Environment and Natural Resources Trust Fund
2020 Request for Proposals (RFP)

Project Title: **ENRTF ID: 061-AH**

Measuring Mussel Habitat Suitability in the Cannon River

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

Sub-Category: A. Foundational Natural Resource Data and Information

Total Project Budget: $ 154,411

Proposed Project Time Period for the Funding Requested: June 30, 2023 (3 yrs)

Summary:

We will measure physical attributes of known mussel sites in the Cannon River watershed and develop hydrodynamic models to determine habitat suitability. Our analysis will identify priority sites for management/restoration.

Name: Jabari Jones

Sponsoring Organization: U of MN

Job Title:

Department: Saint Anthony Falls Laboratory

Address: 2 Third Avenue SE, Minneapolis, MN 55414

Minneapolis MN 55414

Telephone Number: (612) 406-5676

Email jone2176@umn.edu

Web Address:

Location:

Region: Southeast

County Name: Dakota, Goodhue, Rice, Steele

City / Township:

Alternate Text for Visual:

The visual shows a map of proposed sample sites across the Cannon River watershed and illustrates environmental factors that affect mussels including the magnitude of water discharge, sediment, and nutrients.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%

PROJECT TITLE: Measuring mussel habitat suitability in the Cannon River

I. PROJECT STATEMENT

Freshwater mussels are the most imperiled group of species in North America, but the direct causes of their decline have been difficult to identify. Human land-use has been implicated in the loss of mussels, but many competing hypotheses exist: loss of habitat, amplified streamflows, increased sediment supply, and increased nutrient loading, among others. The Cannon River in southern Minnesota is home to 17 species of mussel (5 threatened, 4 of special concern) and has experienced many of the environmental problems that negatively impact mussel populations. Additionally, the Cannon has long-term mussel data collected by Minnesota DNR (dating to 1987), so it is an ideal location to study the relation of mussel populations, habitat, and environmental conditions through field data collection and statistical and hydrodynamic modeling.

We have two primary goals in this study:

1. *Measure the hydrodynamic and environmental characteristics of known mussel habitat*

We will conduct field work at known mussel sites to measure a large number of channel and environmental attributes, including sediment transport, channel geometry, and water quality. All these characteristics are known to impact mussel populations. In addition, we will develop hydrodynamic models at known mussel sites. These models predict velocity and bed stability at a variety of flows and have been successfully coupled with mussel data in other rivers.

2. *Identify suitable mussel habitat and identify areas for habitat restoration*

We will identify suitable mussel habitat by pairing existing DNR mussel data with our hydrodynamic models and environmental data. We will develop statistical models that quantify links between physical characteristics and mussel populations. Based on these models, we will create maps of habitat suitability throughout the Cannon River watershed. This will allow us to identify existing sites that can support mussel re-introduction and to prioritize areas that can be actively managed to protect and improve mussel habitat.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1 Title: *Characterize physical attributes of successful mussel sites*

The Minnesota Department of Natural Resources has collected mussel data in the Cannon River watershed periodically since the 1980s and has several long-term monitoring sites with successful mussel populations. We will re-visit sites on the Cannon River, Straight River, Little Cannon River, Heath Creek, and Chub Creek. These sites span the geographic range of the watershed and have distinct species assemblages, based on DNR reports. At each site we will:

- Measure physical characteristics, including topography, grain size, channel geometry, water quality, and bedload and suspended-sediment transport
- Deploy instruments to continuously monitor discharge and suspended sediment
- Develop statistical relations between discharge and sediment transport to extrapolate beyond the period of record

Using the topographic data, we will develop hydrodynamic models of each site. Hydrodynamic models produce predictions of velocity and sediment transport for a variety of flows. This approach will allow us to identify stable areas of the river bed, which are required by mussels. Previous studies have successfully identified links between hydraulic attributes and mussel habitat.

ENRTF BUDGET: $ 92, 067

Outcome	Completion Date
1. Measure grain size, channel geometry, and sediment transport	11/01/2020

2. Develop hydrodynamic models of known mussel sites	06/01/2021

Activity 2 Title: ***Model habitat suitability and identify restoration sites***

We will use the findings of Activity 1 to create habitat suitability relationships based on statistical relations between mussel populations and physical characteristics. We anticipate that a combination of sediment characteristics, channel geometry, and hydraulic attributes will predict suitable habitat. From these relationships, we will map available and optimal mussel habitat in the Cannon River watershed. Sites with good mussel habitat will be listed as high priority for protection, while sites with some attributes of good habitat provide targets for restoration. We will provide the DNR and Cannon River Watershed Partnership with recommendations to promote additional high-quality habitat.

ENRTF BUDGET: $ 62, 344

Outcome	Completion Date
1. Create habitat suitability curves and maps for the Cannon River watershed	04/30/2022
2. Produce recommendations for restoration sites and actions to improve mussel habitat	06/30/2023
3. Present habitat suitability and restoration recommendations to stakeholders	06/30/2023

III. PROJECT PARTNERS AND COLLABORATORS:

Partners receiving ENRTF funding:

Jabari Jones, PhD student, UMN Earth Sciences – Project manager, environmental data collection, hydrodynamic modeling, habitat suitability

Andy Wickert, Assistant Professor, UMN Earth Sciences – Instrument development and deployment, data collection, hydrodynamic modeling, advising Jones and undergraduate technicians

Partners not receiving ENRTF funding:

Kelly Macgregor, Associate professor, Macalaster College Geology
Dan Hornbach, Professor, Macalaster College Biology
Jess Kozarek, Research Associate, Saint Anthony Falls Laboratory
Bernard Seitman, Malacologist, Minnesota DNR
Mark Hove, Research Associate, UMN Fisheries, Wildlife, and Conservation Biology
Kristi Pursell, Executive Director, Cannon River Watershed Partnership

IV. LONG-TERM IMPLEMENTATION AND FUNDING:

Products of this research will be freely available to resource managers and scientists to design management and restoration strategies. This work builds on work by previous research groups, including the DNR and research groups working in the St. Croix and Minnesota River watersheds. The DNR has collected extensive population data but does not have the capacity to collect detailed environmental and hydraulic data. And the Cannon is distinct from the St. Croix and Minnesota watersheds due to its geographic setting (e.g. mixed bedrock/alluvial sections) and species assemblages. Together, these datasets build a more comprehensive picture on the state of native mussels in Minnesota. Discharge and sediment transport gages will remain in place after completion of the project to continue data collection and environmental monitoring in the watershed. For further scientific research, we will seek grants from the National Science Foundation, while management options based on our recommendations will be pursued by partners from the Cannon River Watershed Partnership and the MN DNR.

V. SEE ADDITIONAL PROPOSAL COMPONENTS:

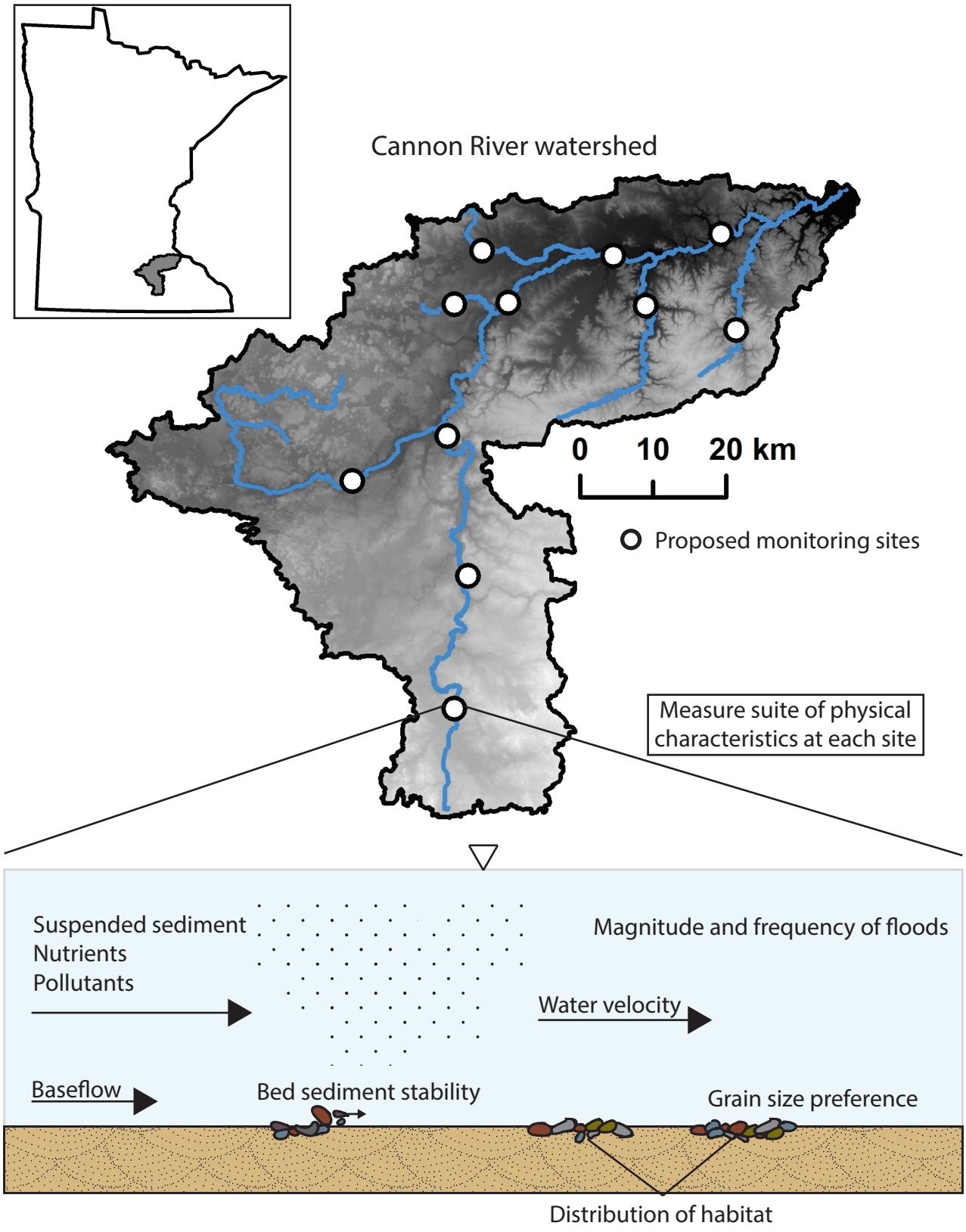
A. Proposal Budget Spreadsheet, **B. Visual Component or Map**, **F. Project Manager Qualifications and Organization Description**

Attachment A: Project Budget Spreadsheet
Environment and Natural Resources Trust Fund
M.L. 2020 Budget Spreadsheet
Legal Citation:
Project Manager: Jabari Jones
Project Title: Measuring mussel habitat suitability in the Cannon River
Organization: University of Minnesota, Saint Anthony Falls Laboratory
Project Budget: $154,411
Project Length and Completion Date: 3 years, June 2023
Today's Date: April 15, 2019

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Budget	Amount Spent	Balance
BUDGET ITEM			
Personnel (Wages and Benefits)	$ 75,483	$ -	$ 75,483
Jabari Jones, PhD student, UMN (86.1% salary, 13.9% benefits, 25% FTE for 3 years) - $23, 725			
Andrew Wickert, Assistant Professor, UMN (73.5% salary, 26.5% benefits, 3.8% FTE for 3 years) - $19, 458			
3 undergraduate technicians, UMN (100% salary, 25% FTE for 2 years) - $32,300			
Professional/Technical/Service Contracts	$ 20,000	$ -	$ 20,000
Water quality analysis at UMN Analytical Geochemistry Lab (monthly samples at mussel sites + opportunistic sampling during high flows), discount for UMN researchers		$ -	$ -
Equipment/Tools/Supplies	$ 27,478		$ 27,478
8 discharge gages to install upstream of mussel sites, developed in Wickert lab, $750 each. $1600		$ -	$ -
6 telemeterd data loggers (developed in Wickert lab) with housings and solar power systems for suspended sediment at existing stream gages, $550 each. $3300			
Telemetry: $3/month at 14 stations for 34 month proejct duration, $1478			
Hardware for gage installation: screened PVC, rebar, clamps, bolts. $150 each for 8, $1200			
14 turbidity sensors for suspended sediment at existing and new stream gages, $750 each. $10,500		$ -	$ -
Suspended sediment sampler + supplies, $3000		$ -	$ -
Water quality supplies, $2050		$ -	$ -
	$ -	$ -	$ -
Capital Expenditures Over $5,000			
	$ -	$ -	$ -
Fee Title Acquisition			
	$ -	$ -	$ -
Easement Acquisition			
	$ -	$ -	$ -
Professional Services for Acquisition			
	$ -	$ -	$ -
Printing			
	$ -	$ -	$ -
Travel expenses in Minnesota	$ 4,000		
Mileage to and from field sites at $0.545 per mile (UMN policy), food, lodging, $4000		$ -	$ -
Other	$ 27,450		
Open access journal publishing fees + local public presentations, $10,000		$ -	$ -
Department administrative and accounting support at 15% of total, $17,450		$ -	$ -
COLUMN TOTAL	$ 154,411	$ -	$ 122,961

SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT	Status (secured or pending)	Budget	Spent	Balance
Non-State:		$ -	$ -	$ -
State:		$ -	$ -	$ -
In kind: Salary and fringe for Jones for duration of project	Secured	$ 94,900	$ -	$ 94,900

Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS	Amount legally obligated but not yet spent	Budget	Spent	Balance
		$ -	$ -	$ -


Cannon River watershed
0 10 20 km
Proposed monitoring sites
Measure suite of physical characteristics at each site
Suspended sediment
Nutrients
Pollutants
Magnitude and frequency of floods
Water velocity
Baseflow
Bed sediment stability
Grain size preference
Distribution of habitat

Project manager qualifications:

Jabari Jones has conducted interdisciplinary research linking physical and environmental characteristics to organisms in diverse settings, including native mussels in Missouri and Arkansas and native fish in Utah. Jones has employed a wide range of analytical techniques including hydroacoustic surveying, sediment transport measurements, and hydrologic data analysis. Each of these research experiences involved collaborative work with scientists from diverse disciplinary backgrounds.

UMN Saint Anthony Falls Laboratory mission statement:

The St. Anthony Falls Laboratory is an interdisciplinary fluids research and educational facility housed in the College of Science and Engineering at the University of Minnesota. Research at Saint Anthony Falls is focused at the intersection of fluid dynamics and major societal challenges in energy, environment and health. Researchers integrate experiments in the laboratory and field with advanced computational tools and theory to obtain innovative, science-based solutions to real-world fluid-flow problems.