Environment and Natural Resources Trust Fund
2016 Request for Proposals (RFP)

Project Title: **ENRTF ID: 059-B**

Evaluate and Quantify Streamflow Changes Affecting Aquatic Life

Category: B. Water Resources

Total Project Budget: $ 300,000

Proposed Project Time Period for the Funding Requested: 2 years, July 2016 to June 2018

Summary:

The project will evaluate the impacts of hydrologic modification on fish and macroinvertebrate communities in rivers and streams using Minnesota streamflow and biological monitoring data.

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Sponsoring Organization: MPCA

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Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Flowchart showing connection of streamflow to aquatic life with three pictures showing hydrologic impacts.

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

PROJECT TITLE: Evaluate and quantify streamflow changes affecting aquatic life

I. PROJECT STATEMENT

Streamflow is widely recognized as a significant influence on the presence and quality of aquatic life in streams and rivers; however, the connection between hydrologic characteristics and the resulting biotic communities has not been quantified in Minnesota. The project will evaluate the impacts of hydrologic modification on fish and macroinvertebrate communities in rivers and streams using Minnesota streamflow and biological monitoring data. The project may identify that reduced streamflows at certain times of the year or that changes in high flows at other times of the year correlate to the health of fish and macroinvertebrate communities in a stream whether as a direct cause of too little water or an indirect cause of increased sediment erosion and deposition resulting in habitat degradation. Flow-ecology relationships developed through this work will provide targets of streamflow magnitude, duration, frequency, timing, and rate of change to lessen the impacts of artificial hydrologic modifications on aquatic ecosystems. The targets will allow the quantification of streamflow alterations as stressors on aquatic life and subsequently guide the development and implementation of management practices designed to lessen the impacts of artificial hydrologic modifications on aquatic ecosystems.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Identify and select indicators of streamflow alteration **Budget: $50,000**

Compile streamflow data for sites with more than 10 years of daily streamflow data, compute hydrologic statistics, incorporate a stream classification system to group similar streams by hydrologic and geomorphic characteristics for hydrologic indices analyses, and select indicators that represent streamflow alteration in each group of streams.

Outcome	Completion Date
1. Selection of approximately 10 streamflow indicators and compilation of the indicators for approximately 300 streamflow sites for use in the development of the flow-ecology relationships in Activity 3.	Dec. 31, 2016

Activity 2: Identification and selection of flow-sensitive biological metrics **Budget: $50,000**

Conduct expert workshop of biologists and complete data analyses of biological data to identify metrics that are sensitive to altered streamflows. Statistical analyses of compiled data to test sensitivity of the biological metrics to the streamflow indicators selected in Activity 1. Select biological metrics for use in the development of flow-ecology relationships.

Outcome	Completion Date
1. Selection of 10 to 20 biological metrics for use in the development of the flow-ecology relationships in Activity 3.	April 1, 2017

Activity 3: Develop flow-ecology relationships **Budget: $100,000**

Develop hypotheses on how the flow indicators selected in Activity 1 influence physical, chemical, and particularly biological processes by river classification type via an expert workshop, literature, and statistical analyses. The hypotheses will address the who (species or group of species), what (flow magnitude or event), when (month or season), where (river type and habitat), and why/how (ecological response). Test the hypotheses using multivariate statistics. Define flow-ecology relationships based on accepted hypotheses.

Outcome	Completion Date
1. Selection of hydrologic indicators and biologic metrics, hypotheses, and resulting flow-ecology relationships that characterize the effects of streamflow alteration on aquatic life.	November 30, 2017

Activity 4: Develop framework and procedures to incorporate the flow-ecology relationships developed in the project into the stressor identification process and watershed restoration and protection strategies. **Budget: $100,000**

Draft framework and procedures for use in assessing flow alteration as a stressor on aquatic life. Provide for review and comments on the draft documents by expert and stakeholder groups. Compile and evaluate comments, revise documents, and finalize the framework and recommendations.

Outcome	Completion Date
1. Framework and procedures for the use of biological and hydrologic indices in addressing hydrologic stressors on aquatic life.	June 30, 2018

III. PROJECT STRATEGY

A. Project Team/Partners

Project Team Receiving Funds:

- United States Geological Survey – Mr. Jeffrey Ziegeweid ($200,000): Data compilation, statistical analysis and interpretation, national technical expertise and assistance, report writing.
- University of Minnesota – Dr. Joseph Magner ($100,000): Literature review, statistical analysis and interpretation, report writing.

Project Partners:

- Minnesota Pollution Control Agency – Mr. Gregory Johnson and other staff (0.5 FTE, in-kind) – project management and reporting, coordination of data, technical expertise and support, communication with partners and stakeholders.
- The Nature Conservancy – Dr. Kristen Blann: Advising project team and providing limited technical support.

B. Project Impact and Long-Term Strategy

With streamflow alteration identified as a significant problem for aquatic life in rivers and streams, the project will provide a better understanding of the role streamflow alteration plays as a factor in degrading water quality. The project will provide a foundation of streamflow and biological data relationships for use in improving our understanding of complex watershed systems to meet the aquatic life and recreational use goals of the Clean Water Act. The foundation will directly support the MPCA's stressor identification process and the development of watershed restoration and protection strategies in Minnesota's watershed approach to quantify and address the impacts of artificial hydrologic modifications on aquatic life. It may serve as a component in the development of environmental flow criteria for sustainable water management efforts in Minnesota, if agencies and organizations pursue such an option.

C. Timeline Requirements

The length of the proposed project is 24 months. This length of time is needed to ensure adequate time for interpretation of the data analysis, testing hypotheses, communicating results, refining hypotheses and retesting, and finalization of the project deliverables.

2016 Detailed Project Budget

Project Title: Altered hydrology as a stressor on aquatic life

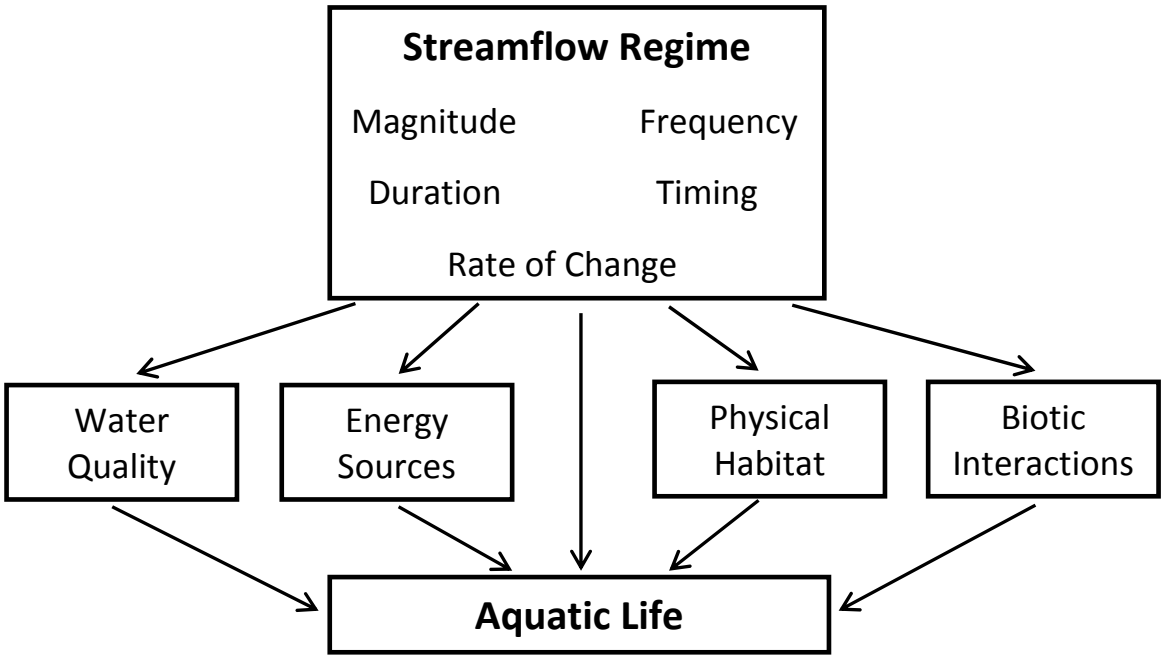
IV. TOTAL ENRTF REQUEST BUDGET 2 **years**

BUDGET ITEM	AMOUNT
Professional/Technical/Service Contracts:	
University of Minnesota: Compile streamflow and biological monitoring data, conduct multivariate statistical analyses to compute hydrologic indices, develop streamflow-ecology relationships, and develop framework and procedures to incorporate the flow-ecology relationships into the stressor identification process and watershed restoration and protection strategies in conjunction with the USGS and MPCA.	$ 100,000
United States Geoloical Survey: Compile streamflow and biological monitoring data, conduct multivariate statistical analyses to compute hydrologic indices, develop streamflow-ecology relationships, and develop framework and procedures to incorporate the flow-ecology relationships into the stressor identification process and watershed restoration and protection strategies in conjunction with the USGS and MPCA.	$ 200,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 300,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:		
United States Geoloical Survey - federal cooperative funding program	$ 30,000	Pending
Other State $ To Be Applied To Project During Project Period:	N/A	
In-kind Services To Be Applied To Project During Project Period:		
MPCA: Project management and coordination along with assistance in all activities; staff time	$ 105,000	Secured
Funding History:		
MPCA: staff time in developing project and examining data analysis tools	$ 25,000	Completed
Remaining $ From Current ENRTF Appropriation:	N/A	

Evaluate and quantify streamflow changes affecting aquatic life



Project Manager Qualifications

Gregory Johnson
Hydrologist 3
Minnesota Pollution Control Agency

Mr. Johnson is a senior hydrologist in the Watershed Division. He has a Master of Science degree in hydrology and watershed management. He has contributed to development of many aspects of the nonpoint source pollution control and watershed management programs throughout his 29-year career at the Agency. He is responsible for providing technical assistance and training to watershed staff. He provides direction in the synthesis, coordination, and integration of water quality and flow data, watershed and water body conditions, pollutant sources and transport processes, and data analysis for use in the Watershed Approach.

Greg provides leadership in researching and developing tools and approaches to integrate the multi-disciplinary nature of watershed science and management. He has a working knowledge of the use of hydrologic indices and has worked to coordinate efforts with MPCA staff and other agencies and organizations.

Organization Description

The Minnesota Pollution Control Agency is responsible for water quality monitoring, stressor identification, pollution source identification and evaluation, and development of restoration and protection strategies in Minnesota's Watershed Approach. The Agency incorporates the expertise of biologists, hydrologists, engineers, watershed specialists, and others in addressing the point and nonpoint source pollution problems in the state. The Agency works with many agencies, organizations, and individuals in all aspects of watershed management.