

# Minnesota Ground Water Association

www.mgwa.org

## Newsletter

March 2010  
Volume 29, Number 1

### Featured:

- ◆ St. Anthony Falls Lab, page 1
- ◆ Urban Recharge, page 5
- ◆ What's That, A Methane Plume?, page 7



MGWA President  
Steve Robertson

### Inside:

Member News . . . . .	2
National Geothermal Data Compilation . . . . .	4
Groundwater Technical Articles . . . . .	5
Reports and Publications . . .	12
Hans-Olaf Pfannkuch En- dowed Scholarship . . . . .	15
Foundation Minutes . . . . .	16
MGWA Board Minutes . . . . .	17
2009 Financial Report . . . . .	18

## President's Column

by Steve Robertson

As I begin my term as president, let me just say that I am glad that the groundwater vs. ground water vs. ground-water debate has receded, at least for the time being. Grateful I am that the thorny issue unfolded in Scott Alexander's term as president. But in all seriousness, I am glad to be able to rely on his steady hand as he continues in office as past-president.

I am happy also to acknowledge the contributions of Stu Grubb and Jon Pollock, who served the Minnesota Ground Water Association (MGWA) Board most recently as past-president and secretary, respectively. While I will miss their worthy

contributions, I am excited to welcome the two newly elected officers: Mindy Erickson of the USGS and Jill Trescott who works for Dakota County. Mindy will start this year as president-elect, part of the three year term in which she will also serve as president and past-president. Jill is starting a two-year term as secretary. I look forward to working with each of them.

In January, we appointed Tedd Ronning as the new editor of the MGWA Newsletter. Tedd succeeds Norm Mofjeld, who had served as editor since 2003. Having helped out on the newsletter committee for several years, I know that each issue is truly a group effort that is made better by member contributions. If you have a suggestion for an article, please contact Tedd through the links on the MGWA web site.

— continued on page 3

## The St. Anthony Falls Laboratory

By Maia Homstad

The St. Anthony Falls Laboratory (SAFL) is a research unit of the University of Minnesota in the Department of Civil Engineering. Reserachers at the lab include Tim Erickson, contributor of the article on urban recharge in this issue. SAFL is affiliated with the Geology and Geophysics Department and is the world's only fluid-mechanics laboratory that uses a natural waterfall as its prime water source. For over 70 years researchers from around the world have been visiting SAFL's unique location on an island in the Mississippi River to conduct research for develop-

ing innovative and sustainable engineering solutions to major environmental, water resources, and energy-related problems. SAFL is also proud to be the headquarters for the National Center for Earth-surface Dynamics (NCED), an NSF Science and Technology Center. For more info, please go to [www.safll.umn.edu](http://www.safll.umn.edu).

UNIVERSITY OF MINNESOTA

# Stream Lab

Outdoor Stream Lab

Participate in life-sized environmental research at the University of Minnesota.

Our Outdoor StreamLab brings together river scientists, engineers, and managers to explore river flow and ecology in downtown Minneapolis.

Join us and think outside the lab.

Earth > Water > Life

## MGWA Newsletter Team

**Editor-in-Chief**  
**Tedd Ronning**  
Xcel Energy  
[tedd.a.ronning@xcelenergy.com](mailto:tedd.a.ronning@xcelenergy.com)

**Tom Clark**  
Minnesota PCA  
[tom.p.clark@state.mn.us](mailto:tom.p.clark@state.mn.us)

**Jan Falteisek**  
Minnesota DNR  
[jan.falteisek@state.mn.us](mailto:jan.falteisek@state.mn.us)

**Kurt Schroeder**  
Minnesota PCA  
[kurt.schroeder@state.mn.us](mailto:kurt.schroeder@state.mn.us)

**Eric Tollefsrud**  
**current issue editor**  
AMEC Geomatrix  
[eric.tollefsrud@amec.com](mailto:eric.tollefsrud@amec.com)

**Advertising Manager**  
**Jim Aiken**  
Barr Engineering Co.  
(952)832-2740  
[jaiken@barr.com](mailto:jaiken@barr.com)

**MGWA Management & Publications**  
Dr. Jeanette Leete  
WRI Association Mgmt Co.  
(651)276-8208  
[office@mgwa.org](mailto:office@mgwa.org)

**MGWA Web Page**  
Visit [www.mgwa.org](http://www.mgwa.org) for MGWA information between newsletters and to conduct membership and conference transactions.

### Newsletter Deadlines

Issue	Due to Editor
June '10	05/07/10
September '10	08/06/10
December '10	11/05/10
March '11	02/04/11

© Minnesota Ground Water Association. ISSN: 1098-0504  
Material in this publication may be reprinted if appropriate credit is given. Views expressed in this publication do not reflect official MGWA policy unless expressly stated as such.

## MEMBER NEWS

### New Officers Elected

**Dr. Melinda (Mindy) Erickson** has been elected President-Elect of MGWA for 2010. Mindy is a Hydrologist and Groundwater Specialist in the Water Science Center of the U.S. Geological Survey. **Jill Trescott** is the newly elected MGWA Secretary. Jill is a Groundwater Protection Supervisor for the Dakota County Water Resources Department. Congratulations to Mindy and Jill!



*Mindy Erickson*



*Jill Trescott*

### Norm Mofjeld Steps Down from Newsletter Team

After 8 years as the Editor-in-Chief of the MGWA Newsletter, **Norm Mofjeld** is leaving the newsletter editing team. Norm first served as the Editor-in-Chief for the March 2002 newsletter. During his time with the newsletter he saw the publication move to an electronic format; a change in its look, including color; the 25th Anniversary edition; and the posting of all past issues on the MGWA web site. Norm's hard work and dedication to the newsletter will be missed by the other members of the team, and we wish him all the best. Thank you Norm! Norm can be reached at the Minnesota Department of Health at [norman.mofjeld@state.mn.us](mailto:norman.mofjeld@state.mn.us).

### Stu Grubb Joins Northeast Technical Services

**Stu Grubb** has joined Northeast Technical Services as a Senior Hydrogeologist. NTS is headquartered in Virginia, Minnesota with offices in Duluth and the Twin Cities. They provide environmental laboratory, geoprobe, and consulting services to clients throughout Minnesota and Wisconsin. Stu specializes in local and regional groundwater resource studies, groundwater modeling, groundwater/surface water interactions, and pollution remediation. He was MGWA President in 2008. Stu has been active with establishing groundwater regulations for watershed districts, counties, and state agencies. He can be contacted at [sgrubb@netechnical.com](mailto:sgrubb@netechnical.com).

### Pat Lannon Retires from MPCA

**Pat Lannon** retired on disability from the Minnesota Pollution Control Agency Superfund Division, in April 2009. Pat was a Hydrologist III and had been in that position since January 1994. During his employment with the MPCA, he also assisted with Access database development and maintenance of several databases throughout the Agency. Prior to joining the MPCA, Pat worked for over seven years as a project manager with Braun Intertec.

Early retirement has enabled Pat to focus more time on maintaining his health; as a result, he was only hospitalized once during 2009 due to an exacerbation relating to his cystic fibrosis (CF). He will soon be participating in a very important Phase III clinical trial of a new generation of drugs

—continued on next page

## MEMBER NEWS

### Pat Lannon, cont.

that will target the cause of cystic fibrosis on the genetic level. Pat lives in Woodbury with his wife, Cindy, three English cocker spaniels (Kellie, Kayla, and Aimee), and his buddy, Sturgis the cat (a former TV personality).

### Dirk Leemkuil Joins ERM

**Dirk Leemkuil**, PG has recently accepted a position with Environmental Resources Management (ERM) in St. Paul. Dirk has joined a staff of 13 professionals as a member of the Contaminated Site Management group. Dirk will also contribute in the Environmental Compliance and Merger and Acquisition groups. He has over 20 years of experience. ERM is located at 190 East 5th Street, Suite 255, St. Paul, MN 55101. Dirk may be reached at 651-225-4554 or by email at: [dirk.leemkuil@ERM.com](mailto:dirk.leemkuil@ERM.com).

### Andrew Peters is now with Milestone Materials

Since leaving his DNR position as a Southeast Minnesota Regional Groundwater Specialist, **Andrew Peters** has been working as a hydrologist for Milestone Materials, a division of Mathy Construction, in Onalaska, Wisconsin. At Milestone he is responsible for handling water issues and related permitting for quarries and sand pits in the upper Midwest. Andrew's e-mail address is [LewEdd@gmail.com](mailto:LewEdd@gmail.com).

### President's Letter, cont.

January also brought word from the MGWA Foundation that they had agreed to serve as fiscal agent for an endowed scholarship fund that will be organized in honor of the expected retirement in May of Dr. H. Olaf Pfannkuch from the University of Minnesota's Geology Department. There are more details on how that scholarship will be established and operated elsewhere in this newsletter and I am sure there will be additional information in future issues as well as through University channels. 2010 promises to be a busy year for MGWA and groundwater professionals in Minnesota. First, for many state and local governments, revenue from the sales tax increase approved by voters in 2008 (i.e., the Legacy Amendment) is beginning to stream in. Much of the money earmarked for groundwater is being channeled through state government to local governments, and the unique manner in which this funding source was established has created special challenges and opportunities for resource managers. I am hopeful that resources made available through the Legacy Amendment will add to our ability to study, understand, and manage groundwater systems in Minnesota. Another reason this year will be busy is that much of the planning will take place this year for events associated with the 2011 Annual Meeting of the Geological Society of America, to be held in Minneapolis. Look for more information on that throughout the year.

As I write this in early February, the snow is falling and accumulating in great piles. As groundwater scientists, we all understand the snowpack represents great potential for recharging groundwater systems and replenishing soil moisture. As a skier, I have an additional reason for positive reflections as I look out at the accumulation, and I face only the minor inconveniences of snow removal and slippery highways, some of the things that give us as Minnesotans a common bond. But for others the accumulating snow poses a greater threat. Already various prognosticators are speculating that it could be a bad spring for flooding, unless the thaws we experience are gradual and well-spaced.

We deal every day with situations, issues, and activities that exhibit a similar dichotomy. That is particularly apparent in our professional lives, where many of us work on ventures that have the potential to bring great economic benefits but also to do harm to the environment or human health. One such area that has been in the local news quite a bit recently is mining. Changing economics and improved understanding of the state's mineral endowment have combined to create new mining opportunities statewide, especially on the Range. For this reason, we intend to make mining the subject of the Minnesota Ground Water Association (MGWA) Spring Conference on May 6, 2010. More details will be announced in the coming weeks, but for the time being, set the date aside, and I hope to see you there.

## 2010 MGWA Board

**Past President**  
**Scott Alexander**  
University of Minnesota  
(612)624-7822  
[alexa017@umn.edu](mailto:alexa017@umn.edu)

**President**  
**Steve Robertson**  
Minnesota Dept. of Health  
(651)201-4648  
[steve.robertson@state.mn.us](mailto:steve.robertson@state.mn.us)

**President-Elect**  
**Mindy Erickson**  
USGS  
(763)783-3231  
[merickso@usgs.gov](mailto:merickso@usgs.gov)

**Secretary/Membership**  
**Jill Trescott**  
Dakota County  
(952)891-7019  
[jill.trescott@co.dakota.mn.us](mailto:jill.trescott@co.dakota.mn.us)

**Treasurer**  
**Craig Kurtz**  
3M Company  
(763)757-6876  
[craigkurtz@msn.com](mailto:craigkurtz@msn.com)

### 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 for 2009

Pace Analytical

Barr Engineering

Liesch Associates, Inc.

AMEC Geomatrix

Interpoll, Inc.

Northeast Technical Services

Soil Engineering Testing, Inc.

Leggette, Brashears & Graham, Inc.

Links at [www.mgwa.org](http://www.mgwa.org)

## Minnesota to Participate in National Geothermal Data Compilation

*By Harvey Thorleifson, Director, Minnesota Geological Survey*

Significant growth in the role that geothermal energy plays in the national energy portfolio will require reducing the risks and cost of defining resources, characterizing new classes of larger energy resources, optimizing management and expansion of exploited geothermal fields, and ensuring a path for technology growth into the future, thus providing the science and engineering basis for both conventional and enhanced geothermal systems (EGS).

US Department of Energy (DOE) funding announcements in late 2009 therefore included an indication that State Geological Surveys nationwide will receive \$17.79 million over the next three years to compile geothermal data. To arrange for the funding, the Association of American State Geologists (AASG) organized a coalition of 40 states that will populate a new National Geothermal Data System (NGDS) with relevant state-specific geothermal data.

Compiling state-specific geothermal data in an integrated, distributed, and searchable data system is expected to drive renewed efforts to identify, assess and exploit geothermal energy resources across America. This national collaboration of State and Federal agencies, universities, and industry, has the potential to reshape America's energy landscape, reduce greenhouse gas emissions, and leverage non-renewable petroleum resources well into the twenty-first century.

The project team, coordinated by Arizona Geological Survey, will bring data from the State Geological Surveys into the NGDS, by digitizing at-risk legacy, geothermal-relevant

data such as paper records and samples, by preparing existing digital data using standard NGDS data formats, and through collection of new data in areas lacking critical information.

Arizona is also coordinating development of data discovery, access, and exchange formats for the data system as a member of the Geothermal Data Consortium, under a previous award from DOE, building on web services architectures and capabilities developed for the Geoscience Information Network (GIN), coordinated by AASG and the US Geological Survey.

The project will enhance states' abilities to preserve and disseminate geothermal data, to facilitate geothermal resource characterization and development efforts, to expand the scope of data available to the geothermal community, and to foster new services and applications built by third-parties to take advantage of the system's capabilities and content.

As a member of the coalition, the Minnesota Geological Survey (MGS) will work in the region in cooperation with the University of Minnesota Department of Geology and Geophysics, the Duluth-based Natural Resources Research Institute (NRRI), and the University of North Dakota (UND).

The Minnesota-based work will include compilation of regional geological and drillhole data by MGS staff, while a program to collect new downhole temperature profiles will be conducted by the partner agencies. Will Gosnold of UND will provide overall coordination of the data collection, while data collection will also be coordinated by Steve Hauck of NRRI, and Martin Saar of the University of Minnesota.

The result will be Minnesota drillhole data in National Geothermal Data System format, a report on relevant geology, and a database and report on existing and new downhole temperatures for across the State of Minnesota.

## Upcoming Water Communication Talks at the MPCA

Free and open to the public, these informational gatherings are held from 9 to 10 am via the Minnesota Pollution Control Agency's video conference network in all offices (4th floor in the St. Paul office at 520 Lafayette Road). Please inform Gretchen Sabel at (651)757-2686 of your intent to attend so that building access can be arranged as appropriate. This series of talks, begun in 2005, offers speakers on a wide variety of water-related topics. If you would like to give a presentation or wish to suggest a speaker or topic, please contact Gretchen.

- |                       |                                                                                                                     |
|-----------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>March 25, 2010</b> | Pam Anderson, MPCA - Redesign of the Surface Water Assessment Process                                               |
| <b>April 8, 2010</b>  | Mike Trojan, MPCA - Mapping Urban Stormwater Systems                                                                |
| <b>April 22, 2010</b> | Peter Sorenson, U of M and Clifton J. Aichinger, RWMWD: Carp Control in Lakes & TMDL Implementation                 |
| <b>May 13, 2010</b>   | Paige Novak, U of M: Phytoestrogens in Industrial Waste Water - Research Results from Eight Facilities in Minnesota |
| <b>May 27, 2010</b>   | Chris Elvrum, Met Council - Metropolitan Area Master Water Supply Plan                                              |

### Save these Dates!

**MGWA's Spring Conference May 6, 2010**

**MGWA's Fall Conference November 9, 2010**

**GSA Annual Meeting October 9 - 12, 2011**

## The influence of water distribution, sewer, and irrigation networks on shallow groundwater recharge in an urban watershed: A case study in the Vermillion River watershed

By Timothy O. Erickson, St. Anthony Falls Laboratory, University of Minnesota

General hydrologic theory states that urbanization reduces groundwater recharge due to increased imperviousness. A case study in the Vermillion River watershed (VRW) shows that this might not always be the case. A recent study suggests that urbanization in the VRW has led to no significant reduction in shallow groundwater recharge so far, and the trends may actually be toward a slight increase in groundwater recharge.

### The Vermillion River Watershed

The VRW is located on the southern fringe of the Twin Cities metro area. From its headwaters in southeastern Scott County the Vermillion River flows eastward, through Lakeville and Farmington, into the Mississippi River southeast of Hastings near Lock and Dam No. 3. In its upper reaches the Vermillion River is a naturally reproducing trout stream with a large portion (~80%) of its annual streamflow coming from groundwater sources [Erickson and Stefan, 2008]. Due to that high percentage, the VR should be susceptible and responsive to urbanization. A case study on the upper third of the VRW, defined by a USGS gauging station near Empire, MN, and encompassing approximately 129 square miles and most of the river's trout reaches, was conducted to estimate groundwater recharge [Erickson and Stefan 2009].

The VRW has experienced substantial urbanization since 1984, as the edge of the Twin Cities metro area moves southward. According to historic land-use maps, urban land use increased from 12% of the watershed in 1984 to 29% in 2005, and included an increase in impervious surfaces from 8.8% to 13.3%. Most development and imperviousness is in the northern two-thirds of the sub-watershed. The population within the watershed has nearly doubled from about 55,000 in 1988 to over 109,000 people in 2005, with a majority of households connected to municipal water supplies.

### Urbanization effects on recharge

Urbanization alters the pathways of water through landscaping, changes in land and water use, and by introducing new water collection and conveyance systems [Schilling and Libra, 2003]. Urbanization changes the basin-wide groundwater infiltration and evapotranspiration rates by changing the areas available for these processes. The reduction in groundwater infiltration is greatest when sewers are installed to convey storm water directly to streams [Lerner, 2002].

Alternatively, the man-made water supply systems built for domestic, commercial, and industrial consumption are also used for irrigation of lawns in urban areas, and therefore provide additional sources and pathways for water to reach aquifers [Lerner, 2002]. Urbanization can increase the amount and the opportunities for fresh and used water to infiltrate into the soil, thereby increasing the potential for groundwater recharge, especially if the water is imported from water sources outside the urbanized watershed. One can therefore distinguish between natural groundwater recharge from precipitation in a watershed and artificial groundwater recharge from man-made water sources.

### Recharge in the Vermillion River watershed

To study the effect of urbanization on total groundwater recharge

in the VRW, a baseflow analysis was conducted [Erickson and Stefan, 2008] using the USGS program RORA. Monthly and annual baseflow estimates were extracted from streamflow records at the USGS gauging station near Empire, MN. Using baseflow estimates and climate data, values for the hydrologic water budget components were estimated for the period from 1982 to 2005 (Figure 1). Kendall's tau test [Helsel and Hirsch, 2002], a nonparametric trend test, was applied to this time period series to test for trends. None of the hydrologic water budget components showed a statistically significant trend at a confidence interval of 95%. The confidence intervals ranged from a low of 17% for surface runoff to 75% for baseflow, indicating the possibility that no trend existed. Although no statistically significant trends could be found, it was interesting to note that most trends were increasing, with the exception of evapotranspiration and precipitation.

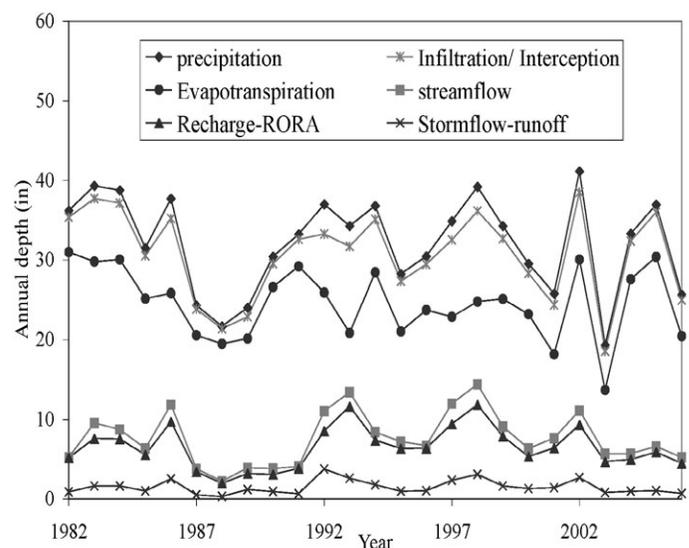


Figure 1: Time-series of annual water budget components (1982 to 2006) for the Upper Vermillion River watershed up to the USGS gauging station near Empire, MN [Erickson and Stefan, 2008].

If the watershed has seen significant urban development over the last 25+ years, why are no significant trends seen in the streamflow record? Erickson and Stefan [2009b] showed that the increase in imperviousness from 8.8% to 13.3% should decrease long-term natural groundwater recharge by about 0.5 inches or 8% from 19.2% of annual mean precipitation to 18%. This may seem small, but imperviousness only increased by 5.5%. The decrease in recharge due to increased imperviousness is compounded by the increase in water demand of perennial vegetation (lawns). This estimated decrease in groundwater recharge was not reflected in the Vermillion River flow record at the Empire USGS gauging station. In fact, the stream flow trend was slightly upwards. Therefore other sources of recharge must exist in the watershed to compensate for the loss of natural recharge of the aquifer.

This additional recharge comes from artificial water sources. The VRW study focused on four sources of artificial recharge: (1) excess lawn irrigation, (2) pipe leakage, (3) crop irrigation, and

— continued on page 6

## Urban recharge, cont.

(4) septic drainage. Excess irrigation, both of lawns and crops, is the excess water applied to the land surface that is not used by the vegetation. Pipe leakage is water lost from municipal water distribution networks. Septic drainage is water from septic systems that drain below the reach of the surface vegetation. There are other artificial recharge sources, such as leakage from storm water detention ponds, infiltration basins, rain gardens, leaky storm sewer systems, and seepage from ditches. These were not included because little data are available.

Annual recharge rates from the four artificial sources were estimated using methods described by Erickson and Stefan [(2009a)]. Well records for municipal water supplies and private irrigation from the Minnesota Department of Natural Resources were used. Values for total artificial recharge can be expressed as a representative depth over the area of the watershed. From 1988 to 2005, total irrigation of crops and lawns increased from 0.11 in/yr to 0.21 in/yr, most coming from increased lawn irrigation. Leakage from municipal water supplies increased from 0.13 in/yr to 0.24 in/yr from 1988 to 2005. The estimated septic system drainage rose from approximately 0.05 in/yr to 0.13 in/yr. Total

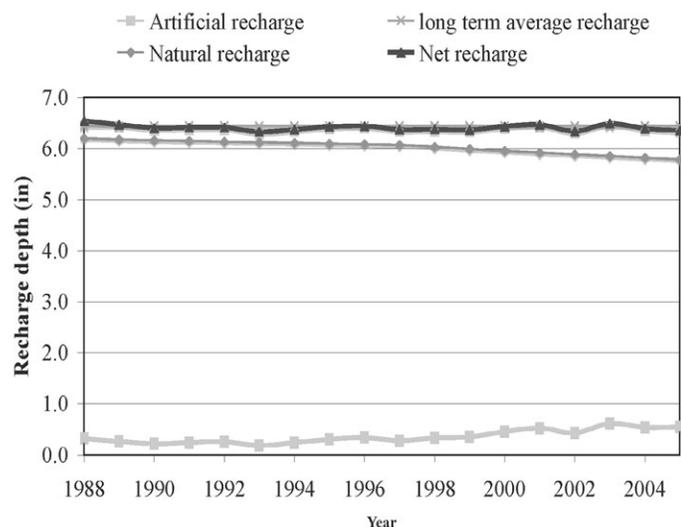


Figure 2: Annual groundwater recharge in the Vermillion River watershed [Erickson and Stefan, 2009a].

artificial recharge doubled from 0.3 in/yr in 1988 to 0.6 in/yr in 2005.

Adding the artificial recharge to the estimated decrease in natural recharge gives a zero net change in recharge. A plot of the natural, artificial, and net recharge as a time series in Figure 2 shows how natural recharge decreases due to increased imperviousness, and artificial recharge increases due to increased population and water use. Values for total artificial recharge can be expressed as a representative depth over the area of the watershed. Figure 2 also demonstrates that the net annual groundwater recharge rate has not changed over two decades of progressive urbanization, and illustrates the basis for the lack of a trend in the long-term average recharge.

If artificial recharge is adding water to the aquifer, changes to the seasonal distribution of base flow should occur. Increased lawn and crop irrigation, combined with changes from annual crops to perennial lawn grasses should increase base flow during the summer months due to the fast response of the shallow aquifer in the VRW. Figure 3 shows the relative changes in monthly baseflow estimates normalized over the record averages. Precipitation is

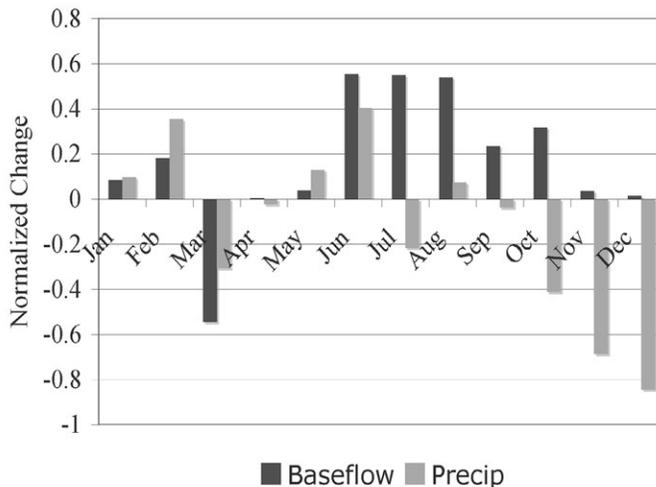


Figure 3: Change in monthly base flow (black bars) and precipitation (gray bars) in the upper Vermillion River watershed from 1982 to 2006. Values are normalized by the 1982-2006 average baseflows for each month [Erickson and Stefan, 2009b].

also included in Figure 3 to rule out major climate change effects. The distribution of baseflow shows the expected increases from June through October, while precipitation actually increased only during June. Base flow is increasing during irrigation months, suggesting that groundwater recharge from irrigation is occurring.

This VRW case study has shown the complexity of urban hydrology and the effects of urban development on the hydrologic system. It has also shown that urban development does not necessar-

— continued on next page

**There's no substitute for experience**

- **Ground-Water Exploration**
- **Wellhead/Source Water Protection**
- **Vulnerability Assessments**
- **Ground-Water Modeling**
- **Well Field Management**
- **Ground-Water/Surface-Water Assessments & Permitting**
- **Environmental Investigation**
- **Remediation Engineering**
- **Risk Assessments**
- **Environmental Risk Transfer**
- **Vapor Intrusion Evaluation**



**Leggette, Brashears & Graham, Inc.**  
Professional Ground-Water and Environmental Engineering Services  
Established in 1944

8 Pine Tree Drive, Suite 250 | St. Paul, MN 55112  
651.490.1405

**Offices Nationwide | toll free: 877-959-7800 | www.lbgweb.com**

## Urban recharge, cont.

ily decrease groundwater supply. When natural, agricultural, and urban areas are compared, it is important to consider the imported water and how agriculture or urbanization changes the pathways of water in the watershed. Groundwater recharge has changed in the VRW, yet contrary to common assumption, total groundwater recharge in the VRW has not decreased. Natural recharge has been reduced, but has been replaced by recharge from ‘artificial’ water sources.

### For more information

This article is a summary of a paper titled “Shallow groundwater recharge in an urban watershed: Effects of water distribution, sewer and stormwater management systems” submitted to the *Journal of Hydrology*. The SAFL Project Reports listed in the references can be downloaded at: [www.safll.umn.edu](http://www.safll.umn.edu). For additional information or questions contact Tim Erickson at [eric1003@umn.edu](mailto:eric1003@umn.edu) or (612) 624-4613.

### Selected References

- Erickson, T.O., Stefan, H.G. 2008. Streamflow analysis on the Upper Vermillion River in Dakota County, Minnesota. Saint Anthony Falls Laboratory Project Report no. 507. University of Minnesota, Minneapolis, Minnesota
- Erickson, T.O., Stefan, H.G. 2009a Groundwater recharge in a coldwater stream watershed during urbanization. Saint Anthony Falls Laboratory Project Report no. 524. University of Minnesota, Minneapolis, Minnesota
- Erickson T.O., Stefan, H.G. 2009b. Projecting natural groundwater recharge response to urbanization in the Vermillion River watershed, Minnesota. *Journal of Water Resources Planning and Management* 135(6) 512-520
- Helsel, D.R., Hirsch, R.M. 2002. Statistical methods in water resources. In: *Hydrologic analysis and interpretations (USGS Techniques of Water Resources Investigations Book 4)*. United States Geological Survey, Reston, VA, Ch A3.
- Lerner, D.N. 2002. Identifying and quantifying urban recharge: a review. *Hydrogeology Journal* 10: 143-152
- Schilling, K.E., Libra, R.D. 2003. Increased baseflow in Iowa over the second half of the 20th century. *Journal of the America Water Resources Association (JAWRA)* 39(4):851-860.
- Simmons, D.L., Reynolds, R.J. 1982. Effects of urbanization on base flow of selected south-shore streams, Long Island, New York. *Water Resources Bulletin* 18(5): 797-805.



#### Complete Environmental Services Including:

- Groundwater and Surfacewater Sampling
- Sampling and Analysis of Natural Attenuation Parameters
- Landfill Gas Monitoring: EPA 25C and VOC's
- Industrial Waste and Wastewater Compliance Monitoring
- Ambient Air and Meteorological Monitoring
- Source Testing
- Certified Full Service Laboratory

Interpoll Laboratories, Inc.  
4500 Ball Road NE  
Circle Pines, MN 55014-1819  
[Field@Interpoll-Labs.com](mailto:Field@Interpoll-Labs.com)

(763) 786-6020  
FAX (763) 786-7854

## What's That, a Methane Plume?

### What Minnesota Is Learning About Denatured Ethanol, E85 Releases, and Methane Gas

by Mark Toso, Senior Hydrologist, Minnesota Pollution Control Agency

Minnesota has always been at the forefront in using ethanol-blended gasoline. In 1997, we became one of the first states to mandate a 10 percent blend (E10). As the state's environmental regulatory agency, the Minnesota Pollution Control Agency (MPCA) didn't consider E10 to be an issue. After an informal review, the potential differences between an E10 and an ethanol-free gasoline release were deemed minor and covered under existing investigation and cleanup policy, which is based on groundwater plume delineation. No ethanol specific issues have arisen from E10 releases since then. But the increased use of high-percentage ethanol-blend fuels (e.g., E85) and a state mandate to ramp up to ethanol blends to E20 by 2013 has given us reason for concern.

Ethanol use has rapidly expanded nationwide, and especially in Minnesota. Currently Minnesota has about 25 percent of all E85 stations in the United States; we rank fifth in ethanol production, with a permitted capacity to produce 1 billion gallons a year. For this reason, we have been contacted by other states seeking advice on investigating and remediating releases of high percentage ethanol-blended fuels. All these factors led us to reevaluate our current policy to see if it is adequate for assessing ethanol-blend fuels greater than E10.

Most studies on ethanol-blend fuels have focused on E10, so information on higher percentage ethanol blends is lacking. Research has shown that ethanol can extend petroleum plumes in groundwater because of co-solvency and that it is preferentially degraded before BTEX compounds. Ethanol can also alter BTEX sorption and retardation and, at higher concentrations, it can exhibit toxicity to microorganisms, resulting in the potential for longer groundwater plumes that may put more water supply wells at risk. While we have not encountered any major issues with E10 under our current policy, we recognized that we really didn't know how higher blends such as E85 would behave. We knew that methane generation might be an issue with higher blends, but this scenario had not been evaluated.

### Study Sites Identified

A study by Cápiro et al. (2007) really brought to light the potential issues with higher percentage ethanol blends. In a bench-scale E95 (fuel-grade denatured ethanol) release into a continuous-flow sand tank, it was found that ethanol migrated upward and spread laterally within the capillary fringe area above the water table. This significantly retarded the vertical and horizontal migration of ethanol. The hydrocarbons phase separated within the capillary fringe, resulting in lower-than-expected dissolved contamination. Interestingly enough, simulated pumping (as in a pump-and-treat system) recovered 98 percent of the ethanol but only 25 percent of the hydrocarbons. All this appeared to have possible implications to release-site investigations.

While we hadn't had any confirmed releases of E85 by late 2006, spills of denatured ethanol (E95) had occurred on a fairly regular basis in Minnesota. Most had been remediated by soil excavation, but there were two large E95 derailment sites that the MPCA, along with other stakeholders, decided could be used to investigate the subsurface effects of a high-percentage etha-

— continued on page 8

## Ethanol and Methane in Groundwater, cont.

nol fuel release in more detail. With funding from the American Petroleum Institute, USEPA, MPCA, and our state Petroleum Tank Release Cleanup Fund, and working in collaboration with Dr. Roy Spalding from the University of Nebraska, we initiated a research project at these sites, located in Balaton and near the town of Cambria in southern Minnesota.

The Balaton release (60,000 gallons) occurred in July 2004, and the Cambria release (28,000 gallons) occurred in November 2006. Both releases were excavated to the extent practicable following the release and were being monitored under current closure policy. Groundwater monitoring was initially conducted for BTEX and ethanol.

During the early phases of the project it was discovered that there were no standard laboratory analytical methods for ethanol and that labs running ethanol analysis may be subject to high detection limits. Working with our Health Department's environmental laboratory we developed a method for quantifying ethanol in groundwater based on a modified version of USEPA Method 8260 with detection limits of approximately 50 µg/L.

In 2007, we installed additional monitoring wells and soil-gas monitoring points at both sites. Well screens with shorter intervals (5 to 7 feet in length) were used versus a standard 10-foot screen length, and we began to collect analytical data for ethanol, methane, acetate, and other bioattenuation parameters in groundwater. Soil gas collected from soil-gas monitoring points was analyzed for fixed gases (i.e., methane, oxygen, carbon dioxide) and volatile organic compounds (VOCs), including ethanol.

### Methane in Groundwater

The results to date seem to confirm the findings of the Cápiro

study. At the more recent Cambria release, ethanol concentrations of up to 5.5 percent were detected in groundwater. The ethanol was restricted to the areas of the original release and had not migrated. Groundwater conditions were reduced, with no dissolved oxygen and very high dissolved iron. Initially, very little methane was found in groundwater and soil gas, but after one year, the methane groundwater plume had rapidly expanded laterally and moved downgradient from the release source. This was believed to result from the initial toxic effects from ethanol on microorganisms that apparently delayed methane production [Figures 1(5H) and 2(5I)].

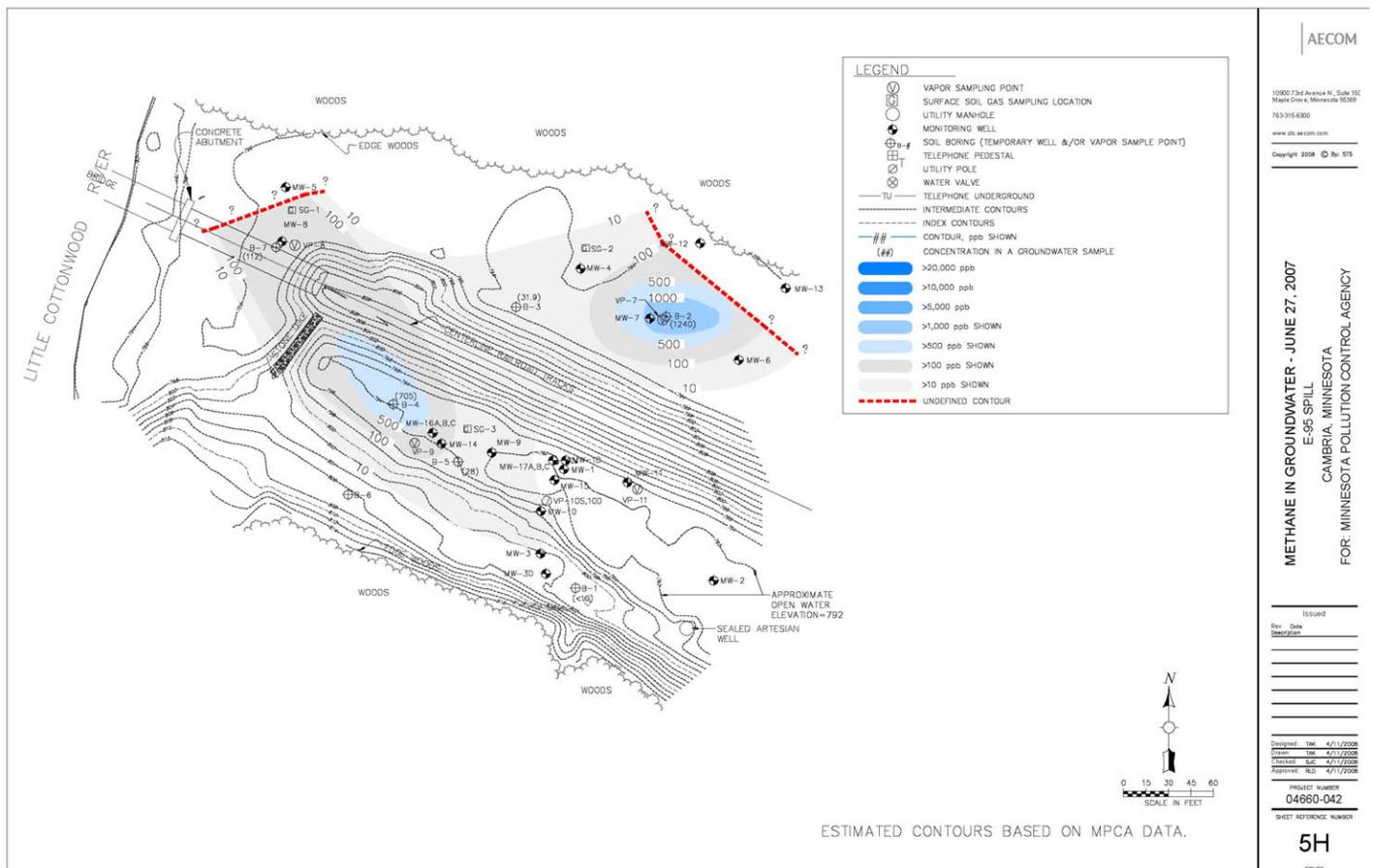
At Balaton, the older of the two releases, methane production was already well established. A large plume of dissolved methane at saturation limits was present in groundwater, and this too had migrated with the natural groundwater gradient. However, ethanol was last detected in December 2007 at 78 µg/L. Since then, the site has maintained a large, stable plume of dissolved methane without the presence of ethanol.

This behavior implies that ethanol is degrading to intermediate compounds that in turn degrade to methane via fermentation. This was verified by acetate concentrations, which were detected at 33,000 µg/L at Balaton (and up to 107,000 µg/L at Cambria). In addition, very high levels of dissolved organic carbon (DOC) were detected at both sites (up to 3,000 µg/L at Cambria). Both of these analytes also migrated away from the source areas.

### Methane in Soil Gas

The soil gas monitoring points were sampled using one-liter evacuated canisters for laboratory analysis of VOCs, including ethanol, by TO-15 and for fixed gases by USEPA 3C. Methane was detected up to 53.8 percent by volume at Balaton, which is

— continued on page 10



# THEIN WELL

Over 100 Years of Service



- Geo Probing
- Soil Borings
- Monitoring Well
- Remediation Wells
- Angle Drilling
- Rock Coring
- Well Televising
- Gamma/E-logging
- Test/Production Wells
- Pump Sales/Service
- Well Rehabilitation
- Well Abandonment



**Certified Master  
Groundwater Contractor**

**1-800-450-8000**

# McCain and Associates, Inc.

ENGINEERS & SCIENTISTS  
*Knowledge. Commitment. Service.*

*Environmental Investigation  
Groundwater Supply and Quality Improvement  
Solid Waste Engineering  
Construction Management  
General Civil Engineering*

Contact Nick Bonow, 952-346-3859, [nbonow@mccainassociates.com](mailto:nbonow@mccainassociates.com)

PO Box 429, 5300 Hwy 12, Maple Plain, MN 55359  
tel 952-346-3900 | fax 952-346-3901



# SOIL ENGINEERING TESTING, INC.



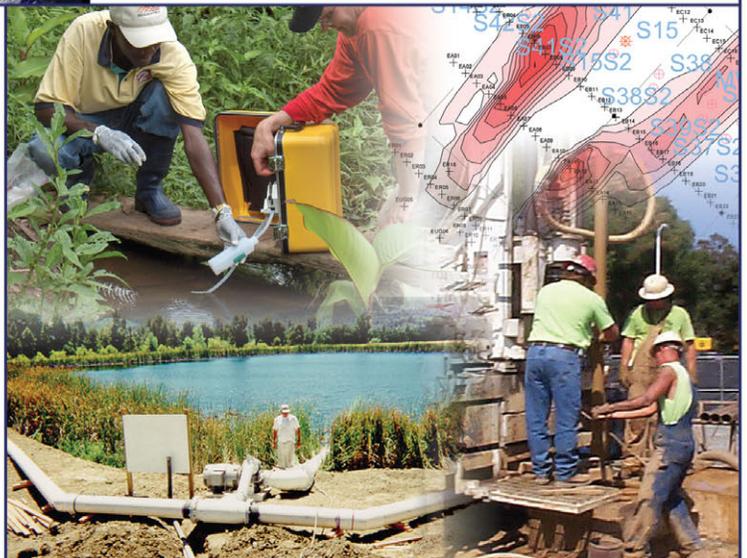
**A Comprehensive Soil Mechanics  
Testing Laboratory**

**Bloomington, MN  
(952) 884-6833**

[www.soilengineeringtesting.com](http://www.soilengineeringtesting.com)

Groundwater professionals solving  
contaminant and water supply  
issues throughout the Upper  
Midwest since 1994.

- ▶ Hydrogeologic Characterization
- ▶ Groundwater Treatment and Remediation
- ▶ Aquifer Testing
- ▶ Groundwater/Surface Water Investigation
- ▶ Groundwater Modeling
- ▶ GIS/Database Management
- ▶ Water Budgets and Safe Yield Estimates
- ▶ Supply Well Design and Construction Oversight



Offices located throughout North America, for more information about our services please contact our local office:

**Eric Tollefsrud, PG**

AMEC Geomatrix, Inc.  
14525 Highway 7, Suite 104  
Minneapolis, MN 55345

Tel: 952-935-1010 Fax: 952-935-1254  
E-mail: [eric.tollefsrud@amec.com](mailto:eric.tollefsrud@amec.com)

[www.amecgeomatrix.com](http://www.amecgeomatrix.com)

## Ethanol and Methane in Groundwater, cont.

similar in magnitude to the methane generated from a municipal solid waste landfill. The explosive range for methane is 5–15 percent. Methane was also detected at 2.7 percent in a surface soil-gas sampler, which explains our initial difficulty in zeroing our field instruments.

We also evaluated the use of field meters for measuring fixed gases, including methane, in soil-gas monitoring points. A good correlation was found between a Landtec GEM™ 2000 landfill gas monitor and USEPA 3C. An in-line carbon filter was used to remove VOCs from the air stream that will also be detected by the GEM™ 2000, thus providing a more accurate measurement for methane. Measured concentrations of methane in soil gas fluctuated between monitoring events, possibly due to barometric and temperature effects between sampling events. Since methane is highly degradable once aerobic conditions in the soil column are encountered, this may also have played a role in the fluctuation. Concentrations of methane in groundwater proved to be much more consistent over time versus levels measured in soil gas.

### Risk? Observations? Questions?

The fieldwork and data analysis at both sites is ongoing and we haven't fully evaluated all the data, but some general conclusions can be drawn. Most importantly, because explosive levels of methane are present in soil gas at both sites, it's apparent that methane is a major risk driver for releases of high-percentage ethanol fuels. This risk continues, even after ethanol has degraded (over two years at Balaton), and as yet, we don't know for how long. This observation implies the need for dissolved methane analysis at high-percentage ethanol fuel releases. Other parameters such as acetate and DOC might also be useful to characterize bioattenuation, but clearly other parameters than just ethanol

need to be analyzed.

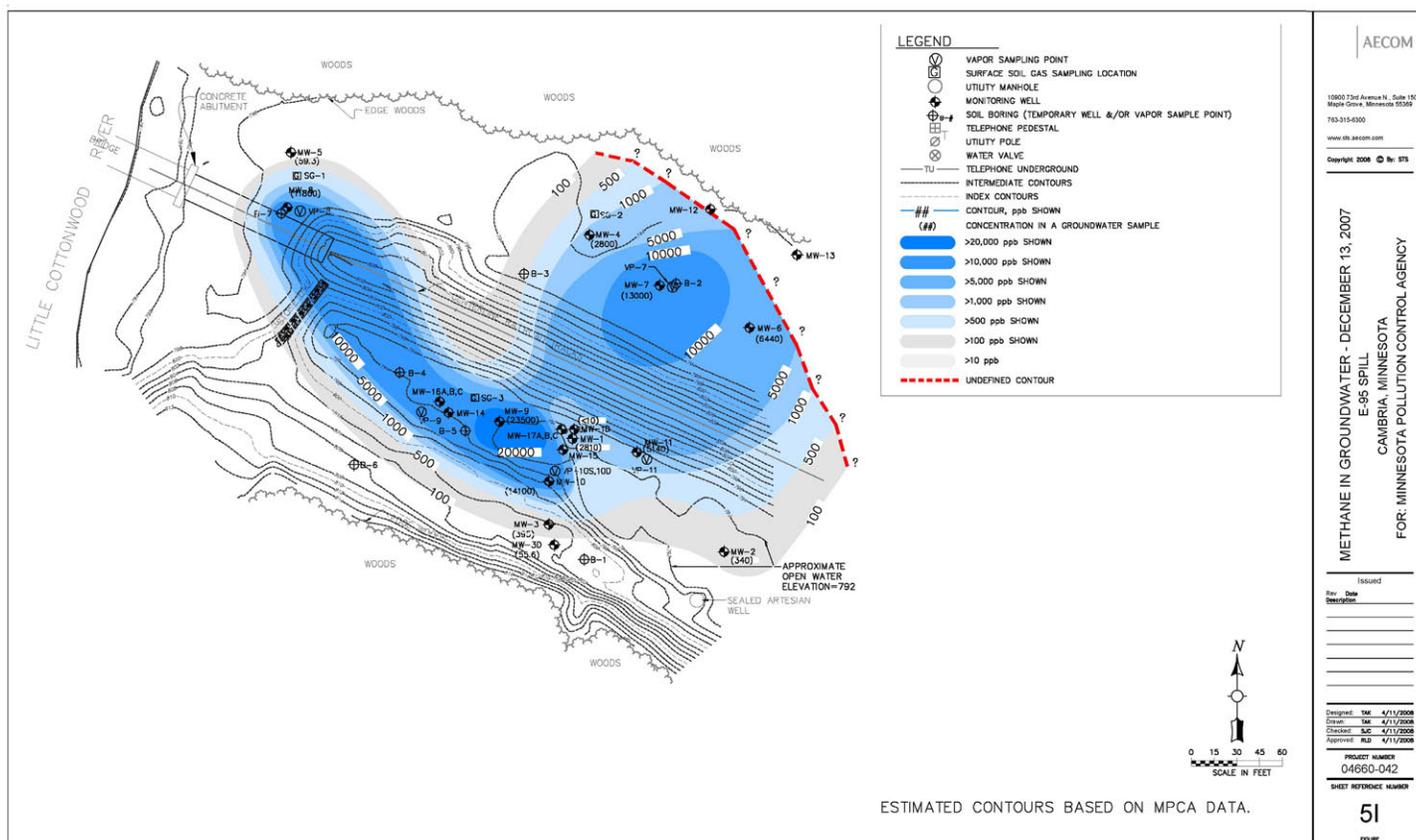
Methane was also shown to migrate with the groundwater gradient whereas ethanol did not. This may imply that alternative site characterization methods, such as suction lysimeters, may need to be used to sample the capillary fringe for ethanol, as the Cápiro study noted. There were also interesting results associated with some bioattenuation parameters that we attribute to well screens spanning several discrete biochemical zones in the aquifer. This may necessitate the use of smaller, discrete screen intervals or multi-level wells.

Perhaps the most important observation from this project has been that releases of E85/95 behave much differently than E10, which will require changes in how these releases are investigated. An unanswered question that remains is: At what E-blend do we need to start being concerned about these different subsurface behaviors? There are some indications that the blend might be as low as E20. Exactly where that is and why remains unanswered.

We plan to continue monitoring with emphasis on methane generation and natural attenuation. We need to understand at what point methane generation will cease and these sites will no longer present a risk. We also plan to evaluate acetate and other degradation products to better understand the degradation pathways. In addition, the MPCA collaborated with the University of Minnesota on a bench-scale geochemistry and microbiology column study using soils collected at Balaton. Results, which have not yet been written up, have shed more light on our findings.

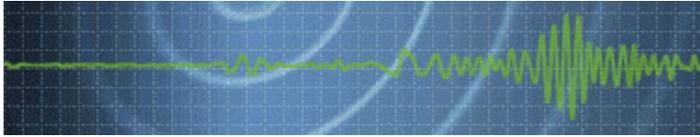
### References

- Cápiro, N.L., B.P. Stafford, W.G. Rixey, P.B. Bedient, P.J.J. Alvarez. 2007. Fuel-grade ethanol transport and impacts to groundwater in a pilot-scale aquifer tank. *Water Research* 41, no. 3: 656–664.  
 — Reprinted from *LUSTLine, Bulletin 63, December 2009*



## USGS Earthquake Resources Online

The United States Geological Survey has made information about earthquakes and earthquake hazard easily accessible on their web page: [earthquake.usgs.gov](http://earthquake.usgs.gov). Given the recent high profile of earthquake hazards worldwide, this resource will help you answer the questions that your friends and family may direct to you, given your earth science background!



## Changes to State E-Mail Addresses

Please note that Minnesota State agency e-mail addresses have changed. Where the addresses used to specify the agency (e.g., dnr, pca, or mdh) the address now are a generic @state.mn.us.



### LABORATORIES, Inc.

P.O. Box 249  
NEW ULM, MN 56073-0249

*Independent laboratory services, specializing in testing of groundwater, soil, hazardous wastes, sludges and drinking water.*

*On site sampling services available  
Call: (800-782-3557)*



Virginia • Duluth • Twin Cities

Analytical Laboratory  
Certified Low Level Mercury  
Environmental Sampling  
Sample Pickup  
Water & Wastewater Services  
Geoprobe Services

[www.netechnical.com](http://www.netechnical.com) 1-800-569-4179  
Twin Cities Lab and Service Center 763-497-9111

## GEOPHYSICAL SERVICES

Environmental - Geotechnical - Engineering

952.556.1118 Tel  
952.556.1119 Fax  
[info@3dgeophysics.com](mailto:info@3dgeophysics.com)



*Our goal is to develop  
on-going relationships  
with our clients  
as we provide them  
with innovative solutions  
to their environmental issues.*



- Water Supply Services
- Wastewater Treatment
- Soil and Groundwater Remediation
- Well-head Protection
- Phase I & II Environmental Site Assessment Services
- Asbestos Assessment & Management
- Industrial Hygiene Services
- Underground Storage Tank Investigation & Remediation
- Environmental Compliance Assessments
- Indoor Air Quality Services

LIESCH ASSOCIATES, INC.

CONTACT: JIM DE LAMBERT - 800/338-7914  
13400 15th Ave N, Minneapolis, MN 55441

### New Minnesota Geological Survey Publication on Geochemical Data

Lively, R.S., and Thorleifson, L.H., 2009, Minnesota soil, till, and ground-water geochemical data. Minnesota Geological Survey Open File Report OFR-09-02, 19 p., 1 poster, 69 atlas pages, 8 digital tables, 1 geodatabase. The report and data are available on the MGS ftp site at [ftp://mgssun6.mnngs.umn.edu/pub5/geochem\\_rpt](ftp://mgssun6.mnngs.umn.edu/pub5/geochem_rpt).

The Minnesota Geological Survey (MGS) and the Minnesota Pollution Control Agency (MPCA), in cooperation with the United States Geological Survey (USGS), have assembled three geochemical data sets for soil, soil parent material, and water as a basis for an atlas that provides an overview of geochemical patterns, and as a reference that will place more thorough environmental geochemical surveys into a context. Atlas pages were prepared for each parameter, with maps for each sampling medium on a single page, along with a generalized explanation. The data are available in Excel tables and as an ESRI geodatabase from the MGS ftp site.

### USGS News and Publications

#### New USGS Web Page Is Available on Redox and Aquifer Vulnerability to Contamination

You can access a new United States Geological Survey Web page on redox that highlights publications and a decision-support tool for determining aquifer vulnerability to contamination by visiting the USGS Web site.

Included is direct access to a recently released USGS Fact Sheet that extends a previous USGS analysis and framework of redox processes, which was highlighted in NGWA's publication, Ground Water, to additional principal aquifer systems using a larger set of USGS water-quality data.

#### Collaborative Efforts Study Sources of Emerging Contaminants

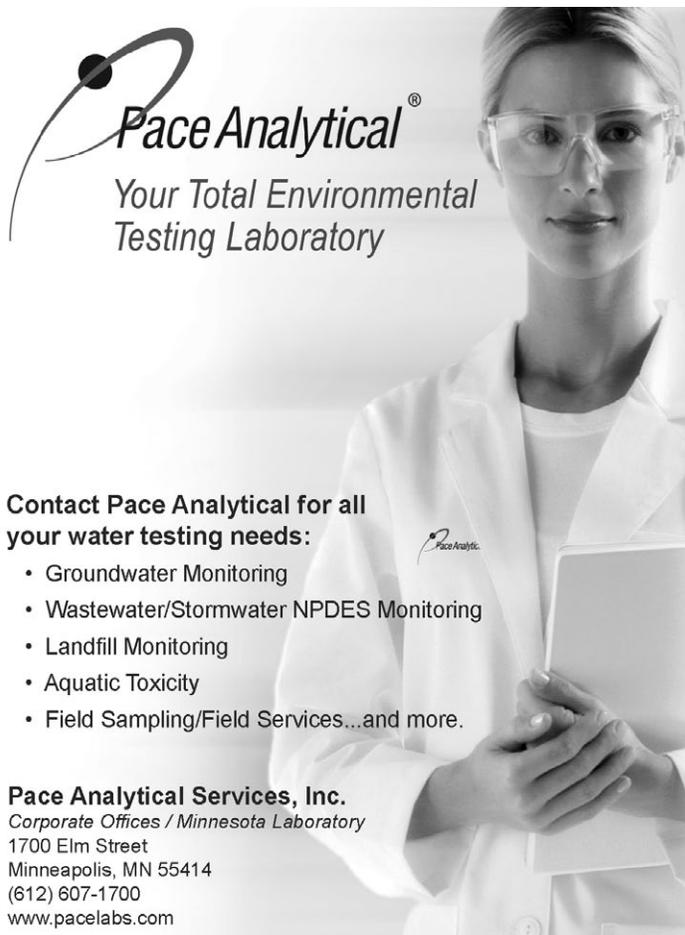
Recent work has identified wastewater as a source of emerging contaminants to streams, lakes, and groundwater, and other studies have raised questions about the effects of these contaminants on fish. Given the many lakes in Minnesota at risk from point and nonpoint sources of emerging contaminants, relevant information is needed on how fish will respond to exposure to endocrine active compounds (EACs) in terms of development and reproduction. Several Minnesota Water Science Center (Center) projects

are providing insights about the extent of this problem at a state-wide scale. Staff from the Center, the USGS National Research Program (NRP), the National Water Quality Laboratory (NWQL), St. Cloud State University and the Minnesota Pollution Control Agency are collaborating to determine the relative contributions of EACs and pharmaceuticals in streams, lakes, and groundwater. These compounds may originate from wastewater treatment plant effluent, septic-system effluent, or agricultural activities. Samples are being obtained from streams, lakes, and groundwater at locations with known or suspected wastewater or agricultural influence, from lakes with varying degrees of on-site septic tank or nonpoint-source influences, from urban-runoff lakes with little or no septic tank influences, and from reference lakes. An assessment will be made of the reproductive and developmental effects of fish exposed to water and sediment with varying concentrations of EACs. A website will be developed, summary reports will be prepared, and outreach events will be planned for disseminating information on emerging contaminants.

#### National Crude Oil Spill Fate and Natural Attenuation Research Site, Bemidji Minnesota

For more than 25 years, the long-term fate of hydrocarbons in the subsurface has been investigated by a multi-disciplinary group of scientists at the Bemidji site. Research at Bemidji has involved extensive investigations of multiphase flow and transport, volatilization, dissolution, geochemical interactions, microbial populations and biodegradation. Detailed monitoring of multiphase fluid

— continued on page 13



**Pace Analytical®**  
Your Total Environmental Testing Laboratory

**Contact Pace Analytical for all your water testing needs:**

- Groundwater Monitoring
- Wastewater/Stormwater NPDES Monitoring
- Landfill Monitoring
- Aquatic Toxicity
- Field Sampling/Field Services...and more.

**Pace Analytical Services, Inc.**  
Corporate Offices / Minnesota Laboratory  
1700 Elm Street  
Minneapolis, MN 55414  
(612) 607-1700  
[www.pacelabs.com](http://www.pacelabs.com)

Phone: (763) 427-6100

Fax: (763) 427-0533

Mobile: (763) 286-9355

[rerenner@ehrenner.com](mailto:rerenner@ehrenner.com)

[www.ehrenner.com](http://www.ehrenner.com)

1-(800)-409-9355

**ROGER E. RENNER**

President

NGWA Certified Master Ground Water Contractor

**E.H. Renner & Sons**

INCORPORATED

WELL DRILLING FOR FIVE GENERATIONS

15688 Jarvis Street N.W.

Elk River, MN 55330



**USGS News and Publications, cont.**

distributions, sediment and mineral properties, groundwater concentrations, microbial populations, and gas vapors has resulted in an improved understanding of the natural processes limiting the extent of the hydrocarbon plume. In 2010, additional research monies will be available through a Request for Proposals (RFP) process, which is part of a newly signed Collaborative Agreement between Enbridge Energy, Beltrami County, the Minnesota Pollution Control Agency, and USGS. The RFP will be announced in February 2010 with a proposal submittal deadline in late March or early April. Proposals will be reviewed, scored, ranked, and selected during April and May for work beginning in summer 2010. The 2010 site field season will be July 19-30.

For more information contact Mindy Erickson or view the project website: [mn.water.usgs.gov/projects/bemidji](http://mn.water.usgs.gov/projects/bemidji).

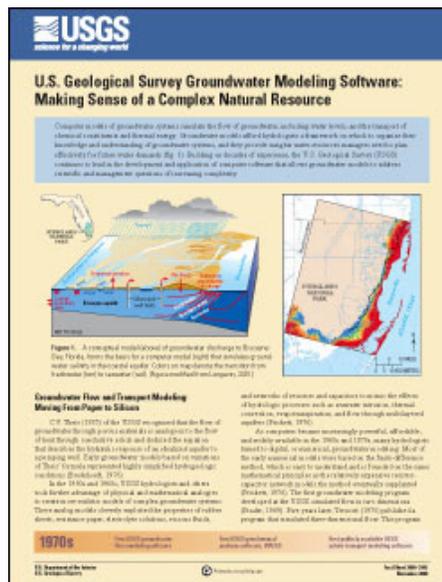
**New and Updated Groundwater Software Releases**

The Office of Groundwater announced the availability of a new Multi-Node Well Package for MODFLOW (MNW2) and updates to several additional groundwater software packages. Each of the packages is available through the USGS Groundwater Software webpage: [water.usgs.gov/software/lists/groundwater](http://water.usgs.gov/software/lists/groundwater) or the MODFLOW and Related Programs webpage: [water.usgs.gov/nrp/gwsoftware/modflow.html](http://water.usgs.gov/nrp/gwsoftware/modflow.html). New releases include the following:

- ◆ MNW2 Package released with version 1.8 of MODFLOW-2005
- ◆ GSFLOW version 1.1
- ◆ Farm Process version 2.0 for MODFLOW-2005
- ◆ Groundwater-Management (GWM) Process 1.2 for

**MODFLOW-2005**

- ◆ Updates to MMA (Multi-Model Analysis), MODFLOW-GUI, WTAQ, and ZONEBUDGET
- ◆ Release of two programs for analysis of hydraulic interaction of stream-aquifer systems (STLK and STWT)
- ◆ A new fact sheet “U.S. Geological Survey Groundwater Modeling Software: Making Sense of a Complex Natural Resource” is also now available online at: [pubs.usgs.gov/fs/2009/3105](http://pubs.usgs.gov/fs/2009/3105)



**BARR**

resourceful. naturally.

Since 1966, companies in the mining, power, manufacturing, refining, and forest product industries have turned to Barr for solutions in:

- Water Resources
- Permitting and Environmental Review
- Environmental Management
- Site Remediation and Redevelopment
- Engineering Design
- Process and Materials Handling

**Now serving North Dakota from Bismarck and other locations**

Call us at **701.255.5460**  
or visit our website at **www.barr.com**  
Minnesota • Michigan • Missouri • North Dakota

## Long-Term Protection of the State's Surface Water and Groundwater Resources

In January the Minnesota Department of Natural Resources submitted to the legislature an evaluation, including funding recommendations, for long-term protection of the state's water resources. The report delineates the areas within DNR mapping, monitoring, and managing programs that need continued or increased funding to move Minnesota forward toward the goal of long-term water resource protection. Partner funding needs are also recognized.

The report is available at [files.dnr.state.mn.us/aboutdnr/reports/legislative/surface\\_water.pdf](http://files.dnr.state.mn.us/aboutdnr/reports/legislative/surface_water.pdf).

## Carver County Geologic Atlas, Part A, Completed

Part A of the Carver County Geologic Atlas is now available. The report, recently published by the Minnesota Geological Survey (MGS), includes five map plates that describe the county's surficial geology; bedrock geology; Quaternary stratigraphy and sand distribution model; bedrock topography, depth to bedrock, and mineral endowment; and the data sets that support these maps. Faulting and deep, buried valleys have affected the distribution of bedrock aquifers in Carver County. Discontinuous glacial outwash sediments (potential glacial aquifers) are sandwiched between till layers above the bedrock. The MGS created a series of maps that depict the areal extent of these aquifers, their tops (by elevation) and their thicknesses (by contours).

The Carver County Geologic Atlas, the 21st report in the County Geologic Atlas Series, is a cooperative effort of the Minnesota Geological Survey, the Minnesota Department of Natural Resources, Division of Waters and Carver County. This portion of the atlas will be joined in the future by Part B, to be prepared by the Minnesota DNR Waters, which will include maps of ground water and pollution sensitivity.

County Geologic Atlases are underway in Blue Earth, Sibley, Nicollet, Clay, Renville, Wright, and Anoka counties. Reports in the County Geologic Atlas Series may be purchased at the Minnesota Geological Survey, Publications Sales Office, at 2642 University Avenue, St. Paul, 55114, phone (612) 627-4782.

The Carver County Geologic Atlas was prepared using geographic information system (GIS) technology. A DVD was prepared that includes versions of the atlas maps and data accessible to GIS users and to those who do not use this technology. Data files and portable document format (PDF) images of plates are available for download. Data for Part A of the report is downloadable from the MGS ftp site at <ftp://mgssun6.mngeo.umn.edu/pub5/c-21/>. More information is on the MGS web site at [www.geo.umn.edu/mgs/](http://www.geo.umn.edu/mgs/). For more information about other reports in the atlas series and access to completed Part B reports please see the DNR Waters web site at [www.dnr.state.mn.us/waters/groundwater\\_section/mapping/status.html](http://www.dnr.state.mn.us/waters/groundwater_section/mapping/status.html).

For more information contact Emily Bauer, Minnesota Geological Survey, at (612) 627-4780 or Jan Falteisek, DNR Waters, at (651)259-5665.

# BRAUN INTERTEC

Steve Albrecht  
952.995.2622

[salbrecht@braunintertec.com](mailto:salbrecht@braunintertec.com)  
[braunintertec.com](http://braunintertec.com)



### Analytical Laboratory Services:

- Ground Water Testing
- Waste Water Testing
- Soil Remediation
- Industrial Hygiene Monitoring
- Asbestos and Lead Paint Testing
- Hazardous Waste Testing

————— • Celebrating 50 years of Growth Through Service and Trust

### MGWA Foundation Hans-Olaf Pfannkuch Endowed Scholarship Fund Established

In honor of Professor Hans-Olaf Pfannkuch's 42 years of dedicated teaching, research and service, the MGWA Foundation has established an endowed scholarship fund to support hydrogeology education and research in Minnesota and the adjacent states and provinces.

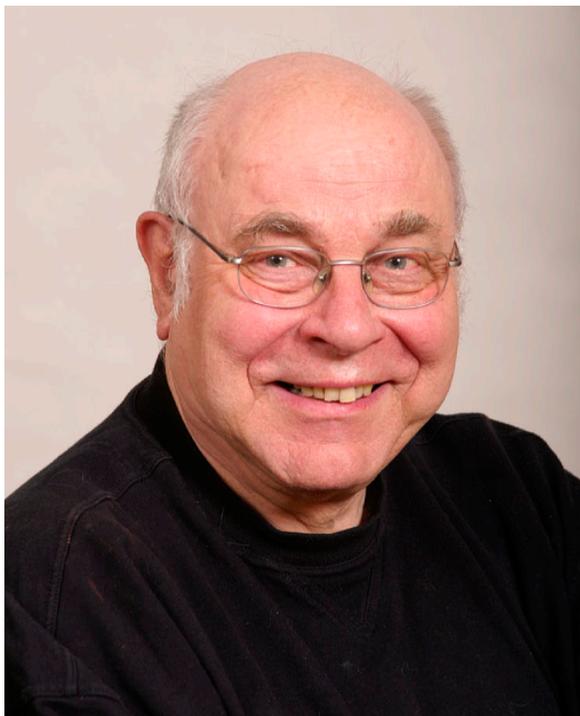
Professor Pfannkuch joined the University of Minnesota Geology & Geophysics Department faculty in 1968. Olaf has been instrumental in establishing the science and profession of hydrogeology as a key component of environmental management in Minnesota at all levels. Olaf is a founding member of the MGWA. Most MGWA members have directly gained from Olaf's teaching, research, public service and wisdom. Many MGWA members first learned hydrogeology in one of Olaf's many undergraduate and graduate hydrogeology courses. Olaf's former students hold key positions in hydrogeology throughout Minnesota and the United States. With little hyperbole, Hans-Olaf Pfannkuch is the father of Minnesota Hydrogeology.

The proceeds from the endowment of the Hans-Olaf Pfannkuch Fund (Fund) will be used to:

- ◆ Support full-time degree seeking students attending a hydrogeology field camp engaged in the study of Minnesota's regional hydrogeology, or
- ◆ Support hydrogeology research expenses of undergraduate and graduate university and college students in Minnesota and surrounding states and provinces should there be no hydrogeology field camp.

The Fund was established by the MGWA Foundation Board in late December 2009. More than \$10,000 had been given or pledged to the Fund by early February 2010. It will take an endowment of at least \$25,000 to generate enough income to support an annual scholarship. Contributions can be made to the fund on the MGWA Web site on credit cards or via check, (payable to The MGWA Foundation, please note on the check that it is for the Pfannkuch Fund). Calvin Alexander, Geology & Geophysics Department, 310 Pillsbury Dr. SE, Minneapolis, MN 55455, is the initial fund-raising coordinator and contributions can be sent to him. If you have any questions or comments about the fund-raising for the Pfannkuch Scholarship Fund, Calvin can be reached at alexa001@umn.edu or (612) 624-3517.

A retirement party to celebrate Olaf's long career at the University of Minnesota is being organized. The event will be held on Saturday, May 15, 2010, on the Minneapolis Campus of the University of Minnesota. The event is open to any friend, colleague or admirer of Professor Pfannkuch. If you are interested in attending the retirement party contact either Kathy Ohler (612) 624-9031, k-ohler@umn.edu, or Calvin Alexander for information and to make a reservation.



**Reserve your place at  
Dr. Pfannkuch's  
retirement party.  
Call Kathy Ohler at  
(612)624-9031**

## MGWA Foundation Board of Directors

**President**  
**Gil Gabanski**  
Hennepin County  
(612)418-3246  
[ggabanski@hotmail.com](mailto:ggabanski@hotmail.com)

**Secretary**  
**Cathy Villas-Horns**  
Minnesota Department of  
Agriculture  
(651)297-5293  
[cathy.villas-horns@state.mn.us](mailto:cathy.villas-horns@state.mn.us)

**Treasurer**  
**David Liverseed**  
(651)366-3640  
[david.liverseed@dot.state.mn.us](mailto:david.liverseed@dot.state.mn.us)

**MGWA Liaison**  
**Scott Alexander**  
612-624-7822  
[alexa017@umn.edu](mailto:alexa017@umn.edu)

**Director**  
**Chris Elvrum**  
Metropolitan Council  
(651)602-1066  
[christopher.elvrum@metc.state.mn.us](mailto:christopher.elvrum@metc.state.mn.us)

**Director**  
**Amanda Strommer**  
Washington County  
(651)430-6655  
[amanda.strommer@co.washington.mn.us](mailto:amanda.strommer@co.washington.mn.us)

***The MGWA Foundation is a 501(c)3 charitable organization. Donations to the Foundation are deductible on your state and federal income tax returns.***

## FOUNDATION MINUTES

### Minnesota Ground Water Association Foundation Board Meeting Minutes

- Meeting Date:** December 8, 2009  
**Location:** Metro 94 Building, 455 Etna Street, St. Paul  
**From:** Cathy Villas-Horns (Secretary)  
**Members Present:** Gilbert Gabanski, Chris Elvrum, David Liverseed, Stu Grubb and Cathy Villas-Horns. MGWA Management Present: Sean Hunt and Jennie Leete  
**Minutes:** The meeting minutes for the September 15, 2009 meeting were unanimously approved on November 6, 2009. The minutes were provided via e-mail to the MGWAF Board and the MGWA Newsletter staff.  
**Treasurer's Report:** Foundation balance to date is \$94,044.70. Interest in the amount of \$449.10 was accrued since 9-15-09 and was swept into the endowment. Total credits of \$587 from renewing memberships and donations to the MGWA Foundation were received during this period. One debit of \$1,500 was paid as a grant to the Minnesota Children's Water Festival during this period. In February 2010 the 60-month CD which is currently valued at \$12,410.48 is maturing. Dave suggested that this money be put into the Membership Savings account where the money would accrue interest (at a low rate). Other options include a 12-month CD at an rate of approximately 1.96% or another Step-Up CD which would provide progressively higher rates of return over time. Dave moved that the 60-month CD maturing in February 2010 be transferred to the Membership Savings account upon maturity. Cathy seconded the motion. Motion passed.  
**New Business:** Grant requests – One grant request received from the University of Wisconsin River Falls for a Western Regional Field Trip in Wyoming, Utah, Idaho and Montana for \$1,000. Chris moved that the grant request be approved for funding. Stu seconded the motion. Motion passed. Olaf Pfannkuch Scholarship – Discussion of idea to honor the many years of service of Olaf Pfannkuch in teaching and researching ground water hydrogeology in Minnesota with an endowed scholarship. Donations to the proposed Hans-Olaf Pfannkuch Endowed Scholarship Fund (the Fund hereafter) would be to the MGWAF and would be administered by the MGWAF Board under the MGWAF bylaws. Awards would be made only from the income on the Fund and would not draw down the principal. The Fund may not make an award every year until the Fund grows to the point that annual awards can be funded from the income and the awards will vary depending on the performance of the Fund as determined by the MGWAF Board. The Fund would be dedicated to support full-time degree seeking students attending a one to three-week Hydrogeology Field Camp based in Minnesota. If the Hydrogeology Field Camp in Minnesota ceases to operate the funds would be open to support hydrogeology research expenses of undergraduate and graduate University and College students in Minnesota and surrounding States and Provinces. Dr. Calvin Alexander has agreed to be the fund raising coordinator to establish the Fund and may recommend a successor to the MGWAF Board at that time he desires to step down from that activity. The MGWAF Board would not be responsible for fundraising.  
**Old Business:** MGWA Board Meeting report – Stu reported that the fall MGWA conference was successful. The National Geological Society of America (GSA) conference will be held in the Twin Cities in October 2011. Semi-annual vs. Quarterly MGWAF board meetings – Following discussion, the board members present decided that MGWAF board meetings will be held in March and September each year, and that the March meeting will be the "annual" meeting. The June and December meetings will be optional, depending on the amount of business to be discussed in those time periods. Single grant requests received during quarters when a meeting is not scheduled to occur will be reviewed and approved via e-mail. Gil will send out a calendar for 2010 soon.  
**Next Meeting:** The first 2010 meeting of the MGWA Foundation Board was held March 9.

## MGWA BOARD MINUTES

### Minnesota Ground Water Association Board Meeting Minutes

**Meeting Date:** December 11, 2009  
**Location:** Fresh Grounds Coffee Shop, 1362 West 7th Street, St. Paul, Minnesota  
**Attending:** Scott Alexander, President; Stu Grubb, Past President; Steve Robertson, President-Elect; Jon Pollock, Secretary; Tedd Ronning, Newsletter; Sean Hunt, WRI  
**Past Minutes:** The November 6, 2009 minutes were approved as written.  
**Treasury:** Preliminary net income for 2009 is approx. \$12,104.00. Wells Fargo checking balance is \$29,479. Affinity Plus savings balance is \$15,973.  
**Newsletter:** December issues files in draft.  
**Web Page:** Conference page up with presentation audio files and pictures.  
**WRI Report:** Dues coming in 200-300 received so far. WRI will send second notice. Conference was full and WRI was managing conference activities. Conference information was added to web page. May 6 and November 9 in 2010 were booked for conference dates. Corporate renewals were sent out. Foundation looking at going from four to two meetings per year.  
**Old Business**  
Groundwater sustainability – no action.  
Field Trip – no action. GSA conference here 2011. Harvey Thorleifson is local coordinator and Jim Miller is field trip coordinator for conference.  
Fall Conference – Comments were distributed and generally positive. Sean suggested using an electronic survey after the conference rather than written comments as the written comments take a lot of time to process. Electronic survey is also used for MGWA elections. Motion to approve MGWA to spend up to \$200.00/year for Survey Monkey subscription was seconded and passed.  
Officers – Election notice being sent out by email next week.  
**New Business**  
Foundation - next MGWA Foundation meeting scheduled for March 9, 2010.  
Spring Conference - Ideas include metal (nickel and copper, etc.) mining in northern Minnesota, mercury pollution in Saint Louis River Basin, microbiology in Sudan mine, and geophysics.

**Meeting Date:** January 8, 2010  
**Location:** Fresh Grounds Coffee Shop, 1362 West 7th Street, St. Paul, Minnesota  
**Attending:** Steve Robertson, President; Mindy Erickson, President-Elect; Craig Kurtz, Treasurer; Scott Alexander, Past President; Jill Trescott, Secretary; Norm Mofjeld; Gil Gabanski; Tedd Ronning; Sean Hunt, WRI  
**Past Minutes:** December minutes approved.  
**Treasury:** Review of balance sheet reveals cash on hand is approximately \$30,000 in the checking account. Net income for 2009 is about \$11,000.  
**Newsletter:** Norm Mofjeld asked for nominations for a new editor. Steve nominated Tedd Ronning. Scott seconded the nomination. All were in favor.  
**Web Page:** Sean has done maintenance on the website. The latest newsletter has been posted.  
**WRI Report:** Report distributed. Highlights include: 1) Dues payments still arriving. Second notices will be sent next week. 2) 2010 dues paid in 2009 moved into 2010. 3) Wrapped up Fall Conference. 4) Corrected, printed, and distributed December newsletter, including posting on website.  
**Foundation:** Gil Gabanski reported on the Olaf Pfannkuch scholarship fund, for which Calvin Alexander is heading up the fundraising. Decisions would be handled by the MGWA Foundation Board. It would support full-time students to attend a hydrogeology field camp or support student (graduate or undergraduate) research.  
**Old Business:** Fall conference: Audio from the conference is available on the website. GSA will hold a joint meeting with MGWA in October 2011. Harvey Thorleifson is coordinating the GSA meeting.  
**New Business:** Spring Conference: Steve Robertson discussed topics (May 6). The theme will be mining, both hard-rock mining such as that being proposed for northern Minnesota and aggregate mining such as in the Metro area.  
WRI contract is up for renewal and will be voted on at the next meeting.  
**Next Meeting:** February 12, 2010, at 11:30 at Fresh Grounds at 1362 West 7th Street, St. Paul, Minnesota.

**The MGWA Board of Directors meets once a month.**

**All members are welcome to attend and observe.**



*Environmental Concepts  
& Design, Inc.*

**Consultants for Landfills,  
Groundwater & Environmental  
Remediation.**

Professional Geologists &  
Engineers

**Toll-Free (800) 709-5263  
ECADengineering.com**

# MGWA FINANCES

## Treasurer's 2009 Year-End Financial Report

### Income Statement January 1 - December 31, 2009 (all values rounded to nearest U.S. Dollar)

<b>Income</b>	Member, Student, and Corporate Dues	\$17,442
	Advertising	\$4,006
	Interest	\$224
	Conference and Program Fees	\$48,746
	Products	\$57
<b>Total Income</b>		\$70,667
<hr/>		
<b>Expenses</b>	Administration	\$11,065
	Conference Expenses	\$32,965
	Membership Services	\$12,464
	Public Services	\$1,573
<b>Total Expenses</b>		\$58,067
<b>Net Income</b>		\$12,600

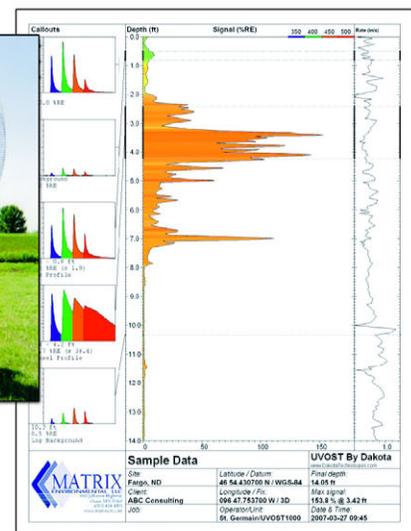
### Treasurer's Report

- ◆ 2009 ended with a surplus of \$12,600 on a total income of \$70,667. This amount is approximately \$4,000 more in net income compared to last year
- ◆ Upon the Board's approval, the \$12,600 in net income from 2009 will be transferred to the MGWA Foundation in mid-2010
- ◆ At the end of 2009, the MGWA had approximately \$46,200 available for operations. This amount is approximately \$2,000 less than at the end of 2008
- ◆ If you have any questions, comments, or concerns regarding the MGWA finances please contact Craig Kurtz at 763.757.6876 or at [craigkurtz@msn.com](mailto:craigkurtz@msn.com)



## Environmental Field Services

- ◆ **Geoprobe®**  
4x4 Trucks, All-Terrain Vehicles & Portable Units
- ◆ **Mobile Lab**  
VOCs, Hydrocarbons, PCBs, PCP, PAHs & Metals
- ◆ **Direct Sensing**  
UVOST - Laser Induced Fluorescence, Membrane Interface Probe (MIP), Electrical Conductivity Logging
- ◆ **Remediation**  
Bioremediation, In-situ Chemical Oxidation, Stabilization



Our ultra-violet optical screening tool (UVOST) is specifically designed for delineating the NAPL found at Petroleum, Oil, Lubricant (POL) sites. UVOST can be deployed by all forms of direct push across a wide range of site conditions.

Matrix MN Office  
8631 Jefferson Highway  
Osseo, MN 55369  
(763) 424-4803  
Fax: (763) 424-9452

**MATRIX ENVIRONMENTAL LLC**  
[www.matrixenv.com](http://www.matrixenv.com)  
email: [customerservice@matrixenv.com](mailto:customerservice@matrixenv.com)

OH Office  
P.O. Box 364  
Galena, OH 43021  
(740) 965-8271  
Fax: (740) 965-8037