

**Environment and Natural Resources Trust Fund  
2010 Request for Proposals (RFP)**

**LCCMR ID: 031-A3**

**Project Title:**

Protection of Trout Streams from Adverse Land-use Impacts

**LCCMR 2010 Funding Priority:**

A. Water Resources

**Total Project Budget: \$** \$370,438

**Proposed Project Time Period for the Funding Requested:** 2 years, 2010 - 2012

**Other Non-State Funds: \$** \$0

**Summary:**

This study will quantify the state-wide impact of urban and agricultural land use practices on trout stream temperatures. Costs and effectiveness of thermal impact mitigation strategies will be summarized.

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**Location:**

**Region:** NE, Central, Metro, SE

**County Name:** Statewide

**City / Township:**

_____ Knowledge Base	_____ Broad App.	_____ Innovation
_____ Leverage	_____ Outcomes	
_____ Partnerships	_____ Urgency	_____ TOTAL

**PROJECT TITLE:** Protection of Minnesota Trout Streams from Adverse Land-use Impacts

**I. PROJECT STATEMENT**

Stream temperature increases due to land use changes are increasingly recognized as a significant factor in habitat loss for trout. Research and management emphasis to date has been placed on stream temperature impacts due to the conversion of natural or agricultural lands to urban (commercial, industrial, residential) land use. Agricultural land use can also increase coldwater stream temperatures in comparison to, e.g., natural prairie and forested lands, but little is known about thermal impacts in agriculture dominated watersheds. Overall, the cumulative thermal impact from urban and agricultural land use on trout stream habitat in Minnesota is not known.

Ongoing research at the University of Minnesota St. Anthony Falls Lab (SAFL), funded by the Minnesota Pollution Control Agency, has increased the level of understanding of stream temperature impacts from urbanized watersheds. SAFL has developed software tools to evaluate thermal loading to streams from surface runoff, including stormwater management practices (BMPs). To make these technical results accessible and useful to personnel concerned with coldwater habitat protection, they need to be summarized and cast into a set of management guidelines, and extended to include more current mitigation and BMP measures. Information gaps in temperature impacts of agricultural practices must be filled to allow a comprehensive assessment of temperature impacts of all land use in a watershed, and to prioritize mitigation. Costing information for different thermal management practices need to be developed and summarized.

The goals of the proposed study are 1) to quantify the hydrothermal impacts of urban and agricultural land use practices on trout stream thermal habitat in the key regions of Minnesota where trout streams are found, and 2) create a set of management guidelines for mitigating the impacts of land use changes on trout stream thermal habitat.

The proposed study will build on the results of the MPCA funded thermal impact study and the EPA funded thermal trading study in the Vermillion River watershed.

**II. DESCRIPTION OF PROJECT RESULTS**

**Result 1: Quantify local impacts of agriculture on trout stream temperatures Budget: \$120,497**

The influence of agricultural land use practices such as ditching, drain tiles, and buffer strips on trout stream temperatures will be quantified by analyzing field data of impacted and unimpacted streams and by simulating these systems using existing, mechanistic stream temperature models. Study streams will be selected from the central and southeastern (Driftless) areas of Minnesota. Previous studies on the impact of agriculture on watershed hydrology will provide important background information. Additional field data will be collected, where needed, to characterize specific practices such as ditching and drain tiles. Existing stream temperature models will be used to quantify the sensitivity of stream temperature to variations in channel shading, e.g. for different types of buffer strips, and to hydrological changes associated with ditching, drain tiles, and seasonal vegetation coverage. Result 1 will provide the more detailed, mechanistic relationships required for the state-wide impact study (Result 2).

**Deliverable**

1. Mechanisms for agricultural land use impacts on trout stream temperatures

**Completion Date**

January 2012

**Result 2: State-wide impacts of urbanization and agricultural on trout stream temperatures Budget: \$117,001**

To generalize impacts of urbanization on trout stream temperatures, key regions of Minnesota will be identified with both significant predicted population growth and significant trout stream habitat, such as watersheds in the Twin Cities metro area and the North Shore. Current and future thermal impacts will be

estimated based on projected growth and current stormwater regulations, using previously developed simulation tools. Results on agricultural impacts at study sites (Result 1) will be generalized for key regions of the state with intensive agriculture and significant trout habitat, e.g. southeast Minnesota. By extrapolating the results for specific trout stream watersheds, overall trout habitat loss due to urban development and agriculture will be estimated.

**Deliverable**

1. State-wide impacts of urbanization on trout thermal habitat
2. State-wide impacts of agriculture on trout thermal habitat

**Completion Date**

June 2012  
June 2012

**Result 3: Management guide for thermal impact mitigation**

**Budget: \$132,940**

Existing data on the performance and cost of stormwater best management practices (BMPs) will be augmented with observed flow and temperature data and model simulations to relate rate and volume control performance to thermal mitigation performance. A document will be created in a style similar to that of the Minnesota Stormwater Manual that will summarize performance and cost information on expected temperature mitigation of different BMPs. Results from the agricultural practices study will be included. Land use and watershed decision makers can use this document to better assess and prioritize mitigation strategies to maximize benefits and cost-effectiveness.

**Deliverable**

1. Thermal Impact Mitigation Guidelines for Urbanization
2. Thermal Impact Mitigation Guidelines for Agriculture

**Completion Date**

June 2011  
June 2012

**III. PROJECT STRATEGY**

**A. Project Team/Partners**

The project team includes Dr. William Herb and Prof. Heinz Stefan, at the University of Minnesota St. Anthony Falls Lab (SAFL), and Prof. Jay Coggins, University of Minnesota Department of Applied Economics. Herb and Stefan have extensive experience with lake and stream water quality studies, and will be responsible for the technical work on this project. Coggins will lead the economic analysis portions of the study. We anticipate that several graduate students in the departments of Civil Engineering and Applied Economics will be involved with the project. We will partner with the Minnesota Pollution Control Agency (Bruce Wilson) and the Minnesota Department of Natural Resources (Brian Nerbonne). Wilson will work with SAFL in determining appropriate management guidelines for temperature mitigation. Nerbonne will assist in evaluating the severity of temperature impacts on trout habitat, to prioritize the mitigation of different types of temperature impacts.

**B. Timeline Requirements: July 2010 – June 2012**

**C. Long-Term Strategy**

The proposed work builds on previous work at SAFL on the impacts of urbanization on trout streams, including studies of urbanization in the Vermillion River (Scott and Dakota Counties) and in Miller Creek (Duluth, MN). The proposed study focuses on land use change, and is complimentary to current and planned studies on climate change impacts on streams in Minnesota. A nation-wide study, e.g. funded by the National Science Foundation, can also be pursued as an extension to this project.

## Project Budget

### IV. TOTAL PROJECT REQUEST BUDGET (2 years)

BUDGET ITEM <i>(See list of Eligible &amp; Non-Eligible Costs, p. 13)</i>	AMOUNT
<b>Personnel:</b>	\$ -
Position Type: Research Associate (1), 1=94% Full Time, 67.7% Salary, 32.3% Benefits, period = 7/1/2010 to 6/30/2012	\$ 156,340
Position Type: Research Fellow (1), 75% Full time, 67.7% Salary, 32.3% Benefits, period = 7/1/2010 to 6/30/2012	\$ 93,591
Position Type: Grad Students (1 in Civil Eng., 1 in Applid Econ) 50% Full Time, 60% Salary, 40% Benefits, period = 9/1/2010 to 8/30/2011	\$ 74,070
Position Type: Administration (3) 10% Full Time, 63% Salary, 37% Benefits	\$ 37,437
<b>Contracts: N/A</b>	\$ -
	\$ -
<b>Equipment/Tools/Supplies:</b> 1. Field equipment and supplies for hydrologic and thermal measurements, including temperature, surface flow and climate at trout stream sites (\$3000). 2. Copying and publishing costs (\$500) 3. Miscellaneous office and computer supplies (\$500)	\$ 4,000
<b>Acquisition (Fee Title or Permanent Easements): N/A</b>	\$ -
<b>Travel:</b> <i>Travel within state for field instrumentation, site inspections, and meetings with state agencies and local authorities</i>	\$ 5,000
<b>Additional Budget Items:</b> <i>In this column, list any additional budget items that do not fit above categories. List by item(s) or item type(s) and explain how number was</i>	\$ -
<b>TOTAL PROJECT BUDGET REQUEST TO LCCMR</b>	<b>\$ 370,438</b>

### V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
<b>Other Non-State \$ Being Applied to Project During Project Period: N/A</b>	\$ -	
<b>Other State \$ Being Applied to Project During Project Period: N/A</b>	\$ -	
<b>In-kind Services During Project Period: N/A</b>	\$ -	
<b>Remaining \$ from Current Trust Fund Appropriation (if applicable): N/A</b>		
<b>Funding History: N/A</b>	\$ -	

## **Project Manager Qualifications and Organizational Structure**

Dr. William Herb is a Research Associate at the St. Anthony Falls Laboratory (SAFL), where he has worked with Prof. Heinz Stefan on a number of projects relating to lake and stream water quality, beginning in 2001. His educational background includes MS and PhD degrees in Mechanical Engineering and an MS in Water Resources Science, all from the University of Minnesota. Dr. Herb has over 20 years of engineering and science experience in industry and academia, including project management roles at the Honeywell Technology Center previous to his work at SAFL. His work at SAFL has focused on water quality modeling for lakes and streams, including lake temperature models and stream flow and temperature models. He also has expertise in hydrologic modeling, including hydro-thermal modeling of surface runoff, storm sewers, and best management practices such as detention ponds and wetlands. Dr. Herb also has experience in field instrumentation for water quality measurement, including flow, temperature, and dissolved oxygen of surface water and groundwater. Dr. Herb will lead the technical effort for the project at SAFL. Prof. Heinz Stefan will provide additional technical guidance and advise the Civil Engineering graduate students working on the project. Prof. Jay Coggins will lead the economic analysis work associated with this project. Herb, Stefan, and Coggins previously collaborated previously on a EPA funded project to study the feasibility of implementing a thermal impact trading system in the Vermillion River watershed.

The technical work of the proposed project will be performed at the St. Anthony Falls Laboratory, a research unit of the University of Minnesota's Institute of Technology in the Department of Civil Engineering. The laboratory is also closely affiliated with the Department of Geology and Geophysics and the Department of Ecology, Evolution and Behavior.

