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

Project Title: **ENRTF ID: 070-B**

Forecasting Lake Superior Water Level and Community Security

Category: B. Water Resources

Sub-Category:

Total Project Budget: $ 329,687

Proposed Project Time Period for the Funding Requested: June 30, 2022 (3 yrs)

Summary:

Lake Superior's water level is changing in unpredictable ways threatening important fisheries, parks, and North Shore environments. We will find how to predict level to sustain environmental and recreational quality.

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Sponsoring Organization: U of MN - Duluth

Title: Director

Department: Minnesota Sea Grant College Program

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Location

Region: Northeast

County Name: Lake, St. Louis

City / Township:

Alternate Text for Visual:

Diagram of what happens when water levels are high and low plus trend in Lake Superior water level

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%
____ If under $200,000, waive presentation?			

PROJECT TITLE: Forecasting Lake Superior water level and community security

I. PROJECT STATEMENT

Background

- Currently, scientists think it takes 200 years to fill Lake Superior from streams around it
  - This is 1000-times slower than your bathtub would fill from a slow drip

What's happening?

- Lake Superior's water level is swinging widely up and down (see visual)
- It now has highest water levels in 20 years and near to the all-time recorded high of 1985
  - Recent increase = 1/3 the volume of Lake Erie
  - This is 200-times rates of sea-level rise
- 10 years ago water was lowest since dust-bowl
  - Drop was about 2/3 the volume of Lake Erie
- Current science and models cannot explain this, nor can we predict future levels
- This is because we ignore deep groundwater, do not know how weather alters stream inputs, and have poor information on evaporation
- Because this is a new phenomenon, we don't know how this will alter the North Shore environment or peoples' use of it.

Why does it matter?

- Lake Superior's North Shore has 8 important state parks; 4 of the top-10 MN parks
- North Shore streams yield 20% of the trout fishing in the state
- Lake Superior shores offer important bird habitat and flyway
- The North Shore environment is iconic for recreation
- High water levels cause shore erosion, loss of recreational environment and beaches, loss of bird habitat, drowning stream mouths impeding fisheries (see visual)
- Low water levels isolate streams from the lake, impeding fish movement and destroying stream/lake interface (see visual)

What's the problem to solve?

- We need to figure out how groundwater, precipitation, and evaporation change Lake Superior and what this means to the North Shore environment

What are we going to do about it (3 activities)?

- **Do research** to assemble current knowledge about Lake Superior's water budget and water level trends
- Get **experts to figure out** what groundwater and meteorological data are needed to make better predictions
- Do social science to understand **environmental and human costs** of water level change.

How will this help?

- We will be able to predict lake level changes better than we can now
- We can consider options for stabilizing levels
- We can compensate for rates of change to preserve environmental and recreational quality

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Find out what alters stream flow into the lake and evaporation from it **Budget: $133,051**

Outcome	Completion Date
1. Collect historical run-off data from gauged streams, analyze relation with weather, create report; analyze and report on historical weather and lake-level trends	June 2020
2. Estimate run-off from un-gauged streams, weight with run-off from gauged watersheds, combine with Outcome 1 to discern historical trends in inputs and outputs	June 2021
3. Summarize historical evaporation data from weather stations, relate to weather conditions, create report to combine with Outcomes 1-2	June 2021
4. Combine surface flows with evaporation and groundwater status and weather projections	June 2022

from Activity 2 to project future water level trends	

Activity 2: Define inputs of groundwater and the effects of weather **Budget: $80,134**

Outcome	Completion Date
1. Evaluate the current state of knowledge on submarine groundwater flux (SGF) via inviting annual expert panels of hydrogeologists. Collect data and summarize	June 2020
2. Evaluate summarized current information on SGF and weather projections critical to Lake Superior and create a report summarizing predictions and identifying further needs.	June 2021
3. Convene expert panel of meteorologists, weather and ice-scientists to summarize controllers of rain, temperature, wind, ice-cover, and evaporation and create a report.	June 2022

Activity 3: Find how environments and recreationists will be impacted by lake levels **Budget: $116,502**

Outcome	Completion Date
1. Conduct needs assessment and photo inventory displaying lake level change impacts to Lake Superior community stakeholders. Stakeholders will include: business owners (marinas, recreation, tourism), land owners, parks, resource and fisheries managers, local governments, conservation districts, city/county staff, sport fishing interests, and tribal groups (Grand Portage and Fond du Lac).	June 2020
2. Stakeholders will visualize future impacts of different water-level scenarios – concentrating on reasonable levels of variation in water levels projected by Act. 1-2	June 2021
3. Stakeholders will participate in a socio-economic analysis of the costs/benefits of the various lake level change scenarios, and identify priority actions for reducing environmental vulnerability. Workshops will identify priority adaptation strategies to increase resilience	June 2022

III. PROJECT PARTNERS:

A. Partners receiving ENRTF funding

Name	Title	Affiliation	Role
John A. Downing, PhD	**Director & Professor**	**MN Sea Grant & LLO**	**PI and project manager**
Chris T. Filstrup, PhD	**Research Associate**	**MN Sea Grant & LLO**	**Co-PI & science lead**
Thomas Beery, PhD	**Extension Educator**	**MN Sea Grant**	**Co-lead of outreach and lead of social science**
Jesse Schomberg, MS	**Extension Educator**	**MN Sea Grant**	**Co-lead of outreach**

IV. LONG-TERM IMPLEMENTATION AND FUNDING: The project will work with communities to adapt to future lake level changes resulting from trends and variations in Minnesota's weather, using the best available information. We will define critical knowledge gaps to fill to help Minnesota's coastal communities adapt to lake-level changes. Future proposals to USGS, the National Science Foundation, and NOAA will deal with filling knowledge gaps in groundwater flux, weather severity, and evaporation with increasing precision and accuracy.

V. Timeline Requirements: We are requesting project funding for three years with the project running from June 2019 – June 2022.

2018 Detailed Project Budget

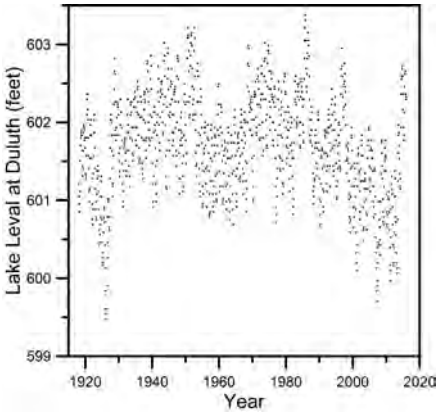
Project Title: Forecasting Lake Superior Water Level and Community Security

IV. TOTAL ENRTF REQUEST BUDGET *[Insert # of years for project]* **years**

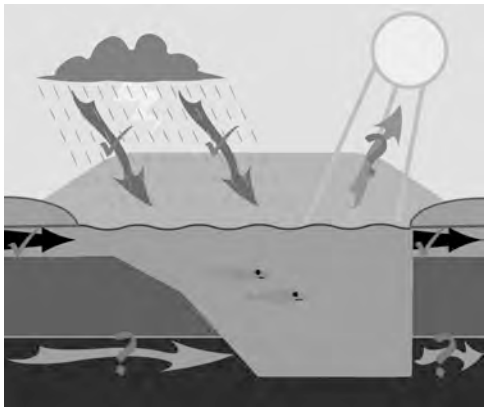
BUDGET ITEM *(See "Guidance on Allowable Expenses", p. 13)*	**AMOUNT**
Personnel: Chris Filstrup to analyze streamflow, evaporation, lake level (60% time), and participate in workshops in activity 2 (30% time) (total=90% time); Tom Beery to organize and undertake stakeholder outreach (30% time); Jesse Schomberg (15% time) to organize and undertake surveys and stakeholder workshops; John Downing (5% time) to organize and run groundwater section of the work	$ 304,190
Christopher Filstrup, Co- PI (75% Salary, 25% benefits); 90% in years 1-3 $189,098	
Tom Beery, Outreach, (75% Salary, 25% benefits); 30% in years 1-3: $72,417	
Jesse Schomberg, Outreach, (75% Salary, 25% benefits); 30% in years 1-3: $42,675	
Professional/Technical/Service Contracts: *In this column, list out proposed contracts. Be clear about whom the contract is to be made with and what services will be provided. If a specific contractor is not yet determined, specify the type of contractor sought. List out by contract types/categories - one row per type/category. If an RFP will be issued, state that.*	$ -
Equipment/Tools/Supplies: *Miscellaneous supplies*	$ 1,200
Supplies for Activity 2 to include but are not limited to: (Name tags, folders, stuff $200 x 3 =$600)	
Supplies for Activity 3 to include but are not limited to: (Name tags, folders, stuff $200 x 3 =$600)	
Acquisition (Fee Title or Permanent Easements): *In this column, indicate proposed number of acres and and name of organization or entity who will hold title.*	$ -
Travel: *Travel and meeting costs associated with expert panels and stakeholder meeting costs*	$ 21,387
Travel for Activity 1: Mileage to the cities once each year (320 miles @ $.545 per mile x 3 = $523); Travel to sites on lake Superior (1,379 miles @ $.545 per mile x 2 = $1,503, Per diem for travel 10 days @ $48 and 20 days @ $64 = $1,760, Hotel 20 days @ $160 = $3,200)	
Travel for Activity 2: Expert panel groups with five people on each panel; (flights - 2 people @ $550each x 3 = $3,300, In state travel - 3 people @ 300 miles each x $.545 x 3 = $1,471, Hotels - 5 people @ 3 nights each x $150 x 3 = $6,750, Per diem - 5 people @ $48 per day x 4 days x 3 = $2,880)	
Additional Budget Items: *Rental of meeting space for stakeholder planning and meal/ refreshments for meetings*	$ 2,910
Food for Activity 2 to include but not limited to: (Morning and afternoon refreshments $15 x 10 people x 3 = $450, Lunch $25 per person x 10 people x 3 = $750)	
Food for Activity 3 to include but not limited to: (Refreshments - $10 per person x 12 people x 3 = $360)	
Meeting space for Activity 2: (Rental of room for expert panel groups at tbd place $300 x 3 = $900)	
Meeting space for Activity 3: (Rental space at tbd place on the north shore $150 x 3 = $450)	
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 329,687

applicable.)

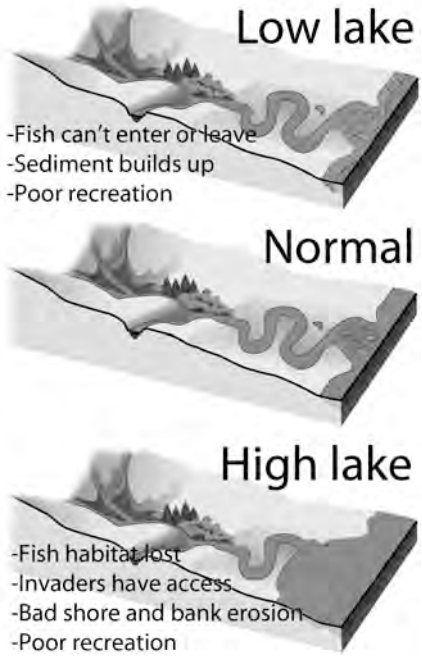
SOURCE OF FUNDS	**AMOUNT**	**Status**
Other Non-State $ To Be Applied To Project During Project Period:	$ -	
Other State $ To Be Applied To Project During Project Period:	$ -	
John Downing, PI (75% Salary, 25% benefits); 5% in years 1-3: $43,204; donated to project	$ 43,204	*Secured*
In-kind Services To Be Applied To Project During Project Period:	$ 108,351	*Secured*
Unrecovered (donated) indirect: 33% MTDC - Base less the short term room rental ($329,687 - 1,350 = $328,337 x .33 = $108,351)		
Past and Current ENRTF Appropriation:	$ -	
Other Funding History:	$ -	



Here's the mystery: rainfall is increasing but water levels are decreasing and swinging widely



Known (streams & rain) and unknown (groundwater & evaporation) parts of the Lake Superior water budget. This project fills in the question marks.



Here's why it matters: abnormally high or low levels harm the environment and impede recreation

One hint that groundwater is important. The famous 15' "ice volcano" of Duluth, MN, is one of many artesian seeps along the north shore. There are also lots of springs and ice-cliffs along the North Shore. These imply long-distance groundwater input to Lake Superior.

Powerful wave erosion wreaks havoc on environments when levels are high (Duluth News Tribune)

Here's can happen to recreational infrastructure when we do not keep changing water levels in mind (Duluth News Tribune)

Project Manager Description

Project Manager Qualifications and Responsibilities

John A. Downing will manage this project. He has 40 years of experience in aquatic research and community outreach. He is currently the Director of the Minnesota Sea Grant College Program, a research scientist at the Large Lakes Observatory, and a tenured Professor in the Department of Biology at the University of Minnesota Duluth. Although he has life-long roots in Minnesota, he was formerly a Regent's Excellence Professor of Ecology, Evolution, & Organismal Biology and Agricultural & Biosystems Engineering at Iowa State University and ran one of the best-funded and long-standing research operations at that institution. His 150+ peer-reviewed books and journal articles cover diverse topics in limnology, marine science, environmental economics, and terrestrial ecology. His leadership experience has been as the Director of the Laurentian Biological Station (Montreal, Quebec), the co-founder of the Inter-University Limnological Research Group (Montreal, Quebec), Director of the Iowa State University Limnology Laboratory (Ames, Iowa), Chair of the Environmental Science Interdepartmental Graduate Program (Ames, Iowa), President of the Association for the Sciences of Limnology and Oceanography, and Chair of the Council of Scientific Society Presidents (Washington, DC). Recent outreach programs have assisted citizens in agricultural regions to understand and mitigate nutrient pollution and helped citizens and industries in northern Minnesota combat eutrophication and avoid lake degradation from aquatic invasive species.

Organization Description

Minnesota Sea Grant is part of the National Oceanic and Atmospheric Administration's (NOAA) Sea Grant Program, which supports 33 similar programs in coastal states throughout the United States and Puerto Rico. Our mission is to facilitate interaction among the public and scientists to enhance communities, the environment and economies along Lake Superior and Minnesota's inland waters by identifying information needs, fostering research and communicating results. Minnesota Sea Grant concentrates on research, outreach, and education in four focus areas: Healthy coastal ecosystems, sustainable fisheries and aquaculture, resilient communities and economies, environmental literacy and workforce development.