Environment and Natural Resources Trust Fund

M.L. 2022 Approved Work Plan

General Information

ID Number: 2022-272

Staff Lead: LCCMR General Universal Staff User

Date this document submitted to LCCMR: June 24, 2022

Project Title: Salt Threatens Minnesota Water Quality and Fisheries

Project Budget: $1,228,000

Project Manager Information

Name: Mark Edlund

Organization: Science Museum of Minnesota - St. Croix Watershed Research Station

Office Telephone: (612) 965-6946

Email: medlund@smm.org

Web Address: https://www.smm.org/scwrs

Project Reporting

Date Work Plan Approved by LCCMR: July 27, 2022

Reporting Schedule: March 1 / September 1 of each year.

Project Completion: June 30, 2025

Final Report Due Date: August 14, 2025

Legal Information

Legal Citation: M.L. 2022, Chp. 94, Sec. 2, Subd. 04l

Appropriation Language: $1,228,000 the second year is from the trust fund to the Science Museum of Minnesota for the St. Croix Watershed Research Station to determine chloride tipping points that lead to water-quality and food-web degradations, measure how and when lakes are salinized, identify lake and food-web resilience to chloride, and test impacts of deicing alternatives.

Appropriation End Date: June 30, 2025

Narrative

Project Summary: Salt levels are rising in Minnesota lakes, and biological impacts may be worse than we think. We determine effects on water quality and foodwebs, and how to save our lakes.

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Road salt is essential for human safety in Minnesota, but it also damages our fisheries and lake water quality. Salinity is a threat all across the state: salty discharges come from water treatment plants, water softeners, and fertilizer, not just from busy roads in the Metro. A proposed rule change by the MN Pollution Control Agency could further increase salty discharge from new sources. Past LCCMR funding helped identify the causes of salinization and fine-tune winter de-icing, but the effects of salt on lakes — on food webs, fish, water clarity, and noxious algae — remain largely unknown.

Lakes suffering from salt pollution are often our greenest lakes, rich in nutrients, choked with algae, with oxygen loss and fish kills. In addition, salt can harm the beneficial zooplankton Daphnia, which graze on algae to clear the water, and are a critical food source supporting fisheries. We do not currently understand how sensitive to salt Daphnia are, and thus how resilient our lake foodwebs are. What happens to fisheries and water quality when Daphnia are affected? What can we do to avoid the worst effects? What should we be monitoring for? How can we adapt fisheries management to the continuing salt wave?

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

We can solve this knowledge gap efficiently by comparing lakes that have been affected by salt to varying degrees. These lakes are chosen from Central Minnesota (support letter DCLA) and in the Twin Cities Metro, and provide a model for lakes across the state that could become saltier.

We will show how salt (in particular chloride) affects lake health, by using interlocking methods that illuminate each lake's present, past, and future conditions:
1) Lake surveys to determine current conditions: nutrient cycles, noxious algae, and food webs;
2) Historical analysis to determine when, why, and how much salt has changed nutrients, algae, and food webs;
3) Lake simulation experiments for "what if?" scenarios to understand how salinity alters lake oxygen and nutrients.

Because of the importance of these results to resource managers, communities, anglers, and other lake users, our proposed project also includes a robust plan for:
4) Communication of results and solutions for how to protect lakes from increasing salt.

Of great concern is identifying "tipping points," levels of salt beyond which irreparable damage to a lake occurs. And to protect fisheries, we also need to understand the early effects of salinization on Daphnia populations in our lakes.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

The project benefits Minnesotans by:
1) identifying lakes and food webs that have resilience to salinization, and conserving them;
2) protecting vulnerable lakes and fisheries against damage from excessive levels of salt that approach "tipping points";
3) linking ecological processes, experiments, and lake simulations to determine ways to enhance and preserve salinized lakes.

It is difficult to remove salt, so we need to learn to both manage salt at the source and manage lakes that are already

affected. Understanding these linkages and the thresholds beyond which lake quality and food webs suffer will inform policy and prioritize lakes for preservation.

Project Location

What is the best scale for describing where your work will take place?

Region(s): Central, Metro,

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Measure differences among lakes under varying threat of salinization with intensive monitoring

Activity Budget: $536,091

Activity Description:
We will measure water quality and food webs monthly for two years in 15 lakes located throughout Central Minnesota and the Metro; the lakes are grouped in five 3-lake clusters. High frequency monitoring buoys will be deployed in all lakes to record water-column temperature, oxygen, and chloride every 30 minutes. Five lakes (Tanners, Parkers, Powderhorn, Little Johanna, Henry) are "impacted", with chloride levels 500-1000% above background concentrations. Five lakes (Medicine, Bde Maka Ska, Beaver, Wabasso, Uhlenkolts) are "at risk" showing chloride approximately 200% above background levels, and five lakes (Minnetonka, Cedar, Phalen, Josephine, Smith) are "least impacted" but still show chloride 50-100% above background.

Molecular analyses (DNA) will be used to characterize lake food webs. We will isolate 150 Daphnia pulicaria clones (~10 per lake) and survey for genes correlated with chloride tolerance. Daphnia pulicaria, a keystone species, maintains water clarity by eating algae, and serves as preferred forage for recreational fisheries. We will also characterize each lake's cyanobacteria using DNA to determine if genetic diversity of noxious algae is also correlated with chloride tolerance. Threshold changes in water quality and food web genetic diversity will define chloride tipping points for Minnesota lakes.

Activity Milestones:

Description	Approximate Completion Date
Collect and isolate Daphnia clones from 15 lakes to test for adaptation to salinitiy	September 30, 2023
Measure nutrients, salinity, algae, and zooplankton for one year (2023) in 15 study lakes	December 31, 2023
Set up, deploy, and measure lake behavior using monitoring buoys in 15 lakes during 2023	March 31, 2024
Collect surface sediments in lakes to test for differences in cyanobacteria among differentially salinized lakes	March 31, 2024
Measure nutrients, salinity, algae, and zooplankton for one year (2024) in 15 study lakes	December 31, 2024
Set up, deploy, and measure lake behavior using monitoring buoys in 15 lakes during 2024	March 31, 2025
Use molecular tools to analyze lake food webs (Daphnia and cyanobacteria) for chloride tolerance	April 30, 2025

Activity 2: Use core samples to reconstruct the history and threat of salinization

Activity Budget: $472,955

Activity Description:
Every lake accumulates sediments (mud) that record its history, like a stack of newspapers. We will collect sediment core samples from 15 study lakes and determine when and how much they have changed in response to salinization—their food webs, biology, nutrient and chloride levels—by analyzing multiple chemical and biological indicators. We will determine the ages of each core, then reconstruct historic food webs using Daphnia remains, reconstruct past chloride and nutrients using diatoms and existing monitoring data, and reconstruct historic algae using fossil pigments and other indicators of past productivity. We will test whether increasing chloride causes reductions in the abundance of good keystone Daphnia species, degrades the food web, and leads to poor water quality.

When salty snowmelt enters lakes, it flows downward and smothers the bottom, depleting the oxygen, releasing phosphorus, and turning lakes green with noxious algae. We will experiment in the lab on short sediment cores to test

how different levels of salt and dissolved oxygen affect sediment release of phosphorus. We will also replicate these experiments with potassium acetate, an alternative to chloride road salt, to see if it is less harmful.

Activity Milestones:

Description	Approximate Completion Date
Collect short cores to test internal nutrient loading differences in salinized lakes vs alternative deicers	December 31, 2024
Collect, date, and subsample sediment cores from 15 lakes, recover history of salinization among lakes	December 31, 2024
Compare historical changes in water quality, salinity, and food webs among 15 study lakes	June 30, 2025
Analyze historical changes in biogeochemistry (nutrients, algae, zooplankton) of sediment cores from 15 salinized lakes	June 30, 2025

Activity 3: Identify critical salinity thresholds to stabilize the food web: reduce algae blooms and protect resilient food webs

Activity Budget: $218,954

Activity Description:
Lake and genetic simulation tools coupled with experiments will help solve the lake salinization crisis. We will mathematically simulate dense salty layers in lakes that cause low-oxygen bottom waters to determine critical thresholds of road salt or potassium acetate that cause density layers to form. This gives watershed managers scientifically based targets for reducing deicer applications and fixing lakes.

We determine resilience of lake food webs to salinization by measuring genetic relatedness of Daphnia populations among lakes. Study lakes are grouped into clusters, allowing us to explore how chloride-impacted lakes will exchange genes at different spatial scales. We will identify Daphnia populations that have “desired” genes and how likely these genes will be transported to other lakes, increasing lake resilience to increasing chloride—in short, this activity will determine which lakes are at risk for water quality and food web collapse and how we can fix them.

Through reporting, presentations, and outreach (lake associations, MPCA, Road Salt Symposium, MN Groundwater Association), we will spread our findings to help communities and agencies stop salt pollution before it threatens our favorite lakes and fisheries.

Activity Milestones:

Description	Approximate Completion Date
Use lake modeling tools to determine lake response and resilience to salinization	June 30, 2025
Develop reports, factsheets, and outreach to inform managers and Minnesotans on protecting their threatened lakes	June 30, 2025
Use genetic modeling tools to determine lake and food web resilience to salinization	June 30, 2025

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.
The research agenda outlined here, addresses salinization across scales ranging from genes to ecosystems and from local to regional to identify critical "tipping points" not only for Minnesota lakes, but for lake ecosystems globally. From our project we anticipate that we will develop scientific publications, reports, informational factsheets, and engage social media to inform resource managers, the scientific community and lay-persons on the state and fate of Minnesota's salt-threatened lakes. Edlund and project personnel are periodically invited to give presentations within their organizations, to agencies, at professional meetings, and to outside groups, and they will present this work upon invitation. We will communicate the findings of this study with the public through factsheets, blogs, and social media (Twitter and Facebook) accounts associated with the St. Croix Watershed Research Station. We plan on publishing the results of this work as peer-reviewed publications in relevant scientific journals and communicating results at local, regional, state, and national meetings. The following specific deliverables will result from this project:
i) Final project report to LCCMR documenting results from Activities 1-3
ii) Fact sheet for broad audiences summarizing the threat, causes, implications, and management response to Minnesota's lake salinization crisis
iii) Social media posts through the outreach mechanisms and communication specialists at the Science Museum of Minnesota (e.g. https://www.smm.org/scwrs/fieldnotes) including blogs, field Facebook and Twitter posts
iv) Peer-reviewed publications (a minimum of 2-3 anticipated), presentations and technical assistance to local interest groups, county, state, and tribal agencies, and at local, state, or national meetings (e.g. lake associations, MPCA, Road Salt Symposium, MN Groundwater Association, ASLO, SFS).
We will acknowledge the Environment and Natural Resources Trust Fund through use of the trust fund logo or attribution language on all project print and electronic media, publications, signage, and other communications and outreach. We will use attribution language and social media tags found in the ENRTF Acknowledgment Guidelines.

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?
This project will determine chloride tipping points that lead to water quality and food web degradation, measure how and when lakes were salinized, identify lake and foodweb resilience to chloride, and test impacts of deicing alternatives. This information is needed at state and local levels to guide lake management and protection. We build on previous ENRTF funding and collaborations with other research groups, agencies, and stakeholders. Through reporting, presentations, and outreach (newsletters, MPCA, Road Salt Symposium, MN Groundwater Association), we will spread our findings to help communities and agencies stop salt pollution before it threatens our favorite lakes and fisheries.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Tracking and Preventing Harmful Algal Blooms	M.L. 2016, Chp. 186, Sec. 2, Subd. 04a	$500,000
Determining Risk of a Toxic Alga in Minnesota Lakes	M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 06f	$200,000

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Edlund, Senior Scientist		Project coordination, Fieldwork, Sediment Analysis, Water Quality, Diatom Analysis, reporting			43.7%	1.5		$174,600
Heathcote, Senior Scientist		Water Quality, DNA, environmental statistics, reporting			43.7%	0.75		$79,660
Myrbo, Assistant Scientist		Water and Core sampling, Core experiments, Outreach			43.7%	1.5		$152,775
Ulrich/Assistant Scientist		Lake Modeling			43.7%	0.99		$93,629
Field and Laboratory Technician		Field work and lab analyses			43.7%	1		$45,300
Science Communication Specialist		Outreach, communication, and social media			0%	0.1		$12,000
							Sub Total	**$557,964**
Contracts and Services								
University of Oklahoma or competitive bid	Professional or Technical Service Contract	Collection and analysis of 150 Daphnia clones @ $1000 per clone ($150,000; University of Oklahoma or competitive bid)				0		$150,000
TBD	Professional or Technical Service Contract	Lab analysis of pigments samples: Algal pigment analysis: 225 samples @ $150 ($33,750; University of Regina or competitive bid)				-		$33,750
University of MN Genomics Center or competitive bid	Professional or Technical Service Contract	Lab analysis of Daphnia DNA: 150 samples @ $80 ($12,000; University of Minnesota or competitive bid)				0		$12,000
University of MN Genomics Center or competitive bid	Professional or Technical Service Contract	Lab analysis of Cyano DNA: 16S water sample DNA sequencing: 75 samples @ $150 ($3,000; University of Minnesota or competitive bid)				0		$3,000

Science Museum of Minnesota, St Croix Watershed Res Stn	Internal services or fees (uncommon)	Lab analysis of water samples: TN/TP, DIN/SRP, DOC, DIC, chlorophyll a, chloride: 420 samples @ $187 ($78,540) (unit prices for analysis at SCWRS)				0		$78,541
Science Museum of Minnesota, St Croix Watershed Res Stn	Internal services or fees (uncommon)	Lab analysis of sediment samples: 210Pb: 15 cores @ $2,500 ($37,500), loss-on-ignition: 15 @ $800 ($12,000), Sed P: 15 @ $1,875 ($28,125), Diatoms: 15 @ $4,500 ($67,500), BSi: 15 @ $825 ($12,375), Core incubations: 27 @ $5,000/treatment ($135,000), (all unit prices for analysis at SCWRS)				-		$292,500
							Sub Total	**$569,791**
Equipment, Tools, and Supplies								
	Tools and Supplies	Lab/Field supplies	Lab/Field supplies (bottles, reagents, preservatives, consumables, duplicate field gear for AIS prevention - $18,000)					$18,000
	Tools and Supplies	Monitoring buoy supplies, 15 buoy setups at $4500 each. Each buoy will have 2 PME miniDOT dissolve oxygen loggers at $1125 ea, 2 HOBO U24-001 loggers at $840 ea., 10 HOBO temp loggers at $50 ea., and floats/lines/hardware at $70 ea.	Component sensors for constructing and installing monitoring buoys on 15 lakes					$67,500
							Sub Total	**$85,500**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Water Quality and sediment core sampling ($12,345), 84 days, 2 field crew, 11,340 miles, 14 days in hotel	Water Quality and sediment core sampling					$12,345

	Conference Registration Miles/ Meals/ Lodging	MN Lake Conference Outreach (i.e., Minnesota Water Resources Conference), formal presentation + booth for dissemination of project results results, 3 in-state conferences at $800 each	formal presentation + booth for dissemination of project results results					$2,400
							Sub Total	**$14,745**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$1,228,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request

Non ENRTF Funds

Category	Specific Source	Use	Status	$ Amount
State				
			State Sub Total	**-**
Non-State				
In-Kind	All indirect project costs are provided in-kind by the Science Museum of Minnesota (federal indirect rate 40.09% on all direct costs = $502,252)	In-kind contribution of indirects	Pending	$502,252
			Non State Sub Total	**$502,252**
			Funds Total	**$502,252**

Attachments

Required Attachments

Visual Component

File: 21ad95aa-d99.pdf

Alternate Text for Visual Component

Salt levels are rising in Minnesota lakes, but the biological impacts are poorly understood. We determine how salt damages water quality and food webs and how to save our lakes...

Optional Attachments

Support Letter or Other

Title	File
Letter of Support - Science Museum of MN	cea1a8a9-d4e.pdf
Letter of Support - Douglas Cty Lake Assoc	09daf31e-706.pdf
research addendum	5a480cd0-ef3.docx
Background Check form 2022-272	b6a40341-219.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

Please note responses to staff queries and comments:

1) Budget Please review the definitions of sole source P/T/S contracts vs. sub awards in the instructions on that page and reconsider your classification of the University of Oklahoma and UMN Genomics Center accordingly

Response: In our past LCCMR projects, we've had good experience using single source technical service contracts written to labs that do specific analyses for the project based on our positive past working relationships or using competive bids. In the case of UMN Genomics Center, this has worked well in past LCCMR projects; we anticipate the preparation and analysis of Daphnia clones by UOklahoma in Dr Weider's lab is best run that way as well, but would like to have the ability to use a competive bid if needed rather than a subaward.

2) Activities and Milestones Please add some intermediate milestones to Activity 1 to demonstrate progress over the course of the allocation, such as buoy deployment, collection of year one data, daphnia collection, etc.

Response: We've separated the monitoring milestones in Activity 1 into two milestones: data collected during lake visits (nutrients, algae, zooplankton) vs data gathered with monitoring buoys.

3) Project Collaborators It seems as if Dr. Larry Weider at University of Oklahoma should be listed as a project partner and the nature of the work with him is a sub award rather than a single source contract

Response: In our past LCCMR projects, we've had good experiences using single source technical service contracts written to labs that do specific analyses for the project based on our positive past working relationships or using competive bids. We anticipate the preparation and analysis of Daphnia clones by UOklahoma in Dr Weider's lab is best run that way as well, but would like to have the ability to use a competive bid if needed rather than a subaward. Dr Weider has also indicated his preference for this sole-source contract financial arrangement.

4) Activities and Milestones In general, each activity does not contain enough detailed milestones to demonstrate progress over the course of the project. Please revise to provide additional detail for each activity

Response: We've separated the monitoring milestones in Activity 1 into data collected during lake visits (nutrients, algae, zooplankton) vs data gathered with monitoring buoys. For Activity 2 we've added more detail to milestone 1 "Measure changes in internal nutrient loading among 15 salinized lakes vs alternative deiciers", and we've separated milestone 2 into two parts "Collect, date, and subsample sediment cores from 15 lakes" and "Analyze biogeochemistry (nutrients, algae, zooplankton) of sediment cores from 15 salinized lakes". For Activity 3, we've separated milestone 1 into two parts "Use lake modeling tools to determine lake resilience to salinization", and "Use genetic modeling tools to determine lake and food web resilience to salinization."

5) Budget Lab analysis costs: Can you explain what these costs include, especially since it appears personnel for lab analysis is already accounted for above? Is there a reason these costs are not listed in supplies for what we assume would be reagents, etc? Why are they listed as "unit costs" ?

Response: Lab analysis costs (in Other) are budgeted separately from personnel costs because they represent per sample laboratory costs charged at internal lab rates for water quality and sediment analyses. The per sample laboratory costs include labor by our laboratory technicians as part of the per sample analytical cost, which is why we have not included those staff or their time on the personnel budget lines. Personnel costs as listed cover project participants who are doing othe project related work including fieldwork, modeling, sample preparation, specialized analytical tasks and data analysis, project synthesis, coordination and communication.

6) Narrative Can you explain more how outcome #2 "Protect vulnerable lakes" is achieved with this project? Or is this project identifying lakes that need protection due to approaching a tipping point?

Response: The project design uses 15 lakes to provide two measures of how we can protect vulnerable lakes from salinization. First, the sediment records will provide us with timelines of how lakes respond to salinization in their nutrient chemistry, their algae communities, and their food webs. We hypothesize (Hypothesis 2 in Research Addendum) that lakes pass a tipping point where their water quality and food webs change to no longer supporting water quality, recreational, and fisheries/foodweb benefits. The project design includes lakes that range in salinity threat from "least impacted" to heavily "impacted"allowing us to fine tune what the tipping point of salinization is and guide agencies on how to protect lakes from reaching that point. Second, our molecular analysis of Daphnia populations from the lakes will allow us to understand the resilience of lakes and foodwebs to salinization. We hypothesize (Hypothesis 3 in Research Addendum) that lakes that are geographically grouped will be more resilient to salinization as lakes with salinity-adapted genetic variants of Daphnia will be more likely to share those variants among lakes through gene flow within geographic proximity.

7) Narrative The long-term implementation section implies this project will test impacts of deicing alternatives. We don't see that explained elsewhere. Do you mean a future project will do that?

Response: Perhaps this did not read perfectly well in the text in Activity 2, but we are not testing deicing alternatives on roads or impermeable surfaces. Instead, we are considering how these new "safer" alternives such as potassium acetate behave once they reach a lake. We will be testing how "regular" chloride-based salinity affects the internal loading of nutrients from the sediment in lakes. Then we will "replicate these experiments with potassium acetate, an alternative to chloride road salt, to see if it is less harmful (Activity 2)", i.e. compare the effect of potassium acetate on internal nutrient loading and whether it similarly can lead to loading levels that promote harmful algal blooms. We've also adjusted Activity 2, Milestone 1 for clarity to read "Measure changes in internal nutrient loading among 15 salinized

lakes vs alternative deiciers” and provide specific details in the Research Addendum.

8) Attachments Please upload approved research addendum in PDF format

Response: Approved Research Addendum uploaded as requested.

Here are my comments on the second round of staff comments and questions (submitted 24June2022):

1 Activities and Milestones Please add some intermediate milestones to Activity 1 to demonstrate progress over the course of the allocation, such as buoy deployment, collection of year one data, daphnia collection, etc.

RESPONSE: For Activity 1, I split the monitoring into two milestones by year (2023/2024). I split the buoy deployment and analysis into two milestones by year (2023/2024). I added a milestone to separate the collection/isolation of Daphnia from their molecular analysis milestone. I added a milestone for collection of sediment for molecular analysis of cyanobacteria.

2 Attachments Please upload the completed required background check attachment per 5/23/22 email from LCCMR

RESPONSE: Uploaded completed background check as attachment

3 Dissemination Please include in the Dissemination section a statement about how Environment and Natural Resources Trust Fund will be acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications per the ENTRF Acknowledgment Guidelines.

RESPONSE: Added acknowledgement language as requested

4 Activities and Milestones Please revise/expand your activity descriptions and milestones to allow progress to be tracked during 2022 and 2023.

RESPONSE: For Activity 1, I split the monitoring into two milestones by year (2023/2024). I split the buoy deployment and analysis into two milestones by year (2023/2024). I added a milestone to separate the collection/isolation of Daphnia from their molecular analysis milestone.

5 Activities and Milestones Please add one or more milestones to Activity 1 to show experimental set-up at these lakes, sample collection, etc.

RESPONSE: For Activity 1, I split the monitoring into two milestones by year (2023/2024). I split the buoy deployment and analysis into two milestones by year (2023/2024). I added a milestone to separate the collection/isolation of Daphnia from their molecular analysis milestone.

6 Activities and Milestones Please adjust Act 1 Milestone 3: "Measure lake behavior using monitoring buoys in 15 lakes for 2 years" to be more comprehensive. An example might be: "calibrate, deploy, and monitor lake conditions using buoys in 15 lakes for 2 years to determine lake behavior "

RESPONSE: For Activity 1, Milestone 3, I split the buoy deployment and analysis into two milestones by year (2023/2024)

using this language “Set up, deploy, and measure lake behavior using monitoring buoys in 15 lakes during 2023” and “Set up, deploy, and measure lake behavior using monitoring buoys in 15 lakes during 2024”

7 Activities and Milestones Act 2: Milestone 1 could use some additional clarification that links it to the activity description. For example, adding something of this nature is helpful for staff to understand what is going on "Collect short sediment cores to examine how different levels of salt and/or alternative deicers..."

RESPONSE: Changed the working of Act 2: Milestone 1 to “Collect short cores to test internal nutrient loading differences in salinized lakes vs alternative deicers”

8 Activities and Milestones In general, milestones are not very closely linked to activity objectives. Please revisit and make sure you describe the connection between the experiments and the desired outcomes such that staff can follow what you are doing to understand if progress being made in the project.

RESPONSE: See changes to Activity 1 with 4 added milestones as outlined above and more description wording. See wording changes in Act 2, Milestone 1, “Collect short cores to test internal nutrient loading differences in salinized lakes vs alternative deicers”, Act 2, Milestone 2 “Collect, date, and subsample sediment cores from 15 lakes, recover history of salinization among lakes”, Act 2, Milestone 3 “Compare historical changes in water quality, salinity, and food webs among 15 study lakes”, Act 2, Milestone 4 “Analyze historical changes in biogeochemistry (nutrients, algae, zooplankton) of sediment cores from 15 salinized lakes”. Wording of Activity 3 milestones seemed well linked to the activity description and those milestones were not changed.

9 Budget If you are not certain that U. of Oklahoma will be the service provider and may wish to bid, then please remove the "generally ineligible" designation.

RESPONSE: Changed as requested

10 Budget Please provide additional details for the monitoring buoy supplies. Are any of the individual components over $5,000? If so, they must be split into their own budget line and marked as a capital expense. If no capital expense please include some information such as "15 buoy component X for $1,200 each"

RESPONSE: I’ve added the following description on buoy costs: “Monitoring buoy supplies, 15 buoy setups at $4500 each. Each buoy will have 2 PME miniDOT dissolve oxygen loggers at $1125 ea, 2 HOBO U24-001 loggers at $840 ea., 10 HOBO temp loggers at $50 ea., and floats/lines/hardware at $70 ea.”

11 Budget Because these lab analyses are conduct in-house but charged at a certain rate, these expenses should be listed under "professional/technical contract--internal fees" and not in the "Other" section

RESPONSE: These lab analytical charges have been moved to the "professional/technical contract--internal fees" and are no longer in the "Other" section

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

N/A

Do you agree travel expenses must follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I agree to the Commissioner's Plan.

Does your project have potential for royalties, copyrights, patents, or sale of products and assets?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

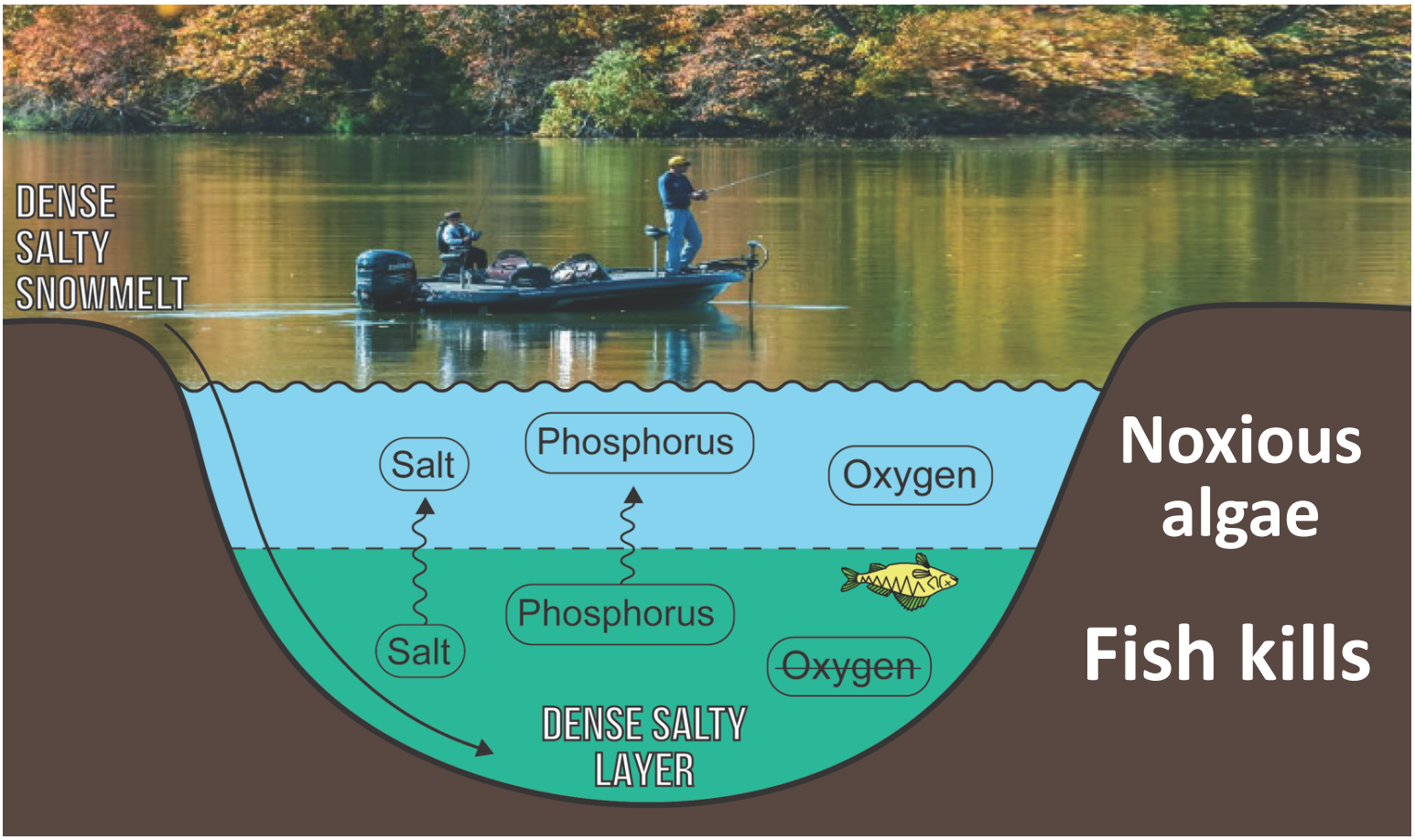
Yes

Does the organization have a fiscal agent for this project?

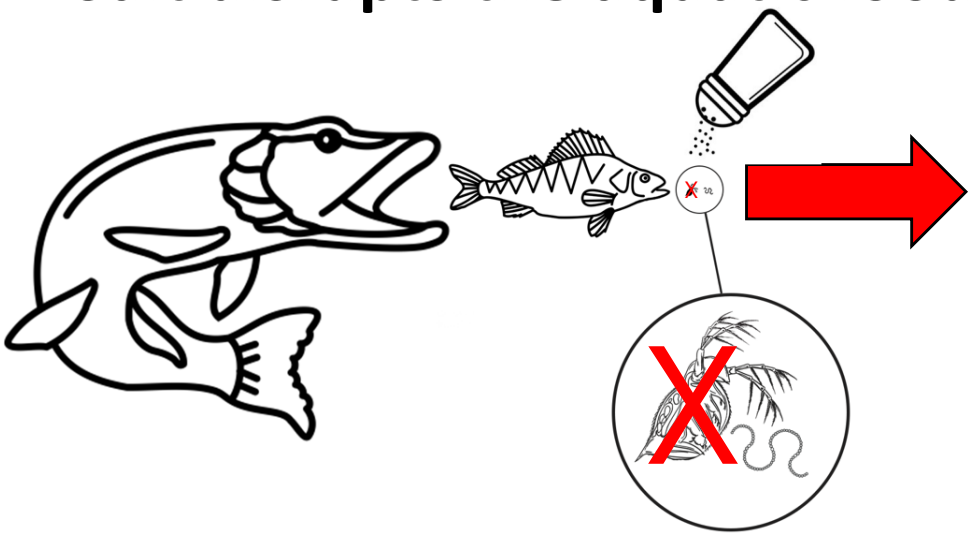
No

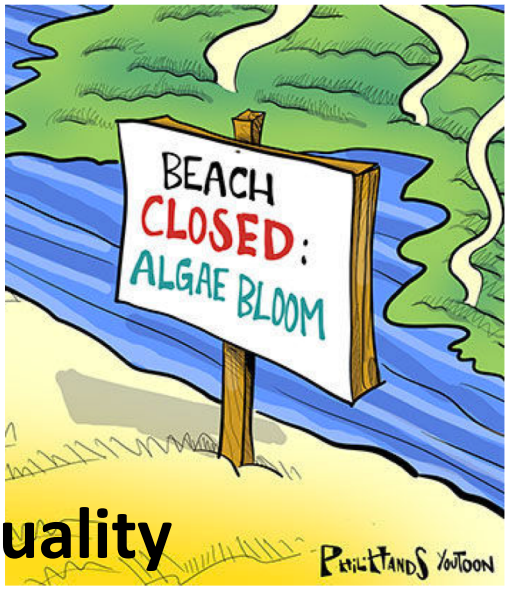
Environmental and Natural Resources Trust Fund (ENRTF)
2022 Main Proposal
Project: Salt threatens Minnesota water quality and fisheries

Minnesota lakes are getting saltier



Salt disrupts the aquatic foodweb…





…and harms water quality

Let's better protect & manage against salty lakes!