Environment and Natural Resources Trust Fund 2011-2012 Request for Proposals (RFP)

LCCMR ID: 026-B Project Title: Capture and Use of Groundwater Sustainability Data Pilot
Category: B. Water Resources
Total Project Budget: \$ \$601,800
Proposed Project Time Period for the Funding Requested: 2 yrs, July 2011 - June 2013
Other Non-State Funds: \$ 0
Summary:
Water supply systems typically collect but do not store groundwater level and flow-rate data. We will demonstrate feasibility and cost savings of automated data capture for groundwater sustainability investigations.
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Sponsoring Organization: DNR
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Location
Region: Statewide
Ecological Section: Statewide
County Name: Statewide
City / Township:

_____Funding Priorities _____Multiple Benefits _____Outcomes _____Knowledge Base _____Extent of Impact _____Innovation _____Scientific/Tech Basis _____Urgency ____Capacity Readiness _____Leverage ____Employment _____TOTAL ____%

2011-2012 MAIN PROPOSAL

PROJECT TITLE: Capture and Use of Groundwater Sustainability Data Pilot

I. PROJECT STATEMENT

Water supply systems typically collect, but do not store, large volumes of groundwater level and flowrate data with automated control systems (e.g. SCADA (Supervisory Control and Data Acquisition) systems). Meanwhile many thousands of dollars are spent to collect virtually identical data for groundwater sustainability investigations and long-term monitoring of areas where aquifers are stressed by pumping. The USGS estimates the value of a detailed water level record from one well for one year at \$2,500. The value of data that could be captured from just half the state's approximately 2,350 permitted drinking water supply systems would be close to \$3,000,000 per year.

This project will demonstrate the feasibility and cost savings of capturing the normally discarded SCADA data and using it for monitoring purposes and to conduct sustainability analyses. Quality assurance methods will be developed to ensure the accuracy of the data. Methods for automatic data retrieval and storage will be developed and tested. Web-based data analysis and review tools will be available to the water managers in the pilot communities and staff will be trained how to manage the new system and in some of the ways the data can be used to better manage groundwater.

Once this concept is proven and deployed, high-quality information about the regional and local status of groundwater resources will be available to all water managers and will form the framework of the "stressed" observation well network. Water suppliers with wells in this network would benefit from improved quality control, improved knowledge of their resource, cost savings in reporting appropriations use data and in performing required aquifer stress testing. Comparable datasets will be available for evaluation of groundwater – surface water interactions.

The capture, compilation, and accessibility of these data could support many ongoing and future groundwater management applications. For example:

- Evaluate the impact of groundwater withdrawals on nearby wells, on other aquifers, and on interconnected surface water resources (springs, streams, lakes and wetlands). These data could assist communities to protect valued resources while meeting DNR's monitoring requirements.
- Provide high quality, detailed pumping and water level change information that could be evaluated as an efficient continuous aquifer test. Results would augment the state's database of aquifer test information maintained by the Minnesota Department of Health.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Capture of Control System (SCADA) Time-Series Data

Budget: \$ 188,325

Automated pumping control systems monitor sensors continuously. We will determine optimal water level and flow rate data collection frequency. We will assess currently deployed control systems in communities of different sizes for their ability to store the measurements they take and evaluate potential costs of control system improvements required for optimal data collection.

Outcome	Completion Date
1. Identify optimal scalable technology for large volumes of time series data (report)	06/30/12
2. Document technology levels of current systems and sensors statewide (report)	06/30/12
3. Estimate costs to bridge the gap between the current systems and optimized systems	06/30/13
that can provide sustainability data (report)	
4. Create and provide tools to assist communities with meeting water level and water	06/30/13
use reporting requirements (beta version of electronic reporting system)	

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Activity 2: Processing, Storing, and Serving Time-Series Data

Determine the criteria for a water data management system that can handle several orders of magnitude more data than what is currently collected and reported. We will create software tools that automatically analyze and process large quantities of data. We will create automated routines to upload data to a secure Internet site at a state or federal agency.

Outcome	Completion Date	
1 Specify design criteria for a state water resource data management system (report)	12/31/11	
2. Develop calibration, quality assurance, and analysis tools (code and documentation)	06/30/13	
3. Complete automated data transfer routines (transfers are active for pilot sites; report)	06/30/13	

Activity 3: Prove the Concept

We will implement the concepts described above in two communities: one urban and one rural. The pilot project will assess the existing monitoring wells and control systems, and upgrade software and equipment as needed

Outcome	Completion Date
1 Assess community water control system components (report)	12/31/11
2. Make necessary upgrades to the monitoring system (permanent upgrades, report)	06/30/12
Assess data management system needs, from well to future web site (report)	12/31/12
4. Train local personnel to operate and maintain the upgraded data collection system	06/30/12
(training complete, operations manual addendum)	
5. Develop implementation plan and cost estimation template for other communities'	06/30/13
use (report)	

Activity 4: Demonstration of Value

Budget: \$86,750

We will demonstrate the value of the pilot's highly detailed time-series data by performing two, potentially significant, water resource evaluations supporting sustainable groundwater management.

Outcome	Completion Date
1 Compare our ability to accurately determine critical aquifer properties using captured	06/30/13
SCADA data versus traditional – expensive – aquifer tests (report)	
2. Compare our ability to accurately determine groundwater flow directions and	06/30/13
elevation trends using SCADA times-series data versus conventional well data (report)	

III. PROJECT STRATEGY

A. Project Team/Partners

Team receiving money from the ENRTF: MN DNR and contractors (USGS, University of Minnesota and Dakota County).

Partners contributing inkind services of staff time or use of facilities: Minnesota Department of Health, Metropolitan Council, two pilot communities (yet to be invited), one urban and one rural.

B. Timeline Requirements

The goal is to implement the project completely during the two-year duration of the grant period. A minimum of one full year of monitoring will be obtained during this period. Results 1, 2 and 3 are interdependent. Results 3 and 4 could be independently completed, but their value would depend upon future availability of data as described in Results 1 and 2.

C. Long-Term Strategy and Future Funding Needs

No project of this type has been attempted in Minnesota. Should this effort prove its cost effectiveness in providing useful high quality data, then a second phase of the project will be proposed to expand its implementation and promote its use by many other communities and other types of water users.

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Budget: \$174,575

Budget: \$151,950

IV. TOTAL TRUST FUND REQUEST BUDGET (2 years)

BUDGET ITEM			AMOUNT
1 FTE IT Specialist 3 - Data Systems, role is to bring together independent databases created			
for groundwater or surface water under a publically accessible web portal for data access			
across platforms and agencies; adapt the DNR groundwater level database for extremely			
large datasets and automated data submittals; work on electronic permitting services to assist			
water appropriation permit holders; salary and fringe	\$	147,500	
1 FTE Project Specialist, role is to assist the obwell manager and IT Spec with conversion of			
groundwater level data from multiple sources into common electronic format and transfer of			
quality-controlled data into new system; salary and fringe	\$	100,000	
.40 FTE Natural Resources Program Consultant, role is to coordinate all aspects of the			
project (contracts, reports, development of electronic water level and use reporting); salary	~	50.000	
and fringe	Ş	59,200	
Personnel:	Tota		\$ 306,700
Dakota County, Environmental Services, William Olsen: Local assistance with Dakota County			
pilot, work with USGS and UM to use pilot data to investigate groundwater flow path changes,	~	27.000	
assessment of existing water control systems.	Ş	27,000	
USGS, Tim Cowdery: To test storage, calibration, and web service of pilot data and to			
calculate firm costs for producing, storing and serving calibrated time series data from			
pumping wells and observation wells in two communities. To train local water supply system			
operators in the use of the upgraded system and to write a draft operator's training manual	ć	60 000	
based on experience during the pilot.	Ş	00,000	
components of existing pilot community water supply systems and municipal control systems			
to include instrumentation of additional wells and metering of possibly unmetered production			
rates	Ś	45.000	
University of Minnesota, graduate student and supervisor Dr. Randal Barnes, Civil	Ŧ	,	
Engineering: Algorithms for guality control of time series data, methodology and prototype			
code for inferring aguifer properties from operational time series data, and test with data from			
the pilot communities, to prepare scientific and technology transfer results.			
	\$	135,000	
Contracts:	Tota		\$ 267,000
Equipment/Tools/Supplies: Water-level measurement equipment, supplies for well			
maintenance, pressure transducers and equipment to retrieve data from wells remotely and in			
person (e.g. GPS data pad), data transfer equipment and use charges (e.g. cellphone modem			4
or radio).			\$ 23,000
I ravel: DNR travel expense includes mileage, meal reimbursement, and lodging.			\$
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND \$ REQUEST			\$ 601,80 0
V. OTHER FUNDS			
SOURCE OF FUNDS	<u>AN</u>	<u>IOUNT</u>	<u>Status</u>
Other Non-State \$ Being Applied to Project During Project Period:		N/A	
In-kind Services During Project Period: Dakota County will match the contract amount with			
inkind services in the amount of \$27,000; USGS will cover all overhead costs in the amount of			
\$40,000; Metropolitan Council's \$15,000 in-kind contribution to Result 4 will be use of the			
metro pilot community's transient and trend data in the Metro Area Groundwater Model to test			
feasibility of using high-density water level data. Minnesota Department of Health's \$6,000			
inkind contribution to Result 4 will be use of data from the pilot communities for time periods			
with multiple pump-on and pump-off cycles to derive aquifer characteristics.	ć	00 000	confirmed
Minneseta DNP's In kind Contribution: \$ 66 700 for shared convises and governance	Ş	88,000	non
	\$	66,700	secured

Capture and Use of Groundwater Sustainability Data Pilot

Water Supply systems take measurements of groundwater levels, pumping rates, and volumes as part of operations. The information is not necessarily stored for future use. If the data could be captured for use, and if monitoring wells could be included in automated reporting, orders of magnitude more groundwater data would be available to water managers.



Schematic of data flow from raw SCADA data to end usable product (above)



Example of a statewide 'stressed' monitoring network, assuming that most major groundwater users could contribute data (right). Example of a 'stressed' monitoring network for the 11-county Metropolitan area, assuming that most public water suppliers could contribute data (left).



Vastly improved monitoring of aquifers in areas where aquifers are under stress would result if public water suppliers and major water users contributed data to the groundwater level monitoring network as seen in these hypothetical network examples.



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Project Manager Qualifications

Dr. Jeanette H. Leete, PG, CPG

Dr. Jeanette Leete is a hydrogeologist (Geoscientist license #30140, Certified Professional Geologist #7499) who supervises the Groundwater Unit with MN DNR Division of Waters. She and her staff provide technical analyses of the nature, distribution, appropriation and sustainability of groundwater statewide. Dr. Leete obtained her PhD and MS in Forest Hydrology from the University of Minnesota, and a BS degree in Geology and Environmental Studies from Macalester College. Ongoing continuing education and post-graduate coursework have kept her up-to-date with new methods in hydrology and hydrogeology.

As a hydrogeologist with the State, she has extensive field and office experience working on groundwater quantity and quality issues. Her current position involves managing and overseeing the work of staff engaged in the technical side of ground water quantity management statewide. She has been involved in wetland hydrology and ground water/surface water interaction research since 1976.

Organization Description

The Minnesota Department of Natural Resources (DNR)'s mission is to work with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life. The department consists of several divisions based on the state's natural resources, such as Fish and Wildlife, Forestry, Lands and Minerals, Parks and Trails, and Ecological Resources and Waters, as well as four regions and four support bureaus.