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

LCCMR ID: 146-E2

Project Title:

Climate-Grade' Observation System by Enhancing Existing Stations

LCCMR 2010 Funding Priority:

E. Natural Resource Conservation Planning and Implementation

Total Project Budget: $ $780,000

Proposed Project Time Period for the Funding Requested: 4 years, 2010 - 2014

Other Non-State Funds: $ $0

Summary:

Existing networks of automatic weather observations that are currently managed to meet long-term state agency needs can be improved and operated jointly to meet climate monitoring needs.

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Sponsoring Organization: DNR

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Location:

Region: Statewide

County Name: Statewide

City / Township:

_____ Knowledge Base _____ Broad App. _____ Innovation

_____ Leverage _____ Outcomes

_____ Partnerships _____ Urgency _____ TOTAL

MAIN PROPOSAL

PROJECT TITLE: 'Climate-Grade' Observation System by Enhancing Existing Stations

I. PROJECT STATEMENT: In order to assess aspects of climate change that impact renewable energy in Minnesota various characteristics of the climate must be accurately observed. This need is emphasized by the recommendation (CC-9 in the 'final report') of the Governor's Minnesota Climate Change Advisory Group's (MCCAG) to 'Dedicate greater public investment to climate data and analysis'.

Observing the climate requires that the instruments used meet tight standards and are so deployed over long periods of time (decades to centuries). The suite of characteristics actually observed, such as temperature, humidity, etc., must be broadened to meet future needs for climate analyses. A permanent archive is required to organize the data and to provide an easily accessed source for anyone engaged in climate analyses.

Networks of automated weather stations that telemeter their data many times every day are already being operated by some state agencies to fulfill certain requirements of their missions. To the extent that such missions are permanent, those networks will have maintenance provided by the agencies' budgets for the foreseeable future. Many of those stations are operating at sites appropriate for long-term climate monitoring. Instruments of lesser accuracy should be replaced. Instruments to observe aspects being sparsely observed such as solar radiation need to be added. Soil heat and moisture of potential interest for heat exchange projects is for the most part not measured at all. The project would buy new instruments as required.

A network of existing networks can be formed in a virtual sense. The data from all participating stations would be collected at a permanent central archive. From that repository any of the data for the entire periods of record would be readily available to any user needing such information. The project would pay an agency MIS bureau to establish the data storage system and acquisition process and easy-to-use user access methods such as 'web pages'.

DESCRIPTION OF PROJECT RESULTS

Result 1: *Network design. Result 1a: Network design fact finding.* Many states have been through the process of designing and implementing a state 'mesonet' to observe the climate. The Oklahoma Mesonet, considered to be the premier network, has invited us to come and learn about their system. Project partners would travel there and to other 'inspection tours', meetings, or conferences as are available such as National Oceanic and Atmospheric Administration meetings concerning the formation of a new National Climate Service (ala National Weather Service). *Result 1b: Specification of various aspects of the required network.* Specify equipment upgrades and new purchases required. Define physical observing site changes that are required. Assemble a 'requests for bids' for new equipment and for work on site including installation of new or upgraded instruments.

Budget: $ 80K

	Deliverable	Completion Date
1.	Travel to training, inspections, conferences, or meetings.	Jun 30, 2011
2.	Specify which parameters will be observed and their associated instrumentation specifications, define sufficient spatial density via meetings of network managers	Sep 30, 2011
3.	Request for bids issued. Decisions for implementation made.	Jun 30, 2012

Result 2: *Design and implement an archive facility for all automated station network data.* Design data formats that comply with national standards. Design, write, implement, and test programs to acquire data in near-real-time and to retrieve and create informational products from data in the archive which can be accessed by the public via the web.
Budget: $ 100K

	Deliverable	Completion Date
1.	Specify formats and implement an archival system to store station data. Specify and implement data retrieval capabilities include Informational products (such as maps and graphs). Requires meetings between all Network managers and MIS personnel.	Dec 31, 2011
2.	All prexisting data from all member networks are imported into the common archive. Web-based versions of retrieval capabilities as will be available for public use are fully functional.	Jun 30, 2012

Work on Results 3-5 ('phase 2') starts in year 3, Jul 1, 2012, after completion of result 1.

Result 3: *Purchase equipment and make site changes as required.*
Budget: $ 500K * (amount depends of results from result 1)

	Deliverable	Completion Date
1.	Equipment purchases made. Install new equipment and make required site modifications on each member station as required	Dec 31, 2013

Result 4: *Upgrade weather station software* to read, store, and transmit data from new or upgraded observing instruments. The effort to do this varies between the constituent networks and in some cases between stations.

Budget: $ 50K
Deliverable Completion Date

1. (re)Write the station instructions (code) and install on each member station and test Jun 30, 2013

Result 5: *Comprehensively test all station programmed output and telemetry.* Fix any problems.
Budget: $ 50K

	Deliverable	Completion Date
2.	Systematically acquire via telemetry data from all stations for extended periods. Check for reliability, data quality and correctness of station programs.	Dec 31, 2013
3.	Fix problems as required. Visits to observing site are required.	June 30, 2014

II. PROJECT STRATEGY AND TIMELINE

Project Partners

Jim Zandlo, State Climatologist and Greg Spoden, Assistant State Climatologist, DNR Waters. Zandlo will act to implement the project and be closely involved with archival and retrieval including informational product generation aspects of the project. Spoden will advise on matters of equipment choices and specifications, station siting and density, station programming, and telemetry.

Partners of the project include the managers of State of Minnesota agency owned networks of automatic telemetered weather/climate observing stations who have voluntarily chosen to participate. Automated telemetered station managers will assess the feasibility of implementing suggested changes to their systems based on their constraints. Their constraints include but are not limited to regulatory requirements, budgets, and available communications bandwidth. The managers must consider the possible long-term incremental costs that must be absorbed by their programs for such things as increased maintenance duties and future equipment replacements or upgrades.

Bob Milton, MNDOT Navigation Systems Section Manager, manages of the MNDOT Aeronautics network of flight service stations, the largest of the existing networks at 70+ stations located primarily at small airports across Minnesota. Doug Miedtke, DNR Fire Intelligence/Fire Training Specialist**,** manages the DNR Forestry Fire Weather Network. Greg Kruse, DNR Waters, manages both Flood Warning and Clean Water Legacy monitoring networks. Water levels are the primary measurement of those systems.

DNR MIS will provide long term data services for the archive.

B. Project Impact

Absolutely all areas of Minnesota experience impacts due to the weather. Having reliable and accurate measures of the climate that produces the weather is essential in understanding the variations that occur in many sectors. Living organisms whether plant or animal, natural or agricultural are especially vulnerable to changes. However, such things as energy use and thus generation, transportation costs as in road maintenance, and water supply all are influenced as well. DNR is currently developing environmental policy predicated on models of climate change. Data from a climate monitoring network will be important to validating and improving existing applied climate models, thus improving State of Minnesota policies. Also, accurate, comprehensive, and spatially dense climate data will be needed to implement many recommendations of the Statewide Conservation and Preservation Plan, such as Habitat Recommendation 9 on page 83, guiding Minnesota's knowledge infrastructure regarding Overall Research on Land and Aquatic Habitats.

C. Time

Existing state-owned networks have stations at a spatial density that is generally thought to be roughly sufficient for most types of observations. Therefore, for the most part, no new stations need to be added. New budget resources to meet physical requirements of the project are only applied to stations that need to have site changes or improved sensors that meet climate observing requirements. An addition cost arises to combine the observed data from the separately managed networks into a single data resource that features public access.

The amount of time required is simply that reasonably required for the project partners to do research, meet, confer, and decide on specific details of implementation plus the time to bid, purchase site work, install and test equipment and to develop the new data resource. [The timeline may be somewhat optimistic.]

D. Long-Term Strategy (if applicable)

The mission of the State Climatology Office, a part of the Waters division of DNR, is the provision of climate information for Minnesota. So, ongoing involvement by the Office in terms of advising the post-LCCMR joint project is anticipated. Each participating network is preexisting and as such brings its own mission and budget to bear; the long-term viability of the 'network of networks' is dependant on the survival of those networks' missions and budgets. The permanent data archive requires new long-term funding. This would most likely be hosted within a state agency such as DNR. The level of funding could be quite low for a maintenance-only strategy but expanding services based on the data resources would, of course, require additional long-term commitments.

Project Budget

INSTRUCTIONS AND TEMPLATE (1 PAGE LIMIT)

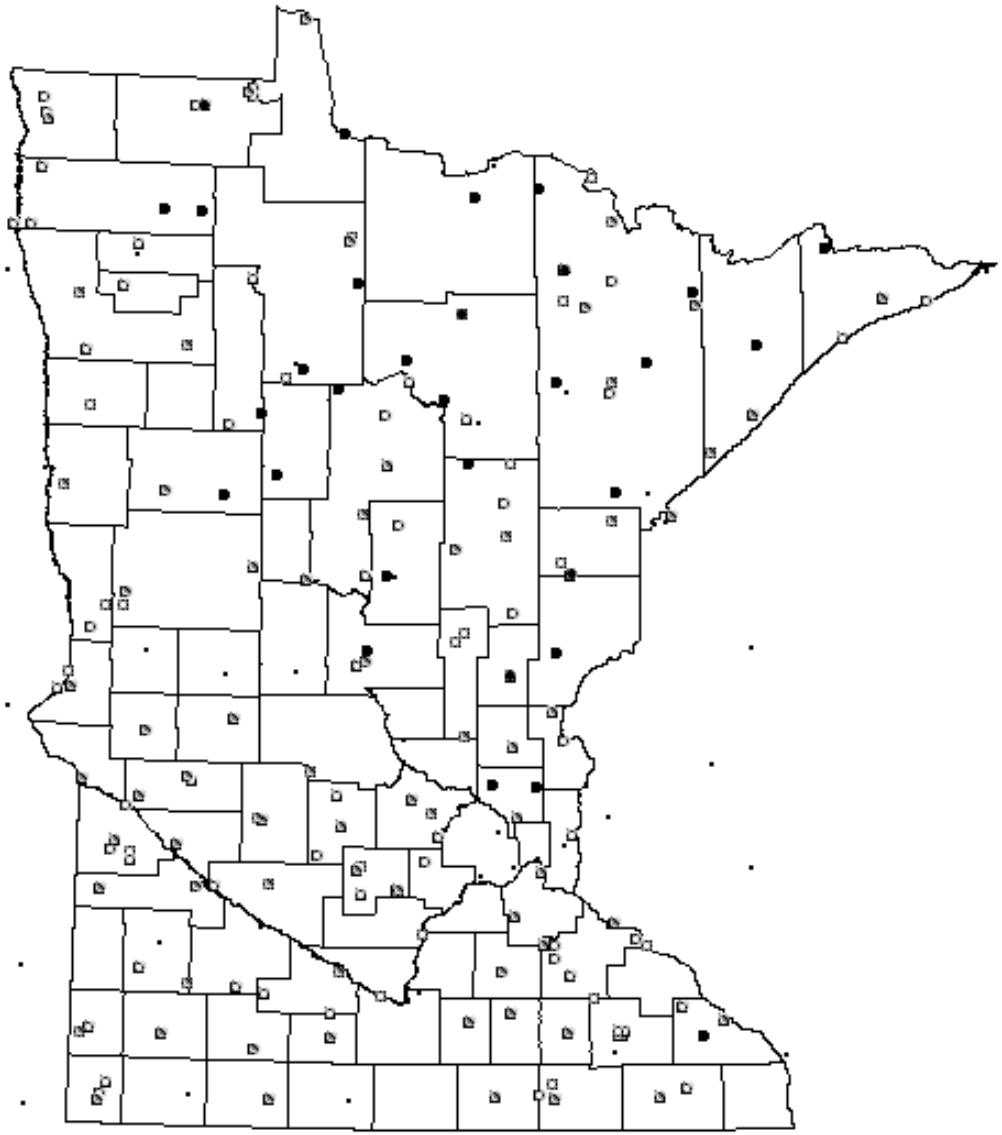
IV. TOTAL PROJECT REQUEST BUDGET

BUDGET ITEM	AMOUNT	% FTE
Personnel:	$ -	%
	$ -	%
Contracts: *With whom and for what?*	$ -	
Network specification and design	$ 40,000	
Station site changes including but not limited to tower/platform installation, concrete pad installation, and similar chores.	$ 50,000	
Sensor installation	$ 50,000	
Station programming, program installation and debugging, and sensor installation.	$ 50,000	
MIS design and implementation of archive and retrival facilities.	$ 100,000	
	$ -	
Equipment/Tools: *Climate sensors. Climate station parts such as but not limited to towers, masts, other hardware, tranceivers, and data loggers.*	$ 450,000	
Acquisition (Including Easements): *List # of acres and who will hold title (e.g., DNR, Non-profit)*	$ -	
Restoration:	$ -	
Other:	$ -	
Out-of and in-state travel for network managers to learn details of and training by the Oklahoma Mesonet and to other meetings, conferences, or inspections	$ 40,000	
	$ -	
TOTAL PROJECT BUDGET REQUEST TO LCCMR	$ 780,000	

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Remaining $ From Previous Trust Fund Appropriation (if applicable):	$ -	*Unspent or Not Legally Obligated*
Other Non-State $ Being Leveraged During Project Period:	$ -	*Secured or Pending*
Other State $ Being Spent During Project Period:	$ -	*Secured or Pending*
In-kind Services During Project Period: NOAA and FAA station data is already of sufficeint quality and will be incorporated into the archive, State climatology Office offers exsiting database design and the data as well as expertise in designing and implementing retrieval and product generation services, network managers' operation and maintenance of existing networks.	$ -	
Past Spending:	$ -	

Telemetered Automated Climate/Weather Stations
Operated by Minnesota State Agencies (and select others)



- basic (temperature,precipitation,humidity,wind,solar)
- ⊗ no solar
- ○ no humidity, wind, solar
- · non State of Minnesota (Federal government)

Advantages to be leveraged by this project

- In Place and Operating
  - Maintenance is a part of long-term 'permanent' missions
  - High quality instruments
  - High spatial density for any variable possible with infrastructure is already in place
- Telemetered
  - Quality control possible soon after measurements are actually made
  - Expands utility: data can be available for client use immediately after measurement taken

Deficiencies addressed by this project

- Management disparities due to mission requirements
  - E.g. flood warning and fire danger
- **NOT** functionally a 'network of networks' ***NOW***
- Access to all data simultaneously not possible
- Missing important variables (see map legend)
  - Alternative energy needs: solar measured only in northeast, soil temperature not at all
  - No soil moisture, UV radiation, etc.

Jim Zandlo, a native Minnesotan, received his Bachelor of Physics from the University of Minnesota in 1978 and his Master of Science - Meteorology from the University of Wisconsin - Madison in 1980. Jim started working at Minnesota State Climatology Office, a part of DNR Waters but physically located at the University of Minnesota St. Paul campus, in 1981 as the Assistant State Climatologist for Minnesota. Since 1986 he has been the State Climatologist. He has developed extensive computer resources for the Office including databases and extensive web-based retrieval capabilities; public users can dynamically create statistical products, maps, and graphs. He has contributed to and conducted applied climate research efforts and has created operational tools based on those results for a wide variety of topics. Jim has done work to identify non-climatic effects, as might be due to land use changes for example, in climate data. Recent work has included the development of tools to provide data on climate change.

The State Climatology Office exists to manage, analyze and disseminate climate information, to design, develop and implement or improve the technical means for such activities, and to coordinate the activities of data producers or suppliers to ensure a contiguous and continuous supply of high quality climate data for the State of Minnesota and its citizens in order that those whose activities or well being are affected by the climate of Minnesota may be advised of those climatic effects.

DNR manages many programs which monitor natural resources. DNR is currently developing environmental policy predicated on models of climate change. Data from a climate monitoring network will be important to validating and improving existing applied climate models, thus improving State of Minnesota policies. The Minnesota Department of Natural Resources, DNR, is a comprehensive, integrated natural resource management agency with divisions focusing on Forests, Water, State Parks, State Trails and Water Accesses, Minerals, Fish and Wildlife, Ecological Resources, and Enforcement. The State Climatologist's Office is housed in the DNR's Division of Waters.