**PROJECT TITLE: Complete Sonar Data Mapping on Three Minnesota Rivers**

**I. PROJECT STATEMENT**

The National Park Service and U.S. Geological Survey Upper Midwest Environmental Sciences Center would like to continue building on “phase 1” of the project “Develop Sonar Data Mapping on Three Rivers to Assess Suitability for Native Mussel Habitat” to complete detailed maps of underwater habitat features. Habitat layers (developed from acoustic data) can be combined to understand the river’s biological dynamics in geographic context. The ability to view combined, or overlapping datasets for a specific area can provide the following benefits:

* guide removal efforts of aquatic invasive species
* assess ecosystem threats or damage
* guide mussel conservation efforts
* measure success or failure of habitat restoration efforts
* help understand distribution of aquatic species in Minnesota
* establish guidelines to detect changes in habitat, geomorphology, and sediment transport

We are requesting funding for “Phase 2” to further develop sonar (acoustic) data into map products that will be combined into an online interactive web map (similar to Google Earth format) that will allow local, state, federal agencies, academia, and recreational boaters (i.e. general public) to explore riverbed habitat for their needs.

Currently, underwater acoustic data was collected on the lower 48 kilometers of the St. Croix river during the summer of 2018, and is being processed into bathymetry (water depth), underwater image mosaics, and shaded relief images. This summer, the project will continue with the Upper Mississippi River (M.L 2018, Chp. 214, Art. 4, Sec. 2, Subd. 03j). However, more information can be derived from these acoustic datasets, such as substrate type (sand, gravel, rock), riverbed morphology (bed forms), submersed vegetation beds, woody debris, and man-made structures. Additionally, bed complexity, slope, hardness, and water column characteristics can be derived. Combining these data layers can reveal where features coincide, suggesting relationships that drive the distribution and abundance of aquatic organisms. This project would be valuable to past and current ENRTF projects (see attachment) that have research in these aquatic areas by providing previously unknown underwater habitat information. For example, survival of native mussels can depend on physical habitat characteristics, such as substrate stability and river current. Acoustic information combined with spatial underwater habitat characteristics would assist managers in evaluating substrate stability for potential mussel propagation and relocation sites.

The following is an extensive list of existing information needs for resource management:

* Identify preferred aquatic invasive species habitat
* Evaluate underwater habitat damage
* Monitor sediment dynamics of large rivers
* Identify Threatened & Endangered species preferred habitat
* Emergency Response (oil spills)
* Island erosion monitoring
* Flood assessment

To effectively address these issues, a comprehensive understanding of the type, geographic extent, and condition of underwater resources is needed. For example, species of Asian Carp prefer different habitats. Silver Carp prefer deep water habitat, but spawn in shallow river tributaries. Grass carp prefer habitat resources that include submersed vegetation. Zebra mussels prefer hard surfaces, like cobbles, boulders, and native mussels, but will reside on submersed vegetation stalks too. Knowing locations of preferred habitat can help with control and removal efforts. Completion of “phase 2” will provide resource managers needed information to develop strategies for large river resource management.

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1:** **Map and quantify underwater habitat features from previously acquired acoustic data**

To date, acoustic data has been collected for the lower St. Croix River to develop bathymetry and imagery products, and will continue through 2020 for the Mississippi River (M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 03j). To identify underwater habitat features, GIS and specialized software will be used to map acoustic data. Activity 1 will focus on data mining for existing water quality and river velocity parameters; collecting underwater video (to assess map accuracy); develop supporting acoustic data layers (i.e. slope, roughness, hardness); and develop habitat layers (i.e. sediment, bed morphology, etc.).

**ENRTF BUDGET: $452,336**

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| **Outcome** | **Completion Date** |
| 1. Field collection of underwater videos; Data mining for existing data | Oct 31, 2021 |
| 2. Develop data layers derived from acoustic data & complete Accuracy Assessment | June 30, 2023 |

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| **Activity 2:** **Design and develop online web map for users**  A web developer will design a user-friendly web-based habitat map (similar in format to Google Earth) to be a fully interactive web GIS application. The map will be designed to let users display underwater habitat features (developed from Activity 1). All previously funded and current project data will be compiled into a GIS framework viewable online. This tool will help support resource management decisions.  **ENRTF BUDGET: $73,609** |  |

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| **Outcome** | **Completion Date** |
| 1. Web design of the Minnesota Three Rivers Habitat Mapper | June 30, 2023 |

**III. PROJECT PARTNERS:**

**A. Partners receiving ENRTF funding**

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| **Name** | **Title** | **Affiliation** | **Role** |
| **Nancy Duncan** | **Natural Resource Program Manager** | **NPS** | **Project Manager** |
| **Jenny Hanson** | **Biologist** | **USGS** | **USGS Lead** |

**B. Partners NOT receiving ENRTF funding**

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| **Name** | **Title** | **Affiliation** | **Role** |
| **Byron Karns** | **Acting Chief of Resource Management** | **NPS** | **SCNSR Park Lead** |

**IV. LONG-TERM- IMPLEMENTATION AND FUNDING:** The Minnesota Three Rivers Habitat Mapper (St. Croix, Mississippi, and Minnesota Rivers) will be available to users as an interactive online web map which will include links to download the data to be applied to user’s project, or the user will be able to print or export a map. The USGS will host the data for two years after the project is complete, but then will turn the data and web services over to the State of Minnesota.

**V. TIME LINE REQUIREMENTS:** The complete development for the suite of products (with corresponding metadata) compiled into a user-friendly web-based map will be delivered over a three-year project timeline.