Speaker Biographies

Toward Sustainable Water Use in Minnesota – May 4, 2011

Rep Paul Torkelson, rep.paul.torkelson@house.mn
MN House of Representatives

Water Sustainability – Clean Water, Land and Legacy Amendment

Abstract – none provided

Bio sketch – Representative Paul Torkelson was elected to the Minnesota House of Representatives in 2008 to represent House District 21B, covering Brown, Redwood and Watonwan Counties. Rep. Torkelson is an assistant majority leader and currently serves as Vice Chair on the Committee on Environment, Energy and Natural Resources Policy and Finance. Paul also serves on the Committee on Agriculture and Rural Development Policy and Finance and the Legacy Funding Division. His membership on committees that deal with the environment and oversight of Legacy funds position him to have an impact on his abiding interest in clean water issues.

Rep. Torkelson is a fourth-generation farmer who raises corn, soybeans and pork on a farm established by his great-grandfather in 1878. He helped establish the state's Clean Water Council in 2007 on which he still serves. Prior to serving his first term in the Minnesota House Rep. Torkelson was also Vice President of the Minnesota Farm Bureau. He and his wife Cindy, a school teacher, have been married for 30 years and have 2 daughters. Paul is a graduate of from Gustavus Adolphus College.

Princesa VanBuren Hansen, princesa.vanburen@state.mn.us
MN Environmental Quality Board

2010 Minnesota Water Plan

Abstract – The Minnesota Environmental Quality Board recently adopted the 2010 Minnesota Water Plan, a comprehensive long-range water resources plan for the state that presents a vision for achieving sustainable water management. The report can be found on the EQB's website at: http://www.eqb.state.mn.us/documents/2010_Minnesota_Water_Plan.pdf

The water plan, prepared every 10 years, identifies steps the state must take to meet its long-term needs. The report details seven principles and nine strategies for sustainable water management. It calls for new efforts to understand state groundwater systems and the role they play in nourishing surface waters and identifies additional steps to protect Minnesota's lakes and streams. With the support and engagement of local land and water interests, the plan calls for:

- Setting priorities
- Adapting management practices
- Increasing protection efforts
- Promoting wise water use
- Restoring local management capacity

The plan was prepared in cooperation with EQB member agencies and with public advice. It is the latest in a long history of bringing together agencies and others with an interest in achieving sustainable water management. The many local, regional and state stakeholder efforts convened in recent years also were an important part of this effort. The plan was prepared with a long-term vision oriented to protecting Minnesota's valued water resources for generations to come.

Bio sketch – Princesa VanBuren Hansen is a principal planner with the Minnesota Environmental Quality Board. She led development of the EQB *2010 Minnesota Water Plan*, setting a roadmap for the state's activities in ground and surface water protection, and is providing leadership on a number of state water sustainability efforts. She recently worked on development of *Managing for Water Sustainability*, the Board's policy framework for understanding the long-term implications of water availability decisions. Princesa is a Biosystems and Agricultural Engineer who has been with the EQB for five years. Prior to joining the EQB, she worked in both the private and public sectors. She is the President of the Minnesota chapter of the American Society of Agricultural and Biological Engineers, and is active in a number of other organizations.

Dr. Deborah Swackhamer, dswack@umn.edu
Professor and Charles M. Denny, Jr, Chair of Science, Technology, and Public Policy, Hubert H. Humphrey School of Public Affairs
Professor, Environmental Health Sciences
Co-Director, Water Resources Center
University of Minnesota

Looking Far into the Future: The Minnesota Water Sustainability Framework

Abstract – In 2009, the Minnesota Legislature commissioned the University of Minnesota's Water Resources Center (WRC) to develop a long-term strategy for how to achieve sustainability for its water resources, in part to help inform the long term investments of the Clean Water Fund created by the Clean Water, Land, and Legacy Amendment to the state's constitution. The Legislature defined sustainable water use as that which "does not harm ecosystems, degrade water quality, or compromise the ability of future generations to meet their own needs". From July 2009 to January 2011, the WRC collected, compiled, considered, and synthesized the knowledge, insights, and perspectives of hundreds of the best scientists and water management professionals in the state and region, as well as the input of a wide range of citizens and interest groups. The result is the Minnesota Water Sustainability Framework, a bold 150-page report that presents the 10 most pressing issues of the day that must be addressed to achieve sustainable water use, presents strategies for what should be done, and provides recommendations for how to meet these challenges. The Framework addresses long term needs, including how to know and manage our water supply, how to meet federal water quality standards and bring agriculture into the solution, recommendations for managing contaminants of emerging concern, the integration of land and water planning at the watershed scale, how to achieve ecological and hydrologic integrity, and how to manage the nexus of water and energy. The comprehensive plan also addresses economic and social issues that must be addressed to achieve water sustainability.

Bio sketch – Dr. Deborah L. Swackhamer is Professor and Charles M. Denny Jr., Chair in Science, Technology, and Public Policy in the Hubert H, Humphrey School of Public Affairs, and Co-Director of the University's Water Resources Center. She also is Professor in Environmental Health Sciences in the School of Public Health. She received a BA in Chemistry from Grinnell College, 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. 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 currently serves on the National Research Council, National Academy of Sciences committee reviewing the USGS National Assessment of Water Quality Program. She was appointed to serve on the Minnesota Clean Water Council. She currently is President of the National Institutes of Water Resources. She is a Fellow in the Royal Society of Chemistry in the UK. Dr. Swackhamer received the 2007 Harvey G. Rogers Award from the Minnesota Public Health Association. In 2009 she received the prestigious Founders Award from the Society of Environmental Toxicology and Chemistry for lifetime achievement in environmental sciences. She was the 2010 recipient of the University of Minnesota's Ada Comstock Award.

Jay Frischman, jay.frischman@state.mn.us
MN Department of Natural Resources

Plan to Develop a Groundwater Level Monitoring Network for the 11-County Metropolitan Area

Abstract – The MN Legislature has funded a multi-year project to establish a groundwater network in the 11-county metropolitan area that monitors non-stressed systems to provide information on aquifer characteristics and natural water level trends. Additionally the project is to develop an automated data system to capture groundwater level and water use data to enhance the evaluation of water resource changes in aquifer systems that are stressed by pumping of existing wells.

These objectives will be accomplished by expanding and modifying the existing DNR groundwater network through the installation of 50 to 75 new bedrock and water table wells, rehabilitation/replacement of several dozen existing network wells and the instrumentation of approximately 150 wells with data loggers.

A pilot project, involving three communities, will test the feasibility of capturing and storing real-time water level and pumping data from municipal SCADA systems.

All of these data will be incorporated into a new data system, set to go on-line in mid-summer, that will be the repository for all water level/flow data (surface water and groundwater), currently being collected by MDNR, MPCA, MDA and Met Council. This new data system will be the backbone of a more robust, web-based portal, allowing data transfer between the agencies and other stake-holders.

Bio sketch – Jay Frischman, PG, works for the Minnesota DNR, Division of Ecological and Water Resources. Since 1985 he has been actively involved with aquifer testing, well interference investigations, water supply studies and surface water/groundwater interaction studies. He is currently the project manager for the 11-County Metropolitan monitoring initiative.

Dr. Jeanette Leete, jeanette.leete@state.mn.us
MN Department of Natural Resources

Process to Define Groundwater Management Areas

Abstract – The DNR is charged with management of the use of the state's groundwater and surface water (under MS 103G and MR 6115 and others) and is responsible for establishing water appropriation limits to protect groundwater resources, ecosystems, and the ability of future generations to meet their own needs.

Groundwater Management Areas (103G.287) may be designated, and a Water Appropriation and Use Management Plan (MR 6115.0810) may be one of the tools planners could use to achieve these management goals. A successful groundwater management plan requires the input and support of all stakeholders and takes account of the land, water, and related resources. The stakeholders, including all water user groups, must develop the plan and devise a method by which to carry it out. Present and future uses must be established. The impacts of changing precipitation and temperature regimes must be considered.

The process should:

- Define the appropriate areal extent of the management area
- Consider all hydrologic and physical characteristics of the water and land resources.
- Identify, discuss and document groundwater and surface water issues, opportunities, and management options under current conditions and future scenarios.
- Develop and recommend groundwater management area plans for present and future generations.

Candidate areas include areas where water availability problems exist or are predicted, areas where increased water use is expected, areas where land use has resulted in or may yet cause impairments to water quality, and areas where sensitive natural resources are threatened by groundwater or surface water withdrawals.

Bio sketch – Dr. Jeanette H. Leete, CPG, PG works for the Minnesota DNR in the Division of Ecological and Water Resourcess. She is the unit supervisor for Hydrogeology and Ground Water. With a background in geology, a doctorate in forest hydrology and extensive postgraduate training in hydrogeology, she has been involved in groundwater and groundwater/surface water interaction applications and applied research since 1976.

Lanya Ross, lanya.ross@metc.state.mn.us
Metropolitan Council

Twin Cities Water Supply Planning and Use of the Metro Model 2

Abstract – In 2005, the Metropolitan Council began a regional water supply planning effort. Five years of community outreach, data collection, and technical analysis culminated in the development and approval of the seven-county Twin Cities Metropolitan Area Master Water Supply Plan. The framework set forth in this document guides long-term water supply planning at the local and regional level. It is a dynamic plan that recognizes the value of an adaptive approach to water supply management, guided by management tools and based on the best available information generated through resource monitoring and predictive analyses.

A regional groundwater flow model (Metro Model 2) was developed to evaluate the relationship between the factors affecting water sources and projected demands. Metro Model 2 encompasses the entire seven-county Twin Cities metropolitan area and portions of adjacent counties. The model simulates flow through nine geologic units and incorporates available local and regional climatic, land use, soil, geologic, withdrawal and hydrogeologic data. Regional model scenarios were developed to test the hypothesis that, given projected demands, metropolitan area communities can continue to use water and develop supplies using their traditional assumption of aquifer availability.

The Master Water Supply Plan incorporates the results of the Metro Model 2 into local water supply profiles, one for each community, that outline municipal water use, supply sources, and potential issues.

Bio sketch – Lanya Ross is an environmental scientist with the Metropolitan Council, the regional planning agency of the seven-county Twin Cities metropolitan area. She has a bachelor's degree in geology from Macalester College and a master's in geology from Northern Arizona University. She has spent the past decade working on water supply planning issues in the Twin Cities metropolitan area, and she helped to develop the region's first master water supply plan.

Troy Hall, troy.hall@mpsutility.com
Moorhead Public Service

Buffalo Aquifer Management Plan

Abstract – Drought water supply is an important issue for the residents of Clay County in the Red River Valley (Valley). While this region is currently in a wet cycle, there have been very dry periods such as in the 1930s and in the late-1980s. With limited groundwater availability in the Valley, water suppliers in coordination with state agencies have developed a strategy of conjunctive use of surface water from the Red River and groundwater mostly from the Buffalo Aquifer. Since the early-1960s, the Moorhead area has changed from 100 percent reliance on groundwater for drinking water supply to less than 20 percent. Due to the wet cycle and changes in groundwater usage practices, static levels in the Buffalo Aquifer have rebounded to levels not seen since the 1940s.

For the future management of groundwater in the Buffalo Aquifer and other aquifers in Clay County, the Minnesota DNR has developed action items to be used toward the completion of an Aquifer Management Plan (Plan). Once developed, the Plan will help insure sustainable use of groundwater by all users such as irrigators, businesses, and drinking water suppliers. Through good stewardship in groundwater use, water should be available for all users during drought periods when Red River water has limited availability.

The development of the Plan is expected to take several years for completion. Two of the steps toward Plan development will be the completion of a county geologic atlas and the design of an aquifer model for the Buffalo Aquifer. The aquifer model will be used to test pumping simulations under drought conditions. The Plan will be developed through the partnership of several groups including but not limited to the local landowners, the Minnesota DNR, Minnesota Geological Survey, Clay County, the Buffalo Red Watershed District, and Moorhead Public Service.

Bio sketch – Troy Hall is currently the Water Division Manager for Moorhead Public Service, the water and electric supplier for the City of Moorhead. Troy has over 18 years of experience in the drinking water industry, mostly in water treatment. He has an educational background in Chemistry and Environmental Engineering.

Linda Hutchins, Linda.Hutchins@state.ma.us
MA Department of Conservation and Recreation

Sustainable Yield Estimator in Massachusetts Water Management

Abstract – Massachusetts is in the midst of a Sustainable Water Management Initiative, with primary goals of establishing "Safe Yield" and "streamflow criteria" to be implemented under the state's Water Management Act. The United States Geological Survey (USGS) developed the Sustainable Yield Estimator (SYE) tool in a cooperative agreement with the Massachusetts Department of Environmental Protection (MassDEP). The SYE is being used to estimate unimpacted streamflow in Massachusetts, as the basis of safe yield estimates (available water during a drought period). The SYE tool was also used to evaluate water withdrawals and returns, resulting in estimated impacted flows, to characterize flow alteration statewide on a set of 1,400 subbasins and at the HUC-12 scale. In addition, SYE is being used to estimate flow alteration for correlation with fish sampling sites as part of an evaluation of relationships between flow alteration and impacts on aquatic habitat (using fluvial fish as the indicator).

The presentation will include an overview of the Massachusetts Water Management Act, Safe Yield and Streamflow Criteria, and will show how the analyses outlined above are being used to develop Biological Categories, Streamflow Levels, and how we envision using these in the Water Management Act permitting process in the future.

Bio sketch – Linda Marler Hutchins is a Hydrologist with the Massachusetts Department of Conservation and Recreation, Office of Water Resources. She is a liaison for hydrologic monitoring and scientific research with the U.S. Geological Survey (USGS) Cooperative Program in Massachusetts; and is a staff member to the Massachusetts Water Resources Commission. She has been providing technical support to the Massachusetts Sustainable Water Management Initiative under the Executive Office of Energy and Environmental Affairs, and to the Massachusetts Water Management Act Advisory Committee with the Massachusetts Department of Environmental Protection. Prior to working for the Commonwealth, Ms. Hutchins was a consultant for municipal and industrial groundwater supply development and hazardous waste site cleanup.

David Hamilton, P.E., hamiltond2@michigan.gov
MI Department of Environmental Quality

Michigan's Water Withdrawal Assessment Process

Abstract – Michigan's Water Withdrawal Assessment Process is used to regulate new or increased large quantity withdrawals (more than 100,000 gallons of water per day) from any source. The withdrawals are prohibited from causing an adverse resource impact on streams. The assessment process is resource based, built around a stream classification system and fish response models. Every stream in the state is classified as one of eleven habitat types. Fish response models to changes in streamflow were developed for each stream classification, and the legislature used them to determine the maximum withdrawals allowed for each as a percentage of an index flow. To facilitate decision making and avoid a burdensome permit process, a Web-based screening tool was developed to estimate the impact of withdrawing water from a source on the nearby stream ecosystems. The screening tool processes data about factors such as stream flows, pumping frequency, well depth, watershed areas, soil types, and the type and number of fish. It uses that data to estimate how much water will be depleted from the nearby streams and if that is likely to cause an adverse impact on the environment. If the screening tool determines the withdrawal is not likely

to cause an adverse impact, the user may register their withdrawal through the screening tool and proceed with the withdrawal without any additional contact with the department. The screening tool never says no, if the proposed withdrawal is in a sensitive stream, or the screening tool evaluation indicates there is an increased likelihood of an adverse impact, the user is referred to the department for a site specific review. The department uses any information available to better determine the local hydrology, hydrogeology, and stream classification. With this more refined data, and the legislatively determined maximum withdrawals, the department will decide whether or not to allow the withdrawal. The screening tool avoids the burden to the department and water users of having every withdrawal individually evaluated by professional staff as would happen in a conventional permitting program. It recognizes areas with abundant water supply relative to the proposed withdrawal, and where the withdrawal might adversely affect the environment.

Bio sketch – David A. Hamilton is Chief of the Water Management Section, Water Resources Division, Michigan Department of Environmental Quality. He oversees many of the Division's engineering functions, including the Hydrologic Studies, Dam Safety, Lake Level Engineering, Floodplain Management, and Transportation Project Review Programs. In addition, he manages the Water Withdrawal and Water Use program and the Great Lakes Shoreland program. Mr. Hamilton previously managed the Surface Water Quality Division, which included NPDES permits and nonpoint source control; the Soil Erosion and Sedimentation Control Program; and the Inland Lakes Management Program. He has a B.S. degree in Agricultural Engineering from Michigan State University, with special emphasis in Soil Conservation and Water Management. He has a M.S. degree in Civil Engineering from the Massachusetts Institute of Technology, with emphasis in Hydrology and Water Resources. He has worked for the Department of Natural Resources, and the Department of Environmental Quality, since 1978. His work involved both surface and groundwater hydrology, and both water quantity and water quality issues.

Mr. Hamilton is one of the principal developers of Michigan's Water Withdrawal Assessment Tool. The Assessment Tool is designed to evaluate the likely impact of water withdrawals on stream fish populations. It is a unique combination of hydrologic, well hydraulics, and fish response models. The Water Withdrawal Assessment Process has been nationally recognized with the 2010 Outstanding Achievement Award from the Renewable Natural Resources Foundation, a 2010 Innovative State Program Award from the Environmental Council of States, and a 2009 Innovations Award from the Council of State Governments.

He is a member of the American Geophysical Union, Association of State Dam Safety Officials, and the Association of State Floodplain Managers.

Andrew Streitz, andrew.streitz@state.mn.us
MN Pollution Control Agency

Little Rock Creek Groundwater Model: How Groundwater Affects TMDLs

Abstract – The Minnesota Pollution Control Agency recently identified altered flow of groundwater as a cause of stream impairment in the Total Maximum Daily Load investigation of Little Rock Creek. This was the first such designation for the program and was the result of a study that included the development of a groundwater model that determined a causal relationship existed between increasing groundwater withdrawals for irrigation use and corresponding declines in groundwater levels and creek discharge in summer months. Further review of the hydrologic datasets showed that trends discovered during the development of the Little Rock model in Benton County were found to match trends in comparable state-wide datasets.

The identification of areas with demonstrable groundwater-surface water links would be useful to the Agency as a means to prioritize future groundwater investigations. Analyses of high capacity water withdrawals across the state revealed statistically significant increasing trends over the last 20 years. Statistically significant decreasing trends were found in a majority of summer month stream discharges derived from state-wide stream gaging stations randomly selected for this study. Rivers with significant summer month declines were commonly located downriver and down gradient from large numbers of nearby high capacity wells, while gages without trends generally were not. Watersheds with declining summer flow trends become priorities for future studies.

Bio sketch – Andrew Streitz has worked as a hydrologist at the Department of Natural Resources and the Minnesota Pollution Control Agency for over 25 years. During that time he has conducted geophysical surveys for county atlases, organized the collection of sediment cores in the Duluth harbor, worked on the original Metropolitan Area Groundwater Model, analyzed PFC data from fish from the Mississippi River, and collected water samples on BWCA border lakes. He is now happily occupied investigating groundwater contributions to watershed studies for the MPCA's Total Maximum Daily Load program. And he is proud and shocked to discover that his oldest son has selected geology as a college major. Andrew has a BA in History from St. Olaf College, and a MS in Geology from the University of Minnesota. He lives in Duluth.

James Cannia, jcannia@usgs.gov, US Geological Survey and
Rod Horn, rlhorn@spnrd.org, South Platte Natural Resources District (NE)

Benefits of Airborne Geophysical Surveys to Water-Resource Managers in Nebraska

Abstract – Nebraska's Natural Resources Districts (NRDs) play a key role in water management for the state. They are directly responsible for groundwater management within their boundary and must work with the Nebraska Department of Natural Resources for integrated management of groundwater and surface water. The NRDs collect and analyze data on groundwater and surface water. Recently some of the NRDs have begun collecting airborne geophysical data to refine the hydrogeologic framework of their districts. They often plug this data directly into groundwater models to do predictive analysis of management scenarios. An example of this is from western Nebraska, where a groundwater model was constructed with this data that produced significant improvements in model performance in both magnitude and direction of flow. All of this information significantly benefits water-resource managers to make decisions on what is most effective and cost-efficient to manage water supplies.

Airborne geophysical surveys provide high-quality subsurface data, not available from any other source, for building the complex hydrogeologic frameworks needed by water-resource managers. Airborne surveys have the ability to cover large areas quickly with minimal effects on local activities and the environment. These data can be collected, processed, and inverted to provide information on the structure of the geological and hydrogeological environment. Often the data used in building hydrogeologic frameworks consist of borehole lithology and geophysical logs combined with surface geologic maps and occasional surface geophysical soundings. For regional studies this is adequate, but for the detailed studies being conducted to understand local aquifers and surface-water systems, too much error is introduced into the three-dimensional framework to accurately represent actual conditions. The addition of data collected by airborne geophysical surveys provides near continuous data throughout the area that can then be calibrated to the bore-hole logs and other data creating a very accurate and precise subsurface map.

Three-dimensional maps provided by integrating airborne geophysics with other information provide powerful tools for locating features of the aquifer system that water managers need to be aware of. These maps can be combined with a water-table map to provide the geometry of the aquifer including locations of the most saturated thickness, heterogeneity of aquifer materials, lithologic barriers to groundwater flow, and connections to the surface-water system, for example. They also indicate where preferential flow paths may exist, which is particularly important for understanding how water quality can be affected as it moves through the system. This information can be used to determine optimal locations for new wells, focus recharge sites, and facility construction, as well as many other uses to reduce effects on the aquifer.

Bio sketches – Rod L. Horn was born and raised in Fresno, California. He attended the University of Nebraska – Lincoln beginning in 1975 and graduated from UNL in 1980 with a Bachelor of Science Degree in Natural Resources. Horn is the General Manager of the South Platte Natural Resources District - headquartered in Sidney, Nebraska. His responsibilities involve working with a Board of Directors to conserve, protect, and enhance the natural resources in the South Platte Natural Resources District. Horn has been with the District for 25 years.

James Cannia is a registered professional geologist in Nebraska and Wyoming and is currently a hydrologist with the U.S. Geological Survey in Mitchell, Nebraska. He is the team leader for the Nebraska USGS geophysical program focusing on hydrogeologic framework and groundwater-surface water studies. He has worked on various geologic, hydrologic and hydrogeologic investigations within Nebraska and Wyoming on surface water, groundwater, water quality, geology, geologic hazards and geophysics. He has been the principle investigator or senior author for various scientific reports and journal articles. Recent work has included the "2006 Annual Evaluation of Availability of Hydrologically Connected Water Supplies", Department of Natural Resources. He also served as the COHYST Western Model Area modeler and founding member of the COHYST Technical team. He was a founding member of the State of Nebraska Board of Geologists. He served 17 years as the District Geologist for the North Platte Natural Resources District with responsibility for groundwater in the North Platte River Valley and the western Sand Hills of Nebraska. He also was a Hydrogeologist for Conservation and Survey Division in the Panhandle of Nebraska.

Mr. Cannia's current work as project chief includes canal seepage mapping in the North Platte Valley, hydrogeologic Studies of the Sand Hills central Nebraska, determining ground-water resources in eastern Nebraska glacial till area, the Central Platte Natural Resources District magnetic resonance soundings study to determine aquifer properties, Elkhorn-Loup Model area canal seepage mapping and a Helibourne electromagnetic survey for hydrogeologic frame work of the Platte valley. In addition, Jim currently serves as representative to the Nebraska State Map program.

Poster Sessions

Jacob Ciuraru

My name is Jacob Ciuraru and I am a water quality intern with Dakota County. For the past few months I have been working on a study involving the land application of biosolids potentially contaminated with perfluorchemicals (PFCs) on cultivated land in Dakota County. PFCs are synthetic chemicals that were created and produced by companies including DuPont and Minnesota Mining and Manufacturing (3M). Locally, 3M has produced PFCs at their plant in Cottage Grove Minnesota since the 1950s. This plant is located immediately adjacent to the area where elevated PFC results were identified. These chemicals were widely used in industrial and commercial applications and have been used in a variety of products including Teflon coated cookware; oil, water and stain resistant treatment on carpet, upholstery and paper; fire-fighting foams, etc. In 2003 Dakota County Water Resources Department conducted sampling and analysis for PFCs in private water supply wells enrolled in Dakota County's Ambient Groundwater study. The analysis showed low level contamination of perfluorooctanoic acid (PFOA) in 8% of the wells sampled. No known sources of the PFOA contamination have been identified. The study explores three possible sources of PFCs to explain the elevated levels of PFCs found in ambient wells in the County. These include an atmospheric deposition model which is based on spatial proximity to the 3M Cottage Grove facility, a spatial association of wells to known disposal sites throughout the County, and the application of nutrient filled sewage sludge from wastewater treatment facilities to farmers' agricultural land. A trace line analysis was conducted to model the flow of groundwater to the sampled wells. The poster would address the findings that the study has produced, and provide recommendations for additional studies needed to understand the source(s), environmental distribution, affected media and the magnitude of the presence of this synthetic chemical in Dakota County.

Jonathon Wells

Photographer and Geologist Jonathon Wells will have on view his new photo-geologic composite image, *Minneapolis – St. Paul.* This striking study of the geology of the Metro area took over a year to create. The image collages aerial photographs with views of bedrock and groundwater aquifers extending 1,400 feet below the metro area and dating back over one billion years. Wells creates images that are truly like no others in the way they reveal both landscape and underlying layers within a single view.

Wells has combined his education and 12-years work experience as a geologist/hydrogeologist with his passion for photography to create images that offer the viewer a connection to the earth below. Research and interpretation of available data are used to create a framework. Wells then travels the region to locate and photograph representative rock and sediment types. The final step involves construction of the image on the computer.

In his Environmental Series, Wells offers a view of what he visualizes as a hydrogeologist. He represents groundwater contaminated with gasoline, solvents, and waste oil. He shows the hydraulic connection between septic leach field discharge and a nearby municipal drinking water well. It is Wells' hope that viewers will appreciate how vulnerable and valuable groundwater is as a resource.

In his Urban Series, Wells is fascinated by the geology that is the foundation of major populated areas. From the city streets of Manhattan, to the 4-mile deep by 16-mile wide view of Boston Basin, to the steeply dipping Franciscan Formation underlying San Francisco and now the aquifers beneath the Twin Cities. These images help viewers to appreciate the geology that supports their every-day lives.

Visit and see the complexity and detail, the color and texture of earth layers and the imprint that we have had on the earth below.

Evaluating Stream Power Index as a Predictor of Stream Stability

Darren Omoth and Dr. Toby Dogwiler
Winona State University
Department of Geoscience

In order to identify at-risk areas for precision conservation Digital Terrain Analysis and the Stream Power Index can be used to predict localized stream stability. Hydraulic stream surveys were conducted in the Bridge Creek watershed in southeastern Minnesota in the summer of 2010. LiDAR data for the Bridge Creek watershed was taken from 1 meter datasets for Houston and Fillmore counties. Areas with cutbanks and slumps which indicate stream instability were identified by using the 99th percentile of the watershed SPI calculations. Further analysis that identified the most directly connected contributing areas of a stream was used to evaluate different types of riparian buffers by comparing the number of acres taken out of production versus the number of acres of highly connected surface area addressed. The Stream Power Index and Highly Connected Corridor analysis delineated the portions of the landscape where conservation and agricultural best management practices will have the most impact.

GIS-Based Spatial Modeling for Groundwater Exploration and Development

Michael Plante, PG, Roscoe Sopiwnik, and David Hume, PG
Leggette, Brashears & Graham, Inc.

LBG worked with a nine-county rural water system in southwest Minnesota to identify potential groundwater resources of buried sand and gravel aquifers that could be developed into a viable groundwater source to meet an average demand of 1,000 gallons per minute (gpm) and a peak demand of 1,500 to 2,000 gpm. As part of this project, a geographic information system (GIS) was used to analyze the abundant hydrogeologic data and to develop a spatial modeling tool that estimated potential aquifer yield across the area of interest which culminated in the placement of four high capacity water supply wells.

Estimating Groundwater and Nutrient Flux in Deer and Pokegama Lakes in Itasca County

Jacob Smokovitz
M.S. Candidate – Geology and Environmental Science
Iowa State University, Department of Geological and Atmospheric Sciences

Deep, oligotrophic lakes in northern Minnesota occur in abundance in remote areas overlain by complex sequences of glacial outwash and till. Little is known about the nutrient flux to these lakes from groundwater; however, there is great interest in preserving the water quality of the lakes from further degradation. The added expense and logistics of installing monitoring wells often preclude estimation of nutrient flux from groundwater in these lakes. The foci of this study are Deer and Pokegama Lakes. Deer is a 36-m-deep, 1600-ha lake, and Pokegama is a 34-m-deep, 2675-ha lake near Grand Rapids in Itasca County, MN. The purpose of the research is to quantify the groundwater flow and nutrient flux at Deer and Pokegama Lakes in Itasca County using a low-cost method including data from existing private wells, stable isotopes of hydrogen and oxygen in water, seepage meters and minipiezometers, nutrient analyses, and a groundwater flow model. The research is sponsored by the Clean Water Partnership Grant from the Minnesota Pollution Control Agency to the Itasca County Soil and Water Conservation District.

Preliminary water-table maps based on lake stage elevations show Deer Lake to be a flow-through lake and Pokegama Lake to be a groundwater discharge lake. Both lakes have an abundance of shoreline homes with private wells which will be used to reconstruct the subsurface geology and as groundwater access points. Water levels in 25 private wells will be measured three times during summer 2011 in order to estimate the variation of hydraulic head and to provide calibration targets for the groundwater flow model. Samples of groundwater from the same wells will be collected three times during Summer 2011 and analyzed for nutrients (total P, SRP, total dissolved P, NO3-N, NH3-N, silica), alkalinity, pH, DOC, and electrical conductivity in the ICCC water quality laboratory, in addition to cations, anions, and dissolved oxygen. Seepage meters in six pairs will be installed in water depths of 1.6, 3.2, and 5 ft at each lake to estimate the direct flux of groundwater into and out of the lakes. In addition, two minipiezometers will be installed in the lake sediment at each site, offset vertically by about 1.6 ft, in order to measure hydraulic head differences in the nearshore area. Approximately 600 private well (groundwater), lake, surface water, and precipitation samples will be analyzed for δ18O and δ2H; precipitation will be sampled to establish a local meteoric water line for the region. Preliminary isotope data from groundwater and lake water corroborates the hydraulic relationships present on the south side of Deer Lake which suggest groundwater outflow in that area. Groundwater flux to and from both lakes will be estimated using a 2-D analytic element, groundwater flow model (GFLOW). Hydraulic head measurements from private wells and minipiezometers, lake level stage, and stream discharge will be used to calibrate the model. Groundwater from 8 private wells (four at each lake) will be sampled and analyzed for tritium (3H) in order to determine the relative age of the groundwater, source nutrients, and to corroborate groundwater flow velocities. Finally, nutrient data will be used in conjunction with groundwater flux data to estimate a representative groundwater nutrient flux value for the two lakes.

Vegetation History of the late Holocene in East Glacier National Park, Montana: A Paleoenvironmental History

Emma Locatelli
Macalester College
Geology Department

H. H. Lamb identified the Medieval Warm Period (MWP) as a prolonged interval of warmth in northern Europe from AD 900 – 1200 (1150 – 850) cal yr BP (1965). Data from elsewhere of the Northern Hemisphere indicate that there may have been several pulses of warmth, and the timing of these changes varies significantly by location. The Little Ice Age (LIA) was a period of modest cooling in northern Europe from AD 1400 – 1800 (550 – 150 cal yr BP). Outside of northern Europe, evidence for periods of cooling occurs from AD 1200 – 1900 (750 – 50 cal yr BP). The apparent temporal and spatial variability of both the MWP and the LIA suggests that more research is necessary to determine how these climate anomalies extended across the Northern Hemisphere.

This study examines the vegetation history of Many Glacier Valley using pollen extracted from a sediment core taken from Swiftcurrent Lake (SWF) in Glacier National Park, MT. Pollen is used to create a vegetation reconstruction focusing on the past 1200 years, which includes both the MWP and LIA. Changes in vegetation through time reflect vegetation's response to climate, specifically temperature and precipitation, and thus can be used to broadly reconstruct past climate. Evidence from pollen indicates that the region surrounding SWF during the MWP was likely drier and warmer than present climate, and more moist and cool during the LIA. These findings are consistent with other results in from the Western United States.