

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

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**LCCMR ID: 012-A2**

**Project Title:**

Understanding Sources of Aquatic Contaminants of Emerging Concern

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**LCCMR 2010 Funding Priority:**

A. Water Resources

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**Total Project Budget: \$** \$917,432

**Proposed Project Time Period for the Funding Requested:** 3 years, 2010 - 2013

**Other Non-State Funds: \$** \$400,000 (pending)

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**Summary:**

This project develops a suite of chemical markers to characterize sources of endocrine disruptors and pharmaceuticals to surface waters. We will develop recommendations to policymakers for source reduction strategies.

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**Name:** Deborah Swackhamer

**Sponsoring Organization:** U of MN

**Address:** Water Resources Center, 173 McNeal Hall, 1985 Buford Ave  
St. Paul MN 55108

**Telephone Number:** (612) 625-0279

**Email:** dswack@umn.edu

**Fax:** \_\_\_\_\_

**Web Address:** dswack@umn.edu

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**Location:**

**Region:** Statewide

**County Name:** Statewide

**City / Township:**

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

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## MAIN PROPOSAL

**PROJECT TITLE:** Understanding Sources of Aquatic Contaminants of Emerging Concern

### I. PROJECT STATEMENT

Pharmaceuticals, hormones, and other contaminants of emerging concern (CECs) are found in surface waters in Minnesota, nationally, and internationally. CECs in water can disrupt the endocrine system of fish, wildlife, and humans and encourage antimicrobial resistance, and as a result can cause adverse ecological and human health impacts. Many different sources of CECs result in a complex mixture of hundreds of compounds in surface waters. One of the greatest barriers to addressing the problem of CECs with education, treatment, or source reduction is a lack of understanding of where these compounds come from and which sources dominate in different locations and at different times.

We **hypothesize** that different land uses result in the presence of unique marker compounds, relative concentrations of compounds, and temporal occurrence patterns that will differentiate agricultural sources (crop and livestock production) from non-agricultural sources (residential septic, wastewater treatment effluent). These markers can be used to determine the comparative load of CECs to water, which can in turn be used to help policy-makers and stakeholders develop strategies to reduce their occurrence. To determine what these markers are, a field site with a variety of different land uses is needed to define the contribution of each land use to the total CEC load to surface water. Such a site has been identified. The Zumbro River watershed in southeastern Minnesota provides a unique opportunity to study CECs from agricultural and non-agricultural sources because each of its sub-watersheds has a single dominant land use. We will use field data collected from each sub-watershed to develop a suite of markers for source discrimination and load determination. Ultimately, this “source signature” will be applied to other water bodies in the state for similar source characterization.

This project will address three major needs for Minnesota and will simultaneously establish Minnesota as a leader in CEC research and policy for the nation.

- 1. Determine what CECs are associated with specific, discrete sources to water**
- 2. Determine indicator compounds that can be used as a monitoring tool to determine sources and loads of CECs to different water bodies**
- 3. Work with state agency leadership and legislative policy-makers to develop science-based recommendations to assist in development of prevention, reduction, and remediation strategies**

By achieving these goals, we will improve current and future water quality, thus protecting aquatic ecosystems and human health. In addition to furthering an understanding of the sources of CECs, **this project will contribute to our larger initiative to expand Minnesota’s CEC research capacity, understand CECs in a larger context, and provide solutions for such contamination.**

### II. DESCRIPTION OF PROJECT RESULTS

**Result 1: Characterization of CECs from different land uses**      **Budget: \$ 650,950**

Water samples will be collected from 9 sub-watersheds of the Zumbro River watershed in the spring, summer, and fall over two years. These 9 sub-watersheds have land uses differing in percent and type of agriculture and percent of urban sewer or suburban septic-systems. All relevant land uses can be sampled upstream of the wastewater treatment plant. Samples will be analyzed for ~30 selected target compounds associated with wastewater discharge, personal care product use, human pharmaceutical use, pesticide application, animal agriculture, and row crop agriculture. Analysis will be performed with validated laboratory methods.

**Deliverable**

1. *Collection of field samples (yrs 1 and 2)*
2. *Analysis of field samples (yrs 1 and 2)*
3. *Data compilation and analysis*

**Completion Date**

*Fall 2012*  
*Spring 2012*  
*Spring 2012*

**Result 2: Development of “source signature” for CECs in water** Budget: \$ 193,008

Results will be interpreted using the diverse expertise and experience of our research team. We anticipate the detailed characterization of contaminant concentrations and temporal occurrences for each river (Result 1) will reflect the surrounding land use and provide contaminant signatures associated with specific land uses. A variety of statistical methods will be used to facilitate identification of “grouped” CECs and those CECs that are associated with particular land uses. Source signatures (unique combinations of target chemicals that are specific to a given source) and chemical markers will be developed that can be used by others to characterize the sources of CECs to additional surface waters.

**Deliverable**

1. *Source signature & marker compound determination*

**Completion Date**

*Fall 2012*

**Result 3: Development of recommendations to state policy-makers** Budget: \$ 73,474

We will engage policymakers, resource managers, and the regulatory community in discussions where our findings will be the scientific basis of recommendations for strategies to reduce sources, mitigate sources, and remediate sources of CECs.

**Deliverable**

1. *Develop recommendations, and hold workshop with policymakers to discuss strategies*
2. *Final Project Report*

**Completion Date**

*Spring 2013*

*June 2013*

**III. PROJECT STRATEGY****A. Project Team/Partners**

All investigators are from the University of Minnesota, and include the following. Deborah Swackhamer, Project Manager, Water Resources Center and School of Public Health. Pamela Rice, Department of Soil, Water and Climate, and USDA Agricultural Research Service. William Koskinen, Department of Soil, Water and Climate, and USDA Agricultural Research Service. Paige Novak, Civil Engineering. William Arnold, Civil Engineering. Team expertise includes environmental chemistry, toxicology, engineering, and microbiology.

**B. Timeline Requirements**

The proposed project will be completed in the allotted three-year period as described in above.

**C. Long-Term Strategy**

This project grew out of previous work demonstrating the role that wastewater treatment plants (WWTP) play as a source of CECs and in reducing estrogenicity during certain processes. This project is part of a larger initiative to expand the capacity for CEC research in Minnesota, and to build capacity for synthesis of information coming from many different efforts (well monitoring data from MPCA, data from USGS, newly published toxicology information, etc). Our long term goal is to characterize all CEC sources and place this knowledge into a larger context (fate, transport, effects) so that more effective management strategies for the state can be developed.

## Project Budget

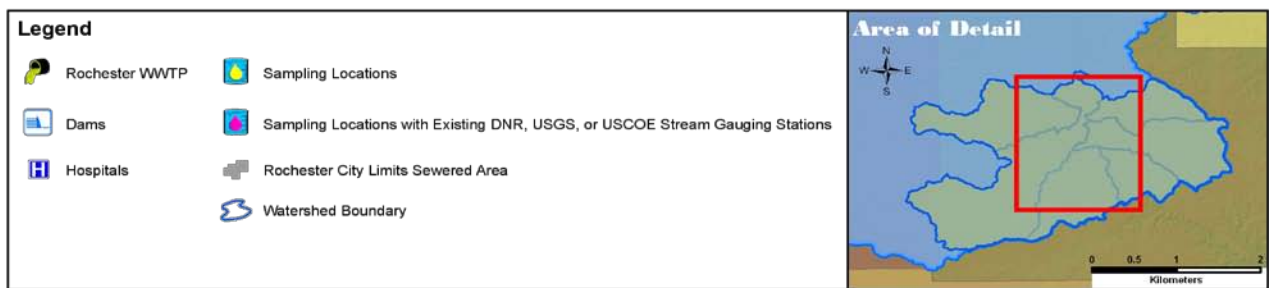
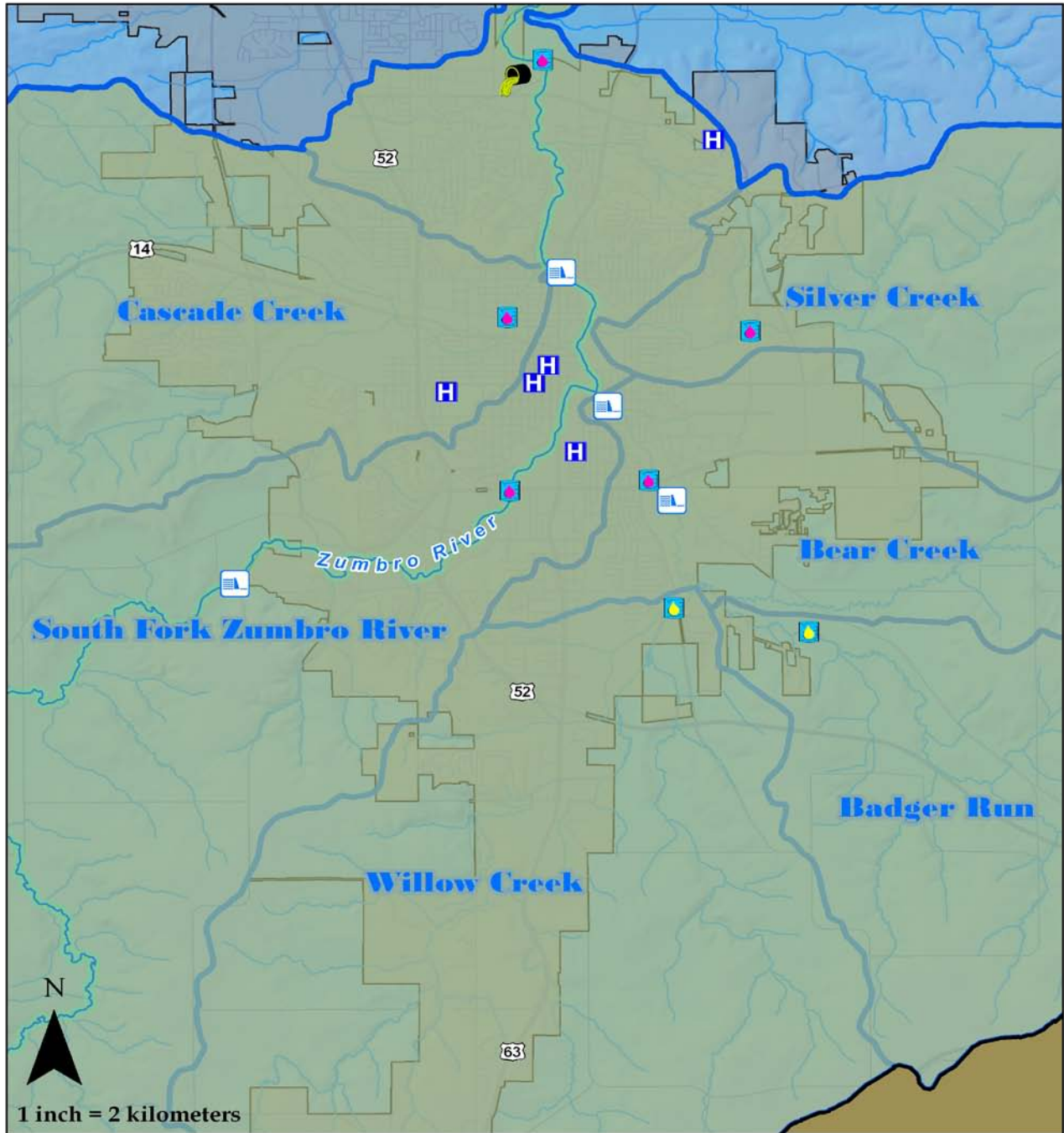
### IV. TOTAL PROJECT REQUEST BUDGET (3 years)

<u>BUDGET ITEM</u> (See list of Eligible & Non-Eligible Costs, p. 13)	<u>AMOUNT</u>
<b>Personnel:</b>	
Deborah Swackhamer, PI (4% effort); 75% salary, 25% benefits	\$ 28,541
Paige Novak (4% effort), 75% salary, 25% benefits	\$ 24,017
William Arnold (4% effort), 75% salary, 25% benefits	\$ 21,221
Brian Barber (50% yrs 1+2; 25% yr 3 effort); 73% salary, 27% benefits	\$ 98,174
3 graduate students (50% effort); 57% salary, 43% benefits	\$ 303,229
<b>Contracts:</b>	N/A
<b>Equipment:</b> Liquid chromatograph - tandem mass spectrometer: needed to expand analytical capacity for endocrine disruptors and pharmaceuticals in environmental samples	\$ 260,789
<b>Supplies:</b>	
Chemical Analyses	\$ 90,000
Hydrologic flow measurements	\$ 30,000
GIS mapping	\$ 45,000
Team meeting expenses	\$ 3,900
Workshop costs	\$ 3,000
Shipping and mailing	\$ 1,100
Printing & copying	\$ 1,400
Travel (outstate, for professional meetings)	\$ 4,000
Travel (instate, for sample collection)	\$ 3,060
<b>TOTAL PROJECT BUDGET REQUEST TO LCCMR</b>	<b>\$ 917,432</b>

### V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
<b>Other Non-State \$ Being Applied to Project During Project Period:</b> we have submitted a grant to the USDA to work in the same watershed with a focus on agricultural pharmaceuticals	\$ 400,000	<i>Pending</i>
<b>Other State \$ Being Applied to Project During Project Period:</b>	N/A	
<b>In-kind Services During Project Period:</b>	N/A	
<b>Remaining \$ from Current Trust Fund Appropriation (if applicable):</b> "Removal of Endocrine Disruptors: Treatment and Education/Communication" (to begin 7/1/09 with Legislature approval)	\$ 275,000	<i>Not Legally Obligated</i>
<b>Funding History:</b> prior LCCMR projects have focused on waste water treatment plants and not source characterization	\$ -	

Study Location: Zumbro River Watershed



## **Project Manager Qualifications**

Dr. Deborah L. Swackhamer, Project Manager, will oversee project progress and administration; assist with data interpretation and synthesis, and lead the team in the development of chemical markers for source determination. She will be responsible for the preparation and delivery of all required progress and final reports, and will participate in the development and publication of peer-reviewed manuscripts.

Dr. Swackhamer is Professor of Environmental Chemistry in the Division of Environmental Health Sciences in the School of Public Health at the University of Minnesota, and Co-Director of the University's Water Resources Center. She received a BA in Chemistry from Grinnell College (Grinnell, IA) and a MS and PhD from the University of Wisconsin-Madison in Water Chemistry and Limnology & Oceanography, respectively. After two years post-doctoral research in Chemistry and Public & Environmental Affairs at Indiana University, she joined the Minnesota faculty in 1987. She has studied the processes affecting the behavior of, and exposures to, toxic chemicals in the environment, including bioaccumulative chemicals in the Great Lakes and environmental estrogens in wastewater.

Dr. Swackhamer currently serves as Chair of the Science Advisory Board of the US Environmental Protection Agency, and on the Science Advisory Board of the International Joint Commission of the US and Canada. She is appointed by Governor Pawlenty to serve on the Minnesota Clean Water Council. Dr. Swackhamer is a member of the Editorial Advisory Board for the journal *Environmental Science & Technology*, and she chairs the Editorial Advisory Board of the *Journal of Environmental Monitoring*. She was recently named a Fellow in the Royal Society of Chemistry in the UK. Dr. Swackhamer received the Harvey G. Rogers Award from the Minnesota Public Health Association in June, 2007.

## **Organization Description**

The University of Minnesota is one of the largest public research universities in the country, and is a Land Grant and Sea Grant university. The Water Resources Center Center is one of the 54 Water Resources Research Institutes authorized by Congress and partly funded through the USGS. The WRC mission is to conduct research, outreach, and education to improve and protect the quality and value of water resources for Minnesota citizens.