

Minnesota Ground Water Association

www.mgwa.org

Newsletter

March 2008

Volume 27, Number 1

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MGWA President
Stu Grubb

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MGWA Member Assists Water Supply Needs, Bolivia 2007

By Jeff Green, DNR Waters

Imagine walking in the country on a warm morning. Parrots fly past, calling raucously as the rising sun reflects off of their green and red plumage. In the distance, you can hear a river roaring, swollen with runoff from rains that fell in the mountains the night before. Or, in an urban setting, hearing the slogans of demonstrators marching through the streets, shouting and setting off firecrackers. During the first two weeks of November, I had the opportunity to experience this and many other sights and sounds while I was on a short-term mission trip to Bolivia.

I went to Bolivia at the request of LATCOM, a small mission agency that has been working there since the 1950's. They work in partnership with EPLABOL, a Bolivian mission



Figure 1. The Monte Blanco/San Isidro landscape. Coordinates (to see the area using Google Earth) are 18 deg. 01 min. 20.73 sec. S and 64 deg. 26 min. 47.72 sec W. At these coordinates you will see the buildings, hills, river valley and the airstrip.

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President's Letter

I would like to first express my thanks and congratulations to Jeff Stoner on his excellent term as MGWA President. Jeff's capital achievement was the Fall Conference marking MGWA's first 25 years. It was a rare opportunity to look back at past achievements with some of the venerable local legends of our profession. It was also great fun to think about what is to come with futurist Jack Bacon, especially at the evening banquet. Those involved in organizing the event especially appreciate the extraordinary effort that Jeff and others put into lining up speakers, planning the banquet, and producing a special edition of the newsletter. The feedback from conference attendees was overwhelmingly positive.

We have just passed another professional milestone worth noting. It has been 10 years since the first Minnesota Professional Geologist registrations were issued. I recall submitting my PG application as soon as possible back in 1997 because 1) being grandfathered in was going to be a lot easier than taking the

exam, and 2) I thought it would be cool to have a low registration number that might impress some young geologist in the future.

A lot of people put a lot of time into establishing the PG registration. Their efforts are chronicled in past MGWA newsletters. The saga goes back at least to the beginnings of MGWA. In MGWA's second newsletter (Fall 1984), Kelton Barr discussed the pros and cons of proposed state legislation to establish a certification program for hydrologists and geologists. Maybe someone remembers why these early ideas never materialized? Gil Gabanski quoted George Bernard Shaw: "Every profession is a conspiracy against the laity."

Activity picked up again in 1993 led by members of the American Institute of Professional Geologists and the Consulting Engineers Council of Minnesota, including Bob DeGroot, Terry Swor, Rob Wahlstrom, and Kevin Powers. Bills were introduced to the 1994 state legislature and were eventually

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MGWA Web Page

Visit www.mgwa.org for MGWA information between newsletters and to conduct membership and conference transactions.

Newsletter Deadlines

Issue	Due to Editor
June '08	05/09/2008
September '08	08/08/2008
December '08	11/07/2008

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MGWA NEWS

Member News

Steve Thompson has been named supervisor of the Ground Water Monitoring and Flow Unit within the Water Monitoring Section of MPCA. Steve joined the MPCA in 1990 as a hydrogeologist in the Petroleum Remediation program. Since 2004, he has been a supervisor in the Superfund program. Steve has a Masters degree in Geology and also has worked as a consultant and science teacher. The major responsibilities of the Ground Water and Flow Monitoring Unit include continuing the MPCA's ambient ground water monitoring efforts and implementing a statewide load monitoring network.

Julie Ekman, Minnesota Department of Natural Resources, Division of Waters (DNR Waters), accepted the position of Water Permit Programs Supervisor last October. She is leading the development, implementation, and administration of the statewide regulatory programs for alterations of public waters. She is also leading the allocation and use of surface water and ground water. Most recently Julie worked as a Natural Resources Area Hydrolo-



Julie Ekman, DNR Waters

gist in the metro area and prior to that as a hydrogeologist in DNR Waters' County Atlas and Regional Assessment Program.

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President's Letter, cont.

signed into law on May 22, 1995. It took two years for the Minnesota Board of Architecture, Engineering, Land Surveying, Landscape Architecture, Geoscience and Interior Design (AELSLAGID), aka the Board of Random Vowels and Consonants, to work out the specifics. The continuing education requirement was introduced in 1999, and led to a marked increase in MGWA conference attendance.

Geologist registration has never had unanimous support or acceptance. MGWA historically has taken a neutral position. This is probably because different members had strong feelings that registration was either: 1) a useful way to uphold the standards of the profession and protect public interests, or 2) an unnecessary waste of time and resources.

I do not suggest that MGWA take a different position now, but I would like to offer the following observations from both perspectives:

- ◆ The PG registration is certainly popular. There are currently 568 PG licensees compared to 99 Soil Scientists, 576 Land Surveyors, and 11,610 Engineers.
- ◆ It is difficult to point to a pattern of geologic or ground water problems that occurred before 1997, but that now are

prevented by better-qualified geologists.

- ◆ There are few tasks that require a PG registration in Minnesota. Wellhead protection plans must be signed by a PE or PG, and aquifer test reports must have a PG signature for submittal to the DNR.
- ◆ In my consulting career, I have had only one client request or require a Minnesota PG's involvement in a project.
- ◆ People occasionally comment on the "PG" designation on my business cards. They apparently recognize it similarly to a PE registration, at least as it relates to geology and ground water work. Other professions without a registration (i.e. biologists, ecologists) seem to have more difficulty gaining recognition for their training and skills.

The PG registration has gained more popularity and prominence than other certifications and registrations (e.g., Certified Ground Water Professional).

Has the PG registration benefited the profession and the public, or is this only a "conspiracy against the laity"? I would welcome your thoughts and opinions.

Stu Grubb, MGWA President

Bolivian Water Supply, cont.

organization. One of their main areas of focus is to work on leadership and ethics training; one of the ways they do that is through Monte Blanco, a retreat center/camp they are developing at Tambo, the former New Tribes Mission School. I was part of a small team that went to work on water and wastewater issues and both short- and long-term site planning. We also made ourselves available to the local water authorities to help them with the myriad of problems they face as they try to provide clean water and adequately treat their wastewater.

The area I went to is in the western part of the Santa Cruz province. It is in the foothills of the Andes Mountains (see Figure 1); the bedrock is well-cemented sandstone that has been uplifted by the rise of the Andes Mountains over the last 70 million years. The rainfall is in the range of 12-16 inches per year. At the site I was working, the San Isidro River has cut through the foothills, creating a plain that is used for irrigated agriculture. One of our projects was to measure flow in the irrigation canal to determine water loss. Using the floating orange method (see Figure 2), we determined that the canal was losing approximately 25% of its flow over a distance of 3000 feet. This is an opportunity to implement water conservation!

At Monte Blanco, we also evaluated their long-term water supply options. For the short-term, they can continue to utilize the San Isidro River as it flows past the property (see Figure 3). The river has significant concentrations of fecal bacteria, sediment, and pesticides so it would be good to develop an alternative source. One option, groundwater supply, is problematic because locals report that wells drilled in the area hit saline water. While there is a well on the property; funds are needed to clean it out and test pump it to see if the salt levels drop. Another option would be to work with the local water board as they seek funds to provide clean water to the village of San Isidro and the Monte Blanco area. Currently, the area's water supply is from the river via a pipeline. Their plan is to build a new pipeline to get water from the river near its source, upstream of the areas that contribute bacteria, sediment and pesticides. This water would still need to be treated but the treatment options at Monte Blanco would be simpler and cheaper. In San Isidro, we could work with the water board to distribute solar water purifiers to the people so they could have clean, treated water.

We had several discussions with the local water boards at the towns of Comarapa and San Isidro and with the Alcalde, the "mayor" of the area. The water boards are very interested in gaining a better understanding of the water resources of the San Isidro and Comarapa rivers. We talked about doing stream gauging, installing gage plates at selected points, and continuing to measure irrigation canal loss. Having no equipment to do any of this was of course a major obstacle to our efforts! Several of our team members also met with the local Bolivian government hydrologic technician. He was out of supplies (which he buys out of his salary) for his recording rain gage. We told him we would try to find more for him here.

Implementation of water management at Monte Blanco, evaluation of water resources with the local water boards, and development of water treatment projects with the local village are reasons why I hope to return and continue the work we started. This work will help Monte Blanco and the local people manage their water supplies and gain access to clean water.



Figure 2. Stream gauging using the orange method in the irrigation canal.



Figure 3. The water supply for San Isidro.

2008 MGWA Board

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The primary objectives of the MGWA are:

- ◆ Promote and encourage scientific and public policy aspects of ground water as an information provider;
- ◆ Protect public health and safety through continuing education for ground water professionals;
- ◆ Establish a common forum for scientists, engineers, planners, educators, attorneys, and other persons concerned with ground water;
- ◆ Educate the general public regarding ground water resources; and
- ◆ Disseminate information on ground water.

MGWA's Corporate Members

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Links at www.mgwa.org

Save the Date!

MGWA's Spring Conference on Biofuels

May 8, 2008

See page 6 for details.

Member News, cont.

Jeanette Leete (Jennie) has been promoted to the Unit Supervisor position in DNR's Division of Waters most recently held by Brian Rongitsch until his retirement. The Hydrogeology and Ground Water Unit is responsible for analysis of water availability in support of



Jennie Leete, DNR Waters

Julie Ekman's Permits Unit (see above) and for technical analysis of all types of ground water quantity issues over which the Department of Natural Resources has jurisdiction. Recent 'hot' topics have included ethanol plants, peaking power plants, public water supply planning, and expansion and reclamation of iron mines. Jennie's Unit also oversees the underground storage of natural gas in Minnesota.

Tom Roushar, PE, has joined HDR Engineering, Inc. in the Minneapolis office as a Senior Water/Wastewater Project Manager. Tom brings over 30 years of experience in managing major capital improvement projects covering all facets of water supply and treatment, and wastewater collection, conveyance, and treatment. Prior to joining HDR, Tom headed Bonestroo's Water/Wastewater Group.

Laura Triplett recently accepted a position as assistant professor in Geology at Gustavus Adolphus College where she will teach hydrogeology, geomorphology and global climate change, among other courses. Her research focuses on human impacts to biogeochemical cycles, and in 2007 she completed her dissertation in Geology at the University of Minnesota, in collaboration with scientists at the St. Croix Watershed Research Station. Previously, she worked at the Minnesota Pollution Control Agency (1997-2000).

Geoff Delin, Research Hydrologist and Ground Water Specialist with the U.S. Geological Survey (USGS) Water Science Center in Mounds View, Minnesota, has accepted a position as the USGS Central Region Ground Water Specialist in Denver, Colorado. Geoff began his career with the USGS, in the Minnesota District in 1979, as a team member on the Upper Midwest Regional Aquifer Systems

Analysis study of the hydrogeology of Paleozoic aquifers. Since then, Geoff has been lead scientist of many ground-water studies. Geoff has many years experience with the application of ground-water models. His most recent efforts included regression modeling of ground-water recharge and assessment of ground-water contamination, including the USGS Toxics Substances Hydrology Program's crude-oil spill research site near Bemidji. Geoff has 56 lead-author or co-author publications that include 17 peer-reviewed journal articles, three Professional Papers, and two Water Supply Papers. He has been an active member of several professional societies, is a technical reviewer for a number of refereed journals, and has participated as an invited member on internal and interagency science advisory panels. Geoff plans to continue to be involved in some of his Minnesota research, and as Regional Ground Water Spe-



Geoff Delin, USGS

cialist, he will continue to be available for assistance on technical issues of local importance. Geoff is expected to transfer to the Denver area in May or June 2008.

Jeff Stoner has accepted the assignment as Science Program Officer for a new USGS Regional office, North Central Area. The new office was developed in the Twin Cities under a restructuring intended to bring executive leadership closer in line to field operations more similar to other federal agencies and to employ more integrated-science approaches involving scientists from the disciplines of biology, geology, geography and water resources. He will be responsible for reviewing and coordinating programs for USGS Science Centers in the seven-state area of Montana,

continued on page 7

INDUSTRY NEWS

Pace Analytical Acquires Laucks Testing



Pace Analytical, MGWA's newest Corporate Member, is pleased to announce that, effective February 19, 2008, it has purchased the assets of Laucks Testing Laboratory, Inc. in Seattle, Washington. For more than 100 years, Laucks has provided analytical chemistry and microbiological services for environmental, industrial manufacturing, clinical, pharmaceutical, toxicological and mineralogical customers, and offers one of the most extensive listings of approved testing parameters certified by the Washington Department of Ecology.

Laucks Testing Laboratories, Inc. was founded in 1908. The laboratory started by providing assay services for the Alaska gold rush. Steve Vanderboom, CEO of Pace Analytical, commented: "We are excited to add a Pace location in Seattle. We have retained an experienced staff from Laucks and will be focused on building a strong Pace facility to serve our west coast customers".

PROFESSIONAL NEWS

Brooke Asleson Joins MPCA

Brooke Asleson received her Masters of Science degree from the University of Minnesota Water Resources Science Program and has joined the MPCA as a Senior Pollution Control Specialist. Brooke's thesis was titled "The Development and Application of a Four-Level Rain Garden Assessment".

In her position at MPCA, Brooke is advising the agency's Stormwater and Total Maximum Daily Load (TMDL) programs. Brooke has written an article about her work which appears on page 11 of this newsletter.



Brooke Asleson with advisors Ray Hozalski, John Gulliver, and John Nieber

ASSOCIATION NEWS

New 2008 MGWA Officers Elected

Scott Alexander of the University of Minnesota's Department of Geology and Geophysics is the MGWA President-Elect for 2008. After receiving a Bachelor of Science degree in Geophysics in 1984, Scott worked with several Twin Cities companies developing shallow geophysical techniques and monitoring systems for underground storage tanks. Since 1987, Scott has worked full time for the University of Minnesota as a field and lab coordinator for the Department of Geology and Geophysics. He also advises University staff on storm water and ground water issues affecting the campus environment. He has private consulting experience in projects using chemical and isotopic tracers to help solve ground water problems, such as fluid flow with residence times ranging from hours and days to tens of millennia.



Scott Alexander, University of Minnesota

Jon Pollock has been re-elected to the position of MGWA Secretary. Jon is President of Frontline Environmental, LLC, providing environmental consulting and management services to both the public and private sectors. Jon also worked eight years as a hydrologist with the Minnesota Pollution Control Agency and has several years of laboratory experience as well as experience in oil and gas exploration work. He has a Bachelor of Science degree in Geology and Geophysics and a Masters degree in

Geological Sciences. He is a member of the Dakota County Solid Waste Management Advisory Committee and is a volunteer firefighter for the City of Lakeville.

Eric Tollefsrud Joins Newsletter Team

Eric Tollefsrud is a Principal Hydrogeologist with Geomatrix Consultants, Inc. He has an active practice assisting clients with the investigation and remediation of contaminated groundwater. Geomatrix is a diversified technical consulting and engineering firm with offices throughout North America and a professional staff of more than 450 scientists, engineers, and technical experts. Eric has been with Geomatrix for 13 years, and has been an environmental consultant for 20 years. He has an MS in Geology from the University of Kansas, and a BS in Geology from the University of Nebraska – Lincoln. In addition to membership in MGWA, he is a member of AIPG and is a registered professional geologist in Minnesota, Wisconsin and Nebraska.



Eric Tollefsrud, Geomatrix

ASSOCIATION NEWS

Spring MGWA Conference to Highlight Biofuels and Ground Water

The Spring 2008 MGWA Conference is scheduled for Thursday, May 8, 2008, at the University of Minnesota Continuing Education and Conference Center on the St. Paul campus.

The biofuels industry is booming, with ethanol leading the way here in Minnesota. The industry continues to receive considerable political and financial support as a key part of the nation's future energy supply. Minnesota's ground water resources could be locally impacted by this industrial expansion. Ground water will be a controlling factor that shapes where and how fast the industry develops. This conference will explore the relationship between biofuels and ground water and how we should best use and conserve our resources.

The conference organizing committee has invited an diverse group of speakers on the subject, including:

Mark Lindquist, MN Department of Natural Resources (DNR), State Water Use For Biofuels

Michael Yost, Minnesota Department of Agriculture (MDA),

State and Federal Legislation

Ralph Groschen, MDA, State Biofuels Programs and Policies
Derek Crompton, University of Minnesota Extension, Small Scale Biofuel Production

Nancy Kelly, MN Technical Assistance Program, Water and Energy Efficiency in Ethanol Production

Jeff Broberg, Citizen Member of the Legislative-Citizen Committee on Minnesota Resources and President of the Minnesota Trout Association, Trout Streams in Southeastern Minnesota

Mary Savina and **Michael Griffin**, Carleton College, Public education on geology and ethanol plant siting

Jim Sehl, MN DNR, Water Appropriations Permitting

Harvey Thorliefson, Minnesota Geological Survey, Carbon Sequestration and Ethanol Plants

Katsumi Matsumoto, University of Minnesota Geology and Geophysics, Biofuel Use and Global Warming

Mark Seeley, University of Minnesota Soil Water and Climate, Biofuel Use and Weather Trends

On-line registration is available.

News from the Fall 2007 MGWA Conference and 25th Anniversary

By Jeff Stoner, Past President of MGWA

We tried something a little different with the sequence of the Fall Conference and the Fall Newsletter of MGWA in 2007. That is, they happened concurrently thanks to several high-energy members. Typically the Fall Newsletter is published about a month and a half after the conference allowing time to report on what happened during that event. Many of the happenings from this conference, which in part was to celebrate our 25th anniversary, actually made it into the extra thick volume 26, number 4. Some of us tried to predict what would happen, but that rarely works out perfectly or even close to reality. One event during the conference was an attempt to recognize extra service to our Association by several members. Printing that result concurrently with the conference date would have busted the element of surprise. Also, the conceiver of the idea crafted some recognition criteria then proceeded to apply them inconsistently. Several folks helped him through this dilemma during and shortly after the conference. For the record, the recipients and a brief note of their worthiness of effort is provided below. Leaders like this inspire others by example and make the MGWA the success it is today.

Past President **Dale Setterholm** was presented a MGWA plaque for his outstanding service to the board during the past three years, for leading two great conferences while he was President in 2006, for extra outreach activities particularly to educate State legislators about ground water, and for his no-nonsense, cut-to-the-chase leadership style.

Norman Mofjeld, Thomas Clark, Jan Falteisek, Kurt Schroeder and **Steve Robertson** received a "desk-to-desk" plaque in recognition of consistent, unselfish time devoted to outlining, compiling, editing and creating the quarterly newsletter of MGWA. The Newsletter documents in an exceptional way our mission, progress, and plans for MGWA. I hope this small



Newsletter team members recognized for their service at the Fall 2007 Conference (l to r) - Norm Mofjeld, Jan Falteisek, Jon Pollock, Jim Aiken, Kurt Schroeder and Tom Clark - Steve Robertson is not pictured

token will be shared by active participants on this team now and in the future.

Another plaque was presented to **James Lundy, Steve Robertson**, and **Norman Mofjeld** for their leadership and extra volunteerism in developing and producing the 25th Anniversary Volume of the Newsletter—a 130-page sampling of MGWA past contributions and (commentaries) about the future ground water in Minnesota; spiced with facts about our organization.

Last, but not least in the plaque presentations was recognition of decades of steadfast dedication and perseverance as the management and publications team of MGWA, **Jeanette Leete** and **Sean Hunt**.

The following people were recognized with a MGWA "Commitment" pen for providing more than five years of unselfish service

continued on next page

Fall MGWA Conference features Jack Bacon as Keynote Speaker

The fall MGWA conference convened in St. Paul on November 13, 2007, to recognize 25 years since the founding of the MGWA and to discuss important changes in our understanding



Futurist Jack Bacon

of groundwater in the past 25 years. Much of the December 2007 issue of the MGWA newsletter was devoted to these topics, so instead of recapping them here in detail, I will note that the keynote speaker at the conference and at the evening dinner, was NASA scientist, Dr. Jack Bacon.

Dr. Bacon, a two-time recipient of NASA's

Outstanding Speaker award, is a noted futurist and technological historian. One of the themes he comments on in his talks is the role of technology in shaping human society. For MGWA, Dr. Bacon gave a lively, educational and entertaining set of presentations in which he talked about the pace of change in human society and our abilities to understand and process that information.

Submitted by Steve Robertson, Newsletter Team

Member News, cont.

North and South Dakota, Minnesota, Iowa, Nebraska, and Wyoming. Jeff is leaving what used to be called the District Chief position, now titled 'Director of the Water Science Center'. MGWA member **James Stark** has been named Acting Director of the USGS Minnesota Water Science Center.

Jane Willard was appointed as a trustee of the AIPG Foundation. Jane has a long track record of service to AIPG.

Gil Gabanski, MGWA Foundation President and President of GJG Environmental Consultants has accepted a permanent position with Hennepin County Contaminated Lands Unit. Through his existing consulting business he will continue to assist clients outside of Hennepin County.

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2007 Fall Conference, cont.

during our first 25 years as an association. Here is where the presenter really messed up by not closely tracking service records. Some deserving folks were not given their pens at the conference. They did receive a pen later and are included in the alphabetical listing below (deepest apologies to Lundy, Sabel and Stark):

James Aiken, 8 years as advertising manager

Thomas Clark, 8 years as chief editor, 5 years on the newsletter team, and 4 years as membership chair, plus prolific writer for the newsletter for a generation

Jan Falteisek, 6 years as secretary, 4 years as chief editor, 13 years on the newsletter team.

Gilbert Gabanski, 4 years as president and 1 year as past president (but gets an extra point for being first president)

James Lundy, 3 years as board member, 7 years on the newsletter team.

Norman Mofjeld, 6 years as chief editor

Jon Pollock, 6 years as secretary, 4 years on the newsletter team.

Steve Robertson, 12 years on the newsletter team

Gretchen Sabel, 6 years as board member

James Stark, 6 years as board member.

Several of the above listed folks are still cooking in leadership roles for MGWA. I encourage you to help them out in any way your talents move you. The services that the MGWA provides to the industry, professionals, students and the public can only be enhanced by your participation.

Also during the conference, we publicly thanked all of the members who have devoted their time to contributing articles to the over 100 issues of the MGWA Newsletter published during our first quarter century. Several of the original contributors were asked to comment on past articles from the perspective of today and the future. All came through with timely and well-written notes that made the 25th Anniversary Volume a success.

Finally, thanks to all of you who participated in the 2007 fall conference and banquet, and any MGWA event in the past. We also thanked everyone who has served in a leader or support role on behalf of MGWA. Many of these individuals have been listed in the 25th Anniversary Volume or have been noted in the article in this newsletter "History of the MGWA Newsletter Team and Advertising Editors, 1982-2008." I invite you to thank them individually. Our membership response, such as happened for the fall event, validates how we are off to a great start for the next generation of ground-water activities in Minnesota.



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History of the MGWA Newsletter Team and Advertising Editors, 1982-2008

Following is a listing (to the best of my knowledge) of everyone who has been a member of the MGWA newsletter team or an advertising editor since volume one, number one appeared in October 1982. Note that during most of the 1980's into the mid-1990's, the "team" consisted of just the editor. It was after the job of advertising editor was made separate in 1995 that the team concept for the newsletter took off. In the following, EIC means editor-in-chief, and AE means advertising editor:

- 1982: Pat Leonard Meyer (EIC); Pamela Watson (AE)
 1983: Pat Leonard-Meyer (EIC); Pamela Watson (AE)
 1984: Pat Leonard-Meyer (EIC,AE)
 1985: Kevin Powers (EIC, AE)
 1986: Kevin Powers (EIC, AE)
 1987: Kevin Powers (EIC, AE)
 1988: Lee Trotta (EIC, AE)
 1989: Lee Trotta (EIC, AE)
 1990: Lee Trotta (EIC, AE)
 1991: Jan Falteisek (EIC, AE)
 1992: Jan Falteisek (EIC, AE)
 1993: Jan Falteisek (EIC, AE)
 1994: Jan Falteisek (EIC, AE)
 1995: Tom Clark (EIC); Jan Falteisek (AE)
 1996: Tom Clark (EIC); Jan Falteisek; Jim Lundy; Steve Robertson; Jim Almendinger (AE)
 1997: Tom Clark (EIC); Jan Falteisek; Jim Lundy; Steve Robertson; Jim Almendinger (AE)
 1998: Tom Clark (EIC); Jan Falteisek; Steve Robertson; John LaFave; Jim Lundy; Leigh Harrod (AE)
 1999: Tom Clark (EIC); Jan Falteisek; Steve Robertson; Jim Lundy; Leigh Harrod (AE)
 2000: Tom Clark (EIC); Jan Falteisek; Steve Robertson; Jim Lundy; Charlie Tiller; Jim Aiken (AE)
 2001: Tom Clark (EIC); Jan Falteisek; Steve Robertson; Jim Lundy; Jon Pollock; Jim Aiken (AE)
 2002: Tom Clark and Norm Mofjeld (EIC); Jan Falteisek; Steve Robertson; Jim Lundy; Jon Pollock; Aaron Fredrikson; Jim Aiken (AE)
 2003: Norm Mofjeld (EIC); Tom Clark; Jan Falteisek; Steve Robertson; Jon Pollock; Aaron Fredrikson; Jim Aiken (AE)
 2004: Norm Mofjeld (EIC); Tom Clark; Jan Falteisek; Steve Robertson; Jon Pollock; Kurt Schroeder; Jim Aiken (AE)
 2005: Norm Mofjeld (EIC); Tom Clark; Jan Falteisek; Steve Robertson; Kurt Schroeder; Jim Aiken (AE)
 2006: Norm Mofjeld (EIC); Tom Clark, Jan Falteisek; Steve Robertson; Kurt Schroeder; Jim Aiken (AE)
 2007: Norm Mofjeld (EIC); Tom Clark; Jan Falteisek; Steve Robertson; Kurt Schroeder; Eric Tollefsrud; Jim Aiken (AE)
 2008: Norm Mofjeld (EIC); Tom Clark; Jan Falteisek; Steve Robertson; Kurt Schroeder; Eric Tollefsrud; Jim Aiken (AE)

submitted by Tom Clark (aka the "Ed Asner" of the MGWA newsletter)

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CONFERENCE AND LECTURE SUMMARIES

Fall 2007 Midwest Ground Water and Eastern South Dakota Water Conference

The 2007 Midwest Groundwater Conference was held in conjunction with the Eastern South Dakota Water Conference in late October, 2007. While the conference meetings were in Sioux Falls, a pre-conference field trip on a splendid fall day took attendees to the Earth Resources Observation and Science (EROS) Data Center, which is a U.S. Geological Survey (USGS) facility outside of Sioux Falls, and to Gavin's Point Dam on the Missouri River, near Yankton, South Dakota. The conference was sponsored by South Dakota State University, the South Dakota Department of Environment and Natural Resources, the USGS, the US Army Corps of Engineers, and the Eastern Dakota Water Development District.

The EROS facility is well worth a visit. The lobby is a showcase of many of the technologies used in the acquisition, processing and analysis of a large variety of earth-based data, much of it based on remote sensing. If you are unable to visit in person, check out the web site (eros.usgs.gov) to see a sampling of their work. Links are available on the site to access humongous amounts of free data, as well as data available for a fee. I recommend in particular the almost real-time stream of imagery data from one of the various Landsat satellites (earthnow.usgs.gov).

After leaving the EROS Data Center, we went down Gavin's Point Dam, one of a series of dams on the Missouri River built in the 1940s and 1950s, largely as a result of the Flood Control Act of 1944 (Pick-Sloan Plan). In addition to flood control, the dam system was designed to provide a steady source of water for navigation and electric power generation. Interesting facts about the hydroelectric facility at the dam include the following:

- 1) the gargantuan turbines spin at only 58 rpm, which makes sense to those among us who moonlight as electricians,
- 2) the impellers lose about 300 pounds of stainless steel each year, which must be replaced during periodic maintenance, and
- 3) the electromagnetic fields inside the generating facility are sufficiently strong to destroy powerpoint files on pocket USB drives (thus reinforcing a habit of redundancy).

The lake formed upstream of the dam is called Lewis and Clark Lake. The kind folks at EROS provided us with aerial images of the upstream end of the lake (Figure 1) that show the sedimentation experienced in the area since construction. Once about 28 miles long, Lewis and Clark Lake is now closer to 20 miles in length. In addition, downstream of the dam, the released water is free of sediment load and, as a result, is degrading the river bed. The stream bed degradation, in turn, affects other resources. For example, water table elevations in nearby floodplain and terrace deposits are falling, and, accordingly, surface water bodies such as lakes, ponds and wetlands are in some cases drying up.

Indigenous to the upper reaches of the Missouri River is the pallid sturgeon, a prehistoric-looking fish that not surprisingly evolved during the Cretaceous. Pallid sturgeon can grow to over 60 inches and 85 pounds in the wild, but due to habitat pressures and the time required (over a decade) to mature and reproduce, fish hatcheries are key to its ongoing survival. Such a fish hatchery exists for the pallid sturgeon near the Gavins Point Dam. There, young rainbow trout are raised to delight children (as the children feed the trout) as well as the pallid sturgeon (as they are eating them). Pallid sturgeon are so sensitive to water quality

conditions that the water from Lewis and Clark Lake that feeds the hatchery must be disinfected with large UV lamps.

The conference included a number groundwater and surface water talks, including some on water resources management in areas where the Missouri River streambed is being degraded. A complete listing of the talks with the submitted abstracts and links to presentations can be found at: wri.sdstate.edu/esdwc.

submitted by Steve Robertson, Newsletter Team



Figure 1. Digital orthophoto of upstream section of Lewis and Clark Lake annotated to show observed and predicted areas of loss of open water due to sedimentation (image courtesy of David Greenlee, USGS EROS data center, sedimentation interpretations from U.S. Army Corps of Engineers).

2007 Minnesota Water Resources Conference – A Recap

The 2007 Minnesota Water Resources Conference, held in October 2007, featured talks by water resources professionals including resource managers, researchers, local, state and federal agency staff, consultants and practicing hydrogeologists and engineers that highlighted water resources research and water resource management techniques.

The two-day conference attracted an attendance of over 600 and was highlighted by plenary presentations on the history of the Mississippi River by Dr. John Anfinson of the National Park Service and on biofuels production by Dr. Steven Taff of the University of Minnesota and Mark Collins of HDR Engineering. Luncheon presentations were given by Patrick Brezonik of the National Science Foundation and University of Minnesota on the “National Water Research Agenda: Dawning of a New Era of Agency Collaboration” and by James Chiles of the Minnesota Pollution Control Agency on “Of Fire Hoses and Fish Ladders: How Does Information Move in Your Organization.” Chiles is the author of the book, “Inviting Disaster, Lessons from the Edge of Disaster.” In his luncheon presentation Mr. Chiles presented an analysis of the ways in which organizations exchange information and track problems, providing fascinating details from his

investigations of natural and human disasters. More information regarding James Chiles is available at www.invitingdisaster.com.

In addition to the plenary and luncheon talks were presentations in the following areas: lake management and assessment, understanding impacts on groundwater quality, emerging contaminants, urban storm water best management practices, total maximum daily load (TMDL) policy and application, environmentally sensitive design, volume reduction/infiltration, stream habitats, managing and modeling water in agricultural landscapes, transportation drainage, stream morphology and restoration, low impact development, flooding, landscape and watershed management, and water resource management.

The event was sponsored by the Water Resources Center and the College of Continuing Education and co-sponsored by the Department of Civil Engineering, the Minnesota Section of the American Society of Civil Engineers, the Minnesota Sea Grant College Program, and the Natural Resources Research Institute. More information about this annual conference is available via the website of the University of the Minnesota Water Resources Center, wrc.umn.edu/waterconf/index.html.

submitted by Eric Tollefsrud, MGWA Newsletter Team

Another Successful Fall Field Trip for the Wisconsin Ground Water Association

By Lee Trotta, WGWA President

The 2007 Wisconsin Ground Water Association (WGWA) Fall Field Trip (October 5-6, 2007) was truly a success! Leaving the hotel in Dubuque, the first day covered northeastern Iowa with stops at Pikes Peak, Spook Cave (one of only two in the U. S. that can be entered by boat), Big Springs Hatchery, a sinkhole that opened nearby that day, and the Dyersville ethanol plant. The evening Trout Symposium was very interesting and there was plenty of time to visit with colleagues. The second day brought us into southwestern Wisconsin with stops at the Dickeyville roadcut, Hoadley Hill, Majestic View Dairy Parlor, Schreiner Park, Wyalusing State Park, Don Orr gravel pit, a meander cut off by glacial processes, and the St. John’s mine. Thanks to all the stop leaders including Ray Anderson, Gary Siegwarth, Michael Bounck, Troy Thompson, Bruce Brown, Lee Trotta, and James Knox.



entering the aquifer at Spook Cave - photo by Lee Trotta

MGWA 2007 Year-End Financial Report

January 1 - December 31, 2007

(all values rounded to nearest U.S. Dollar)

Income		
	Individual and Corporate Dues	\$18,600
	Advertising	\$3,448
	Interest	\$293
	Conference Income	\$54,780
	Printed Materials Fees	\$737
Total Income		\$77,858
Expenses		
	Administration	\$15,797
	Conference Expenses	\$41,631
	Membership Services	\$15,212
	Public Services	\$1,276
	Products	\$30
Total Expenses		\$73,946
Net Income		\$3,913

Treasurer's Report

- 2007 ended with a surplus of \$3,913 on a total income of \$77,858. This amount is less than one-half of the net income of last year.
- Upon the Board's approval the net income from 2007 will be transferred to the MGWA Foundation in mid-2008.
- At the end of 2007, the MGWA had approximately \$21,437 available for operations.
- If you have any questions, comments, or concerns contact Craig Kurtz at 763.757.6876 or at craigkurtz@msn.com

The Development and Application of a Rain Garden Assessment Technique

By Brooke Asleson, Minnesota Pollution Control Agency

Introduction

A high priority for municipal public works departments over the past three years (Minnesota Stormwater Steering Committee, 2005) has been the need for better and more detailed information regarding the function and performance of stormwater best management practices (BMPs), specifically rain gardens. To help meet these needs as well as the need for a standardized method for assessing the effectiveness of stormwater BMPs, two stormwater projects emerged.

The first project funded by the Minnesota Pollution Control Agency (MPCA) Stormwater Program was "Assessment of Stormwater Best Management Practices." This project involved the development and review of techniques to assess the effectiveness of stormwater BMPs. The final outcome was a manual to assist municipalities in assessing their stormwater BMPs.

The second project, which was funded by the Metropolitan Council Environmental Services (MCES) and Local Road Research Board (LRRB), was "Assessment of Stormwater Treatment Practices on the Quantity and Quality of Runoff." This project involved development and implementation of new techniques for the testing of underground facilities, proprietary devices, rain gardens, and bio-retention facilities for stormwater treatment.

The research projects were undertaken by the University of Minnesota (U of M) through a collaborative effort that included several departments at the U of M and local partners.

The local partners served on the Technical Advisory Committee, provided feedback on the directions of the research, and provided opportunities to integrate local research efforts with the project. The local partners that participated in this project were the City of Bloomington, the City of Plymouth, Dakota County Soil and Water Conservation District, Ramsey Washington Metro Watershed District, Three Rivers District, Washington County Conservation District, and the Wisconsin Department of Natural Resources.

Rain gardens are locally a popular stormwater BMP due to the variety of treatment processes they provide including: settling, filtration, adsorption, plant uptake, and microbial degradation (e.g., nitrification). In addition, rain gardens also provide habitat for small mammals, birds and insects (Prince George's County, Maryland, 2002). The primary process occurring in rain gardens is the capture of rainwater runoff through curb cuts or storm sewer inlet structures and infiltration of the water into the soil.

Dietz and Clausen (2005) reported that 98.8% of inflow entering the two rain gardens monitored in their study left as subsurface flow. This infiltrated water will either enter waterways via subsurface flow or recharge the groundwater supply. Some rain gardens may have underdrains for improved infiltration in areas where the native soils have low permeability or in areas where groundwater recharge is not desired.

A complete assessment of rain gardens requires a comprehensive evaluation of all of its components: inlet structures, the health and cover of specified vegetation, soil properties (texture, color, moisture content, bulk density), and hydraulic properties. Efficient treatment of stormwater runoff by soil processes requires soils that are stable and noncompacted due to construction activities. The soils of rain gardens are designed to promote infiltration, support vegetation and adsorb pollutants. Soil properties, such as bulk density, texture, porosity, water content, and organic matter content, can influence the ability of the soil to allow

water to infiltrate (Buttle and House, 1997; Maidment, 1993). Hydraulic conductivity (a measure of a soil's ability to transmit water) is most affected by porosity, pore-size distribution and pore continuity. The presence of macro pores formed by the shrinking and swelling action of clays, freezing and thawing cycles, decaying roots, erosion, and biological activity, such as earthworms, insects or burrowing animals, can also have significant control on the water transmission property of a soil. Macropores range from 1 millimeter (mm) to over 50 mm in diameter and serve as primary paths for infiltration and

drainage of water (Hillel, 1998).

Soil properties, such as porosity and hydraulic conductivity, can change over time therefore changing the rain garden's ability to allow water to infiltrate. These changes can be due to compaction, loss of soil structure, and/or clogging. Soil compaction reduces infiltration rates by reducing the pore space available for water transmission. Soils in rain gardens may become compacted during construction while post-construction soil compaction likely only occurs when heavy machinery is used for maintenance or redevelopment of a site. These soil properties are therefore critical to maintaining a functional rain garden and should be monitored over time.

There are several reasons for assessing the performance of rain gardens including: construction due diligence, scheduling maintenance, fulfilling stormwater permit regulatory requirements,



Example of a rain garden on the St. Paul campus of the University of Minnesota

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Rain Garden Assessment, cont.

and assigning Total Maximum Daily Load (TMDL) allocations. The increasing number of TMDLs required for impaired waters will lead to a need for quantifying the source reduction that rain gardens provide for determining load allocations. In addition to providing necessary information about the current and long-term performance of the rain garden, the data collected in an assessment program can be used to improve design features of future rain gardens. The results of the assessment also allows for an improved understanding of the role of the various system components (i.e. soil, plants, etc.) in pollutant removal and volume reduction.

Several methods for determining the efficiency of rain gardens to treat stormwater have been developed as part of a four-level assessment program (Gulliver and Anderson, 2007):

(1) visual inspection, (2) infiltration capacity testing, (3) synthetic runoff testing, and (4) monitoring. The *visual inspection* involves examination of the vegetation and soil and is used to quickly determine if a rain garden is malfunctioning and in need of maintenance or replacement. *Infiltration capacity testing* involves the use of infiltrometers to make measurements of saturated hydraulic conductivity (K_{sat}) throughout a rain garden. *Synthetic runoff testing* uses supplied runoff from a fire hydrant or water truck to fill the basin with water to determine an overall drain time of the rain garden. *Monitoring* can be used to assess the function of a rain garden within a given watershed, and is useful for watershed-scale studies to assess overall pollutant loads to receiving waters.

The intent of the four-level program is to begin at level one and only progress to the next level when passing criteria have not been completely satisfied. The main goal of this research was to develop a relatively rapid, low-effort and low-cost approach for assessing the performance of rain gardens. Visual inspection criteria and infiltration rate measurement techniques were refined through numerous field tests performed over the course of a growing season.

Assessment Techniques

Visual Inspection

The visual inspection provides qualitative information to evaluate whether the rain garden is functioning properly and includes: (1) hydraulic issues, (2) vegetation, and (3) soil. Based on these criteria a rain garden may be selected for a more detailed assessment (i.e. level 2 or higher) or considered to be failing and in



Figure 1. Photograph of the soil texture and color being determined in a rain garden.

need of maintenance. A visual assessment of the presence and health of the plants is made by examining and recording the color, size, and quality of the leaves, stem and flowers using the design plans when available. A plant field guide is used to identify species. The percent cover that the vegetation provides is also estimated to ensure plants are growing adequately. The rain garden should also be inspected for the presence of wetland plant species as this is an indicator of the formation of hydric soils. Soil texture can be determined using the feel method (Thien, 1979) and the USDA Textural Triangle. The color of the soil is determined by matching the color of a soil sample from each layer with a color chip in a Munsell® soil-color book. Figure 1 is a photograph of these methods being conducted in the field.

Infiltration Capacity Testing

The capacity of the rain garden to infiltrate water is an important assessment parameter and rain gardens are typically designed to drain within 40 to 72 hours. There are several devices available for measuring the infiltration rate of soils in the field including: the double ring infiltrometer, Guelph permeameter, tension

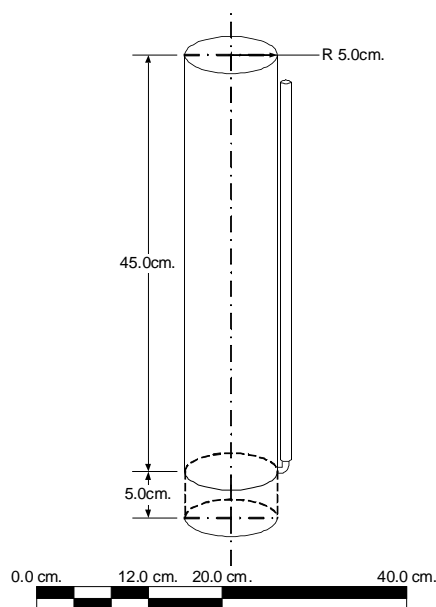


Figure 2. Diagram of the Modified Philip-Dunne permeameter (Nesting, 2007).

infiltrometers and a Philip-Dunne permeameter. The Phillip-Dunne permeameter, intended to be used in a borehole (Munoz-Carpena et al., 2002), was modified to incorporate the potentially limiting layer of surface soil and sediment (Nesting, 2007). Due to the minimal volume of water necessary, ease of use in the field, low cost of the device, and transportability of the equipment, the Modified Philip-Dunne infiltrometer (Figure 2) was selected for measuring the K_{sat} of the rain garden soils.

The Modified Philip-Dunne (MPD) permeameter is an open-ended, thin-walled aluminum cylinder which has a maximum height of approximately 60 centimeters (cm), a minimum height of 30 cm, and a diameter of 10 cm. A transparent piezometer tube is located 5 cm from the bottom on the outside of the device with measurement markings along it for making visual readings. Its use involves a falling head technique that assumes three-dimensional flow through isotropic homogeneous

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Rain Garden Assessment, cont.

soil. The device is pounded into the soil to a depth of 5 cm then filled with water to a height of 43 cm. The water height over time is then recorded. The initial and final soil moisture content of the top 6 cm of soil is required to calculate K_{sat} (an easy to use Microsoft Excel spreadsheet template was developed to calculate K_{sat} using the MPD measurements and can be downloaded from the project website: wrc.umn.edu/outreach/stormwater/bmpassessment/levels/level2/index.html). It can be measured directly using the gravimetric method or indirectly with a capacitance probe. Bulk density measurements are required to convert gravimetric water content to volumetric water content. These measurements can also be used as an index of the degree of compaction. For this research, MPD infiltrometers measurements were made throughout each basin and the coordinates were determined using a Trimble ProXR global positioning system (GPS) unit.

The median K_{sat} value was calculated for each site to estimate the total time required for the rain garden to empty when filled to its capacity or water quality volume (WQV). The infiltration discharge (Q_i) is calculated based on the measured median K_{sat} value and the surface area of the rain garden. The time to drain is then determined using the calculated Q_i and the WQV . This time is then converted to hours to determine if the rain garden is draining within the required or desired timeframe.

Synthetic Runoff Tests

The third level of assessment included filling the rain garden to capacity using a fire hydrant or water truck to evaluate the drain time of the entire rain garden. Once the rain gardens were filled with water the relationship of water level versus time was recorded using a staff gauge and a stop watch. To verify the accuracy of visual measurements, continuous measurements were also collected with an ultrasonic sensor mounted to a post at the lowest point in the basin. During the synthetic runoff test the total time required for the entire basin to drain was measured. The result of this test was then compared to the drain time the rain garden was designed to achieve as well as the estimated drain times computed using the results of the MPD tests.

Monitoring

Monitoring is the most comprehensive assessment method and relies on natural rainfall and runoff. Flow measurement, sample collection, and sample analysis are required to determine the volume of water and mass pollutants entering and exiting the system. Although both monitoring and synthetic runoff testing can provide information on infiltration and pollutant removal performance, monitoring can also provide data on runoff and pollutant loading for the local watershed. Nevertheless, monitoring results will typically have a larger associated uncertainty because of the uncertainties and variability of the inflow (Erickson *et al.*, 2007). While the monitoring of rain gardens for comprehensive watershed studies may be desired in some instances, this fourth level of assessment was not included in the study reported herein.

Assessment Results

Visual Inspection

A total of twelve sites were evaluated to be included in the development and implementation of the four-level assessment procedure. Of the twelve rain gardens considered for use in the

development of the assessment techniques, extensive data was collected at eight over one growing season (four were not evaluated further due to obvious problems observed during a preliminary visual inspection). The sizes of the rain gardens ranged from 300 square feet to 14,500 square feet. The smallest rain garden was located in a residential area receiving stormwater runoff from the street via a curb cut inlet. Several other rain gardens received runoff from parking lot areas, or a combination of stormwater runoff sources. The three oldest rain gardens were installed in the fall of 2003 and were online (i.e., receiving runoff) in the spring of 2004. Eight of the rain gardens were evaluated using both level one (i.e. visual inspection) and level two (i.e. capacity testing) assessment techniques. Three of the sites were evaluated using synthetic runoff testing (i.e. level three). None of the sites where a level three assessment was conducted were constructed with underdrains. Three of the rain gardens assessed using the first two levels of assessment did contain underdrains and were also the three largest rain gardens evaluated.

All of the rain gardens contained various species of native perennial vegetation. Four of the sites contained new plantings and, based on their stage in development, were considered to be in good health. With the exception of the four sites determined to be not functioning properly, most other sites had well-established vegetation that appeared to be healthy. One site was rated as poor based on the presence of failing trees. Nevertheless, the prairie grasses and perennial plants in that rain garden appeared to be established and growing well.

Further inspection of the soil properties at this particular location will provide insight into possible causes of the failing health of the trees. A soil core was taken to a depth of approximately forty-seven inches and the texture and color of that profile was determined in the field. Several bulk density samples were taken at each functional site for the conversion of water content and for a quantification of the level of compaction. The bulk density of soils under standard conditions ranges from 1.30 to 1.35 g/cm^3 . Sandy soils with a relatively low volume of pores may have a bulk density of 1.6 g/cm^3 , whereas aggregated loams and clays soils may fall below 1.2 g/cm^3 . The measured bulk densities of the rain gardens assessed cover a wide range values, but fall within the expected ranges.

Based on these measurements, compaction did not appear to be a problem for any of the rain gardens. The topsoil of several rain gardens consisted of a sandy loam soil. Examining the entire soil profile of the rain gardens is important for the detection of restrictive soil layers which will control the rate at which water moves through the soil profile. One rain garden contained a lower permeability silt loam soil layer beneath the sandy loam topsoil. Two additional sites had underlying native soil of finer texture than the overlying topsoil, however, these rain gardens were designed with underdrains to compensate for this situation. The soil profile at the site containing the failing trees consisted of forty inches of sand overlying gravel. The poor retention of water and nutrients by sand are a potential cause of the failing plants discovered during the inspection of the vegetation.

Infiltration Capacity Testing

Six MPD infiltrometers were used simultaneously. Therefore, infiltration capacity testing was typically completed within eight hours at each rain garden, with the exception of one site (20

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Rain Garden Assessment, cont.

hours) due to its large size. The time required for each individual MPD test to be completed ranged from 10 minutes to 8 hours. Only 1% of the MPD tests were terminated due to minimal change in water level over a period of several hours. The number of locations where measurements were made using the MPD varied among the rain gardens from 4 to 40 due to differences in rain garden size. The variability of K_{sat} within each rain garden was extremely large as expected and the coefficient of variation ($CV = \text{standard deviation/mean}$) ranged from 57% to 174%. The highest measured K_{sat} value was 0.08148 cm/second and the lowest was 0.0000007 cm/second. Based on the combination of statistical tools utilized, it was determined that a log-normal distribution fit the data best in all cases. Based on the GPS coordinates taken at each location within the rain gardens where K_{sat} was measured, maps were developed to demonstrate the spatial variability. Figure 3 is an example of one of the sites which displayed a large range of K_{sat} values. In summary the lowest K_{sat} values occur most often near inlets and at the center of the basins, coinciding with the areas most impacted by water flow and sedimentation

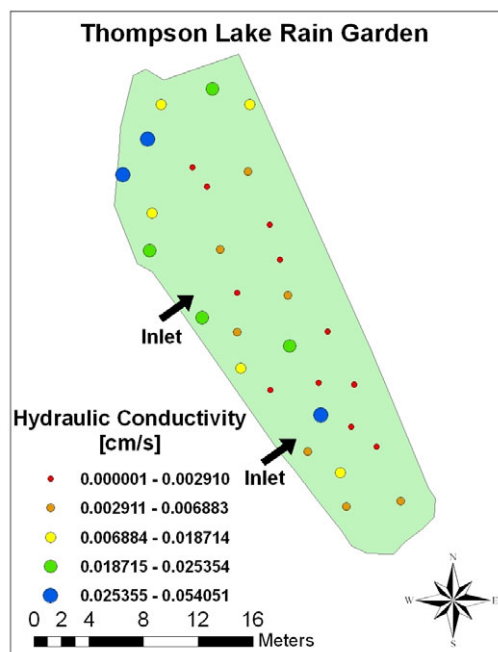


Figure 3. Map showing the range of K_{sat} values measured using the MPD infiltrometer at various locations within the Thompson Lake Rain Garden.

Synthetic Runoff Tests

The three rain gardens where synthetic runoff tests were performed drained well within the required 72 hour drainage period, indicating that the rain gardens were functioning properly with respect to infiltration. The mean and median values of K_{sat} obtained from the MPD tests were used to estimate the drain time based on the same initial volume used for each synthetic runoff test. The appropriate K_{sat} value used to estimate drainage time, if the piezometric head difference is assumed to be equal and the low K_{sat} values are spaced randomly, is shown by Darcy's law to be the arithmetic mean. Nevertheless, the median K_{sat} is better than the mean as an estimator of drainage time. Perhaps the location of the higher K_{sat} values around the perimeter of the basin

influenced the mean to a greater extent than they influenced drainage time. As the drainage progresses, for example, the region around the perimeter of the basin would cease to participate in drainage.

With the exception of one rain garden, the estimated drain times using the median value of K_{sat} from the MPD test data were consistent with measured drain times. The site in which there was inconsistency was the rain garden with the restrictive soil layer below the topsoil. The level one assessment results were useful in explaining the large discrepancy. The benefit to conducting a synthetic runoff test is that the drain time can be determined quickly and easily. Infiltration capacity testing, however, provides information on spatial variability in infiltration behavior which could be useful for specifying areas in need of maintenance. There is also the potential to incorporate pollutants of interest into the model for determining pollutant removal efficiencies.

Conclusion

All three levels of assessment provided helpful information regarding the overall function of rain gardens. Visual inspection of the vegetation and soils provided information on their ability to contribute adequately to the uptake and infiltration of stormwater runoff. Capacity testing provided information on the spatial variability in K_{sat} which could be used to estimate the overall drain time of the rain garden. The combination of level one and two assessments is particularly useful for assisting in the development of maintenance tasks and schedules. Synthetic runoff tests (level 3) rapidly determine drain times and can be used to assess the removal efficiencies of particular pollutants. Of the twelve rain gardens assessed in this research, four were not functioning properly and two of them had the potential for failure. The multi-level assessment approach identified potential causes and therefore solutions to solving the problem. The development and application of this assessment approach demonstrated that assessment using all three levels is the most effective and comprehensive method for evaluating the ability of rain gardens to treat stormwater. Nevertheless, when there are a large number of rain gardens to evaluate and limited funds available, level 1 assessment can be used to identify obvious problems.

While the use of rain gardens to treat stormwater runoff is a common stormwater BMP in urban and suburban areas, there is still much to learn regarding their long term function, maintenance requirements, implications for ground water and optimal performance requirements. Interactions between stormwater, soil and vegetation are numerous and complex. Quantifying these interactions and the implications that they may have is necessary as rain garden implementation increases. The tools developed through this research provide an opportunity to use standardize techniques which can be compared among researchers for a comprehensive understanding of the performance of rain gardens under various conditions to treat stormwater runoff.

The project, "Assessment of Stormwater Best Management Practices," integrated this rain garden research project into the on-line manual which was developed to provide guidance for the assessment of all stormwater BMPs and can be found at: wrc.umn.edu/outreach/stormwater/bmpassessment/index.html. Additional funding from the Stormwater Steering Committee

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Rain Garden Assessment, cont.

will allow for the continuation of the project under the title *Assessment and Maintenance of Stormwater Best Management Practices* and will build upon and expand this research by incorporating maintenance procedures, develop and evaluate the new testing methodology, and assess the implications of increased infiltration from impermeable surface runoff on groundwater quality. This work was conducted by Brooke Asleson at the U of M under the guidance of Dr. John Gulliver, Dr. Raymond Hozalski, and Dr. John Nieber. The author coordinated and led the research efforts with graduate student, Rebecca Nestingen. For more information regarding this project contact Brooke Asleson at brooke.asleson@pca.state.mn.us.

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Springshed Mapping Project in Southeast Minnesota

By Jeff Green, DNR Waters

The Legislative Citizen Commission on Minnesota Resources has funded a two-year study to identify and delineate supply areas (springsheds) for springs serving as coldwater sources for modern and historic trout streams (see Figure 1) and to assess impacts on these important resources from land and water development. Trout streams depend on a steady supply of clean, cold water to exist.

Each of Minnesota's trout streams is sourced from springs. Trout streams are under increasing pressure from changing land use in the Minnesota's karst lands from the Twin Cities metropolitan area to the Iowa border. Additional large groundwater withdrawals for energy production and other development loom in the future.

Delineation of the recharge areas or springsheds of the trout streams is a crucial first step in the protection of the trout fisheries and the restoration of those that have been degraded.

Dye tracing, the proven method for accurately delineating springsheds in karst, is the "gold standard" but is logistically difficult to apply statewide. Development of supplemental springshed mapping tools is a critical component of extending springshed mapping to wider scales.

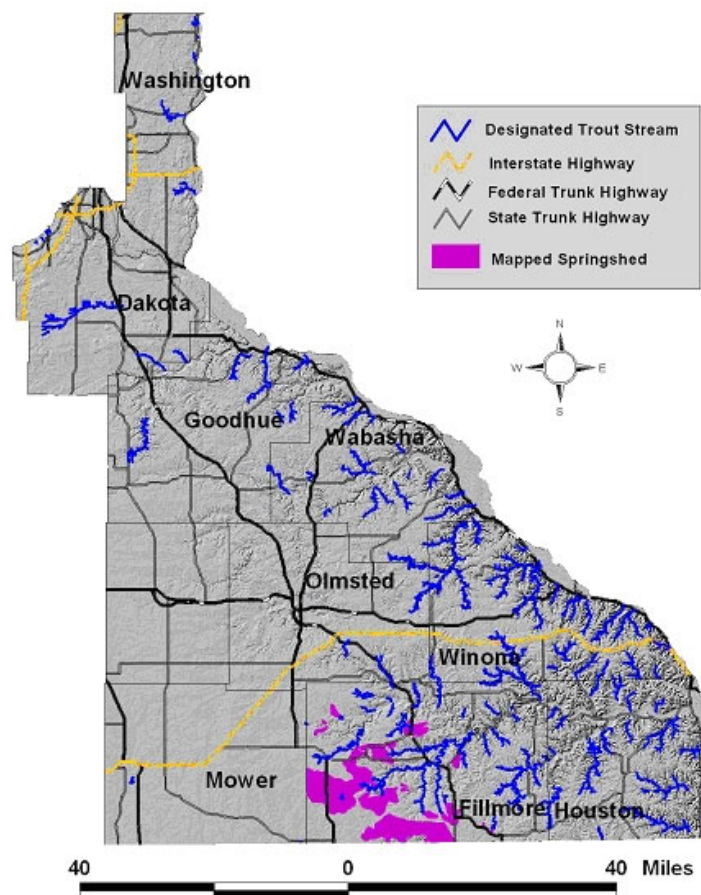


Figure 1. Springsheds and trout streams in southeast Minnesota.

Never Mind EDB, What About 1,2-DCA? Minnesota's Curious Little Piece of the Puzzle

by Mark Toso, Minnesota Pollution Control Agency

As state regulators, working the day-to-day grind of site remediation, we often only see what's happening in our own little worlds. Because of this, we sometimes have information we've picked up along the way that could be beneficial to others but that gets lost in the shuffle or filed away when the next big project comes along. This occurred to me one day while reading through some past issues of LUSTLine. While a few articles made it pretty obvious that there was a heightened national concern over the leaded gasoline additive ethylene dibromide (EDB), my first reaction was: "Never mind EDB, what about 1,2-DCA?" (See LUSTLine issues #47, "Lead Scavengers: A Leaded Gasoline Legacy?," #50, "What South Carolina Is Learning about Ethylene Dibromide at LUST Sites," and #51, "Leaded Gasoline? Hmm, What's in Those USTs?")

Our Long-Term Scavenger Hunt

Recent articles and presentations at the National Tanks Conference by other states (particularly South Carolina) have emphasized the need to expand groundwater analysis to include the leaded-gasoline additives EDB and 1,2-dichloroethane (1,2-DCA). In Minnesota we've been fortunate to have some very forward-thinking people in our environmental programs. Since the creation of our leaking underground storage tanks (LUST) program in 1987, volatile organic compound (VOC) analysis using USEPA method 8260 has been required for all first-round groundwater sampling. Our VOC-parameter list was designated by our Health Department lab and included the leaded-gasoline additives EDB and 1,2-DCA (and with even more impressive foresight, methyl-tert butyl ether (MtBE) in 1989). Although it's likely our VOC sampling requirement was implemented to screen for nonpetroleum contaminants (more than one chlorinated plume was discovered this way), we've been keeping track of EDB and 1,2-DCA for a long stretch.

As reported previously in LUSTLine, both EDB and 1,2-DCA were part of the tetraethyl lead (TEL) additive package designed to remove excess lead from gasoline-engine combustion chambers. Since 1942, these two compounds were added in molar ratios with lead that resulted in almost equal quantities, ranging from 0.27 – 0.34 g/L, (Falta, June 2004). An interesting side note is that EDB is added to aviation gasoline because chlorine from 1,2 DCA in the exhaust would be corrosive to aluminum airframe parts. And since TEL was only added to increase the octane rating for gasoline engines, it would never have been used in any turbine engine (jet) fuels, which comprise the vast majority of aviation fuels used today.

Minnesota's experience with these two additives is that EDB is not a significant problem. An informal survey of Minnesota Pollution Control Agency (MPCA) petroleum-remediation program staff found that while we have numerous examples of drinking water wells that are contaminated with 1,2-DCA, only two are known to contain EDB (up to 1.4 ug/L). In both cases, the 1,2-DCA concentrations were much higher than the EDB and also exceeded the state drinking water standard of 4 ug/L (the federal maximum contaminant level (MCL) is 5 ug/L). In addition, routine analysis of public water supply wells by the Minnesota Department of Health, using method 8260B, has never detected EDB; however, 1,2-DCA has been detected in 26 wells.

Looking Harder and Meaner for EDB

Because of the extremely low drinking water standards for EDB (0.004 ug/L state health risk limit (HRL) and 0.05 ug/L federal MCL), the elevated detection limits with method 8260B were a concern. The current thinking is that perhaps EDB was persistent below detection levels, which typically are in the 0.4-1.0 ug/L range. So when the USEPA Office of Underground Storage Tanks (OUST) in collaboration with the USEPA Office of Research and Development (ORD) got word out that it was looking for leaded-gasoline release sites to sample for low-level EDB using EPA method 8011 through the Kerr Environmental Research Lab, we were more than happy to participate.

One site we submitted represented a typical scenario seen in Minnesota. In the beautiful north central city of Alexandria, a large petroleum-distribution terminal is situated above an aquifer consisting of predominantly sand, occurring from 80-120 feet below grade. Separating this deep aquifer from a shallow surficial aquifer is a confining unit consisting of clay-rich till that is 30-40 feet thick. The deep aquifer is considered the sole source for the city and surrounding area, and downgradient from the terminal it is contaminated with 1,2-DCA, but not EDB.

Since the terminal is located just inside the city limits, approximate 300 deep-aquifer wells were impacted in new residential developments outside the city. We have been tracking 1,2-DCA concentrations of up to 8.0 ug/L in select offsite wells in this area; several have exceeded the state standard of 4 ug/L (MCL is 5 ug/L). These levels have remained relatively consistent over the last 12 years. The front edge of the plume has been migrating slowly to the current maximum extent of 3,200 feet downgradient (ironically the few residences that have shallow sand-point wells have no contamination). With the exception of the rare, extremely low-level detection of a benzene, toluene, ethyl benzene and xylene (BTEX) compound, 1,2-DCA was the only compound detected.

The highest 1,2-DCA concentration seen in any onsite deep well was 20 ug/L, again without any detectable EDB. The last EDB detection at the site was in a shallow aquifer well in June 1994 at 1.2 ug/L. There have been no detections of 1,2-DCA in a shallow-aquifer well since April 1999. This could be the result of various remediation systems that have operated entirely in the shallow aquifer since the early 1990s.

A total of eight well samples were submitted to the Kerr Environmental Research Lab for low-level method 8011 EDB analysis. Of these, two were onsite monitoring wells, and the remaining six were offsite private wells. These wells were all selected based on historical detection of 1,2-DCA. All samples were also analyzed for VOCs using EPA method 8260B. All but one well had a detection of 1,2-DCA. However the 8011 analysis did not detect EDB in any of the wells at a level of 0.010 ug/L.

And the Winner Is...1,2 DCA

As is typical of what we experience in Minnesota, the 1,2-DCA outlived all the other VOCs at this site. While the degradation of these two additives in leaded-gasoline releases is not well

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What about 1,2-DCA?, cont.

understood, it's clear that at least in Minnesota, EDB is attenuating at a rapid rate and 1,2-DCA is not. In fact our experience has been that of all the VOCs we analyze for at petroleum-release sites, 1,2-DCA is the longest-lived, most traveled compound we've seen. It may even rival MtBE for risk to drinking water supplies (incidentally, MtBE was found in the onsite deep wells beginning in 2003).

Why Minnesota's data seem to contradict that of states such as South Carolina, where EDB is more prevalent, is a puzzle. This is especially interesting when you consider that we see the same results across a wide variety of geologic settings (i.e., glacial, carbonate, and igneous bedrock formations). Perhaps there are some significant differences in geochemistry (there is the obvious difference in temperature) or some other factor. It's known that EDB had been used as an agricultural pesticide more widely in South Carolina and that there might even be more recent leaded racing gasoline releases than Minnesota.

So far, there is nothing to suggest that we need to make a change in our investigation and cleanup policy. However, if you are concerned about EDB and not currently sampling for 1,2-DCA, you might want to think about reevaluating your strategy. And stay tuned for additional information as we plan to develop this and

several other case studies as part of the national evaluation of leaded-gasoline scavengers.

But That's Not Quite the End of Our Story

It's always something! We have also been seeing occasional detections of 1,2-dichloropropane (1,2-DCP), which is usually found associated with 1,2-DCA. Often the levels are right at the detection limits of method 8260B, but some have been as high as 46.5 ug/L (MCL is 5 ug/L). While one of the listed uses of 1,2-DCP is as a lead scavenger, a major manufacturer of TEL additives claims its use was extremely limited. There is the possibility that 1,2-DCP is produced as a byproduct during the manufacture of 1,2-DCA. However, there was apparently an acute shortage of 1,2-DCA between 1957 and 1960, and 1,2-DCP was used as a replacement. This may hold promise for dating some old releases. We plan to investigate this further as well.

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The Lotus Lake Well Field: When You're Out of the Blue and Into the Black

By Ray W. Wuolo, Barr Engineering Company

During the peak of last summer's drought, three wells in Chanhassen's Lotus Lake well field went from producing a combined yield of about 2,000 gallons per minute (gpm) to nearly nothing within a few days. The City implemented temporary lawn-watering restrictions in order to compensate for the reduced pumping capacity. Those restrictions were lifted in August 2007, as the drought broke. The three wells (Wells 2, 5, and 6), remained shut off to allow their capacities to recover. However,

they didn't.

The specific capacity of a well (pumping rate divided by drawdown) can decline for a variety of mechanical reasons: failure of pumping equipment; obstructions in the discharge line; clogging of the well screen, open hole, or filter pack; or collapse of the well screen or open-hole portion. These are usually repairable conditions, although in extreme circumstances, such as the collapse of a well bore, a new well may need to be drilled. City staff verified that there was nothing wrong with the construction of their wells.

Specific capacity can also drop in response to lower potentiometric head. During peak summer watering season, well interference from nearby pumping wells is a common cause of reduced yield in some parts of the metro area and during prolonged droughts, increased regional water demand can result in a lowering of the potentiometric surface over a large area. Water levels typically rebound after peak pumping periods, albeit potentiometric heads may be slightly reduced. In the case of the three Chanhassen wells, water levels in the wells did not recover after a month without use. In fact, water levels did not rise even when all of the other wells in the well field were shut down. What happened in Chanhassen's Lotus Lake well field was something not seen before in the Twin Cities area – the nearly complete (and probably

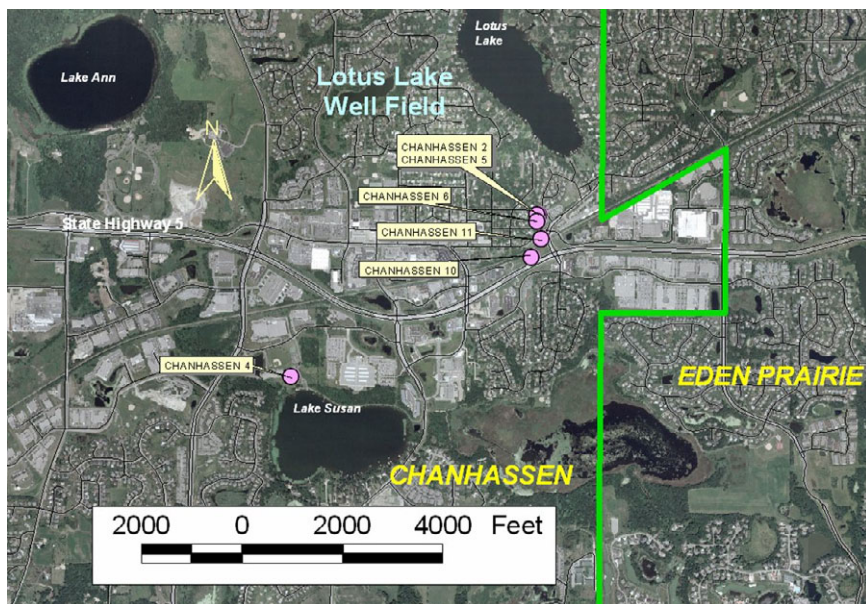


Figure 1. The Lotus Lake well field, Chanhassen.

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Lotus Lake Well Field, cont.

permanent) depletion of storage within an aquifer. A more colloquial term for this is “aquifer mining”.

There are six wells in the Lotus Lake well field. Wells 2, 4, and 10 are completed in the Prairie du Chien-Jordan aquifer system. Wells 5, 6, and 11 are screened in an unconsolidated sand and gravel aquifer that overlies the Prairie du Chien Group. The unconsolidated aquifer is very transmissive and over 100 feet thick in the vicinity of the wells. Separating the unconsolidated aquifer from the bedrock aquifer is a gravelly clay that is typically 25 to 100 feet thick.

Examination of the well-field layout leads to an immediate suspicion that well interference effects between Wells 2, 5, and 6 must be very large due to their close proximity to one-another (the three wells are within 150 feet of each other). In fact, well interference has not been a problem here because only Wells 5 and 6 are completed in the unconsolidated aquifer and the transmissivity of this aquifer is so large that interference between the two wells is small. There are many examples in the Twin Cities of high yielding wells located next to one another but completed in different aquifers – leakage resistance afforded by a separating aquitard can minimize well-interference effects.

The likely cause of the loss of specific capacity for Wells 2, 5, and 6 reveals itself by contouring and drawing of cross sections. Logs of wells in the area were used to construct an isopach map of the unconsolidated aquifer (Figure 2). Materials described in

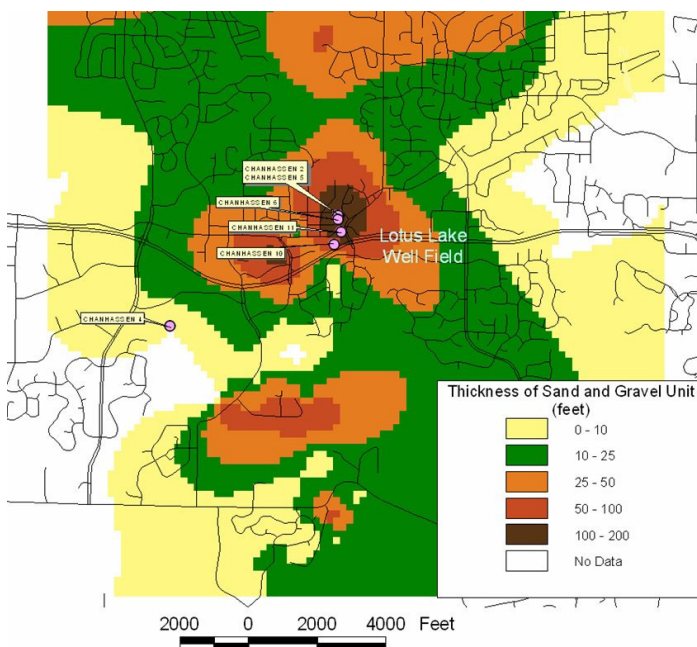


Figure 2. Thickness of the unconsolidated aquifer.

the driller’s logs as having a texture of sand or coarser were considered aquifer material, whereas silts, clays, and clayey gravels were considered to be lower permeability till deposits. The resulting isopach map suggests that the unconsolidated aquifer trends in a narrow north-south band and is less than 25 feet thick in most locations. The unconsolidated materials are much thicker (over 100 feet) in the immediate vicinity of the City’s municipal

wells but thin considerably away from these wells.

A north-south cross section through the well field (Figure 3) shows that the sandy-to-gravelly clay till that separates the unconsolidated aquifer from the underlying Prairie du Chien-Jordan aquifer is missing near the municipal wells, resulting in a “window” through the basal till that provides good hydraulic connection between the two aquifers. What is also apparent is the thick sequence (100 to 200 feet) of low-permeability till deposits that everywhere overlie the unconsolidated aquifer. The overlying till unit is continuous and it is hard to imagine that these tills allow much in the way of recharge from infiltrating precipitation or leakage from lakes and wetlands. The most likely mechanism for recharge of the unconsolidated aquifer is by upward leakage from the Prairie du Chien Group through the window in the basal

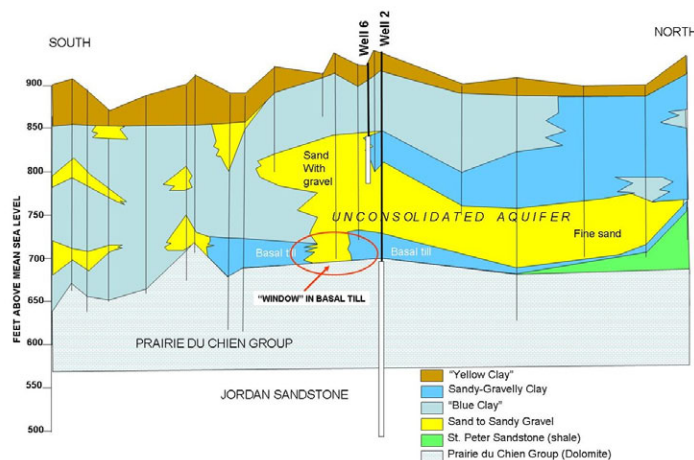


Figure 3. North-south cross section through well field.

till, with lesser amounts leaking upward through the sandy and gravelly clays of the basal unit.

So, what happened to the City’s wells? Here is one hypothesis. Before widespread pumping began in southeastern Carver and southwestern Hennepin County (early 1960’s), the hydraulic heads in the Prairie du Chien Group and the unconsolidated aquifer were likely nearly equal to one another and the unconsolidated aquifer was fully saturated. There likely was little leakage between the two aquifer systems because there was no hydraulic gradient (Figure 4).

The hydraulic head of the Prairie du Chien Group was lowered in response to pumping of Chanhassen Well 2 and other pumping in the region (Figure 5). The lowering of hydraulic head in the Prairie du Chien Group caused downward leakage from the unconsolidated aquifer, with the largest rate of leakage likely taking place through the “window” in the basal till. In response to this leakage, the hydraulic head in the unconsolidated aquifer began to drop. When the hydraulic head reached the top of the unconsolidated aquifer, water that was stored in the pore spaces of the aquifer began to drain, causing dewatering of the top of the aquifer. Replenishment via recharge from the overlying till was likely minimal.

Wells 5, 6, and 11 were installed and began pumping in the unconsolidated aquifer and Well 2 continued to pump. Pumping of

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Lotus Lake Well Field, cont.

Wells 5, 6, and 11 further depleted storage in the unconsolidated aquifer and the hydraulic head dropped more (Figure 6). Regional pumping in the Prairie du Chien Group, combined with pumping of Well 2, further lowered the hydraulic head in the Prairie du Chien Group and prevented the Prairie du Chien Group from recharging the unconsolidated aquifer from below. The hydraulic head in the Prairie du Chien Group lowered to its current level near the pump intake in Well 2, resulting in a substantial drop in specific capacity of this well. The unconsolidated aquifer was now dewatered to a level where the hydraulic head

was slightly above the pump intakes for Wells 5 and 6 – these wells, then had substantially reduced capacity because there was very little available drawdown left (Figure 7). Well 11, which is about 500 feet from the other wells and is screened slightly deeper in the unconsolidated aquifer, continues to have sufficient available drawdown to operate. However, much of the unconsolidated aquifer depleted of storage. According to DNR water appropriations records, Chanhasen has pumped a total of about 4 billion gallons of water from the unconsolidated aquifer. That volume of water is about 60 percent of the available storage, which is calculated to be about 6.5 billion gallons. If there is very little recharge to replenish storage, conditions appear to be

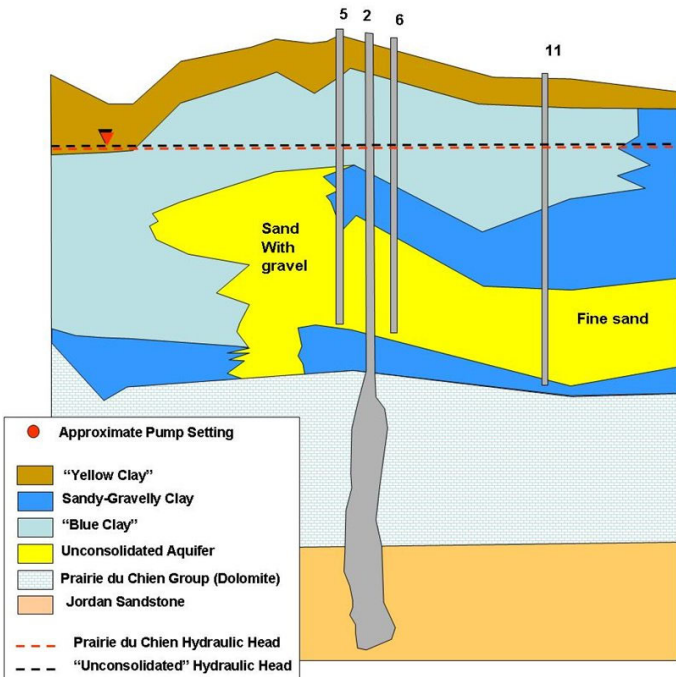


Figure 4. Pre-development ground-water flow.

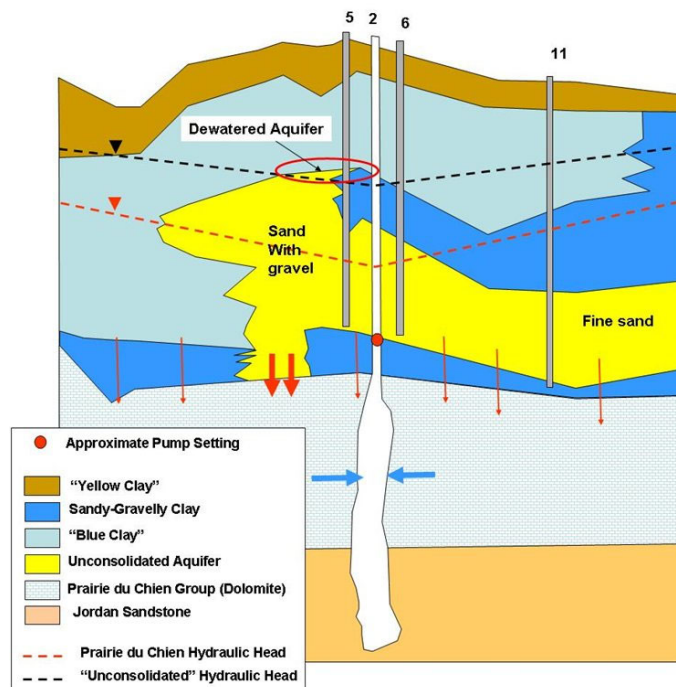


Figure 5. Ground-water flow after installation of well 2.

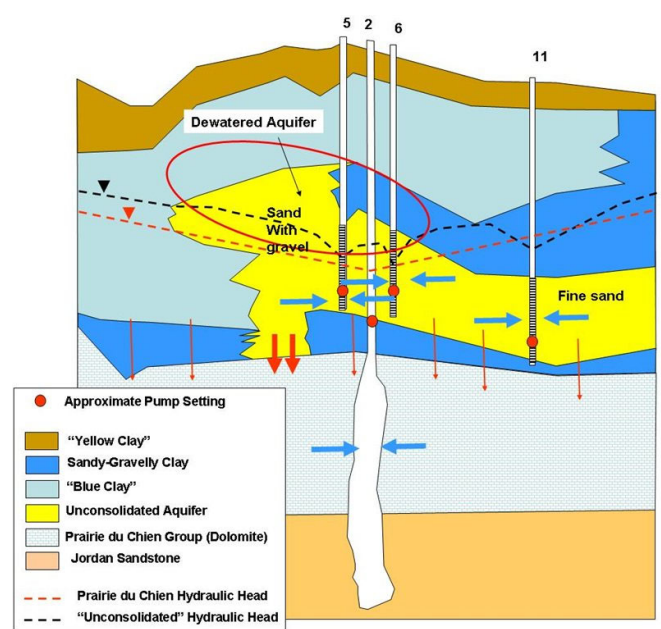


Figure 6. Ground-water flow with wells 2, 5, 6, and 11 pumping.

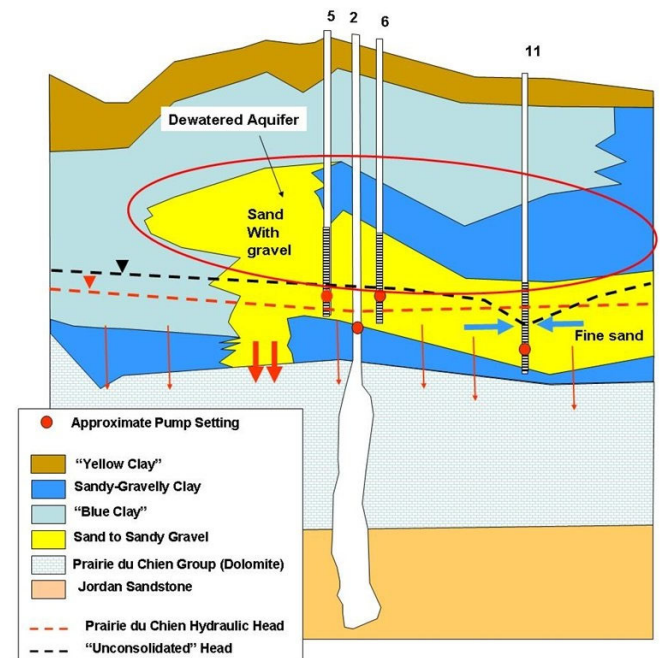


Figure 7. Current ground-water flow conditions.

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Lotus Lake Well Field, cont.

ripe for long-term well-yield problems.

What's the prognosis? In September 2007, city staff measured the static (non-pumping) water levels in the Lotus Lake well field wells and also measured changes in water levels when Well 11 was turned on and off. They found that the static water levels in all of the wells were at about the same elevation. They also found that water levels responded to cessation of pumping, but not at the level one might normally expect (i.e. only a couple feet at most). This lack of response is likely the result of unconfined conditions within the unconsolidated aquifer. Unconsolidated aquifers are slow to respond to changes in pumping because of the high values of storage.

Over the winter, water levels in the Prairie du Chien Group may rise and begin to recharge the sand and gravel aquifer from below. However, it is unlikely that the upward vertical flow into the unconsolidated aquifer will be sufficient to replenish much of the depleted storage. In spring, when demand increases, Wells 5 and 6 may be operational but only for a very short period. There is likely insufficient time during the winter to replenish storage. In fact, it would likely take many years of no pumping in the unconsolidated aquifer combined with high potentiometric levels in the Prairie du Chien Group to result in substantially resaturation of the unconsolidated aquifer. The City is moving swiftly to install two new Prairie du Chien-Jordan aquifer wells, spacing the wells sufficiently far apart from one another. They are also lowering the pump intake in Well 2 to increase the available head.

Could this situation have been foreseen? Probably not. In hindsight, more water-level monitoring of the unconsolidated aquifer may have provided an earlier indication of things to come. It is important to remember that these wells went from producing nearly 1,000 gpm each to nothing in the span of about a week as the available drawdown reached a critically low value. It's hard to get a sense of storage depletion from monitoring water levels in wells that are pumping nearly all the time. In high-transmissivity aquifers of limited extent, pumping rates can go south so quickly that well yield is not a reliable indicator of problems.

What are the lessons of the Lotus Lake well field "experience"? First, it is important to recognize that glacial drift aquifers are not easy to characterize in terms of interconnectivity and extent. It may be prudent to assume they are of very limited extent. Mapping is important because aquifer testing (even month-long testing) may not provide an indication of future storage depletion issues. It is also vitally important to understand the mechanisms by which a prospective water-supply aquifer is recharged because pumped storage must be replaced to prevent mining. Glacial drift aquifers are often hydraulically connected to underlying bedrock aquifers and pumping from both aquifers may be robbing Peter to pay Paul. We must always think in terms of aquifer systems. What happened in the Lotus Lake well field reminds us that the specific capacity of a high yielding well can drop like a stone if the potentiometric surface reaches a critically low level.

The occurrences at Lotus Lake show that we can inadvertently mine aquifers, even in the water-blessed Twin Cities. Where recharge is limited, aquifers with depleted storage may remain unusable for a generation. In the immortal words of Neil Young, "Once you're gone, you can't come back – when you're out of the blue and into the black."

Study of Point-of-Use Treatment Devices for Removal of Perfluorochemicals

By the Well Management Section, Minnesota Department of Health

Since 2004, a class of chemicals known as perfluorochemicals (PFCs) has been detected in groundwater in southwestern Washington County and northern Dakota County, affecting the communities of Cottage Grove, Lake Elmo, Newport, South St. Paul, St. Paul Park, Oakdale, and Woodbury. To date, testing by the Minnesota Department of Health (MDH) and the Minnesota Pollution Control Agency has detected one or more PFCs in 45 municipal wells and over 700 private wells. PFCs are a group of chemicals that were manufactured by the 3M Chemolite facility in Cottage Grove, beginning in the late 1940's, and utilized in a wide variety of products, including water- and stain-resistant fabric coatings (i.e. Scotchgard™), film coatings, fire-fighting foams, and non-stick products (i.e. Teflon™). Manufacturing wastes were disposed of at three sites in Lake Elmo, Oakdale, and Woodbury and at the Chemolite facility. PFCs are very mobile in groundwater, are very stable and resist degradation, and show some characteristics of bioaccumulation. The health risks of PFCs are the focus of active scientific research.

With such a widespread impact on drinking water supplies, a variety of options for providing clean drinking water are being explored. Because PFCs are such a unique group of chemicals and because testing for PFCs has only been available since 2004, there is limited information regarding the capability of existing water treatment technologies to reduce or remove PFCs. The 2007 Legislature directed the MDH to evaluate point-of-use water treatment devices for effectiveness in removing PFCs from water. The MDH issued a Request for Proposals (RFP) on July 30, 2007, seeking proposals from independent testing laboratories to evaluate a variety of point-of-use treatment devices for PFC removal. The contract was awarded to the team of Water Science & Marketing, LLC (WSM), and the Water Quality Association (WQA).

The first task was to survey manufacturers of point-of-use water treatment devices and identify those devices that the manufacturers would recommend for evaluation. Staff from MDH, the U.S. Environmental Protection Agency, WQA, and WSM reviewed the manufacturers' recommendations and selected 14 devices for bench-scale testing at the WQA testing facility in Lisle, Illinois. All water analyses are performed by the MDH Public Health Laboratory. Devices being tested include carbon filters (utilizing granular activated carbon, carbon block or other carbon media), reverse-osmosis membranes, and resins. Bench scale testing was completed by December 2007. The team then selected the eleven best-performing devices and currently is testing them in the field at two locations (an Oakdale municipal well having a mixture of PFCs and a municipal well in St. Paul Park having just one PFC – perfluorobutanoic acid). The study is expected to be completed by May 1, 2008. If you have questions about the study, please contact Tom Alvarez at (651) 201-4581 or Mike Convery at (651) 201-4586.

Strange Wells of Yesterday

By Greg Brick, Department of Geology & Geophysics, University of Minnesota

How did Minnesotans get their fix for ground water news before the Minnesota Ground Water Association Newsletter came along? Perhaps from newspapers? I spent several days going through a defunct newspaper, The West Saint Paul Times (published from 1887 to 1938) on microfilm at the Minnesota History Center for one of my research projects. Along the way, amid the eyestrain, I found entertaining references to ground water phenomena around the world, and here are a few of the more unusual. Some of the clippings below are abridged, but the original wording has been retained, and they are presented in chronological order.

FLORIDA UNDERGROUND (December 7, 1889)

"Talking about adventures in strange places," said J. S. M. Hodge, of Jonesville, as he settled himself down in a three legged chair in the office, "one year ago I had an experience that I shall not soon forget or repeat. In my neighborhood there are numbers of natural wells. These wells are round, and the walls are of rock. Some of these wells are very deep and others have no bottom.

"One year ago my neighbor, Henry Turner, lost a calf, and after searching for it a week he decided that it had fallen in one of these unused wells and came to me for assistance. I told him that the calf was dead, but consented to go down the well. Descending to the depth of about forty feet I came to what I supposed was the bottom. Becoming accustomed to the darkness, I discovered a long, horizontal cave in the rock. The lost calf had a bell, and after listening I heard the tinkling far off in the distance. Moreover it appeared to be partly submerged in water. The hunt was growing exciting, but I could not enter that dark hole, peopled with snakes by the imagination, by myself. Calling to the top, I asked that another man come down with a lantern. My brother came down, and we started on our journey through the earth. We had to crawl, for the crevice was not more than three feet high. We had proceeded about 100 yards when suddenly we came to a large cavern, which could not be measured in the darkness. Just before us was a body of water into which the calf had fallen. We managed to throw a rope around it and pull it up, and then we got out of there with all possible haste. I had no inclination to explore further, and I shudder when I think of the possible danger that surrounded us in the earth."

These natural wells are among the wonders unexplained. It is believed by many that in ages past the ground sunk in, leaving these round holes in the solid rock. Mr. Hodge used the water from one of these wells for drinking. It is sixty feet deep, and the water is cold, clear and pure.—Gainesville Record.

A WINDY WELL (February 13, 1897)

Arizona possesses some of the greatest natural wonders in the world, not the least of which is this phenomenon of a current of air issuing from or going into the bowels of the earth through sundry natural and artificial openings made in the earth's crust. Something over a year ago a Mr. Coufman undertook the drilling of a well at his place. Everything went well to a depth of some twenty-five feet, when the drill suddenly dropped some six feet and a strong current of air issued from the hole. The escaping air

current was so strong that it blew off the men's hats who were recovering the lost drill.... The air will escape from the well for days at a time with such force that pebbles the size of peas are thrown out and piled up about its mouth until it looks very much like the expanded portion of a funnel. At the same time it is accompanied by a sound much like the distant bellowing of a fog-horn.... Again, there will be for days a suction current...and any light object, as a feather, piece of paper or cloth, will, if held in close proximity, be immediately sucked into the subterranean labyrinth of Aeolus. Just the cause of this phenomenon no one has yet been able to determine, but it is supposed that there is an underground opening between the Grand Canyon of the Colorado, which cleaves the earth for more than a mile in depth, and the Sycamore Canyon, some eighty miles to the south of it, of the same proportions, but much shorter. This would seem possible from the fact that the current of air is always passing from north to south or vice versa, carrying, of course, a few points of the compass from the true meridian, but always in these general directions, as determined by experiment, and then the stratum underlying the quaternary is of volcanic cinder. This is very porous, and in many places so-called bottomless holes exist.

WELLS AS BAROMETERS (June 26, 1897)

Facts were presented at a recent meeting of the Science club of the university of Wisconsin which tend to show that the surface of the ground water in a well is much more responsive to atmospheric changes than is the barometer; and in stormy weather, according to Prof. F. H. King, "the movements of the water surface are so complex and so short a period that a rapidly moving chronograph is required to separate them." So, too, the rate of discharge of water from springs changes very greatly with variations in the pressure of the atmosphere. These facts suggest the scientific reasons for the use, which has sometimes been made in popular weather lore, of springs and wells in predicting storms.

FRESH WATER FOUND IN ROCKS (March 19, 1898)

Fluid Fit to Drink Found at a Depth of 100 Feet

In the November number of the Geographical Journal we find a communication from Sir Clements Markham, who describes how Baron Nordenskiöld reasoned out the possibility of finding fresh water by boring strong crystalline rock. Baron Nordenskiöld's idea was that by boring through the granite rocks he would strike water-bearing fissures. He therefore selected the rocky islets on the Swedish coasts which serve as pilot and light stations, and completing borings found sweeter water lying in the fissures, in the depth of 100 feet, the texture of the surface rock preventing the salt water from percolating through and commingling with the sweeter water lying in the fissures. In the same number of the Geographical Journal there is an article by M. E. A. Martel on "British Caves and Speleology." Mr. Martel describes a descent

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Ground Water History, cont.

into caves near Enniskillen, as well as other descents in Ireland, and also describes what he saw of underground rivers and lakes in Derbyshire and in Yorkshire. In the case of the Irish caves he says their flowing waters must have an outlet under the sea, as there is no other way to account for the phenomenon. We refer to these matters, as they interest cable engineers, and bear upon a paper read before the Institution of Electrical Engineers during the last session by Mr. Benest. In this paper it was stated that it was believed by some engineers that submarine telegraph cables when laid on a continental slope and in a direction more or less parallel to the coast line, were liable to interruption from the effects of an outburst of subterranean water on these slopes even in deep water. Deductions from the evidence furnished by Baron Nordenskiöld and Mr. Martel seem to increase the belief in the theory referred to in Mr. Benest's paper.

QUEER WELL IN HAWAII (October 15, 1898)

Water Rises and Falls Regularly Every Day

A most curious phenomenon has been observed in the flow of an artesian well on the Kealia plantation, Kauai, says the Hawaiian Star. The water has regular variations in its flow, being lowest at 8 o'clock in the morning, gradually rising until it attains its greatest flow at 2 o'clock in the afternoon, and then as gradually falling until 8 o'clock in the morning.... It has been suggested that this change in flow is due to the tides or to the rotation of the earth or to the influence of the sun.

A CURIOUS SALAMANDER (December 23, 1899)

Mr. Blackford writes from Washington, D.C., to Nature, of Aug. 24, giving an account of some strange discoveries in Texas. The United States fish commission bored an artesian well at its station, near San Marcos, Tex., and soon after the well was opened a number of living animals began coming up with the water. Four kinds of crustacea and a blind salamander, all of them new to science, were obtained. Two living specimens of the blind salamander were shipped by mail to the head office of the fish commission in Washington, where they excited great interest. Mr. Blackford believes that there is some great cavern or subterranean lake communicating with the artesian well.

ABUNDANT UNDERGROUND WATERS (October 10, 1903)

The earth contains an abundance of water, even in places like some of our great western plateaus, where the surface is comparatively arid, says the Mining World. The greatest depth at which underground water can exist is estimated to be about six miles. Below that, it is believed, the cavities and pores of the rock are completely closed. The amount of water in the earth's crust is reckoned at nearly one-third of that contained in the oceans, so that it would cover the whole surface of the globe to a depth of from 3,000 to 3,500 feet. The waters underground flow horizontally after sinking below the unsaturated zone of the rocks, but in the sands of the Dakota formation, which supply remarkable artesian wells, the motion does not exceed one or two miles a year. The underflow toward the sea beneath the great plains may sometimes take the form of broad streams or moving sheets of water, but the movement is excessively slow.

REPORTS AND PUBLICATIONS

Northeast Wisconsin Karst Task Force Final Report Issued

Contamination of the shallow fractured bedrock aquifer in several northeast Wisconsin counties is not a new environmental problem. Local residents have noticed color and odor changes in their well water for years. Contaminants, including coliform bacteria, E. coli and nitrate, are becoming more of an issue across a five-county area. Despite many years of educational efforts and millions of dollars spent helping municipalities, farmers and rural homeowners address the issue, the number of contaminated wells and the severity of contamination has continued to rise.

In recognition of the problem, the University of Wisconsin Extension Services and Wisconsin Geological Survey convened a karst task force to study the issue in depth and make recommendations for addressing it, including making recommendations for separation distances between sources of contamination and karst bedrock. Although the northeast Wisconsin karst is somewhat different from the karst bedrock of southeast Minnesota most of us are familiar with, many of the same issues and recommendations identified in the Wisconsin task force report are applicable in Minnesota as well. The team of scientists and local educators contributing to the report included two Minnesotans, Dr. E. Calvin Alexander of the University of Minnesota Department of Geology and Geophysics, and Jeff Green of the Minnesota Department of Natural Resources Division of Waters, Rochester office.

Here's a link to the 2007 Final Report of the Northeast Wisconsin Karst Task Force, edited by Kevin Erb and Ron Stieglitz, University of Wisconsin Extension Services:
mywebspaces.wisc.edu/kaerb/karst

MPCA Publishes Report on the Condition of Minnesota's Ground Water

Minnesota's Ground Water Condition: A Statewide View is now available electronically on the Minnesota Pollution Control Agency (MPCA) website at:

www.pca.state.mn.us/publications/wq-gw1-02.pdf

One of the goals of the MPCA's Strategic Plan is to "assess the status or condition of Minnesota's ground water systems" as part of the overall vision calling for "clean and sustainable surface and ground water systems." This report was prepared to provide MPCA managers and others with information about Minnesota's ground water and Minnesota's progress in implementing ground water condition monitoring. It refers to "condition" primarily as ground water quality, since the MPCA's mission is to monitor and protect ground water quality, however ground water quantity is also discussed on a limited basis. The report's primary author is Cathy O'Dell, a Past-President of MGWA.

MDNR Issues Final Status Report of Well Sealing on State Land

Final Status Report of Well Sealing on State Land is now available electronically on the Minnesota Department of Natural Resources (MDNR) website at:

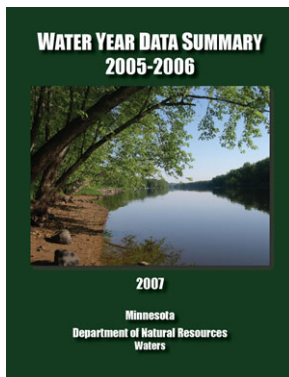
files.dnr.state.mn.us/waters/groundwater_section/wellsealing/well_sealing_final.report.pdf

A total of 1375 wells have been sealed since the well sealing program began in 1995, when the Minnesota legislature allocated bonding money to start the work, and the work was continued with additional appropriations in 1997 and 2001. Average cost to seal each well was \$1000-\$1500, but ranged as high as \$39,000. The total cost to seal all wells since the program began was \$2,522,000. For more information, contact Dan Zwilling, DNR Waters in St. Paul at 651-259-5722 or dan.zwilling@dnr.state.mn.us.

Water Year Data Summary 2005-2006

The Water Year Data Summary for 2005 and 2006 prepared by DNR Waters is now available on-line at: www.dnr.state.mn.us/publications/waters/water_year_2005-2006.html.

This publication provides a review and summary of basic hydrologic data gathered through DNR Waters programs. The report included four major areas of data collection, including climatology, surface water, ground water, and water use. These areas are arranged in order of the hydrologic cycle and important facts are provided concerning the distribution and availability of Minnesota's water resources.





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GWPC Publishes Ground Water Report to the Nation

Ground Water Report to the Nation: A Call for Action is now available electronically on the Ground Water Protection Council (GWPC) website at:

www.gwpc.org/calltoaction.

The report consists of ten sections, each of which can stand on its own as an educational resource. In addition, printable one-page color fact sheets on each of the topics can be used as handouts or in educational displays. The target audience for the report includes the general public as well as local units of government. Examples of topics covered include storm water management, on-site wastewater treatment, land use planning and development, and characterization and monitoring of ground water.

Ground Water Story Animation

Having trouble communicating with others about ground water? Finally, there is a solution for ground water scientists who just can't talk about ground water without using a lot of confusing terms and concepts. What we've really needed was a singing aquifer!

A musical animation, "The Groundwater Story", was developed by the King County (Washington) Groundwater Protection Program and is designed for kids and adults who like watching funny cartoons while learning (Figure 1). It is viewable on-line at dnr.metrokc.gov/wlr/wq/groundwater-animation.htm. You will need Macromedia Flash to view it. The ground water animation is public domain and available for use if credit to the creators is provided (available on the download web page).

The creators of the animation also used gopher characters to help tell the story so this animation is especially applicable for the home of the Minnesota Golden Gophers! For more information, contact Larry Stockton, Groundwater Protection Program Manager, King County (Washington) Department of Natural Resources and Parks, ph. 206-296-1910, laurence.stockton@kingcounty.gov.



Figure 1. Scene from "The Groundwater Story" on-line animation.

QUESTION OF THE QUARTER

Question of the Quarter!

Test your knowledge!

Learn something new!

Subsurface life: How deep is it?

The Question of the Quarter is a continuing feature of your newsletter in which a question is posed and all members are invited to respond. This month we challenge your knowledge of subsurface life in Minnesota's ground water.

How deep can microbial life be found in Minnesota ground waters?

- a) 16 inches
- b) 16 feet
- c) 16 meters
- d) 16 rods
- e) 16 kilometers
- f) 16 miles

Email your answer and your "two cents worth" to: editor@mgwa.org

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TRAINING OPPORTUNITIES

Midwest Friends of the Pleistocene

The 54th Midwest Friends of the Pleistocene Field Conference, hosted by the Illinois State Geological Survey, May 16-18, 2008, De Kalb, Illinois.

www.isgs.uiuc.edu/about-isgs/events/fop/fop-2008.shtml

Institute on Lake Superior Geology

The 54th Annual Meeting, May 6-10, 2008, Marquette, Michigan. www.lakesuperiorgeology.org

Nielsen Environmental Field School

The Nielsen Environmental Field School announced its Spring 2008 open-enrollment field course schedule, now posted on the company's web site at www.envirofieldschool.com. Field courses to be held in 3 locations across the U.S. from March through May 2008, including:

The Complete Ground-Water Monitoring Field Course

May 5-9, 2008 – Columbus, OH

Ground-Water Monitoring Well Design, Construction and Development

May 5-6, 2008 – Columbus, OH

The Complete Ground-Water Sampling Field Course

May 7-9, 2008 – Columbus, OH

The Complete Surface Water & Sediment Sampling Field Course

May 12-13, 2008 – Columbus, OH

Courses are approved for continuing education credit by many licensing/certification/registration programs across the country.

Detailed information on course content, instructor qualifications, course registration and hotel accommodations, and testimonials from hundreds of past students can be found at the company's web site. Information is also available by calling The Nielsen Environmental Field School at (575) 532-5535, or by e-mailing them at info@envirofieldschool.com.

Minnesota Rural Water Association (MRWA)

May 6, 2008 Arsenic Workshop in St. Cloud, Minnesota

Contact: Jennifer Koenig jennifer.koenig@mrwa.com



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Assessing Ground Water Movement and Contaminant Migration Through Aquitards

From Investigative Techniques to Hydrogeologic Characterization

May 6, 7, 8, 2008

Location:

Northern Illinois Univ. Extension
- Naperville, Illinois

with field components at:
Fermi National Accelerator Laboratory
(Fermilab)

Instructors:

Ken Bradbury, PhD, PG
Wisconsin Geological & Natural History Survey

Paul Kesich
Fermi National Accelerator Laboratory

Dave Hart, PhD, PG
Wisconsin Geological & Natural History Survey

Madeline Gotkowitz
Wisconsin Geological & Natural History Survey

Mark Adamski, PG
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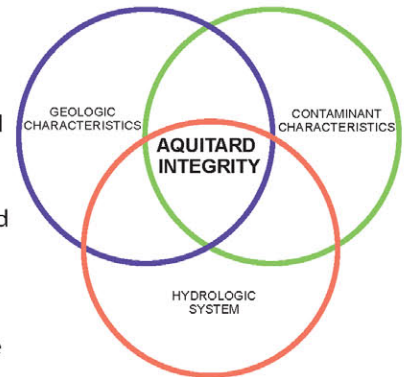


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Aquitards (low-hydraulic conductivity hydrogeologic units) are critically important to groundwater and contaminant movement. Characterizing aquitards for environmental and water resource projects is important for protecting deep aquifers and understanding potential contaminant pathways for previously impacted aquifers. Both unconsolidated and bedrock aquitards share inherent low hydraulic conductivities, but approaches and field methods for characterizing each type can be completely different. Appropriate characterization requires site-specific understanding about the aquitard's origin, unit distribution, heterogeneity, fracturing, and the effects of secondary weathering or tectonics. From basic hydraulics to comprehensive fracture analysis, this course addresses the practical aspects of comprehensive analysis applied to **environmental, engineering and water resources projects**.



Learn Up-To-Date Methods for Investigating & Characterizing Aquitards

- Improve your characterization of ground water movement & contaminant migration through aquitards by gaining a better understanding of aquitard hydraulics, vertical seepage, confining conditions and more
- Discover the importance of differentiating a sequence of low hydraulic conductivity units
- Discover new techniques and field instrumentation for monitoring aquitards
- Compare water sampling and slug test procedures in low hydraulic conductivity units
- Identify and characterize fractures from an angle boring using continuous rotasonic sampling
- Examine a regional bedrock aquitard and understand fracture distribution and mapping
- Explore new approaches for ground water and solute transport modeling in aquitards
- Gain better understanding about petroleum contamination in weathering zones within fine-grained sediments
- Understand the potential for pathogenic virus contamination in deep aquifers thought to be protected by overlying aquitards

Fractures in Aquitards Workshop: Professionals use a variety of techniques to identify and characterize fractures, macropores, and other discontinuities in aquitards. Share your successes and ideas during a special workshop session.

(It was) an exceptional course and top-notch group of instructors. The tools provided and the skills I learned will be a major contribution towards solving problems in low permeability formations. Thanks again and I look forward to future courses.

- Bradley D. Nordberg, Sr. Hydrogeologist, Minnesota Pollution Control Agency

REGISTRATION FORM

Assessing Ground Water Movement
and Contaminant Migration Through Aquitards:
From Investigative Techniques to Hydrogeologic Characterization
May 6, 7, 8, 2008

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CALENDAR

Regional and Local Events

April 24-25, 2008

GSA North-Central Section Meeting, Evansville, Indiana, Information: www.geosociety.org

May 8, 2008

Minnesota Ground Water Association Spring Conference, University of Minnesota Continuing Education and Conference Center, Information: www.mgwa.org/meetings/index.html

September 20-24, 2008

AIPG 45th Annual Meeting, Flagstaff Arizona. Changing Waterscapes and Water Ethics for the 21st Century. Abstracts due by April 15. Website: www.aipg.org

September 29-October 2, 2008

53rd Annual Midwest Ground Water Conference, Grand River Center Dubuque, Iowa. Abstracts due June 6, 2008. Website: www.igwa.org

October 27-28, 2008

2008 Minnesota Water Resources Conference Rivercentre, St. Paul. Information is posted at: wrc.umn.edu/waterconf/index.html

November 13, 2008

MGWA Fall Conference

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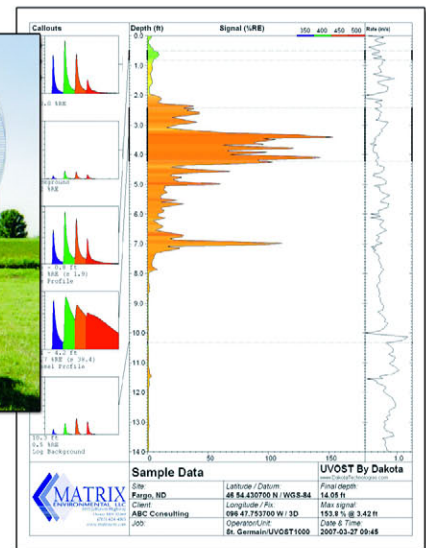
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Guidelines for Submission of Newsletter Articles

The newsletter team appreciates the efforts of article contributors, without whom our newsletter would not be possible. To make the process easier on the author, the newsletter team and production staff, we have established some guidelines we would like authors to follow. For a complete list of guidelines, please see the MGWA web site:

- ◆ Submittals should be complete and ready for publication.
- ◆ The text of the article should be submitted as a Microsoft Word document in an attachment to an e-mail or on disk.
- ◆ Tables, captions, figures and graphics should be submitted as separate high quality files.
- ◆ A version of the article with embedded tables, figures, and graphics may be submitted as an additional file to indicate the preferred layout of the tables, figures and graphics within the article.
- ◆ The contributor should include the contributor's name and affiliation following "By" below the title of the article.
- ◆ The contributor should secure permission to print or reprint if applicable and provide the required text to be included with the article.
- ◆ Materials should be submitted before the deadline.
- ◆ If there is any question about the suitability of a proposed article's content for the MGWA newsletter, it is advisable for the contributor to call the editor before investing significant time in article preparation.

**Eric Tollefsrud
Joins
Newsletter Team
see article on page 5**

MGWA 2008 Newsletter Advertising Policy

Advertising Rates to Increase in MGWA Newsletter

The MGWA Board has voted to increase advertising rates for display ads in the MGWA Newsletter beginning with the March 2008 issue. The increase is due to increasing costs for the production and publication of the newsletter. The new rates are for four issues and will be as indicated below. Advertisers provide significant support in the publication of this newsletter. With their support we are able to produce a higher quality newsletter of which we can all be proud. The MGWA Board has also voted to increase advertising rates in the MGWA Directory as indicated below.

Display ads:

Size	Inches Horiz. x Vert.	Quarterly Newsletter 4 issues	Membership Directory 2 issues
Business Card	3.5 x 2.3 or 1.9 x 3.5	\$100	\$50
Quarter Page	3.5 x 4.8 or 5.4 x 3.5	\$150	\$100
Half Page	7.5 x 4.8	\$250	\$200
Full Page	7.5 x 9.75	\$500	\$400
Inside Cover	7.5 x 9.75	not available	\$500

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There are no commissions on ads. Advertising copy must be received by the publication deadlines as published in the newsletter. Advertisers should submit material as a digital file in TIFF, GIF, JPEG or PCX format at 300 to 600 dpi.

Please make checks payable to "Minnesota Ground Water Association" or "MGWA." Direct your orders and questions concerning advertising rates to Jim Aiken, Advertising Manager, c/o MGWA, 4779 126th Street, White Bear Lake MN 55110-5910; (952)832-2740; jaiken@barr.com. The complete advertising policy is available on the MGWA web site at www.mgwa.org/newsletter/adrates.html.

Questions concerning advertising policy should be directed to the MGWA President.

Join the Minnesota Ground Water Association!

If you are reading this newsletter secondhand, we'd like to take this opportunity to invite you to become a member of MGWA for 2008. Annual dues are \$30 for professional members and \$15 for students (for corporate membership, see www.mgwa.org).

Members receive e-mail notice of the availability of the quarterly newsletter for downloading from the MGWA web site. If desired, members may subscribe to a printed edition of the newsletter (4 issues for \$10).

Members are also entitled to purchase a paper copy of the annual membership directory for \$7; an electronic version will be available on the website for paid members.

Tax deductible contributions to the MGWA Foundation scholarship fund will be gratefully accepted.

Dues paid to MGWA are **not** deductible as charitable contributions for federal income tax purposes. However, dues payments are deductible as ordinary and necessary business expenses to the extent allowed by law.

Just complete the form below and mail to: MGWA, c/o WRI, 4779 126th St. N, White Bear Lake, MN 55110-5910 or visit our web page and join on-line at www.mgwa.org.

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**MGWA Foundation
Grant Request Deadlines
are quarterly:
March 1
June 1
September 1
December 1**

MGWA FOUNDATION NEWS

2007 Metro Children's Water Festival Once Again is a Big Success

A great thank you to everyone who contributed to the huge success of the 2007 Metro Children's Water Festival (CWF), held September 26, 2007. This year's program provided a great environment for about 1300 fifth graders to learn how "Water Connects Everyone and Everything on Earth". The weather was the best we've had in years, the presenters were enthused, the students were engaged, and the volunteers were in high spirits. You can stay in touch with past and upcoming CWF activities by checking the website at www.metrocwf.org

Editor's note: This message was received from John Bilotta, Regional Extension Educator for the University of Minnesota and one of the organizers of the CWF. The MGWA Foundation contributed \$1000 to help fund the day's activities.

Minnesota Ground Water Association Foundation Board Meeting Minutes

Meeting Date: Tuesday, December 18, 2007
Location: Opus Corporation, Minnetonka
From: Cathy Villas-Horns (Secretary)
Members Present: David Liverseed, Gilbert Gabanski, Amanda Goebel, Christopher Elvrum, Dale Setterholm and Cathy Villas-Horns
MGWA Management Present: Jeanette Leete and Sean Hunt

Review of Minutes The meeting minutes for the September 11, 2007 meeting were approved and provided via e-mail to the MGWAF Board and the MGWA Newsletter staff on October 3, 2007.

Treasurer's Report Foundation balance to date is \$77,291.07. The MGWAF Quarterly Financial Report was provided at the meeting by Dave. Interest in the amount of \$907.58 was accrued since 9/11/07. This interest was swept into the endowment. The MGWAF received a total of \$371 as donations to the 25th Anniversary Newsletter of the MGWA as well as a \$100 unspecified donation. The registration fees for two students were paid for by the MGWAF for the fall 2007 conference.

Old Business Highlights of MGWA Board meeting from Dale: Positive feedback was received from attendees of the MGWA fall 2007 conference. Gretchen Sabel of the MPCA recommended more educational outreach on ground water be provided to the legislature. She will be attending the next MGWA Board meeting to discuss this. Gil stated that Susan Thornton of the LCCMR staff encouraged MGWA to do another educational tour and to include all those serving on the LCCMR. Chris stated that his group will be doing a tour of the St. Paul water plant for the MN Senate Finance Committee to provide information on the new connection project for the Minneapolis and St. Paul water supplies.
Bylaws update: The bylaws for both the MGWA and the MGWAF are being revised and are nearly done. Once the MGWAF bylaws are in final draft form Gil will send them out for MGWAF board review. Gil also thanked Dale Setterholm for his excellent service in 2007 as the MGWA liaison to the MGWAF Board.

New Business Grant Request – A request for \$3,889.02 for a replacement hand pump and associated materials, labor and benefits for an exhibit prototyper was received from the Science Museum of Minnesota (SMM). One of the hand pumps at the outdoor ground water exhibit was broken by museum visitors this past summer. Gil stated that he is doing additional research on this proposal and recommended that the board not vote on it until this information is received. Motion was made by Chris to table the request, seconded by Dave. Motion passed.
SMM GW Exhibit – Chris and Gil met with SMM staff. The SMM staff is very appreciative and thankful to the MGWA for its support in the ground water exhibit. They are collaborating with the American Museum of Natural History in NYC on the Water Planet exhibit, and were given an additional \$50,000 from the National Ground Water Association in support of this larger, traveling exhibit. Chris and Lanya Ross of the Met Council are meeting with SMM staff on a 3-D ground water display. The Met Council would also like to put together a 3-D visualization of the metropolitan ground water system which could be part of the Water Planet exhibit when it is shown in St. Paul. This visualization could then return to the Met Council for their use after the Water Planet exhibit moves on.
MGWAF Scholarship – The current endowment for an MGWAF scholarship is at \$68,628.38. If future additions to the endowment keep pace with past additions, it is likely that the scholarship goal of \$100,000 can be achieved in three years. Fund raising options were also discussed, but no action was taken by the Board.

Next Meeting The next meeting will be March 11, 2008 at 11:30 AM at the Metro 94 building.

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BYLAWS REVISION

MGWA Bylaws revised and will need membership approval

In 2006, the Board had decided that some revisions of the Bylaws would be appropriate. Bylaws should reflect how the business of the organization is really conducted. Since the last Bylaws revisions in 1999, MGWA has among other activities formed its own Foundation. Under our current Bylaws, changes to the Bylaws must be considered upon receipt of a petition signed by at least 10% of the members, which was accomplished during the Fall 2006 MGWA Conference.

With the signed petition, the Board directed a workgroup comprised of the 2006 MGWA Past President (Laurel Reeves), President (Dale Setterholm), President Elect (Jeff Stoner), and the MGWA Foundation President (Gil Gabanski). This group was charged to draft revised Bylaws and put the proposed changes before the membership for a vote by a majority of the ballots cast.

In addition to minor corrections, clarifications, definitions, and rearranging, the workgroup attempted to address the following substantive changes:

- 1) add two membership types, corporate and retiree, which have been created by the Board;
- 2) change the requirement for membership meetings from every three years to as necessary;
- 3) define the Board's quorum;
- 4) add specific duties for the Past President and the President-Elect;
- 5) volunteer positions that were termed Non-elected Officers will be called Appointed Officials when referred to in the Bylaws and they will no longer have tie-breaking votes at meetings of the MGWA Board;
- 6) delete the Executive Committee option;
- 7) add the option for the Board to propose amendments to the Bylaws as well as the membership;
- 8) define the method to decide on dissolution of the organization.
- 9) correct the statement of operational limitations to accurately represent the limits that apply to a tax-exempt 501(c)(4) organization such as the Minnesota Ground Water Association.

The Board recently approved the posting of the revised Bylaws in this issue of the Newsletter and on the MGWA Web page. Members are encouraged to read the proposed revised Bylaws and to cast their recommendation for approval. The ballots will be forthcoming in one of two methods; (1) if your membership record contains an email address, you will be sent an electronic ballot at that address. (2) those without email addresses in the MGWA database will be sent a paper ballot in the mail to be completed and returned to MGWA.

The revised Bylaws are published both here in the newsletter and on the MGWA web page.

Minnesota Ground Water Association Proposed Bylaws

Article I Name

- Section 1. This Organization shall be known as the "Minnesota Ground Water Association" hereinafter referred to as MGWA, organized under Minnesota Statute 317A as a non-profit corporation and recognized as tax exempt by the Internal Revenue Service (IRS) under IRC 501(c)(4).
- Section 2. The newsletter is the official publication of the MGWA.

Article II Objectives and Purposes

The primary objectives of the Association are:

- (a) Promotion and encouragement of the scientific and public policy aspects of ground water;
- (b) Establishing a common forum for scientists, engineers, planners, educators, attorneys, policy-makers and other persons concerned with ground water;
- (c) Education of the general public regarding ground water resources;
- (d) Dissemination of information on ground water through meetings of the membership, newsletters, and participation in any other activities not enumerated herein that are designed to encourage the exchange of information relating to ground water resources.

Article III Members and Meetings

- Section 1. Membership shall be open to all persons who have an interest in ground water resources.
- Section 2. Condition of membership shall be payment of annual dues as prescribed by the Board.
- Section 3. Membership is on a calendar year basis. The board may authorize partial-year rates for members who join after June 30.
- Section 4. A member-in-good standing is one whose dues are paid for that year.
- Section 5. There are four types of memberships:
(a) professional;
(b) student;
(c) corporate;
(d) retiree.
- Section 6. The Board may determine additional membership categories of which the required dues payment differs from that for regular members.
- Section 7. Membership meetings shall be called, as deemed necessary by the Board.
- Section 8. A quorum shall mean those members in good standing attending any publicized meeting.

Article IV. Board of Directors

- Section 1. Board of Directors (Board). The Board shall consist of the five elected officers.
- Section 2. Election
a) The Board shall annually appoint a Nomination Committee to prepare a slate of candidates for officers. The slate shall be announced by electronic communication and in the fourth quarter edition of the newsletter. Additional nominations from the membership, may be made following announcement of the slate. Nominees must agree to serve if elected. Elections of officers shall be by a mail or electronic communication ballot completed before December 31. The

— continued on page 33

outcome of the election shall be announced at the next board meeting and in the next regular edition of the newsletter following the election. Those candidates who receive a simple majority of ballots for each position shall be declared elected. Ties shall be decided by a majority vote of the Board. New Board members shall take office at a subsequent meeting designated by the Board, but no later than four (4) months after the election

b) Elections for President are held annually, elections for Secretary/Membership Chair and Treasurer are held in alternate years.

Section 3. Meetings

a) The regular business meetings of the Board may be attended by any member in good standing.
b) The Board shall meet as often as it deems necessary for efficient operation of MGWA, but at least once a year.

Section 4. "Approved" or "approval by the Board"

- "Approved" or "approval by the Board" shall mean a majority of Board members voting.

Section 5. Quorum - The Quorum shall be a majority (3) of the Board.

Article V. Officers

Section 1. Number of Officers - The officers of this corporation shall be a President, President Elect, Past President, Secretary/Membership Chairman, and Treasurer.

Section 2. Terms - Officers may serve more than one term. The term of President shall have duration of three years. The first year of a President's term is served as President-Elect, the second as President, and the third as Past-President. Terms of Secretary/Membership Chair and Treasurer have duration of two years. Officers shall serve in their positions until the next officer for the position is elected.

Section 3. Past President - The Past President:

a) shall serve as the MGWA Liaison to the MGWA Foundation Board; and
b) may be assigned other responsibilities as directed by the Board.

Section 4. President - The President:

a) shall call and conduct meetings of the Board and of MGWA;
b) shall be the primary operating officer of MGWA.

Section 5. President Elect - The President-Elect:

a) shall perform the presidential duties in the absence of the President,
b) shall chair the Nomination Committee;
c) shall oversee coordination of field trips;
d) may be assigned other responsibilities as directed by the Board.

Section 6. Secretary/Membership Chair - The Secretary/Membership Chair:

a) shall keep and report the minutes of the Board and of MGWA;
b) shall keep and report to the Minnesota Secretary of State any revisions or changes in the Articles of Incorporation;
c) shall keep a list of property belonging to MGWA, and shall keep all books of correspondence, and papers relating to the business of the corporation (except those of the Treasurer);
d) shall also keep an active membership list, and;
e) shall keep a list of prospective members to be included in subsequent mailings.

Section 7. Treasurer - The Treasurer:

a) shall maintain the accounts of MGWA including: all financial transactions, dues information, tax statements, necessary reports to the IRS and the Minnesota Department of Revenue, and funding information, and;
b) shall present a financial report at each meeting of the Board and of the Association.

Section 8. Other duties - All officers shall be responsible for such other duties as the Board may prescribe.

Section 9. Vacancies - Vacancies on the Board shall be filled as follows:

low:

(a) President: The President-Elect shall become President should the position become vacant.

(b) Other vacancies on the Board shall be filled by appointment by the President with approval of the Board at its next regular meeting. The appointment of the new officer shall be announced in the next regular newsletter.

(c) The term of appointed officer(s) shall be limited to the unexpired term of the vacated position.

Section 10. Removal and resignation - Any officer may be removed from the Board by an affirmative vote of the majority of directors present at an official meeting of the Board. Notice of the proposed removal will be given to members with the notice of the meeting. The officer involved will be given an opportunity to be present and be heard at the meeting at which his or her removal is considered.

Article VI Committees and Appointed Officials

Section 1. Committee Appointment - The Board is empowered to appoint from among the members of MGWA such committees as it considers necessary to conduct any phases of MGWA business.

Section 2. Appointed officials include, but are not limited to the Newsletter Editor, Advertising Manager, and Executive Manager. Appointed officials shall attend meetings of the Board, as needed.

a) The Newsletter Editor shall coordinate and oversee preparation of the newsletter.
b) The Advertising Manager shall coordinate advertising in the MGWA newsletter.
c) The Executive Manager may be appointed annually by the Board with the duties defined by the Board.

Article VII Fiscal Year

Section 1. Fiscal Year of the Corporation. The fiscal year of the corporation shall begin on the first day of January and end on the last day of December in each year.

Article VIII. Management and Finances

Section 1. The business and property of MGWA shall be managed by the Board.

Section 2. The operating funds of MGWA shall be derived from annual dues, any residual funds arising from advertisements, sales of products and publications, sponsored meetings, and from grants, contributions, and endowments.

Section 3. The President and/or Treasurer are empowered to expend funds of MGWA to an extent, and for purposes, approved by the Board.

Section 4. The Board may contract for professional business management assistance for services. Specific functions of and all actions of such professional management assistance or services shall be directed by and performed under the direction of the Board in order that actions of the professional management always reflect the goals of MGWA.

Section 5. Any duality or conflict of interest on the part of any officer, appointed official or committee member of the MGWA shall be disclosed to the Board, and made a matter of record through an annual disclosure procedure and also when the interest becomes a matter of Committee or Board action. Any officer, appointed official or committee member having a duality or conflict of interest shall not vote nor use his or her personal influence on the matter, and she or he shall not be counted in determining the quorum for the meeting. The minutes of the meeting shall reflect that a disclosure was made, the abstention from voting, and the quorum situation. Any new officer, appointed official or committee member will be advised of this policy upon entering the duties of his

— continued on page 34

or her position.

Article IX. Affiliation

Cooperation or affiliation with other organizations may be arranged by the Board as deemed consistent with the objectives and interests of MGWA.

Article X. Amendments

Section 1. Amendment by the Board.

- a) The Board shall have power to resolve to make, alter, amend, and repeal the Bylaws of the corporation by affirmative vote of a majority of the Board.
- b) The Board must present the proposed resolution(s) to the membership for approval. The proposed resolution(s) shall be published in the next regular edition of the newsletter and ballots shall be distributed to all members within 90 days of publication to vote on the proposed resolution(s). Ballots must be returned to MGWA within 30 days of distribution to be counted.
- c) If the proposed resolution(s) is (are) approved by a majority of ballots cast by members of MGWA, the bylaws shall be so amended, adopted or repealed.

Section 2. Amendment by the Members

- a) By petition to the Board signed by at least 50 members or 10 percent of current members in good standing, whichever is less, members may propose a resolution to adopt, amend, or repeal bylaws adopted, amended, or repealed by the Board. The resolution must contain the provisions proposed for adoption, amendment, or repeal.
- b) After a valid petition is received by the Board, the Board must present the proposed resolution(s) to the membership for approval. The proposed resolution(s) shall be published in the next regular edition of the newsletter and ballots shall be distributed to all members within 90 days of publication to vote on the proposed resolution. Ballots must be returned to MGWA within 30 days of distribution to be counted.
- c) If the proposed resolution is approved by a majority of ballots cast by members of MGWA, the bylaws shall be so amended, adopted or repealed.

Article XI. Nonprofit

Section 1. The Association shall not afford pecuniary gain, incidentally or otherwise, to its members. No part of the net earnings of MGWA shall inure to the benefit of, or be distributable to members, officers, or other private persons except that MGWA shall be authorized and empowered to pay reasonable compensation for services rendered and to make payments and distributions in furtherance of its purposes in accordance with its status as a community organization.

Section 2. The Association shall not participate in or intervene in (including the publishing or distribution of statements) any political campaign on behalf of any candidate for public office.

Article XII. Operational Limitations

Notwithstanding any other provision of these articles, the organization shall not carry on any other activities not permitted to be carried on by an organization exempt from Federal or Minnesota Income Tax under section 501(c)(4) of the Internal Revenue Code.

Article XIII. Dissolution Clause

Section 1. MGWA may be dissolved at any time by the written consent of not less than 2/3 of the voting members.

Section 2. Upon the dissolution of MGWA, the Board shall, after paying or making provisions for the payment of all of the liabilities of the organization, dispose of all of assets of the organization exclusively for the purposes of the Association

in such a manner, or to such organization or organizations organized and operated exclusively for charitable, educational, or scientific purposes as shall at the time qualify as an exempt organization or organizations under Section 501(c)(3) of the Internal Revenue Code of 1986 (or the corresponding provision of any future Minnesota or future United States Internal Revenue Law), as the Board shall determine.

Article XIV. Indemnification

Section 1. In accordance with Minnesota Statutes Chapter 317A, directors, officers, or agents who serve without compensation are not civilly liable for acts or omissions if the act or omission was in good faith, was within the scope of the person's responsibilities as a director, officer or agent, and did not constitute willful or reckless misconduct.

Section 2. The MGWA shall, to the fullest extent permitted by Minnesota law, indemnify a person made or threatened to be made a party to a proceeding by reason of the former or present official capacity of the person against judgments, penalties, fines, including settlements, and reasonable expenses, including attorney's fees and disbursements, incurred by the person in connection with the proceeding, if, with respect to the acts or omissions of the person complained of in the proceeding, the person:

- a) has not been indemnified by another organization for the same liability described in the preceding paragraph with respect to the same acts or omissions;
- b) acted in good faith;
- c) received no improper personal benefit as a result of a conflict or duality of interest;
- d) in the case of a criminal proceeding, did not have reasonable cause to believe the conduct was unlawful; and
- e) reasonably believed that the conduct was in the best interests of the MGWA.

Revised and Referred to the Membership for Approval



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CALL FOR ABSTRACTS

53rd Annual

Midwest Ground Water Conference

September 29-October 2, 2008

Grand River Center, Dubuque, Iowa

ABSTRACT GUIDELINES:

Abstracts must be submitted electronically via either e-mail (Paul.VanDorpe@dnr.iowa.gov or Chad.Fields@dnr.iowa.gov) or CD (2008 Midwest Ground Water Conference, Iowa Geological and Water Survey, 109 Trowbridge Hall, Iowa City, IA 52242-1319). (The use of diagrams, charts, tables, and figures is discouraged.) Abstracts must be submitted by June 6, 2008. Indicate whether this is an oral or poster presentation.

SUGGESTED TOPICS:

- ground water quantity
- ground water quality
- ground water supply and sustainability issues
- ground water modeling
- ground water contamination from point or nonpoint sources
- ground water/surface water interactions
- ground water/vegetation relationships
- wetlands
- recharge
- karst
- information management
- mapping
- global ground water supply issues
- rules & regulations
- public and private wells, well permitting
- well construction, development and sampling
- geothermal wells and related issues
- ethanol water use issues
- wellhead/source water protection

HIGHLIGHTS:

Iowa Groundwater Association sponsored Karst Tour of Northeast Iowa
Mississippi River dinner cruise on a paddle boat
National Mississippi River Museum and Aquarium

CEUs will be applied for Iowa well contractor certification, Iowa groundwater professionals, and Iowa water operators.

MGWA BOARD MINUTES

Minnesota Ground Water Association Board Meeting Minutes Regular Monthly Meetings

The MGWA Board of Directors meets once a month.

All members are welcome to attend and observe.

Meeting Date	October 25, 2007
Place	Fresh Grounds, 1362 West 7th Street, St. Paul, Minnesota
Attending	Jeff Stoner, President; Stu Grubb, President Elect; Craig Kurtz, Treasurer; Jon Pollock, Secretary; Norm Mofjeld, Newsletter Editor; Sean Hunt, WRI; Jennie Leete, WRI.
Treasury	Treasurer received letter from IRS dated October 12, 2007, indicating that penalty for late filing has been removed. Checking/savings balance of \$25,555.82. Net income of \$9834.28.
Foundation	No Report
Newsletter	September issue is out
Web Page	Conference Announcement, on-line ordering, selection of foods for dinner at conference, Fox 9 news and science, southeast Minnesota flooding tour, MGWA 25th anniversary funding opportunity.
WRI Report	Report handed out. Number of people signed up for conference is on target. Registration reminder to be sent out October 31, 2007.
Old Business	<u>MGWA 25th Anniversary Publication</u> : Copies made for advertisers and for people who have paid for hard copies. Motion to authorize WRI to print up to 250 copies of the MGWA 25th Anniversary publication at approximately \$15.00 per copy. Motion carried.
New Business	<u>Fall Conference</u> : Logistics and who will be helping with what tasks at the conference. <u>MGWA Board Openings</u> : President Elect working on finding candidates for positions opening in 2008 (Secretary and President). The Secretary position is a two-year term and the President position is a three-year term. Current Secretary has agreed to run again. <u>Use of MGWA Logo</u> : Motion to allow baker to use MGWA logo on the MGWA 25th Anniversary cake. Motion carried. Secretary to authorize use of logo on the cake.
Next Meeting	November 15, 2007 at Fresh Grounds at 1362 West 7th Street, St. Paul, Minnesota.
Meeting Date	November 15, 2007
Place	Fresh Grounds, 1362 West 7th Street, St. Paul, Minnesota
Attending	Jeff Stoner, President; Stu Grubb, President Elect; Dale Setterholm, Past President; Jon Pollock, Secretary; Sean Hunt, WRI; Jennie Leete, WRI.
Treasury	Report was handed out. Checking/savings balance of \$24,124.19. Net income of \$11,003.68.
Foundation	No Report
Web Page	Utilization of web resources for conference, newsletter completed, but very large.
WRI Report	Worked on newsletter layout and printing. Drove to Eagan to pickup newsletter for distribution at conference. Need to address corporate renewals. May want to think about not sending out election ballots due to cost. Postage for mailing the ballots approximately \$630.00, copying costs approximately \$250.00, and labor cost of approximately \$700.00. Discussion of various voting methods, including printed ballots from WRI, printed ballots from third party entities, and electronic voting methods to save money, yet provide privacy, and keep the integrity of the voting process. Looking at experimenting with electronic voting methods this election with members without email addresses receiving ballots in the mail.
Old Business	<u>Election</u> : Will need information on candidates. President Elect will get information from the candidate for President. WRI already has information on candidate for Secretary. <u>Minnesota Association of Watershed Districts</u> : President Elect will set up MGWA display at their conference, which is on November 30, 31, and December 1, 2007. President Elect handed out a draft handout for conference noting that he will be updating the display.
New Business	<u>Fall Conference</u> : Fall conference feedback looks very good. Motion to approve up to \$400.00 for awards awarded at the 2007 MGWA Fall Conference for the newsletter team and individuals contributing greater than five years of service to the organization, valued at less than \$30.00 per recipient. Motion passed unanimously. <u>Education</u> : One of the MGWA members has expressed interest in getting groundwater information to legislators. President will invite the interested member to our next board meeting in December to see what they have in mind. The President has expressed interest in reaching out to college students.
Next Meeting	December 20, 2007, at 1130 at Fresh Grounds at 1362 West 7th Street, St. Paul, Minnesota. Meeting adjourned at 1241.

**Send your comments to
editor@mgwa.org**

Minnesota Ground Water Association Board Meeting Minutes, cont.

Meeting Date	December 21, 2007
Place	Fresh Grounds, 1362 West 7th Street, St. Paul, Minnesota
Attending	Jeff Stoner, President; Stu Grubb, President Elect; Dale Setterholm, Past President; Craig Kurtz, Treasurer; Jon Pollock, Secretary; Sean Hunt, WRI; Jennie Leete, WRI; Gretchen Sabel, MGWA Member; Susan Thornton, LCCMR (Legislative-Citizen Commission on Minnesota Resources) Staff.
Treasury	The checking/savings balance was reported as \$17, 053.00. \$19,170.00 in dues this year, down about \$800.00 from last year. \$3448.00 in adds this year, up about \$650.00 from last year. \$54,600.00 in programs and conferences. Gross revenue of \$78,252.00. Net income of \$5521.00.
Foundation	No Report
Web Page	Updates for employment, notice of newsletter on-line, two versions of newsletter on line (different sizes to accommodate different speeds), updated directory, using web page for membership renewals. Need calendar items for 2008.
WRI Report	Report handed out. Recorded financial transactions and sent information soliciting contributions along with dues notice for the MGWA Foundation. Worked on fall conference items, dues billing, processing of conference payments, newsletter, and researched ballot options for the MGWA.
Old Business	<u>Election:</u> WRI found free website to conduct electronic election for MGWA offices up for re-election. Approximately 132 ballots received thus far, which is about double the usual return. Voting ends at end of year. <u>Minnesota Association of Watershed Districts:</u> President Elect set up updated MGWA display at their 2007 conference. Location of display at conference was in a low traffic area. Not a lot of interest in groundwater among the attendees. <u>Minnesota Environmental Partnership:</u> MGWA is currently a member. Discussed if MGWA should pay dues to remain a member. Current President indicated that former MGWA President Laurel Reeves and he are interested in remaining a member at the \$100.00 per year level rather than the \$250.00 level. Group has two lobbyists and can lobby very strongly on a number of issues. Motion made by Secretary: The MGWA will join the Minnesota Environmental Partnership for another year at the associate member level of \$100.00 per year. Motion carried.

Members can access the current year's newsletters in the 'Members Only' area of the web page.

The user name is mgwa and the password is emailed to members with each announcement of newsletter availability.

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Minnesota Ground Water Association Board Meeting Minutes, cont.

Old Business	<p><u>Fall Conference:</u> Comments from members on conference have not yet been typed, but may be ready for next meeting.</p> <p><u>Bylaws:</u> Committee looking into updating the MGWA bylaws (Jeff Stoner, Dale Setterholm, Laurel Reeves, and Gil Gabanski) has finished their task and the Past President has submitted the revised bylaws, indicating that there are no major changes; however, the current bylaws do not accurately reflect the way the organization is operated. Board members will review the bylaw changes and vote on whether to adopt the changes and present the revised bylaws to the membership for approval.</p>
New Business	<p><u>LCCMR:</u> Gretchen outlined past MGWA activities at the state capitol noting that she is interested in having the MGWA provide input to legislators. Discussed field trip for legislators arranged by Dale. Susan indicated that such trips are a very good way of educating legislators. Susan noted that shoreline rights are currently a big issue. Dale indicated that MGWA did not receive any feedback on field trip and that we do not have pre-planned presentations. Dale indicated that:</p> <ol style="list-style-type: none"> 1) He believes more is accomplished in informal meetings, such as on the bus during the field trip, 2) We should get used to repeating ourselves to drive home the points we are making, and 3) he inquired whether legislators would like groundwater professionals to visit them in their offices to discuss groundwater issues in their areas. Susan indicated that we should stress what we do know and what we do not know, because it is sometimes assumed that we know more than we actually do and that LCCMR will be coming to the MGWA with questions. Stu noted that the day at the capitol was not a big success and that field trips for groundwater can be difficult since there is not often a lot to see. Jennie noted that the field trip arranged by Dale worked well with the LCCMR handling lunch, transportation, and other administrative issues and MGWA handling technical issues. Gretchen asked Stu to contact members of the MGWA Education Committee to inform them of what we are doing. Stu agreed to be the LCCMR's contact for the MGWA. <p><u>Price for Remaining Portfolios:</u> Approximately 40 portfolios remaining from fall conference. WRI indicated the portfolios cost \$14.33 each and that we need to set a cost for them that includes taxes and shipping. Secretary made motion: Portfolios remaining from the 2007 MGWA Fall Conference will be sold on the web page for \$25.00 to cover the cost, taxes, and shipping. Motion passed. <i>Note: At the next conference portfolios will be sold for \$20 plus sales tax - no shipping nor packaging needed.</i></p>
Next Meeting	January 18, 2007. Meeting adjourned at 1251.

**Don't forget:
Professional Geologist
license requirements
include continuing
education.**

Meeting Date	January 18, 2008
Place	Fresh Grounds, 1362 West 7th Street, St. Paul, Minnesota
Attending	Stu Grubb, President; Scott Alexander, President Elect; Jeff Stoner, Past President; Craig Kurtz, Treasurer; Jon Pollock, Secretary; Sean Hunt, WRI; Jennie Leete, WRI.
Treasury	2007 profit and loss estimate handed out. Dues \$18,600.00, advertising \$3448.25, program fees \$54,780.00, gross profit \$77,858.39, administrative cost \$15,753.48, programs \$41,630.35, newsletter \$10,931.02, net income \$4186.69. 2008 net income with no expenses yet is approximately \$13,130.00, 2008 liquid assets approximately \$21,480.00.
Newsletter	No Report
Web Page	Conference webpage done – photos converted and Power Point presentations to PDF. Electronic ballot, MGWA Foundation has sent updates for education links.
WRI Report	Report handed out. Processed all transactions received before the end of the year, pre-pays transferred into next year, sorted previous transaction records for treasurer, managed the election, etc.
Membership	368 renewals so far and 8 corporate members
Old Business	<p><u>Bylaws</u> Proposed changes to bylaws submitted to Board by the temporary Bylaws Committee were discussed. Some language to clarify various sections were discussed, including dissolution of the MGWA and funds going to the MGWAF, as well as how Board can amend bylaws. Board will compare the current bylaws to the clarified proposed bylaws prior to next meeting. Past President will take comments on proposed bylaws.</p> <p><u>Fall Conference:</u> Comments from members were passed out and reviewed.</p> <p><u>Spring Conference:</u> Scheduled for May 8, 2008. Possible topics include a field service theme or an ethanol conference could discuss global warming.</p> <p><u>Legislative:</u> President left message for LCCMR. President Elect indicated that there are several field locations where people could be taken to show them various groundwater issues.</p>

Minnesota Ground Water Association Board Meeting Minutes, cont.

New Business	<p><u>PG Registration:</u> Requirement is now ten years old President was asking how the registration is used. One area is aquifer tests for the DNR that require signature by a PG, another area is a portion of the Well Head Protection plan that requires a PG or PE signature.</p> <p><u>2008 WRI Contract:</u> Proposed contract for 2008 written by WRI was passed out. Board decided to compare it to 2007 contract and discuss at the next meeting.</p>
Next Meeting	February 21, 2008. Meeting adjourned at 1320.
Meeting Date	February 21, 2008
Place	Fresh Grounds, 1362 West 7 th Street, St. Paul, Minnesota
Attending	Stu Grubb, President; Scott Alexander, President Elect; Jeff Stoner, Past President; Craig Kurtz, Treasurer; Jon Pollock, Secretary; Norm Mofjeld, Newsletter Editor; Sean Hunt, WRI; Jennie Leete, WRI.
Treasury	2007 profit and loss statement and balance sheet handed out. Cash on hand in December 2007 was \$21,436.89. Net Income in 2007 was \$3,609.28. Current balance sheet and profit and loss forms handed out and show cash balance of \$25,152.17 and net income of \$15,866.30. 2007 audit should be completed by next meeting.
Newsletter	Norm is issue editor. Will need pictures of new officers.
Web Page	Will be adding conference information to web page. Started process of moving to new server, including backing up material. We were coming close to using all space on old server.
WRI Report	Report handed out. Dues coming in. W-9 forms coming in and being completed and sent back.
Membership	426 members thus far. Will be sending out 2 nd renewal notice – membership is on target to be similar to previous years.
Old Business	<p><u>Proposed changes to bylaws:</u> Motion by secretary to approve bylaws submitted by Past President. Motion seconded by Treasurer and unanimously carried. Proposed bylaws will be published in March newsletter for membership vote.</p> <p><u>Legislative:</u> Meeting with LCCMR postponed until March 3, 2008, at 1400.</p> <p><u>WRI Contract:</u> Motion to approve contract for 2008 was unanimously passed. Contract will be signed by WRI, Secretary and President.</p> <p><u>Spring Conference:</u> Scheduled for May 8, 2008. Planning meeting to be held immediately following the MGWA Board Meeting.</p>
Next Meeting	March 24, 2008, at 1130 at Fresh Grounds at 1362 West 7 th Street, St. Paul, Minnesota. Meeting adjourned at 1250.

2008 MGWA Conference Dates

May 8, 2008
November 13, 2008

2008 Earth Science Week "No Child Left Inside"

The American Geological Institute (AGI) is pleased to announce the theme of Earth Science Week 2008: "No Child Left Inside." Being held October 12-18, Earth Science Week 2008 will encourage young people to learn about the geosciences by getting away from the television, off the computer, and out of doors.

AGI hosts Earth Science Week in cooperation with sponsors as a service to the public and the geoscience community. Each year, local groups, educators, and interested individuals organize celebratory events. Earth Science Week offers opportunities to discover the Earth sciences and engage in responsible stewardship of the Earth.

This year marks the 10th anniversary of the first Earth Science Week, held in 1998. The program is supported by the U.S. Geological Survey, NASA, the AAPG Foundation, International Polar Year, and other major geoscience groups. For details, visit www.earthsciweek.org.

