

**Environment and Natural Resources Trust Fund**

# 2022 Request for Proposal

## **General Information**

**Proposal ID:** 2022-285

**Proposal Title:** Trace Metal Benchmarks for NE Minnesota Lakes

## **Project Manager Information**

**Name:** Richard Kiesling

**Organization:** US Geological Survey - Upper Midwest Water Science Center

**Office Telephone:** (612) 817-2826

**Email:** kiesling@usgs.gov

## **Project Basic Information**

**Project Summary:** : This project will establish baseline trace metal accumulation rates and pre-industrial and pre-mining sediment trace metal benchmarks for a chain of lakes downstream of proposed copper-nickel mining area in Minnesota.

**Funds Requested:** $176,000

**Proposed Project Completion:** June 30 2025

**LCCMR Funding Category:** Small Projects (H) **Secondary Category:** Water Resources (B)

## **Project Location**

**What is the best scale for describing where your work will take place?** Region(s): NE

**What is the best scale to describe the area impacted by your work?** Region(s): NE

**When will the work impact occur?** During the Project and In the Future

## **Narrative**

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

Development of copper-nickel mining within the Birch Lake watershed near Ely, MN, has the potential to discharge trace metals into Birch Lake and the other downstream lakes in the White Iron chain, adding to existing issues with trace metal and sulfate pollution in Birch Lake water and sediments. The White Iron Chain of Lakes Association is concerned that trace metals in these lakes be adequately characterized prior to any new mine development and have requested the U.S. Geological Survey to conduct the proposed study.  
  
Previous monitoring of trace metals in Birch Lake and the downstream lakes has lacked the resources to examine current rates of trace metal sediment deposition or to assess background concentrations in deeper sediment samples deposited before European settlement. There is an urgent need for a better understanding of how surface water concentrations of trace metals are related to their accumulation in sediments before mining activity expands. By coupling sediment accumulation sampling with surface water sampling and analysis of deeper sediment cores, it is possible to establish a baseline for net rates of metal deposition to the sediments and a benchmark for sediment trace metal concentrations in these lakes based on pre-settlement conditions.

**What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.**

To understand how current loading of trace metals are related to sediment accumulation of trace metals, we propose to deploy multiple sediment traps in Birch and White Iron Lakes as well as individual traps in Bogberry Lake on Filson Creek and South Kawishiwi River below the confluence with Filson Creek. Recent work funded by ENTF (Elliott et al. 2020) has documented naturally occurring loads of trace metals to Birch Lake from Filson and Keeley Creeks. Data on current trace metal accumulation rates would put these naturally occurring loads into a lake-wide perspective while documenting the fate of additional loads to the chain of lakes.  
  
To establish the historical benchmarks for trace metals in lake sediments, we propose to perform trace metal analyses of archived samples from previously collected lake-sediment cores from the chain of lakes. In addition, we propose to sample water for trace metals from each of the lakes to provide an updated water-quality baseline data set using updated water analysis methods to complement the sediment trap data.  
  
Elliott, S.M. et al. 2020. Assessing the influence of natural copper-nickel-bearing bedrocks of the Duluth Complex on water quality in Minnesota, 2013–15: USGS

**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 proposed study will provide a critical baseline for lake-wide trace metal accumulation in Birch and White Iron Lakes under current conditions while providing a historic sediment quality benchmark against which all changes in trace metal discharge and loading in the watershed can be assessed in the future. Insufficient baseline data has been a major issue for managing mining activities. Data from this study will address this problem by providing an objective benchmark against which managers can evaluate the effects of past activities within the watershed and screen proposed discharges to the Kawishiwi River / White Iron Chain of lakes.

## **Activities and Milestones**

### **Activity 1: Trace element profiles from dated sediment cores in the White Iron Chain of Lakes**

**Activity Budget:** $38,000

**Activity Description:**A prior study, Paleolimnological Reconstructions for the White Iron Chain of Lakes, collected detailed lake-sediment cores from each of the five lakes in the study area in 2011. These cores have been analyzed for nutrients, diatoms, and basic physical and chemical characteristics under the direction of Dr. Euan Reavie, NRRI. In addition, the cores have been dated by lead-210 by Dr. Daniel Engstrom, SCWRS. Subsamples from these dated cores are archived, and available for trace metal analysis. Therefore, the current proposed study takes advantage of substantial prior investment in field, analytical, and interpretive work. We propose analyzing all archived core increments from the surface (representing approximately 2011) down to a depth in the sediments that corresponds to approximately the year 1800, as previously determined from lead-210 dating. In total, this represents 160 samples from five lake cores. Samples would be analyzed for a suite of 44 trace elements, including key elements of interest copper, nickel, zinc, aluminum, iron, manganese, and cobalt. Samples will be analyzed by a U.S. Geological Survey contract laboratory that is quality-assured by the USGS. Data will be interpreted and summarized in a peer-reviewed journal article or USGS series report.

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Completion Date** |
| Subsample NNRI sediment core archives | November 30 2022 |
| Sample analysis at USGS contract lab | May 31 2023 |
| Data quality assurance & upload into data base | June 30 2023 |
| USGS-approved interpretive report | June 30 2025 |

### **Activity 2: Trace element sediment accumulation rates from Birch, White Iron, and Bogberry Lakes and South Kawishiwi River below Filson Creek**

**Activity Budget:** $68,000

**Activity Description:**Sediment accumulation samplers (i.e., sediment traps) will be deployed at eight locations distributed as follows: four sites in Birch Lake, two sites in White Iron Lake, one site in Bogberry Lake, and one site on the South Kawishiwi River downstream of the confluence with Filson Creek. Filson creek is a known source of nature trace metal loading to Birch Lake (Elliott et al. 2020). Samplers will be deployed twice per year for two years for a total of 32 environmental samples plus eight quality assurance samples including field blanks and replicates. Material collected by the samplers will be de-watered and analyzed for a suite of 44 trace elements, including key elements of interest: copper, nickel, zinc, aluminum, iron, manganese, and cobalt. Concentrated samples will be analyzed by the U.S. Geological Survey National Water Quality Laboratory. Data will be interpreted and summarized in a peer-reviewed journal article or USGS series report. Data will be made available permanently via a publicly available online data report and through the online USGS National Water Information System (NWIS).

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Completion Date** |
| Deploy and retrieve eight sets of sediment traps over two years | October 31 2024 |
| Analyze 40 samples for trace metals at USGS National Water Quality contract lab | December 31 2024 |
| Model accumulation rates and draft a ScienceBase data release of results | February 28 2025 |
| USGS-approved interpretive report | June 30 2025 |
| Present results at two Minnesota conferences | June 30 2025 |

### **Activity 3: Seasonal water sampling for trace elements in the Kawishiwi / Birch / White Iron Chain of Lakes**

**Activity Budget:** $70,000

**Activity Description:**Water samples from each of the five lakes in the White Iron chain (Birch, White Iron, Farm, Garden, South Farm) will be collected on three synoptic sampling events in May, July, and September to capture a range of seasonal conditions. Both filtered and whole water will be collected to capture both dissolved and total trace element and major constituent concentrations. A total of 15 environmental and 3 quality-assurance samples will be collected. Samples will be analyzed at the U.S. Geological Survey’s National Water Quality Laboratory, which has been used in numerous regional and national water quality assessments. Samples will be analyzed for a suite of 44 trace elements, including elements of interest: copper, nickel, zinc, aluminum, iron, manganese, and cobalt. Data will be interpreted and summarized in a peer-reviewed journal article or USGS series report. Data will be made available permanently via a publicly available online data release, through the online USGS National Water Information System (NWIS) and supplied to the Minnesota Pollution Control agency for inclusion in their water quality database.

**Activity Milestones:**

|  |  |
| --- | --- |
| **Description** | **Completion Date** |
| Seasonal water sampling and sample analysis from Birch and White Iron Chain of Lakes | December 31 2024 |
| Data quality assurance review, approval, and upload of data into online public database | December 31 2024 |
| Present results at Minnesota conferences | June 30 2025 |
| USGS-approved interpretive report | June 30 2025 |

## **Project Partners and Collaborators**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Organization** | **Role** | **Receiving Funds** |
| Jeff Pike | White Iron Chain of Lakes Association (WICOLA) | Representatives from the WICOLA Board will serve as project advisors and WICOLA study partners will be integrated into the planned sampling of Birch Lake and the White Iron Chain of Lakes. | No |
| Marty Rye | U.S. Forest Service | As a Forest Hydrologist with the Superior National Forest, Marty Rye coordinates water quality sampling for the Kawishiwi River and downstream chain of lakes. He will serve as a liason between the proposed project and the US Forest Service. | No |

## **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 be funded?**The interpreted data will provide a baseline of conditions against which future work can be compared. The results will help inform the ongoing citizens monitoring program run by WICOLA as well inform water quality sampling by WICOLA, the U.S. Forest Service, and Lake County Soil and Water Conservation District. We are not seeking long-term funding beyond the proposed three-year timeline for the project. The three year project timeline is requested to provide for sediment accumulation data collection from two full ice-free seasons.

## **Other ENRTF Appropriations Awarded in the Last Six Years**

|  |  |  |
| --- | --- | --- |
| **Name** | **Appropriation** | **Amount Awarded** |
| Biological Consequences of Septic Pollution in Minnesota Lakes | M.L. 2015, Chp. 76, Sec. 2, Subd. 04c | $364,000 |
| Protect Water Quality with Efficient Removal of Contaminants in Treatment Ponds for Storm Water | M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 04d | $325,000 |

## **Project Manager and Organization Qualifications**

**Project Manager Name:** Richard Kiesling

**Job Title:** Hydrologist and Lake Specialist

**Provide description of the project manager’s qualifications to manage the proposed project.**Richard Kiesling is a hydrologist and limnologist with the U.S. Geological Survey. He holds a B.S. in Biology from the University of Minnesota (1980) and a Ph.D. in Ecology from the University of Michigan (1990) with specialization in limnology and community ecology. He is currently the Lake Specialist with the Minnesota Office of the Upper Midwest Water Science Center. Dr. Kiesling has 20 years of experience as a scientist and project manager with the U.S. Geological Survey, with an emphasis on contaminants in aquatic ecosystems (water, sediment, and other media) and an established track record of scientific publications and presentations of findings at stakeholder meetings (https://www.usgs.gov/staff-profiles/richard-l-kiesling).

**Organization:** US Geological Survey - Upper Midwest Water Science Center

**Organization Description:**As the Nation's largest water, earth, and biological science and civilian mapping agency, the USGS provides scientific understanding about natural resource conditions, issues, and problems through joint studies with local, state, tribal and federal partners. The diversity of our scientific expertise enables us to carry out large-scale, multi-disciplinary investigations and provide impartial scientific information to resource managers, planners, and other customers.

## **Budget Summary**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Category / Name** | **Subcategory or Type** | **Description** | **Purpose** | **Gen. Ineli gible** | **% Bene fits** | **# FTE** | **Class ified Staff?** | **$ Amount** |
| **Personnel** |  |  |  |  |  |  |  |  |
| Hydrologist |  | Lead scientist & Project Manger: manage project including overseeing sampling and coordinating with WICOLA, analytical laboratories, and USFS; developing sediment accumulation rate model: draft final report or journal article |  |  | 25% | 0.15 |  | $39,000 |
| Hydrologist |  | Data analyst - quality assurance and statistical analysis of chemical occurrence data; calculation of accumulation rates; drafting final report |  |  | 25% | 0.18 |  | $38,000 |
| Hydrologic Technician |  | Field & Data collection and support including sub-sampling sediment cores; collection seasonal water quality samples; deploying and retrieving sediment accumulation samplers |  |  | 25% | 0.15 |  | $25,000 |
| Supervisory Hydrologist |  | Senior science support including project reporting and publication project review and approval |  |  | 25% | 0.06 |  | $13,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$115,000** |
| **Contracts and Services** |  |  |  |  |  |  |  |  |
| USGS Trace Metal Geochemistry Lab | Professional or Technical Service Contract | Chemical analysis of 160 samples of lake sediment core material |  |  |  | 0 |  | $5,000 |
| USGS National Water Quality Laboratory | Professional or Technical Service Contract | Chemical analysis of a total of 60 solids and water samples from sediment accumulation chambers; chemical analysis of water samples from seasonal surveys. |  |  |  | 0 |  | $35,000 |
| USGS Enterprise Publication Network | Professional or Technical Service Contract | Editorial review, formatting, and publication of Scientific Investigations Report |  |  |  | 0 |  | $8,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$48,000** |
| **Equipment, Tools, and Supplies** |  |  |  |  |  |  |  |  |
|  | Tools and Supplies | Sample containers and miscellaneous field supplies | Storage containers and sampling bottles for chemical analysis; misc field supplies for collecting, cleaning, and transporting samples |  |  |  |  | $2,500 |
|  | Tools and Supplies | Field monitor rental | Ten-month rental of multi-parameter field water quality probe |  |  |  |  | $1,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$3,500** |
| **Capital Expenditures** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Acquisitions and Stewardship** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Travel In Minnesota** |  |  |  |  |  |  |  |  |
|  | Miles/ Meals/ Lodging | Travel to NRRI, Duluth, MN | Subsample sediment core samples archived at UMD |  |  |  |  | $500 |
|  | Miles/ Meals/ Lodging | Field trips to study area (eight to ten multiple day trips from Grand Rapids to Ely vicinity | Field work / sampling lakes, deploying and collecting samplers, and meeting with local stakeholders |  |  |  |  | $4,500 |
|  | Conference Registration Miles/ Meals/ Lodging | Registration for three conferences; travel to two in-state conferences in northern MN | Present findings to three meetings of multiple stakeholders in study area and at state water conference |  |  |  |  | $500 |
|  |  |  |  |  |  |  | **Sub Total** | **$5,500** |
| **Travel Outside Minnesota** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **Sub Total** | **-** |
| **Printing and Publication** |  |  |  |  |  |  |  |  |
|  | Publication | Journal page charges with open access | Publish findings in an open access journal |  |  |  |  | $3,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$3,000** |
| **Other Expenses** |  |  |  |  |  |  |  |  |
|  |  | Shipping | Shipping of samples to analytical lab |  |  |  |  | $1,000 |
|  |  |  |  |  |  |  | **Sub Total** | **$1,000** |
|  |  |  |  |  |  |  | **Grand Total** | **$176,000** |

### **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** |  |  |  |  |
| Cash | U.S. Geological Survey Cooperative Matching Fund program | These funds will match a portion of the ENRTF funds. $60,200 of these dollars will fund indirect costs (bureau & center overhead and facilities costs). The remaining $20,000 will fund project direct costs. | Pending | $80,200 |
|  |  |  | **Non State Sub Total** | **$80,200** |
|  |  |  | **Funds Total** | **$80,200** |

## **Attachments**

### **Required Attachments**

#### ***Visual Component***

File: [80ab18cc-497.pdf](https://lccmrprojectmgmt.leg.mn/media/map/80ab18cc-497.pdf)

#### ***Alternate Text for Visual Component***

Map of NE Minnesota location with detail of Birch Lake and White Iron Chain of lakes including inset map of Filson Creek drainage with lakes...

### **Optional Attachments**

#### ***Support Letter or Other***

|  |  |
| --- | --- |
| **Title** | **File** |
| WICOLA support letter | [bc7f9e11-33c.pdf](https://lccmrprojectmgmt.leg.mn/media/attachments/bc7f9e11-33c.pdf) |

## **Administrative Use**

**Does your project include restoration or acquisition of land rights?**   
 No

**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