M.L. 2008 Projects Completed 2011-2012

MN Laws 2008, Chapter 367, Section 2

M.L. 2008 Projects Completed 2011-2012

M.L. 2008 Projects
MN Laws 2008, Chapter 367, Section 2 (beginning July 1, 2008)

NOTE: Below are short abstracts for projects funded during the 2008 Legislative Session and ending during 2011-2012. The final date of completion for these projects is listed at the end of the abstract. Final Reports for all completed projects are available at http://www.lccmr.leg.mn/projects/2008-index.html or by contacting the LCCMR office.

Subd. 03 Land and Habitat
03b Vermillion River Corridor Acquisition and Restoration in Dakota County
03d Preserving the Avon Hills Landscape
03g State Land Acquisition Consolidation
03i Metropolitan Regional Park System Land Acquisition
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Subd. 05 Natural Resource Information
05a Updating the National Wetlands Inventory for Minnesota
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06b Global Warming - Reducing Carbon Footprint of Minnesota Schools

Subd. 7 Establishment of an Emerging Issues Account

SUBD. 03 LAND AND HABITAT

Vermillion River Corridor Acquisition and Restoration in Dakota County
Subd. 03b $400,000

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Overall Project Outcome and Results
The Vermillion River, a designated trout stream, flows through four cities and five rural townships starting in Scott County and running through Dakota County. The existing watershed plan, like most other comparable plans, identified and addressed water quality issues, but recommended and required that management efforts do not include corridor-related wildlife habitat protection and restoration, or recreational use and conflicts.

The new Vermillion River Corridor Plan developed with these funds establishes a vision and philosophy for the corridor along the main stem and primary tributaries of the Vermillion River from New Market Township in Scott County to Vermillion Falls in Hastings. It is based on integrating multiple benefits: environmental (water quality and upland habitat), social (recreation), and economic (sustainable high-quality places to live and work). The plan creates a foundation for coordinating and prioritizing funding, implementation and management. The plan also includes the "Vermillion River Corridor Handbook", a searchable, online Best Management Practices tool intended for use by a broad audience. The tool includes practices indexed by primary benefits (water quality, habitat, and recreation) and by the predominant landscape type of interest to the user (urban, rural, and developing). Information on and links to potential funding sources and technical information is included. The plan, process, and products were designed to be replicable.

The corridor plan also creates the framework for initiating a comprehensive riparian buffers initiative throughout Dakota County. An 800-point criteria system that includes water quality, wildlife habitat, recreation, financial, and other considerations was developed to evaluate and select future land protection projects. An innovative system for determining financial value for corridor buffer easements based on land cover/use types was developed.

The plan and resulting selection system resulted in the acquisition of a 193-acre permanent conservation easement that protects the headwaters of South Branch of the Vermillion River, a very high quality restored prairie, and a network of trails open to the public.

Project Results Use and Dissemination As the project transitioned from planning to implementation, information has been shared with the general public through various venues and media forms. See the Final Report, Section VII "Dissemination" for more information.

Project Publications:
Vermillion River Corridor Plan: Improving Water Quality, Habitat, and Recreation (PDF - 13.2 MB)
Vermillion River Corridor Handbook (Web-based)

Project completed: 6/30/2011

Preserving the Avon Hills Landscape
Subd. 03d $337,000

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Overall Project Outcome and Results
The Avon Hills Initiative is a group of local citizens interested in preserving the rural nature of the 50,000 acre Avon Hills 15 miles west of St. Cloud. The group helped steer this project made possible with Environment and Natural Resources Trust Fund support. Saint John's provided the staff and fiscal support. This project had three goals:

1. Increase the level of interest and understanding of all citizens and landowners interested in the Avon Hills, mostly through conferences. Outcome: Three day-long conferences were held with nearly 900 total attendees indicating very strong local support.

2. Negotiate and complete acquisition of permanent conservation easements. Outcome: Six conservation easements totaling 400 high quality forest, wetland, and grassland acres in Stearns County were successfully enacted. Two of the easements, totaling 99 acres, were purchased, and four of the easements, totaling 301 acres, were donated by the landowners. These acres contain a total of more than two miles of shoreline on streams, ponds, and lakes, and provide habitat to a variety of species, including several of greatest conservation need. Additionally, through this process we tested a new method for prioritizing and acquiring easements for the best value. Called MMAPLE, the Minnesota Multi-faceted Approach for Prioritizing Land Easements, the system weighs the measurable environmental benefits against the cost that the current landowner wants to provide a permanent easement on that land. Using sealed bids, each landowner chooses their own price which results in lower costs and fewer complaints from landowners and taxpayers about the "fairness" or "price" of the easement process.

3. Provide support for township and county officials to review and change zoning and ordinances that impeded protection of the open space. Outcome: Two "conservation design" conferences for officials and the public as well as reviews of the existing ordinances by professionals resulted in positive feedback from the participants. This gradual education helped create sufficient support for Stearns County to pass a land-use ordinance that requires new housing developments in the Avon Hills to permanently preserve at least 80% of the land. This is believed to be the highest standard in the United States.

Project Results Use and Dissemination
The success of the land use concepts used in the Avon Hills of Stearns County to preserve open space and working forests and farms has been disseminated in a variety of ways. Staff, officials, and citizens have been asked to discuss the concepts with neighboring county officials and at professional meetings.

Todd County, a neighboring county, sent several officials to the land use conferences and has gradually begun to implement similar practices in their county.

The MMAPLE method developed under this grant is being used to apply for a Outdoor Heritage Fund

grant for more easements.

Project completed: 6/30/2011

State Land Acquisition Consolidation
Subd. 03g $500,000

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Overall Project Outcome and Results
The goal of a land consolidation revolving fund was, and is, to enable Department of Natural Resources (DNR) to purchase lands of significant natural resource value adjacent to, or imbedded within, lands that are already managed by public agencies. Many of these purchases are likely to be private, industrial forest lands that would otherwise be subdivided and sold for development. At the same time, the DNR would sell parcels of state-owned land that are isolated and difficult to manage from a resource or public benefit standpoint. The proceeds from the sale of these parcels would go back into the land consolidation revolving fund. By strategically purchasing and selling parcels through this fund, the state could achieve a net gain from both a natural resource and economic perspective.

The appropriation for this project enabled DNR to purchase five parcels in Koochiching County and two parcels in Itasca County, totaling 800 acres. These were key acquisitions as each one was selected because it either was a sole private parcel imbedded in tens of thousands of acres of public ownership, or it was adjacent to DNR managed lands and would enhance that management and provide natural resource benefits. Development or subdivision of these parcels would create fragmentation and potentially hinder forest management activities on adjacent lands.

On the sale side, results were not as successful. DNR identified six parcels in the project area for potential sale, but did not succeed in selling any of them. We learned from this project that the geographic scope of this project was too small. The vast majority of the land in the project area (well over 90%) is state trust fund land and the proceeds of sales from these lands must go to the corpus of the school trust fund and not the revolving account. Had the project been broadened to include some northwestern Minnesota counties, where there are significantly more acquired lands, the project would have had more success. On a positive note, DNR has statutory authority to continue the purpose of this project statewide and will do so. We will continue to provide LCCMR updates on our work in this area.

Project Results Use and Dissemination
The State Land Acquisition Consolidation project information has been disseminated to DNR staff who manage lands in the project area, as well as county land departments and county commissioners in Koochiching and Itasca counties.

As stated above, we were in regular contact with the counties. We also have communicated with third party non-profits such as The Nature Conservancy, The Trust for Public Lands, and The Conservation Fund.

Project completed: 6/30/2012

Metropolitan Regional Park System Land Acquisition
Subd. 03i $1,500,000

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Overall Project Outcome and Results
This $1.5 million appropriation leveraged a total of $1,833,241 of other funds to acquire 66.7 acres for the Metropolitan Regional Park System as follows:

- 0.5 acres including shoreline of the Mississippi River for Above the Falls Regional Park in Minneapolis (Grant SG-2008-143: $81,392 Environment Trust Funds and $54,261 Metro Council bonds, and matched with $45,216 of Minneapolis Park & Rec. Board funds for a total of $180,870).
- 9.42 acres along Rush Creek for Rush Creek Regional Trail managed by Three Rivers Park District in suburban Hennepin County (Grant SG-2009-021: $244,440 Environment Trust Funds and $152,528 Metro Council bonds, and matched with $132,233 of Three Rivers Park District funds for a total of $529,200).
- 8.89 acres including shoreline of Schulz Lake for Carver Park Reserve, managed by Three Rivers Park District in Carver County (Grant SG-2009-059: $431,640 Environment Trust Funds and $287,760 Metro Council bonds, and matched with $239,800 Three Rivers Park District funds for a total of $959,200).
- 8.12 acres including shoreline of Cedar Lake for Cedar Lake Farm in Scott County (Grant SG-2009-062: $221,810 Environment Trust Funds and $147,873 Metro Council bonds, and matched with $123,228 of Scott County funds for a total of $492,911).
- 38 acres including shoreline of the Mississippi River for Grey Cloud Island Regional Park in Washington County (Grant SG-2010-045: $445,455 Environment Trust Funds, and $296,970 Metro Council bonds, and matched with $247,475 of Washington County funds for a total of $989,900).
- 1.8 acres including shoreline of the St. Croix River for the St. Croix Valley Regional Trail in Washington County (Grant SG-2010-052: $75,263 Environment Trust Funds and $60,608 Metro Council bonds, and matched with $45,290 of Washington County funds for a total of $181,161).

Project Results Use and Dissemination
Each regional park agency that received a grant or grants from this appropriation informs the public about the land acquisition with its own website and news releases. The Metropolitan Council also publishes a "Regional Parks Directory and Map" that informs the public about the recreation activities available at each regional park and trail and includes website addresses and phone numbers for each park agency for more information. Finally, the Metropolitan Council's website includes an interactive parks map that contains the same information as the paper version of the "Regional Parks Directory and Map" at http://www.metrocouncil.org/parks/r-pk-map.htm.

Project completed: 6/30/2011

Impacts of Climate Change and CO2 on Prairie and Forest Production
Subd. 03p $330,000

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RESEARCH

Overall Project Outcome and Results
Funds from the Environment and Natural Resources Trust Fund (ENRTF) were used to help establish, maintain, and expand studies regarding impacts of elevated carbon dioxide and changing climate on productivity (i.e. carbon acquisition) and carbon sequestration of woody and herbaceous vegetation. Two new state-of-the-art open air experiments were begun. A new biofuel-oriented experiment was installed in 72 elevated CO2 plots within the ongoing BioCON (Biodiversity, CO2, and Nitrogen) experiment - an effort started in 1997 that is examining how plant communities respond to environmental changes in biodiversity, CO2, and Nitrogen; these plots were planted with potentially "high-yielding" woody and herbaceous perennials. A Boreal Forest Warming experiment in Cloquet and Ely was installed, planted and warming treatments implemented in 2009 and 2010. ENTRF funds were also used to support specific carbon cycling measures in the original, ongoing BioCON experiment. The following findings were documented:

1. In all studies, results showed that acquisition of new carbon is likely in a world with higher CO2 levels and/or with modest warming, but is significantly dampened during periods of low water availability or when soil nutrients are limiting.
2. Long-term sequestration in soil of acquired carbon is likely modest due to the rapid return (through respiration of roots and decomposers) of new carbon to the atmosphere.
3. Soil carbon storage is likely dependent upon soil characteristics however, with sandy soils in our experiments less able to build up carbon stores than finer-textured soils might be.

4. Results suggest considerable potential to grow biomass carbon that could potentially contribute to biofuel offsetting of fossil fuel use and to carbon sequestration in live biomass, dead biomass, and potentially in soils.

Project Results Use and Dissemination Several publications are in preparation. These include experiment-specific papers (about individual experiments), cross-experiment papers for several related experiments at the Cedar Creek station, and meta-analyses and synthesis papers for which data from this ENRTF project have been combined with similar data from other experiments in North America, Europe, and Asia.

Project completed: 6/30/2011

Biofuel Production and Wildlife Conservation in Working Prairies
Subd. 03q $750,000

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RESEARCH

Overall Project Outcome and Results
Minnesota prairies reliably produce bioenergy resources which largely go untapped. This project sought management practices to promote wildlife and habitat diversity on future working prairies used for bioenergy in Minnesota. It combined harvested areas with refuges and monitored wildlife populations and bioenergy potential in Minnesota grasslands, while developing protocols for future long-term work.

We collaborated with land managers of established prairies to survey birds, insects, small mammals, reptiles, amphibians, plants and soils in regions across western Minnesota. Statistical trends show that harvesting grasslands with refuge remaining does not reduce wildlife abundance. In fact, harvested areas supported greater biomass of insects for bird food. Harvesting can also increase overall small mammal abundance when equal area is left as refuge. These results are being clarified in the ongoing second phase of this project.

We measured bioenergy potential measured by harvesting prairies with production-scale equipment. We tested various harvesting machinery, techniques, and bale types, and found current round baling technology more amenable to these plots, a discbine cutter mounted on a four-wheel drive tractor as the most effective cutting equipment, and tractors with custom-made front and rear mounted bale spikes worked best for transport. We obtained noticeably higher quantities of biomass per acre in the south, but biomass quality was approximately the same. Harvesting three years in a row did not reduce yield, and we found mixed-species biomass can produce at least as much liquid fuel per unit mass as

switchgrass. Our bioenergy partners reported that bales of prairie grass have better storage life than other renewable feedstocks they used.

The large amount of data produced is being made available on the project website for general use. Results from this first phase of the project will inform future land management by analyzing the intersection of renewable energy and wildlife conservation.

Project Results Use and Dissemination
We have a project website available (www.cbs.umn.edu/wildlife) to make the ideas and results available world-wide. This website will continue to develop as the protocols for this project are refined and as data become available. The project will also be featured in Cedar Creek educational programs for school-age and other groups. Presentations (oral and poster) to special interest groups, research groups, and other interested parties continued by project collaborators throughout the project. The first publication from this project in a peer-reviewed scientific outlet is now available. (Jungers et al., Characterizing Grassland Biomass for Energy Production and Habitat in Minnesota, Proceedings of the 22nd North American Prairie Conference, 2010). Further publications will be submitted as the project moves into its second phase.

Project completed: 6/30/2011

SUBD. 04 WATER RESOURCES

Accelerating Plans for Integrated Control of the Common Carp
Subd. 04b $550,000

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RESEARCH

Overall Project Outcome and Results
The common carp (Cyprinus carpio) was introduced to Minnesota in the late 1800s and quickly came to dominate the fish communities in the south-central portion of the state where it is now responsible for poor water quality and greatly reduced duck habitat. Our previous Environment and Natural Resources Trust Fund (ENRTF) funded projects from appropriations in 2003 and 2005 had suggested that recruitment (survival of fertilized eggs to adulthood) might be a key weakness in the life history of the carp and that predatory fish, odors, or sounds might be used to control recruitment. This project investigated these possibilities in six studies ('results'):

1. For the first, we monitored the fate of carp eggs and larvae in both the field and lab to determine if predators might be eating them. We discovered that bluegill sunfish, a native game-fish, consume large numbers of carp eggs and larvae.
2. For result 2 we examined correlations between the abundance of young-of-the-year (YOY) carp and predatory game-fish across two dozen lakes using trap-net surveys. We discovered the YOY carp are rarely found in lakes that have bluegills, suggesting that bluegills control carp in lakes.
3. A third study examined the age structure of several populations of adult carp. It found that YOY carp only recruit in years and places where winter oxygen levels are low enough to kill bluegills.
4. A fourth study examined whether food odors might be used to enhance capture rates of YOY carp. While, we found evidence that certain baits are attractive in the lab, field results were variable and application appeared impractical.
5. A fifth study examined pheromones for use in YOY removal and came to a similar conclusion.
6. Lastly, we examined whether air-bubble curtains have potential to reduce the movement of YOY carps from nursery areas by producing sound. These results were promising.

In summary, this project provided compelling evidence that populations of invasive carp can be controlled by promoting the abundance of native predators and controlling movement using bubble barriers.

Project Results and Dissemination The results of this project are presently being implemented by the Riley Purgatory Bluff Creek Watershed District and the Ramsey Washington Metro Watershed District. Both watersheds report that carp densities are reduced and under control while water quality has improved. The barrier bubble developed here is now being developed further by another ENRTF project. This work has been described in 6 peer-reviewed publications (with more in review), over a dozen scientific meetings, a dozen agency meetings and in at least 6 press and TV reports.

Project completed: 6/30/2011

Intra-Lake Zoning To Protect Sensitive Lakeshore Areas
Subd. 04e $125,000

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Overall Project Outcome and Results
Protection of critical fish and wildlife habitat, particularly for "species in greatest conservation need", is necessary given the substantial near-shore habitat losses estimated to date and the losses projected with future shoreland development. This cooperative Cass County/State project identified sensitive shoreland for the county's largest and most valuable waters. The project used objective, science-based criteria to identify sensitive shoreland parcels. Cass County selected seventeen lakes that were the highest priority for assessment (e.g., Ten Mile, Woman, and Leech). The objectives of this project were

to: (1) identify and map sensitive shorelands, (2) develop and adopt shoreland ordinances to provide greater protection to sensitive areas, and (3) propose and implement zoning districts for identified sensitive shorelands.

Biological surveys were completed on the 17 priority lakes, as well as three connecting waterbodies. Species presence was recorded in extensive spatial detail. Botanists documented a total of 69 native aquatic plant taxa, including 42 submerged and free-floating, 7 floating-leaf, and 20 emergent taxa. Surveyors mapped over 2,000 acres of bulrush, and over 6,000 acres of other emergent and floating-leaf plant stands. Seventeen unique or rare plant species were documented. Biologists recorded four fish species in greatest conservation need. Pugnose shiners were the most widespread of these species, and were recorded on 10 study lakes. Longear sunfish, least darters, and greater redhorse were collected on four lakes each. Biologists documented 161 bird species, including 45 species in greatest conservation need. Four of these species are listed as Threatened in Minnesota and seven species are of Special Concern status. Mink and green frog breeding locations were identified on all surveyed lakes.

A total of 190.2 miles of shoreline, representing 40% of the total shoreline miles, were identified as sensitive. Nearly 28,000 acres of shoreland were identified as sensitive. Cass County proposed and adopted innovative zoning provisions within their shoreland ordinance to protect water quality and near-shore habitat.

Project Results Use and Dissemination

We completed sensitive lakeshore assessments on the 17 priority lakes, as well as three connecting waterbodies. Lake reports summarizing sensitive lakeshore assessments were completed for the 20 lakes. These reports describe the results of the biological surveys and provide maps of identified sensitive lakeshore. Reports were distributed to Cass County as well as to interested lake associations, organizations, and individuals. They are also available online at: http://www.dnr.state.mn.us/eco/sli.

Public presentations explaining the sensitive area identification process and results were given to the Cass County Board of Commissioners, Cass County Planning Commission, Association of Cass County Lake Associations, U.S. Forest Service, multiple lake associations, and many other groups.

Several organizations have used the sensitive lakeshore identification information to help protect critical and vulnerable lakeshore areas. In 2010, Cass County received Environment & Natural Resource Trust Fund monies to provide assistance for donation of conservation easements to protect sensitive shoreland parcels in Cass County. The Leech Lake Area Watershed Foundation has identified large, undeveloped parcels that when overlaid with areas of sensitive shoreland have become priorities for conservation easements and acquisition. Recently implemented conservation easements on Wabedo Lake properties protect from development over 3500 feet of shoreline and nearly 70 acres of shoreland. Additional conservation easements that will protect another three to five miles of shoreline are currently in process. In addition, the information has been utilized within the DNR to help identify priority conservation areas (e.g., aquatic management areas). Finally, a project funded by an Outdoor Heritage Fund appropriation to the Leech Lake Area Watershed Foundation, Minnesota Land Trust, and DNR will pay for acquisition-related expenses and monitoring costs of donated permanent conservation easements on sensitive shorelands in north central Minnesota.

Cass County developed and adopted sensitive lakeshore and conservation subdivision ordinances. Other local governments are considering these ordinances for their own use. Crow Wing County modified Cass County's ordinance provisions for sensitive lakeshore protection, as the county is pursuing sensitive

lakeshore zoning districts to better protect areas in their jurisdiction. In addition, the DNR used Cass County's conservation subdivision ordinance within its draft state shoreland standards.

Project completed: 6/30/2011

Native Shoreland Buffer Incentives Program
Subd. 04f $225,000

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Overall Project Outcome and Results
Through a competitive grant process, the MN DNR offered two $75,000 grants. East Ottertail SWCD and the Itasca Water Legacy Partnership (Itasca SWCD) collaborated with DNR and the Water Resources Center (WRC) at the U of M to craft shoreland restoration incentive programs for lakeshore residential properties. Unique to this project was the focus on assessing the effectiveness of applying social science methods (KAP Studies) in promoting the planting of native shoreland buffers. Using a process that is well known but rarely used in natural resources, Dr. Karlyn Eckman (WRC) used KAP Studies to determine Knowledge, Attitudes and Practices of target audiences. The process has three steps:

1. Survey landowners
2. Design & implement incentives
3. Survey again

The second survey determines the effectiveness of project activities in changing the knowledge, attitudes and practices of the target audience. Target audiences for East Ottertail County were lakeshore owners 50 to 70 years old owning 120 feet or more of shoreline and for Itasca County, all landowners on 5 selected lakes. Funds were utilized for designing incentives and analyzing results.

Project conclusions:

- Using a "KAP Study" contributed to more successful outcomes (more shoreland restored) by predicting better incentives and better communication methods.
- People were more knowledgeable than expected about water quality.
- People in these particular studies were not motivated to action by a financial incentive - they took it because it was offered. Therefore, funds intended for financial incentives may have greater impact if they are re-allocated to hire high-quality, knowledgeable professionals.
- Social networks were more important than previously realized. Groups like lake associations, churches, garden clubs, informal groups of neighbors helped spur interest and motivation.
- More projects should incorporate KAP methods so they are "evaluation-ready" before implementation to better utilize the use of conservation funding and document project success to funders.

- Social science practices could be used in areas such as invasive species, habitat restoration, and recreation. Practices include KAP studies, message re-framing and utilizing existing social networks in the community.

Project Results Use and Dissemination

The DNR project manager and partners have shared the results of the project and project components on several different occasions at conferences to a total of approximately 365 attendees.

This project was submitted for consideration for the 2011 Environmental Initiative Awards. Now that the project is complete consideration is now being given for submission again in the spring of 2013.

In order to widen the influence of the results of the demonstrations, several actions are being considered at the present time. They include:

1. This final LCCMR report and the individual detailed survey evaluations will be entered into the DNR Documents Library for reference to others.
2. Development of a Native Shoreland Buffer Initiative web page hosted by the DNR that will provide a gateway to information on the buffer projects including survey examples, final reports from the University of Minnesota, resource products developed by the project partners.
3. Communication back to the original 'class' of buffer proposers participating in the initial workshop.
4. The DNR's Division of Ecological and Water Resources widely distributes results in order to adopt social science principles into natural resources work.

Discussions are ongoing as to the applicability of the project results to other programs within the Department of Natural Resources and elsewhere.

Project completed: 6/30/2012

South-Central MN Groundwater Monitoring and County Geologic Atlases
Subd. 04h $1,600,000

Part 1 ($894,000)
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Part 2 ($706,000)
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PART 1: MN Department of Natural Resources

Overall Project Outcome and Results
To better understand the recharge dynamics of the Mt. Simon aquifer the western edge of this aquifer was investigated through observation well installations, water level monitoring, groundwater chemical analysis, and aquifer capacity testing. Most data collected for this study are derived from the 27 observation wells, drilled to depths of 70 to 718 feet, that were installed at 14 locations by contracted drilling companies.

The combination of chemical residence time indictors, continuous water level data from nested well locations, and a general knowledge of the regional hydrostratigraphy, shows the Mt. Simon aquifer in this region has a very slow recharge rate from a large source area located south of the Minnesota River, and a smaller source area located in the northern portion of the study area. The younger Carbon-14 residence time values of Mt. Simon groundwater (7,000-8,000 years) from this project roughly correspond to a time after the last ice sheet had receded from southern Minnesota suggesting groundwater in the Mt. Simon aquifer in this region began as precipitation that infiltrated during the post-glacial period. The stable isotope data of oxygen and hydrogen support this conclusion. A recharge estimate of the Mt. Simon aquifer south of the Minnesota River based on these minimum residence time data suggest an infiltration rate of approximately 2 cm/year. The resulting 5 billion gallons/year of recharge from the southern source area is approximately equal to permitted volumes (volume of water that the users are allowed to pump) for appropriators in this area. At current groundwater extraction rates the region appears to be in a steady state. A major accomplishment of this project was the creation of a network of observation well nests, base line water level data, and geochemical data in this region that will enable future hydrologists to evaluate the local and regional affects of any future expansion of Mt. Simon groundwater pumping beyond current volumes. This effort is documented in a report "South-Central Minnesota Groundwater Monitoring of the Mt. Simon Aquifer". A document titled "Minnesota Groundwater Level Monitoring Network-Guidance Document for Network Development" was also completed as part of this project. The Guidance Document outlines how Minnesota's current groundwater level monitoring network of approximately 750 wells should be expanded to meet monitoring needs. This expansion is necessary because large areas in Minnesota are not adequately monitored. Many areas of Minnesota are underlain by multiple aquifers, all of which must be considered in developing the long-term network that will provide adequate resource data.

Project Results Use and Dissemination
The reports from this project will be available on the DNR website during the summer of 2011. An abstract of the project results will be submitted to the Geological Society of America for the national conference in Minneapolis during October 2011. In addition, a summary of the project will be submitted to the Minnesota Groundwater Association for inclusion in the quarterly newsletter. The well log and well construction information is currently available in the project report and the Minnesota Department of Health County Well Index. The wells have become part of the DNR observation well network. Water level data is currently available at: http://climate.umn.edu/ground_water_level/.

Project Publication:

South-Central Minnesota Groundwater Monitoring of the Mt. Simon Aquifer (PDF - 3.0 MB)
Minnesota Groundwater Level Monitoring Network-Guidance Document for Network Development (PDF - 3.3 MB)

Project completed: 06/30/2011

PART 2: Minnesota Geological Survey

Overall Project Outcome and Results
County geologic atlases are created to support water and mineral resource management. An atlas provides maps and associated databases at scales appropriate for land use planning and water management decisions. An atlas greatly improves our ability to monitor the resource, to predict the effects of pumping, and to respond effectively to contamination. This project created atlases for Blue Earth, Nicollet, and Sibley counties in paper, digital, and web-accessible formats. They will be published as MGS C-24, C-25, and C-26, and workshops will be held to train users.

Geologic maps describe the distribution of earth materials. The materials determine where water can enter the ground (become ground water), where it can be taken from the ground (aquifers), and how aquifers connect to rivers, lakes, and wetlands. Each geologic atlas contains the below parts.

Database map: shows the location of all well records, borings, scientific drilling, natural exposures, and geophysical measurements used to support all the maps in the atlas. The data itself is also provided.

Surficial Geology map: this map shows the earth materials immediately beneath the soil zone, and describes their composition and ability to convey water. The surface described by this map is the interface between human activities and ground water. Its character determines to a great degree the sensitivity of ground water to contamination.

Glacial Stratigraphy and Sand Distribution Model: A series of maps show the location, depth, and thickness of sand or gravel bodies (aquifers) in glacial materials. This map is useful in finding a water source, determining pumping effects, and in understanding the results of water monitoring.

Bedrock Geology map, bedrock topography map: These maps describe the location and type of bedrock present, and its ability to host and transmit groundwater. Where a sequence of sedimentary rocks are present the contacts between layers are mapped as digital surfaces and this enables numerical simulations of the ground water system that can predict the effects of pumping before wells are drilled.

Through this project, MGS also provided support to the DNR Mt. Simon monitoring well project by examining and describing samples, conducting downhole geophysical surveys, and providing interpretations of the geologic units penetrated by these wells.

Project Results Use and Dissemination
Geologic atlases are created to support informed decision-making. They are applied to wellhead protection, water appropriation decisions, well field design, onsite water treatment designs, facility siting, monitoring, and remediation of contamination. The atlases are printed for those who don't use computers and for use in the field. They are also provided in several digital formats for electronic use including geographic information systems. When the atlases are complete we hold workshops in the county to explain the products and their uses.

Project completed: 06/30/2011

SUBD. 05 NATURAL RESOURCE INFORMATION

Updating the National Wetlands Inventory for Minnesota

Subd. 05a $550,000

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Overall Project Outcome and Results

Over the past 100 years, about half of Minnesota's original 22 million acres of wetlands have been drained or filled. Some regions of the State have lost more than 90 percent of their original wetlands. Urban development, agricultural drainage, mining, road construction, and utility projects result in additional losses each year. The National Wetland Inventory (NWI) is the only comprehensive inventory of wetlands for Minnesota, but it is inaccurate in many places because it is 25-30 years out-of-date. Updating the NWI is a key component of the State's strategy to monitor and assess wetlands in support of efforts to assure healthy wetlands and clean water for Minnesota.

This project is the first phase of a multi-phase effort to update the NWI for all of Minnesota. Under this project, the project team:

1. developed wetland mapping standards and quality control objectives to assure that the final product can meet the broad array of data needs for various stakeholders,
2. developed a request for proposal that incorporates these standards and objectives,
3. acquired high-resolution, spring, leaf-off, digital aerial photography for northeastern and east-central Minnesota (22,500 square miles),
4. developed updated wetland mapping procedures for northeastern and east-central Minnesota that incorporate modern high-resolution digital imagery, radar imagery, and LiDAR elevation data,
5. provided training to DNR and Ducks Unlimited staff (total of six people) on the application of the updated wetland mapping procedures, and
6. performed initial data processing for updating NWI maps for east-central Minnesota and northern Koochiching County.

Subsequent phases of this project are focused on producing updated NWI maps for five different regions of Minnesota; east-central, southern, northeastern, central-lakes, and northwestern. These subsequent phases will also include the continuation of the imagery acquisition for the southern, northeastern, and central-lakes regions.

Project Results Use and Dissemination
The wetland mapping standards and quality assurance objectives developed through this project are presented in reports found on the project website. Imagery acquired as part of this project are freely available to the public through the Minnesota Geospatial Information Office website. The imagery for northeastern Minnesota receives an average of about 62,000 requests per month and the imagery for east-central Minnesota receives an average of more than 300,000 requests per month. Wetland mapping procedures based on pilot studies in northeast and east-central Minnesota are contained in two separate reports. Three hard copies and one electronic copy on CD have been submitted with the final project report to LCCMR. Presentations and workshops have been provided by the University of Minnesota regarding the updated wetland mapping methods as described above.

Project Publications:
Comprehensive Project Plan for the National Wetland Inventory Update of Minnesota
Requirements for the National Wetland Inventory of Minnesota
Quality Assurance Project Plan for the National Wetland Inventory of Minnesota
Wetland Mapping Methods for the Twin Cities Metropolitan Area
Wetland Mapping Methods for the Arrowhead Region of Minnesota

Project completed: 06/30/2011

Updating Precipitation Intensities for Runoff Estimation and Infrastructure Designs
Subd. 05c $100,000

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Overall Project Outcome and Results
Checking the daily weather forecast for where and how bad the next storms will be has become a more important part of our daily routines. Recent variable climate (dry periods, intense storms and floods) have brought heightened awareness by farmers, engineers, cities, and water managers of rainfall intensity (how fast) and duration (how long). Up to now, available summaries (done in the early 1960's) were based on relatively crude analyses of rainfall data collected through the 1950's. This project has updated precipitation intensities based on the compilation of hundreds of rainfall monitoring locations in and around Minnesota (including our neighboring Canadian and adjacent state partners) with continuous data collected through 2009 via a partnership with the National Oceanic and Atmospheric Administration, National Weather Service (NOAA/NWS). State-of-the-art computer-based statistical procedures have generated summary information and maps with a resolution of 4 km by 4 km (or about 2.5 miles by 2.5 miles). NOAA required one contract with all 11 Midwest states (Minnesota, North Dakota, South Dakota, Wisconsin, Michigan, Iowa, Missouri, Colorado, Nebraska, and Kansas) with pass-

through funding via the Pooled Highway Fund. All Environment and Natural Resources Trust Fund dollars were expended by June 30, 2011 with additional funding provided by the Minnesota DOT being used to complete the final work components. This study has generated rainfall frequency estimates for durations from 15 minutes to 60 days and for average recurrence intervals from 1 to 1,000 years along with trend analyses. Final web-based products will be available in early 2012 due to delays associated with reducing huge amounts of data from about 1/2 of the contiguous United States. The results of this work are required for standard engineering practices associated with runoff routing, flood prevention and safe road & culvert designs - and will become part of our daily forecasts ("today's storm is called a hundred year event").

Project Results Use and Dissemination
Precipitation frequency information is required for standard engineering practices for building new roads, highways, bridges, and developments so as to minimize flooding and for water quality treatment, agricultural and other watershed management purposes.

This study has resulted in rainfall frequency estimates from 15 minutes to 60 day durations and for average recurrence intervals from 1 to 1,000 years. Data has been summarized in NOAA's nationally recognized standard engineering tables. New products have been developed for inclusion in GIS formats for a wide variety of computer-based applications and website distribution for watershed management purposes. Regional patterns and comparisons to old TP-40 rainfall frequency data will also be available.

Project products will be freely available from the NOAA website www.nws.noaa.gov/ohd/hdsc, including reports, maps and spatial data with precipitation frequency estimates and downloads of digital files.

Project completed: 6/30/2011

Conservation Easement Stewardship, Oversight and Maintenance
Subd. 05g $180,000

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Overall Project Outcome and Results
Since collection of digital easement data within the Minnesota Board of Water & Soil Resources (BWSR) first began in the late 1990's, every effort had been made to keep the database accurate and complete. However, over a decade later, and with over 5,000 easements and growing, it became prudent (particularly with the advent of more advanced technology) to reexamine, update, and enhance that database.

Attributes and boundaries for easements and conservation practices (planned land cover types based on

the NRCS Field Office Technical Guide) that previously only existed in paper format were scanned and digitized, then added to a Geographic Information Systems (GIS) database for the RIM Reserve easement program. The GIS database is flexible enough to implement future easement monitoring technology that can capture stewardship data such as easement condition and compliance, habitat quality, easement maintenance, and enhancement.

Prior to this undertaking, it would have been impossible to implement a modern long-term conservation easement stewardship plan. Easement boundaries only existed on paper and an outdated database placed limitation on reporting and analysis. As a result of this project, the framework is in place for implementing such a plan. A modern database is being implemented. 220,329 acres of conservation practices within 5,882 easements have been digitized into a GIS database, and a GIS-based monitoring field application has gone through pilot testing.

BWSR now has increased capabilities to target new easement projects using GIS reporting and analysis, as well as ensure the quality of past projects through easement stewardship and monitoring. This maximizes the return of each dollar spent, benefitting Minnesotans through better water quality, reduced soil erosion, and enhanced wildlife habitat.

Project Results Use and Dissemination
As a result of this project, a conservation easement database that is more streamlined has been implemented, giving BWSR staff the ability to edit and update easement boundaries and attributes, conduct geospatial reporting and analysis using GIS technology, create online delivery applications available via BWSR's website, and develop and test future easement stewardship and monitoring applications.

Conservation easement data has been made publically available as both an interactive online web map and a GIS shapefile download, both available at BWSR's web site:
http://www.bwsr.state.mn.us/easements

Project completed: 6/30/2011

Conservation Easement Stewardship and Enforcement Program Plan
Subd. 05h $520,000

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Overall Project Outcome and Results
The DNR needed comprehensive information about its conservation easements in a centralized database and an agency-wide plan to monitor and enforce the easements.

Project objectives were to:

1. Conduct a comprehensive inventory of DNR's easements, classify conservation easements by type, and capture relevant data about each easement in DNR's land records system;
2. Develop a conservation easement stewardship plan that integrates an easement monitoring computer application developed through DNR's Land Records Management Project;
3. Recommend solutions to long-term conservation easement stewardship funding.

The inventory consisted of a review of all deed and easement records maintained by DNR's Lands and Minerals Division, capture of relevant easement data, and reconciliation of the data with records maintained by DNR's conservation easement administrators. The stewardship plan was developed after test monitoring a sample of existing conservation easements and obtaining extensive input from a working group comprised of representatives of DNR divisions that administer conservation easements.

The inventory identified 13 DNR conservation easement types and a total of 974 conservation easements covering 355,623 acres. The stewardship plan outlines monitoring methods and monitoring frequency for each conservation easement type, estimates stewardship costs and identifies options for funding. Project results are detailed in the "Conservation Easement Stewardship and Enforcement Program Plan" dated Feb. 28, 2011.

Under a work program amendment, project staff converted scans of 600 conservation easements into a format for use in the new conservation easement monitoring application, developed GIS tools that identified subdivisions and ownership of 557 trout stream easements and created shapefiles for 170 conservation easements from legal descriptions. The Aug. 15, 2011 Final Report Supplement contains examples of these work products.

The database, forms, tools, and plans developed in this project provide the foundation for the DNR to implement an agency-wide conservation easement stewardship program.

Project Results Use and Dissemination
Project results are currently being used by the DNR in several ways:

- Conservation easement data entered into the DNR's existing land records system in the project are being used to respond to inquiries from DNR staff and the public about DNR's conservation easements.
- A conservation easement Geographic Information Systems (GIS) layer developed by project staff and Division of Lands and Minerals GIS staff is available to all DNR ArcGIS users.
- The DNR is beginning the process of implementing the conservation easement stewardship plan developed in the project.

- Staff in divisions that administer conservation easements are currently using the baseline property report and monitoring forms developed in the project.
- The DNR's land records system contractor, International Land Systems, Inc. (ILS), is using the baseline property report and monitoring forms developed in the project and input about application design provided through the project to build the conservation easement administration application in the DNR's new land records system.
- Staff in divisions that administer conservation easements and project staff for the Conservation Easement Stewardship and Enforcement Program, Phase II will use shapefiles prepared under the Jan. 31, 2011 Work Program Amendment to create maps for baseline property reports and conservation easement monitoring.
- The Division of Fish and Wildlife is in the process of merging its existing GIS layer, which contains trout stream easement shapefiles, with the geoprocessing tools developed in the project to identify subdivisions and current landowners. This will enable Fisheries staff statewide to access the subdivision and landowner data using ArcGIS.
- All data entered into DNR's existing land records system in the project, as well as trout stream subdivision and landowner data and the Access database of easement terms created under the Work Program Amendment, will be migrated to and used in the new land records system currently being built by ILS.

Project results have been disseminated both within the DNR and to members of the public.

Project Publication:
Conservation Easement Stewardship and Enforcement Program Plan (PDF - 10.6 MB)

Project completed: 6/30/2011

SUBD. 06 ENVIRONMENTAL EDUCATION

Global Warming - Reducing Carbon Footprint of Minnesota Schools
Subd. 06b $750,000

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Project Outcome and Results
Minnesota Schools Cutting Carbon (MnSCC) is a three-year project that engaged over 7,000 students in 100 public high schools, colleges and universities across Minnesota to save energy, and reduce

greenhouse gas emissions at their schools.

Results: The 100 MnSCC schools collectively saved their schools about 5 million kWh of electricity (totaling 18 billion BTUs) and $325,000 in energy costs annually, which means the three-year program paid for itself in two and a half years. The project also avoided 9.5 million pounds of carbon dioxide emissions (CO2 is a greenhouse gas).

In addition, 23 of the MnSCC schools received a total of $202,828 in competitive grants for renewable energy, energy efficiency, recycling, and transportation reduction projects. Fourteen schools were able to measure and report savings of over 3 million kWh of electricity; 10,500 therms of natural gas; and 26,000 gallons of gasoline - totaling 14.4 billion BTUs. These projects saved approximately $300,000 in annual energy costs and avoided 6.2 million pounds of CO2 emissions.

The cumulative impact of all 100 MnSCC school projects saved schools 32.4 billion BTUs of energy, $625,000 in energy costs, and reduced carbon dioxide emissions by 15.7 million pounds, the equivalent of taking 1,700 cars off of Minnesota roads.

Our project team helped schools create clean energy teams, personally visited every school, provided individual school reports with recommendations on saving energy and resources, and gave students the opportunity to develop and lead energy-saving projects, network with other schools, and share success stories.

Student leadership was a key focus of our project, and there are many great examples of students having a direct impact on their schools and communities:

- Students presented at the biennial Clean Energy Resource Teams (CERTs) conference in St. Cloud in February 2011 to over 100 conference attendees over two days.
- Students rallied in the State Capitol Rotunda on Earth Day 2010, meeting fellow students and several legislators.
- Students presented before the LCCMR and the House Environment Policy and Oversight Committee to talk about how their work has impacted their school.

Overall, MnSCC demonstrated that our students are highly motivated and very effective. They achieved significant energy savings, and they directly influenced their schools and communities through their leadership and interactions with school officials, teachers, fellow students, and community representatives.

Project Results Use and Dissemination

One of the primary objectives of this project was to raise awareness of energy issues and to implement low cost and no cost energy-saving actions in schools through the leadership of students. We also were focused throughout the project on creating opportunities for students to talk about their projects, share results, and for MnSCC to recognize their successes. A variety of resources, detailed in the final report, were created and made available to enable schools to take clean energy actions and make presentations to their communities and local officials. These resources were made available on a robust MnSCC website. Many schools also used the website to share their project success stories and post rleated text, pictures, and videos. Additionally, ongoing communication, outreach, and interaction with Minnesota's schools, colleges, and universities through a variety of means was at the heart of this project from beginning to end.

Project completed: 6/30/2011

Subd. 07 Establishment of an Emerging Issues Account

Emerging Issues Account
Subd. 07 $155,000

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Funds will be used by the LCCMR to provide assistance for an unexpected, urgent, or emergency need where time is of the essence, as authorized in Minnesota Statutes, section 116P.08, subdivision 4, paragraph (d).

WENT TO:

Statewide Ecological Ranking Conservation Reserve Program (CRP) and Other Critical Lands - $155,000 (completion date for this portion is 6/30/2010)

Other funds include:
M.L. 2007, Chp. 30, Sec. 2, Subd. 7 "Emerging Issues Account" - $13,000 (completion date for this portion is 6/30/2009)

M.L. 2009, Chp. 143, Sec. 2, Subd. 4g "Statewide Ecological Ranking of Conservation Reserve Program (CRP) and Other Critical Lands" - $107,000 (Project due to be completed: 6/30/2011)

Project completed: 6/30/2011