen volunteer-aided method of carp removal

1. Carp actively forage throughout the lake during the summer and fall. Box nets, specialized nets designed to lie flat on the lake bottom, are set up in shallows and baited with corn. Local citizens are enlisted as volunteers to scale up this effort and reduce costs.



2. After several days, carp learn to feed at the bait sites, forming aggregations over the nets. At night, when carp are actively feeding, the sides of box net are lifted, capturing the carp inside for removal. This method can be repeated multiple times and is very selective because only carp are attracted to corn.



Left: Benton lake with proposed locations for 6 box nets. Photo in the middle shows an overhead view of the net during carp removal-not shown to scale.

Below: Side view of box net with sides raised.



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Statement of qualifications

Carver County Water Management Organization (CCWMO) staff members are well equipped to address the technical and educational components of projects associated with ENRTF funding. **Carp Solutions** is a University of Minnesota startup company specializing in assessing carp populations and developing sustainable management solutions for lakes and watersheds based on innovative science. Together, CCWMO and Carp Solutions have a wealth of background in hydrology, biology, water quality, aquatic invasive species, outreach, and environmental education. Combined, staff from each group has over 100 years of experience in water resource management and fisheries biology. A total of five full time CCWMO staff will be available for implementation of this project over the proposed two year period. The main managers of the project and individual qualifications are summarized below:

Andrew Dickhart, AIS Coordinator for Carver County, holds a B.S. in Environmental Science & Biology from the State University of New York. Andrew has extensive experience working with invasive species research, control, and management. He is also the project manager for two Initiative Foundation pilot projects focusing on AIS prevention and management. He will coordinate work with various local stakeholders, CCWMO staff and Carp Solutions staff.

Andrew Edgcumbe, Water Resources Technician, is currently working on his M.S. in Aquatic Ecology with a Fisheries focus from MSU, Mankato. Andrew has an extensive knowledge of lake ecology and water quality, with a broad background in fisheries management. Andrew will be responsible for the majority of field activities for the CCWMO including lake and stream monitoring, stream load analysis, and aquatic macrophyte surveys.

Madeline Seveland, Water Resources Education Coordinator, holds a M.S. in Water Resources Science focused on watershed planning and management. She leads the education and communications program for CCWMO. She will be responsible for educational programs and public outreach for this project.

Przemek Bajer is the owner of Carp Solutions. He has a PhD. in Fisheries Sciences and is experienced in many aspects of carp management, biology and ecology. As a faculty member at the University of Minnesota, he has been at the forefront of common carp research and management since 2006. Many of the most referenced scientific publications on carp management in North America have been authored by Dr. Bajer. He will oversee the entire project.

Jordan Wein has managed all projects for Carp Solutions since June 2015. His previous work on closely related projects from 2008-2010 led to a M.S. in Ecology, Evolution and Behavior. His communication and education-based focus establishes lasting relationships with clients and residents on all projects. He will manage all field operations, data collection, citizen training, and logistics of Carp Solutions staff.

Aaron Claus has worked as a fish biologist for Carp Solutions since 2016 and holds a M.S. in Fisheries Science and Management. He has wide-ranging experience in fish biology, behavior, and management and is an experienced and efficient field operator. He will conduct field work with seasonal technicians, analyze collected data, and prepare reports.