



Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-248

Proposal Title: Soudan Geology Trail Project

Project Manager Information

Name: Zsuzsanna Allerton

Organization: U of MN - College of Science and Engineering

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Project Basic Information

Project Summary: The Soudan Geology Trail Project develops an accessible trail and associated curriculum to educate K-12 students and the public about the geological history of Lake Vermilion-Soudan Underground Mine State Park.

ENRTF Funds Requested: \$290,000

Proposed Project Completion: August 31, 2030

LCCMR Funding Category: Small Projects (G)

Secondary Category: Education and Outdoor Recreation (C)

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.

Current underground mine tours at the Lake Vermilion-Soudan Underground Mine State Park (SSP) do not show the public and students the diverse geology and geological processes present in surficial geological exposures in the park. The Soudan Geology Trail Project will complement and expand upon current underground mine tours by enhancing public engagement with unique surficial geological features in a currently inaccessible part of the SSP—via design and installation of an accessible trail and associated educational curriculum. The project targets K-12 students and the public by promoting awareness and understanding of the park's diverse geological history and ancient geological processes by fostering four-dimensional spatial cognition through experiential outdoor educational activities. The project will incorporate geological findings from recent peer-reviewed journal publications, a Ph. D. dissertation, field trip guidebooks, graduate and undergraduate studies and new mapping in the park conducted by faculty and students from the University of Minnesota Twin Cities and Duluth. We expect our emphasis of student contributions will motivate students and excite the public about discovering Minnesota's rich geological history and show how student research can make major contributions to understanding complicated scientific problems with the goal of stimulating student interest in science and science-related careers.

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.

This project involves the planning and installation of an accessible trail within the Lake Vermilion-Soudan Underground Mine State Park (SSP), and the development of associated informal and formal educational material, the latter of which being part of state-mandated K-12 curriculum. Five exceptionally well-preserved and geologically diverse rock outcrops have already been selected as accessible trail stops, and a draft location map of the trail has been developed. Project components proposed for funding include: 1) biological and archeological evaluations to ensure the trail does not disturb rare biota and/or archeological sites; 2) finalizing the trail design; 3) building of the accessible trail; 4) georeferenced detailed geologic mapping, photography, and development of descriptions for the trail stops; 5) development of detailed outcrop maps and signage for the trail; 6) development of a trail display for the visitors center; 7) development of formal and informal educational material specific to trail features; 8) development of a K-12 teachers workshop to add/modify trail descriptions and/or curriculum; and 9) development of a trail-specific website available online on the outreach section of the Department of Earth and Environment Science at the University of Minnesota.

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?

Soudan Geology Trail Project specific outcomes include the development of 1) a new interpretive and accessible trail in the park highlighting unique geological features and promoting outdoor learning and spatial cognition; 2) trail signage assisting students and the public about ancient earth processes; 3) K-12 curriculum materials supporting teachers and students on park field trips by explaining the geological features of trail stops using principles of awareness through science and education. This project directly supports the protection, conservation, preservation, and enhancement of Minnesota's natural geological resources by revealing and sharing information about the unique geological treasures in this park.

Activities and Milestones

Activity 1: Site Assessment and Trail Construction: evaluating proposed sites and paths, modifying and finalizing design, generating final map, building the trail

Activity Budget: \$105,829

Activity Description:

The objective of this activity is to ensure environmentally and culturally sensitive development of an accessible trail to expose surficial geological features. Tasks include biological and archeological evaluations, finalization of trail design and building the trail. These tasks will be accomplished through collaboration with experts from University of Minnesota and park staff for evaluations using field surveys and regulatory compliance. Design will be executed via GIS mapping following accessibility standards, and construction will follow park guidelines with certified contractors. Outputs comprise of completed evaluations report, finalized trail blueprint, and constructed accessible trail with five outcrop stops. The impact of this project is protecting rare biota and sites while enabling public access to hidden geology, enhancing conservation awareness. The trail will serve as educational pathway for tours and self-guided visits. In order to evaluate impact, we will conduct pre/post-construction surveys for ecological impact and inquire visitor feedback forms to assess accessibility and safety.

Activity Milestones:

Description	Approximate Completion Date
Compile and submit evaluation reports (including compliance documentation for permits/regulatory approvals from DNR)	July 31, 2027
Conduct biological and archeological field surveys and assessments (site visits, species inventories, cultural resource scans)	August 31, 2027
Incorporate evaluation findings into trail route adjustments (GIS refinements for avoidance of sensitive areas)	September 30, 2027
Finalize detailed trail design (engineering plans, accessibility standards, grading specs, preliminary signage layout)	September 30, 2027
Secure construction permits and contractor bids/selection (post-evaluations):	September 30, 2027
Site preparation and trail corridor clearing	October 31, 2027
Install interpretive signage and wayfinding elements (fabrication, placement at five stops, testing for durability/visibility)	May 31, 2028
Conduct final inspections and accessibility compliance checks	June 30, 2028

Activity 2: Geological Documentation and Interpretation: collecting samples, conducting analyses, utilizing existing scientific information, interpreting data

Activity Budget: \$84,057

Activity Description:

Geological Documentation and Interpretation: collecting samples, conducting analyses, utilizing existing scientific information, interpreting data. The objective of this activity is to document, analyze and interpret geological features to inform educational content. Tasks include georeferenced mapping, photography, and descriptions of stops, sample description and analyses, development of outcrop maps and signage, and the generation of visitor center display. These tasks will be accomplished by the research team from University of Minnesota in collaboration with Soudan State Park staff, conducting fieldwork with GPS tools, integrating dissertation and publication data, adding more data by additional samples and analyses, designing signage/display using graphic software and peer review. Outputs include detailed georeferenced maps, annotated photographs, outcrop and sample descriptions, installed signage and visitor center display. Long term impact of this activity is to reveal park's Archean geologic history while fostering spatial cognition and

STEM interest. In order to evaluate impact, we will publish findings in peer-reviewed journals and conference presentations, and intend to use tracking via park visitor logs and digital analytics to generate statistical data.

Activity Milestones:

Description	Approximate Completion Date
Complete georeferenced detailed mapping, photography of outcrop stops and sample collection	September 30, 2028
Create detailed outcrop maps and graphics (illustrations, cross-sections for signage/educational use)	November 30, 2028
Analyses of samples	February 28, 2029
Develop scientific descriptions and content for each trail stop (integrating dissertation data, publications, student research)	February 28, 2029
Design and produce visitor center display (panels, interactive elements, photos/maps)	February 28, 2029
Install and test display in park visitor center	May 31, 2029
Submit a peer-reviewed scientific manuscript	December 31, 2029

Activity 3: Educational Program Development: generating formal and informal educational material

Activity Budget: \$100,114

Activity Description:

The objective of this activity is to create curriculum and resources to inform K-12 students and public on geological processes. Tasks include developing informal and formal educational material, hosting K-12 teachers' workshop, finalizing material for curriculum, and building a trail-specific website on the outreach page of the Department of Earth and Environmental Sciences at the University of Minnesota. These tasks will be accomplished by a team of educators and geologists drafting materials based on mapping and scientific reports, organizing workshops via interactive sessions with teachers for input and developing a dedicated website using university web tools. Outputs will include educational packets, workshop reports and an online website section. Expected outcome and impact is the stimulation of science careers by highlighting student research contributions. Impact can be evaluated by using participant surveys post-workshop, monitoring curriculum adoption rates and website traffic.

Activity Milestones:

Description	Approximate Completion Date
Draft educational materials and trail-specific curriculum packets (lessons, activities tied to MN standards, etc.)	May 31, 2029
Host K-12 teachers' workshop (in-person/virtual sessions for feedback, modifications to descriptions/curriculum)	June 30, 2029
Incorporate teacher input and revise materials (iterative edits for age-appropriateness, engagement)	July 31, 2029
Finalize and format K-12 curriculum materials (print/digital versions, alignment with state education goals)	January 31, 2030
Develop website content and structure (trail maps, stop descriptions, photos, curriculum downloads, virtual tour elements)	May 31, 2030
Build and integrate website on University of MN of Earth and Environmental Sciences outreach section	May 31, 2030
Package and distribute educational materials (digital/print packets, signage links)	June 30, 2030
Official launch and promotion (announce via park events, teacher networks, etc.)	July 31, 2030
Submit a peer-reviewed educational journal manuscript	July 31, 2030

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
George J. Hudak	University of Minnesota Twin Cities	Co-PI, Post-Doctoral Advisor, Field Work and Science Coordinator, Editor	Yes
Christian Teyssier	University of Minnesota Twin Cities	Postdoctoral Co-Advisor, Outreach Coordinator, Editor	No
Annia Fayon	University of Minnesota	Outreach and Educational Coordinator, Editor	Yes
Jim Essig	Department of Natural Resources (DNR) MN	Park Manager/ Trail Installation Coordinator/ DNR contact	No
Stephanie Ericson	Independent	Educational Coordinator	Yes
Andrea Doerr	Department of Natural Resources (DNR) MN	Mine Interpreter Supervisor/ Trail Installation Coordinator/ DNR contact	No

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 dissemination plan outlines comprehensive strategies to share the outputs of the Soudan Geology Trail Project. These outputs include, journal publications, conference presentations, the accessible geology trail and associated interpretive signage, detailed geologic maps and descriptions, K-12 curriculum materials, teachers' workshop resources, visitor center display, a trail-specific website, and associated data such as georeferenced mapping, photographs, and outcrop descriptions. The plan is designed to align with the Environment and Natural Resources Trust Fund (ENRTF) goals by engaging key beneficiaries—K-12 students, teachers, park visitors, and the public. It supports improved management and interpretation of Minnesota's geological resources at Lake Vermilion-Soudan Underground Mine State Park, ensures long-term accessibility and maintenance of both physical and digital products, promotes behavioral changes like increased outdoor exploration and appreciation of geological heritage, and transparently communicates ENRTF-supported accomplishments to Minnesotans.

1. Scientific and Technical Dissemination (Data, Maps, and Publications)

Georeferenced geologic mapping data, high-resolution photographs, detailed outcrop descriptions, and interpretive content developed for the trail stops will be archived with persistent identifiers in open-access repositories such as the University of Minnesota (UMN) Digital Conservancy. All materials will include metadata crediting ENRTF support and will adhere to Minnesota IT Services data standards where applicable.

Key findings and the trail development process will be incorporated into peer-reviewed or technical publications, including updates to existing bedrock geology reports or contributions to Minnesota Geological Survey guides. Results will be presented at professional venues such as the Minnesota Minerals Education Workshop, regional geoscience conferences, and UMN Earth and Environmental Sciences seminars. Student contributions from graduate and undergraduate research and mapping will be highlighted to showcase youth involvement in scientific discovery. Intellectual property, such as curriculum designs, will be managed through UMN channels, prioritizing open licensing for educational use. These efforts will foster awareness and participation among geologists, educators, park managers, and researchers who may build upon or apply the trail's geological interpretations.

2. Stakeholder Engagement and Resource-Management Sharing

The Minnesota Department of Natural Resources (DNR) Parks and Trails Division, which manages Lake Vermilion-Soudan Underground Mine State Park, will receive regular updates and final deliverables. Biological and archeological evaluation results will inform DNR park management, helping to avoid impacts on sensitive features and supporting the long-term preservation of geological and natural resources.

Workshops and site visits will engage DNR interpretive staff, park rangers, and local educators, integrating the trail into existing park programs—such as complementing underground mine tours that focus on mining history. The K-12 teachers' workshop will inform educators on trail use, curriculum integration, and modifications based on feedback, ensuring materials align with state-mandated standards and support field trips. Annual progress reports and the final project report will be shared directly with DNR, LCCMR/ENRTF, and uploaded to the LCCMR project database. This process facilitates incorporation into park management plans, visitor programming, and broader Minnesota geological education initiatives.

3. Longevity of Collections and Products

Physical trail infrastructure—including the accessible trail, signage, outcrop maps, and visitor center display—will be constructed to high durability standards and formally transferred to DNR for permanent installation, maintenance, and ongoing updates as part of the state park infrastructure.

The trail-specific website will be hosted and maintained on the outreach section of the UMN Department of Earth and Environmental Sciences website, with backups and version control for at least ten years post-project. K-12 curriculum materials and workshop resources will be openly licensed (such as through Creative Commons) and archived in UMN repositories and Minnesota Department of Education-aligned platforms for continuous educator access.

All georeferenced data and documentation will be deposited in institutional repositories with DOIs, ensuring ongoing availability for future research, park updates, or potential expansions, such as proposed seismometer installations. These measures guarantee that ENRTF-funded products remain accessible and functional long after project completion, supporting ongoing geological resource interpretation and education.

4. Promotion of Behavioral Change for Environmental Protection

Trail signage, curriculum, and visitor center displays will emphasize ancient geological processes, such as Neoarchean volcanism, sedimentation, and tectonics in the Vermilion District. This approach is intended to foster appreciation for Minnesota's unique geological heritage and the importance of preserving natural outcrops. Experiential activities will build four-dimensional spatial cognition, encouraging outdoor exploration and hands-on learning.

Public and student-facing materials will highlight student research contributions to motivate interest in geoscience careers and inspire actions such as supporting park conservation, participating in citizen science, and advocating for science education. The teachers' workshop and curriculum will equip educators to lead field trips that connect geological features to broader environmental themes such as resource stewardship and Earth's history. These elements are designed to promote shifts toward greater environmental awareness, outdoor engagement, and conservation support for Minnesota's natural geological resources.

5. Accessible Sharing with Minnesotans and ENRTF Transparency

To reach Minnesotans broadly and highlight ENRTF's impact, the trail and visitor center display—accessible to thousands of annual park visitors—will feature ENRTF acknowledgments, QR codes linking to the project website, and plain-language explanations of geological features and project outcomes.

A dedicated, user-friendly trail website hosted on the UMN Earth and Environmental Sciences outreach page will offer virtual trail tours, interactive maps, photos, teacher guides, and project summaries in accessible formats.

Outreach will include press releases, social media posts via DNR and UMN channels, presentations at community events and Minnesota Minerals Education workshops, as well as integration into DNR park interpretive programs and existing educational resources like pre- and post-tour activities.

These dissemination channels will ensure that diverse audiences—families, students, teachers, tourists, and policymakers—learn about and experience ENRTF-enabled enhancements to public understanding of Minnesota’s geological treasures.

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?

Results will be implemented as trail signs, educational material, displayed at the park’s visitor center, and will have a dedicated section, updated and maintained regularly, on the outreach webpage of the Department of Earth and Environmental Sciences, University of Minnesota. We plan to present results at different conferences, meetings and at the Minnesota Minerals Education workshop. Future work will include the installation of seismometers with real-time results at the visitor’s center, and expansion of K-12 curriculum materials based on teachers’ comments and needs. We anticipate submitting a proposal to the National Science Foundation Geoscience Education Program to further support this.

Project Manager and Organization Qualifications

Project Manager Name: Zsuzsanna Allerton

Job Title: Postdoctoral Researcher

Provide description of the project manager’s qualifications to manage the proposed project.

Relevant Expertise:

The project manager, Zsuzsanna Allerton, brings extensive expertise regarding the geological history and surficial features of Lake Vermilion-Soudan Underground Mine State Park. Her knowledge is directly informed by her Ph.D. dissertation research at the University of Minnesota. This doctoral work focused on the thermal and hydrothermal evolution of Archean iron formations in northeastern Minnesota, including detailed investigations of hematite ore genesis, hydrothermal alteration and associated processes, and Proterozoic mineralization events at the Soudan site. The research incorporated new geologic mapping, radiometric and stable isotopic geochemistry, electron and optical microscopic analyses, as well as the integration of peer-reviewed publications, field guides, and student contributions.

Fieldwork and Collaborative Experience:

Dr. Allerton has hands-on experience conducting fieldwork within the park. She has collaborated with faculty and students from the University of Minnesota (Twin Cities and Duluth) on mapping surficial exposures. Additionally, she is adept at translating complex geological processes into interpretations that are accessible to a wider audience.

Role in Trail Project:

This background qualifies Dr. Allerton to oversee trail design, ensure scientific accuracy in signage and educational material, and foster experiential learning that promotes four-dimensional spatial cognition for K-12 students and the public.

Outreach and Leadership:

Her prior involvement in student-led research initiatives and outreach enables her to inspire audiences about Minnesota’s geological heritage, highlight student contributions to scientific challenges, and stimulate interest in STEM careers. With demonstrated skills in project coordination—including site evaluations, mapping, scientific analyses, and participant engagement—Dr. Allerton is well-positioned to lead the Soudan Geology Trail Project to successful

implementation which will enhance public access to the park's geological treasures and support both long-term preservation and education.

Organization: U of MN - College of Science and Engineering

Organization Description:

The College of Science and Engineering (CSE) at the University of Minnesota Twin Cities is a leading academic institution renowned for fostering innovation and advancing knowledge in science, engineering, and mathematics. Established in 1935 (formerly the Institute of Technology), CSE unites a diverse array of programs across engineering disciplines, physical sciences, and related fields. The college is recognized for its rigorous academic curriculum, pioneering research, and impactful service initiatives that address critical global challenges. Through inclusive teaching methods, groundbreaking discoveries, and meaningful community engagement, the college provides students with a comprehensive educational experience, preparing them to become leaders and innovators in their respective fields. The Department of Earth and Environmental Sciences within CSE plays a critical role in enhancing the understanding of Earth's dynamic systems, from surface processes to the planet's deep interior. The department confronts key societal and environmental issues such as climate change, natural hazards, resource management, and environmental sustainability. By integrating curiosity-driven research with comprehensive teaching and outreach, the department stimulates innovation in Earth sciences. The department is devoted to fieldwork, mapping, and interdisciplinary research, providing students with hands-on learning experiences and promoting public awareness of our planet's complexities.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Zsuzsanna P. Allerton, PI		Project Manager, science and trail coordinator and editor			28.1%	183,024		\$82,926
George J. Hudak, Advisor		Postdoc advisor and co-PI, coordinating field and scientific activities			38.5%	302,430		\$49,385
Annia Fayon, Coordinator		Field and educational coordinator			38.5%	232,560		\$56,968
							Sub Total	\$189,279
Contracts and Services								
Stephanie Erickson	Service Contract	Stephanie Erickson will aid the design of formal and informal educational material and K-12 curriculum based on field and scientific data, and she will help with the design and material generated for the outreach website dedicated for the Soudan Geology Trail Project.				183,024		\$41,907
TBD	Service Contract	Specialized trail maintenance, landscaping services, or municipal maintenance team will be hired to expend existing minimally maintained footpaths and remove some trees.				7,500		\$7,500
							Sub Total	\$49,407
Equipment, Tools, and Supplies								
							Sub Total	-
Capital Equipment								
							Sub Total	-
Acquisitions and Stewardship								

							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Field Trip, 1-2/year, 2-3 people/trip, ~500 miles/trip	The purpose to go to Soudan is to collect samples, build the trail, place material in visitor center, evaluate work					\$8,500
							Sub Total	\$8,500
Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Conferences, 1/year, miles TBD, 1-3 people, conference, rate is based on conference	The purpose is to communicate our findings regarding science and educational material	X				\$17,000
							Sub Total	\$17,000
Printing and Publication								
	Publication	Peer-reviewed publication(s); one scientific and one educational planned for the funding period of three years	Scientific and educational publications					\$5,000
							Sub Total	\$5,000
Other Expenses								
		Scientific analyses	Geochemical and geochronological analyses to generate more data for educational material					\$6,000
		Signage (8-10)	Trail signs will be placed along the trail to inform about science					\$14,814
							Sub Total	\$20,814
							Grand Total	\$290,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	Conferences, 1/year, miles TBD, 1-3 people, conference, rate is based on conference	TBD

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Total Project Cost: \$290,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [fbcb1be3-a95.pdf](#)

Alternate Text for Visual Component

The graphic shows 2 maps: the geologic map of the state park (A) containing a rectangle of the proposed interactive trail (B) with details of proposed stops of five different units, as well as developed (continuous red line) and less developed (dashed red line) footpaths....

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Institutional Support Letter	0b62da9f-f78.pdf
DNR Support Letter	8906726b-57a.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Do you understand that travel expenses are only approved if they 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 understand the UMN Policy on travel applies.

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

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

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing \$10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care,

treatment, education, training, instruction, or recreation to children")?

Yes

Do you certify that background checks are performed for background check crimes, as defined in Minnesota Statutes, section 299C.61, Subd. 2, on all employees, contractors, and volunteers who have or may have access to a child to whom children's services are provided by your organization?

Yes

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

George J. Hudak (UMN), Christian Teyssier (UMN), Rory Schoeneman (UMN), and Jim Essig (DNR)

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

Yes, I understand