

Minnesota Ground Water Association

www.mgwa.org

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President's Message

What's Our Mission?

My term as president of the Association is about over and this is my last column. Rob Caho assumes these duties in January. It has been my pleasure to get to know Rob during this last year and I am confident that the organization is being left in capable hands. I've had a great group of people with which to work. They have included Jim Lundy, Jan Falteisek, Rob Caho, Eric Hanson, Tom Clark, Jeanette Leete, Sean Hunt, and Jim Aikin, as well as many others who have helped out with the Association. Jim, Jan and Tom are taking a break from their duties on the Board. Jim has served for three years as president-elect, president, and past-president, in addition to duties on the newsletter team. Jan has kept us organized, as the Association's secretary for four years. As editor for seven years, Tom has ensured that our newsletter is informative, accurate and on time. See the article on page 3 concerning the editor opportunity. These folks have devoted many hours on tasks that are needed to keep the Association going. They will really be missed and they deserve our heartfelt thanks. I'm glad that they will remain active in the organization. The organization will move forward. Luckily we have been able to recruit Marty Bonnell, Jon Pollock and Cathy Villas-Horns to run for offices that are becoming vacant. In addition, Gordy Hess has agreed to serve as president of the Foundation. Gordy replaces Paula Berger, who served us so well during the last year. Please complete and return your enclosed ballot.

We are approaching the 20th anniversary of the formation of this organization. At this milestone we should pause to reflect on the value that this organization brings to our state. Our

mission includes: 1) promoting and encouraging scientific and policy aspects of ground water, as an information provider; 2) protecting public health and safety through continued education of ground-water professionals; 3) establishing a common forum for those concerned with ground water; 4) educating the general public about ground water and ; 5) disseminating information about ground water. In my opinion we do a good job of providing educational and communication opportunities for our members. We have now formalized our Foundation to reach out beyond our membership. However, we still have a long way to go in educating the public about ground water. The Minnesota Pollution Control Agency has recently cut most of its ground-water studies and monitoring activities. Where is the outcry? Are we really the "hidden resource"? Sometimes it seems it must be so in the eyes of the public. At our fall conference Doug Ewald reminded us that our legislators respond with laws and funding to issues that are presented with a unified message. Does ground water have a unifying advocate to organize and facilitate the individual messages from the numerous agencies and organization that are interested in ground water in Minnesota? Possibly that should be the role of the MGWA during the next decade. Possibly that is beyond the reach of where this organization can, or ought, to be? We need your thoughts and opinions on this. We need you to be involved.

That's all from me. Have a nice Holiday season.

— Jim Stark, MGWA President

Capillary Fringe

Preaching to the Choir in the Church of the Unseen Resource

Recently I heard Andrew Stone of the American Ground Water Trust speak on "Decision Maker Education". He argued that ground water scientists bear a responsibility to use their expertise to influence public policy with respect to ground water.

People still expect drinking water — much of it ground water — to be clean, drinkable, healthy and accessible. They regard this as a right, an entitlement. Meanwhile, funding vanishes for remediation, USGS water programs, Minnesota's ambient ground water monitoring program, and the Metro ground water flow model.

We may be seeing the evaporation of the public will to manage ground water.

Ground water scientists well know that ground water differs from surface water and air because it is the unseen resource. Perhaps we know this so well we've forgotten it. When we experts forget, or are unwilling to say what we know—that ground

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Capillary Fringe, cont.

water protection is critical, that it's
simultaneously invisible and utterly
essential—why should we expect the
public to know? And if the public
doesn't know, can we expect the pub-
lic to care?

Striving for technical excellence is
necessary but not enough. If we only
excel, we risk irrelevance in the pub-
lic's eye. It's not enough anymore to
just write a report and expect every-
one, including those who control the
budget, to read and understand it. It's
not enough anymore to just take
PowerPoint presentations to scientific
conferences. That's like preaching to
a choir that's already got religion.

To fully protect the resource, and
avoid irrelevance, we ground water
scientists need to teach. Most of us
don't have teaching certificates, but
that doesn't stop us from telling the
public what we know about the
unseen resource. If we complete
expensive projects but can't tell
engaging stories about them to those
who benefit, then our good work is
vulnerable to elimination.

This is not about "lobbying". Deci-
sion-makers expect us to inform them
about the importance of ground water
matters. They take pride in making
good decisions. They are not ground
water experts, yet their decisions
affect us all, scientist and citizen, pro-
fessionally and personally, making
this group particularly critical. If deci-
sions they make support ground
water activities, that's great. If not,
then at least let us promote the best
possible decision making by providing
the best scientific information we can
find. The responsibility for providing
that information is ours.

Here's a short list of things MGWA
can do:

- Improve the organization's visibil-
ity. MGWA's membership includes
over 500 of the best ground water
scientists in the state, an of-
ten-underused technical resource.
- Inform decision-makers about
ground water issues. Learn when
and where ground water issues
are to be formally discussed (leg-
islative committees, county com-
missions, citizens' meetings, etc.).

- Attend these meetings to provide
the needed information. Don't wait
for a crisis to begin a relationship
with decision makers.
- Become impartial technical re-
viewers to proposed legislation.
- Develop a speakers' bureau to
deliver ground water information
to citizens and schools.
- Tell the public about ground water
issues that affect them. Keep a
current fact sheet (posted on
www.mgwa.org) of the "Top Ten
Minnesota Ground Water Issues".
Develop web page interactivity to
solicit important issues from the
membership and the public.
- Continue to stress educating chil-
dren—the future decision-makers.
Bring our message into the
schools, beginning with our own
children. Guarantee teachers
have what they need (resources,
curricula, demonstrations, techni-
cal support, networks, etc.) to
teach about ground water. Pro-
vide presentation materials for our
members to easily take into the
schools with a minimum amount
of preparation time.
- Develop partnerships with organi-
zations such as Office of Environ-
mental Assistance, Eco-Educa-
tion, American Ground Water
Trust, Project WET, and the
Hamline University Global Center
for Environmental Education. Of-
fer MGWA's assistance in the de-
velopment of curricula related to
ground water.

Surely there are others. Some items
are already receiving the attention of
the MGWA Ground Water Public Edu-
cation Committee. Please contact me
(651-296-7822; [jim.lundy@
pca.state.mn.us](mailto:jim.lundy@pca.state.mn.us)) if you are interested
in helping.

I have heard it said that eventually a
ground water crisis will occur, and the
funding "pendulum" will return, thus
justifying our good work for another
funding cycle. This is a passive
stance that honors neither the
resource, our good work to protect it,
nor those who benefit.

Andrew Stone concluded his talk by
asserting that "we must not be in the

— *concluded on next page*

Newsletter Has Editorial Opportunity

After much thought, I've decided that the March 2002 (v. 21, no. 1) MGWA newsletter will be my last as your editor-in-chief. After seven years, it's time for some "new blood" in this position. It may surprise some readers to learn that there have only been five newsletter editors in MGWA's 20 years:

- 1982-1985: Pat Leonard-Mayer, U. S. Bureau of Mines
- 1985-1987: Kevin Powers, Leggette, Brashears and Graham
- 1987-1990: Lee Trotta, U. S. Geological Survey
- 1990-1995: Jan Falteisek, MN Department of Natural Resources
- 1995-2002: Tom Clark, MN Pollution Control Agency

Like Jan Falteisek before me, I plan to remain active with MGWA as a part of your newsletter team and do what I can to assure that our members continue to receive the best state ground water association newsletter in the country. The last couple of years of my career at MPCA have taken me away from ground water as a primary focus of my day-to-day work. I've found it increasingly more difficult to keep pace with the rapid changes taking place in ground water science. I know there are others out there awaiting the opportunity to keep the newsletter cutting-edge.

I'd like to thank the many folks I've worked with over the years—all of you who've submitted ideas, articles and photos—and especially the current newsletter team of Jan Falteisek, Jim Lundy, Jon Pollock and Steve Robertson. You guys remind me constantly of what good teamwork is all about. And I'd be remiss not to mention our publisher, Watershed Research, Inc. of White Bear Lake. Jennie Leete and Sean Hunt never fail to produce a quality product, even when the newsletter team drops those inevitable last-minute items on them at deadline time.

The original intent was that the MGWA newsletter editorship be a voluntary position for a two-year term. Seems Jan and I may have stretched that a bit over the last 12 years! With the current team approach we've adopted for producing the newsletter, there's no reason why the editor's term can't return to the shorter tenures of the 80's and allow the newsletter to remain healthy. The newsletter's strength has always been and must continue to be with you, the readers. If you'd like a chance to serve your association as editor, contact me or a member of the editorial team, or any member of the MGWA Board of Directors. Contact information is given in the sidebars on pages 2 and 3.

— Tom Clark, MGWA Newsletter Editor

Loss in the MGWA Family

It is with sadness that we report that MGWA member Dr. George N. Huppert died in a car accident October 14, 2001 while driving from the Tucson, Arizona airport to the National Cave and Karst Management Symposium.

George was a long-time "friend of karst" and was a professor in the Department of Geography and Earth Science at the University of Wisconsin, LaCrosse. He was active nationally in the American Cave Conservation Association and was a noted educator both at the university level and among lay people. Memorial contributions in George's name

may be made to the following organizations:

- Second Chance Animal Rescue, Box 10533, White Bear Lake, MN 55125
- American Cave Conservation Association, Box 409, Horse Cave, KY 42749

Capillary Fringe, cont.

ivory tower, but in the lighthouse." I believe the MGWA can play a critical, active role in educating decision-makers on ground water issues. I believe that it must, and that the time to begin is now.

— Jim Lundy, MPCA. Jim Lundy is Past President of the Minnesota Ground Water Association

2001 Board of Directors

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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.

Dye Tracing to Camp Coldwater Spring, Minneapolis, MN

By E. Calvin Alexander, Jr. and Scott C. Alexander, Dept. of Geology & Geophysics, University of Minnesota, 310 Pillsbury Dr. SE, Minneapolis, MN 55455, alexa001@umn.edu, alexa017@umn.edu and K.D. Barr, Kelton Barr Consulting, Inc., P.O. Box 19319, Minneapolis, MN 55419, kbcinc@qwest.net.

Abstract

Camp Coldwater Spring is a ~6.3 liter/sec spring that emerges from a Platteville Limestone ledge at the top of the west side of the Mississippi River gorge. It was the original water supply for Ft. Snelling in the early-mid 1800's and is a registered Minnesota State Landmark. Potential impacts from nearby highway construction led to two successful dye traces to help define the groundwater basin feeding the spring. These traces are the first traces through the Platteville in the Twin Cities. Dye input trenches were dug with a backhoe to the top of the water table. Input B reached the top of the Platteville and the water table was a few inches above the bedrock surface. Eosin dye input into the trench reached Camp Coldwater Spring, 125 meters away in less than 1.5 hours. The minimum flow velocity in the fractured Platteville Limestone was 83 m/hr. Input C reached the water table while still in glaciofluvial sediments and was 305 meters from the spring. Fluorescein dye from Input C reached the spring in 16 days. The slower flow velocity is a combination of flow through the glaciofluvial sediments and through the fractured Platteville Limestone. These two positive traces demonstrate that Inputs B and C are inside the ground-watershed that supplies the Spring and support concerns about the potential impact of dewatering and construction activities on the Spring. The trace is ongoing.

Camp Coldwater Dye Traces

These dye traces were designed to investigate the possible impact of dewatering and other construction activities associated with the construction of the new Highway 55/62 Interchange on the flow of

groundwater to Camp Coldwater Springs. This interchange is in south-eastern Minneapolis, Minnesota on the northeast corner of the Minneapolis/St. Paul Airport. Dye tracing can demonstrate that groundwater flows from specific input points to springs, i.e. that those specific input points are inside the ground-watershed that supplies the springs. A positive trace also provides quantitative measures of the groundwater flow velocity between the input point and sampling point under the flow conditions operative during the trace.

Two basic types of samples have been collected and analyzed during this trace: 1) direct water samples (hereafter "water samples") which provide a quantitative measure of the dye present at the time and place the water sample was collected, and 2) activated carbon samplers (hereafter "charcoal samples") which provide a qualitative, integrated record of the passage of dye past the detector during the interval the charcoal sampler is in the water.

Dye Analysis

The concentrations of the fluorescent dyes Phloxine B (CAS 18472-87-2), Eosin Y (CAS 17372-87-1) and Uranine C or fluorescein (CAS 518-47-8) were quantitatively measured with a Shimadzu RF-5000 scanning spectrofluorophotometer. The dyes were measured simultaneously using a synchronous scan mode where the excitation and emission wavelengths are varied with a constant wavelength separation (DI) of 15 nanometers (nm). Excitation wavelengths are scanned from 385nm to 635nm; emission wavelengths are scanned from 400nm to 650nm at high sensitivity. Bandwidths for emission and excitation are set at 5 nm. Identification and quantification of dye and its concentration is performed using the Peakfit™ 4.0 program (Jandel Scientific Inc.) The detection limits are typically on the order of 10 ppt (parts per trillion, 10^{-12} g/g) or 0.01 ppb (parts per billion, 10^{-9} g/g).

Background Sampling

Background sampling for these traces began on 1 April 2001 at Camp Coldwater Springs and at other locations later in April. The

background sampling points include all of the local springs and seeps that careful field work was able to locate, a variable number of monitoring wells, the outfall from a variable number of dewatering wells, and the outfalls from storm sewers and drainage systems. The number of sampling locations grew during the duration of this trace as new sampling points have been added to the array. Automatic samplers were used to periodically collect direct water samples from Camp Coldwater Springs. Charcoal detectors were used to monitor the other sampling points and to back up the direct water samples from Camp Coldwater Springs. No evidence of pre-existing fluorescein, Eosin Y, Phloxine B, or sulforhodamine B was detected in any of the samples during the background sampling. A variety of background fluorescent organic compounds were present in the samples particularly in the charcoal samplers.

Dye Inputs

Input A consisted of pouring 200.2 grams of Phloxine B dye into a collapse feature along the side of the service road. The dye was input at 08:45 CDT on May 8 and was followed by about 2000 gallons of water.

Input B was a 40-foot by 10-foot backhoe trench to the Platteville Limestone bedrock. The trench was 12 to 13 feet deep and had about 3.5 feet of water in the bottom. The water ran into the trench almost as quickly as the backhoe dug through numerous crevices in the bedrock surface. At 17:00 CDT 8 May 2001, 300 grams of 35% Eosin Y Liquid dye (105 grams of dye) was poured into the trench. The contents of a water truck were then discharged into the hole to push some of the dye out of the trench.

The next morning the trench was backfilled with a bulldozer between 10:00 and 10:15 AM, 9 May 2001. The bulldozer operator backfilled the trench too rapidly and some portion of the remaining water and Eosin Y in the trench rose to the surface and a unquantified but small amount of the diluted dye ran a short distance on the surface and then infiltrated. The process of backfilling created a transient, approximately 9-foot high hydraulic

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gradient that pushed some of the dye remaining in the trench, into the groundwater flow system. As discussed below this unplanned event serendipitously provided a signal that was clearly evident at the data at Camp Coldwater Springs.

Input C: Construction dewatering of the area around the new interchange delayed the third dye input at the interchange. A court-ordered 30-day pause in the pumping allowed a trace from the traffic exchange site. Input C was two distinct inputs both within the construction area of the new 55/62 interchange along the western edge of the new bridge. Both were backhoe trenches dug into the water table in glacial sand and gravel. Both inputs used 350g of 35% fluorescein dye solution; 122.5g of dye. The inputs occurred at 06:30 and 07:15 CDT on June 1, 2001. The dyes were mixed with the standing water in each trench and then 2000 gallons of water was added to each trench.

Results Of Analyses Of The Charcoal Detectors

The results of the qualitative analyses of the charcoal detectors are described below.

Input A, Phloxine B: No Phloxine B has been detected on any of the charcoal detectors.

Input B, Eosin Y: Eosin Y began to be detected in the charcoal detectors in and downstream of Camp Coldwater Springs immediately after it showed up in the water on 8 May 2001. It has been detected nowhere else in the monitoring array. The concentration of Eosin Y is currently near its detection limit in the direct water samples from the spring but remains clearly visible in the charcoal detectors.

Input C, fluorescein: Fluorescein began to be detected in the charcoal detectors in and downstream of Camp Coldwater Springs immediately after it showed up in the water on 16 June 2001.

In addition fluorescein has been detected in several of the monitoring wells to the southeast of input points and has been present in the outfall from the dewatering wells near the

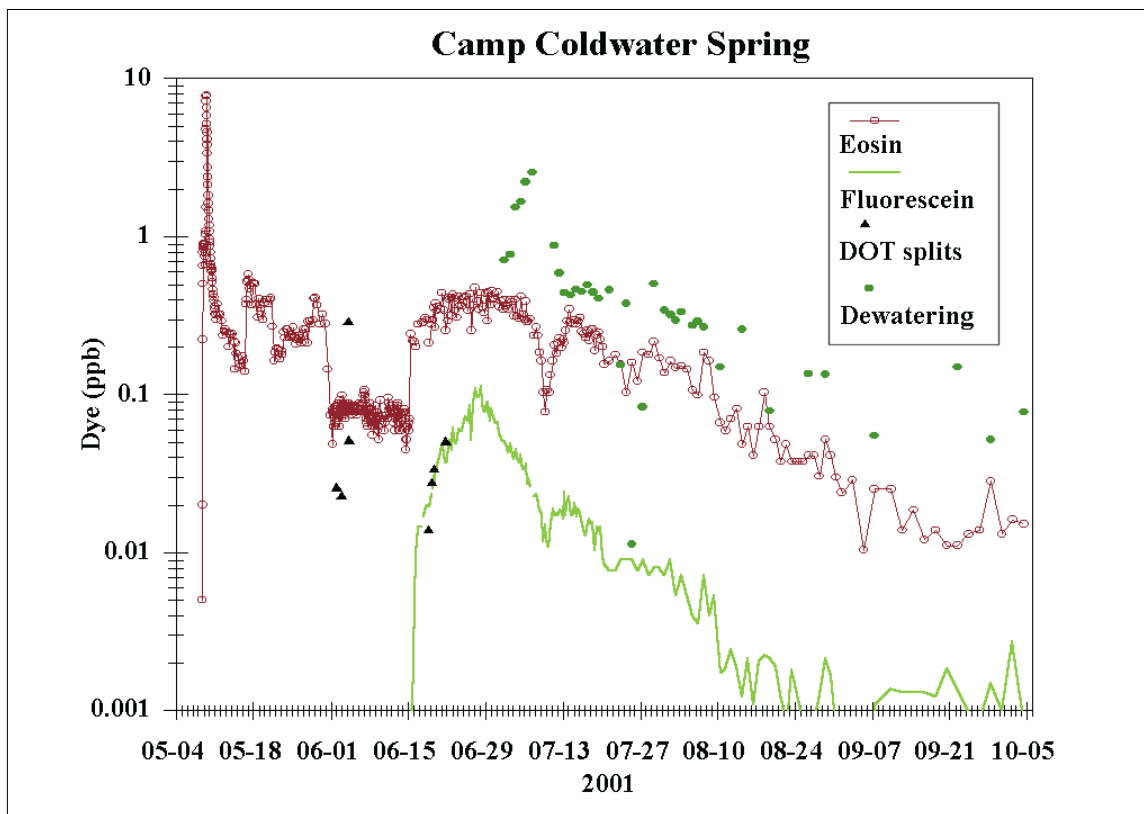
exchange since they resumed pumping at the end of June.

Results Of Water Analyses

The results of our scanning spectrofluorophotometric analysis of the water samples collected from Camp Coldwater Springs are summarized the breakthrough curve in Figure 1. Dye concentrations are in units of parts per billion (10^{-9} g/g). The breakthrough curves of eosin Y and fluorescein at Camp Coldwater Springs are shown in Figure 1.

Input A, Phloxine B: We have not detected any Phloxine dye in direct water samples from the Coldwater Spring crevice or in any of the charcoal detectors.

Input B, Eosin Y: Between 17:30 and 18:30 on 8 May 2001 the leading edge of the Eosin dye began to arrive at Camp Coldwater Springs (Figure 1). The dye had traversed a distance of 125 meters in less than 1.5 hours. Dye concentrations from the original input pulse reached about one ppb. This corresponds to a travel velocity of 273 ft/hr (1.24 miles/day) or 83 m/hr (2 km/day).



A second pulse of dye reached the Camp Coldwater Springs between 11:00 and 11:30 and reached a peak concentration of 7.5 ppb at 13:00 on May 9. The transient head imposed on the system when the input trench for the Eosin Y was filled apparently caused this second pulse. The travel time is consistent with the travel time of the first pulse (about 1.5 hours).

The backfilled trench has apparently produced a long-term source of Eosin Y and, as of early October 2001, Eosin Y continues to emerge from Camp Coldwater Springs.

Figure 1. Breakthrough Curve of Dye Samples Collected at Camp Coldwater Spring.

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Dye Trace, cont.

The dye concentration in the direct water samples is near the detection limit but Eosine Y remains clearly detectable in the charcoal detectors, which are currently being changed every two weeks. The long tail contains a potentially useful - but complex and cryptic record - of the flow from input B to the spring.

Input C, fluorescein: Fluorescein was first detected in the water sample collected by the auto samplers at 20:00 on 16 June 2001, sixteen days after it was poured into the pits at Input C, see Figure 1. This corresponds to a travel velocity of 63 ft/day or 19 m/day. Peak concentration occurred on June 27, 2001.

Conclusions

From these results we conclude that dye input Location B and Location C are within the ground-watershed that contributes flow to Camp Coldwater Springs. That conclusion applies to the flow conditions present between 8 May and the present for Input B and to the flow conditions that existed between June 1 and the present for Input C. Under these conditions, dewatering of the area around Location B or C will decrease the flow of groundwater to the springs. Specifically, these results support the concern that the interception of groundwater by a stormwater basin and groundwater subgrade drains associated with the Highway 55/62 interchange will permanently reduce groundwater flows to the springs.

There is also evidence of a groundwater flow component from Input C to the southeast. The dewatering pumping near the exchange is currently impacting both the flow to the southeast and the flow to Coldwater Spring. Pumping will cease this fall. Monitoring of the dye plume will continue as the local flow returns to its previous conditions.

These results are, to our knowledge, the first successful dye traces in the Platteville Limestone in the Twin Cities. The flow from Input B to Camp Coldwater Springs was via some type of high transmissive zone, fracture, or conduit. The leading-edge velocity of 83 m/hr is far greater than any

possible flow in porous media. The geophysically determined fractures and karst solution features in the Platteville are obvious candidates for the high velocity pathways and both types of features are known to exist in the Platteville Limestone.

The pathway(s) from Input C to Coldwater Springs is more complex because Input C is in a buried river valley and an unknown part of the pathway from C to the springs was through glaciofluvial sediments. The dewatering pumping that immediately preceded Input C further complicates any interpretation. Nevertheless, the leading edge velocity of 19 m/day is also far in excess of porous media velocities.

The dye trace results not only show that lowering of the water table at C will impact the flow in Coldwater Springs but also indicate that groundwater-flow codes based on laminar flow in porous media are not adequate to model the flow in the Platteville Limestone.

Acknowledgments

These traces were supported by the Minnehaha Creek Watershed District and were conducted in cooperation with Kelton Barr Consulting, Inc.

Editor's Note: The above is modified from a poster presented at the 2001 Midwest Ground Water Conference. Readers interested in further background on the issue of ground water dewatering at the MSP airport and Highway 55/62 interchange may wish to review articles by Stu Grubb, P.G. and Ray Wuolo, P.E., P.G. that appeared in the September 2000 MGWA newsletter (v. 19, no. 3).

MGWA Spring Conference April 23, 2002

Mark your calendars now for next year's spring conference so you won't miss it! We'll be returning to a topic in need of revisiting in light of all the recent technological advances—drilling and field investigation techniques. Welcome spring at the Earle Brown Center and be prepared to “get dirty” with hands-on demonstrations. Watch for more details and registration information in future newsletters and on the website.

MGWA Fall 2001 Conference - The Value of Water

More than 130 professionals attended the conference on November 6 to learn more about the value of water in Minnesota and how value is considered and established.

The morning session introduced those attending to the science of economics and what that discipline has to offer when ground water must be valued.

Steve Taff, University of Minnesota, Applied Economics, provided an overview of the role economics could play when decisions on ground water must be made. He explained that value is attached to a service that ground water provides not ground water itself. Tracking down and attaching dollar amounts to all the tangible and intangible, market and non-market, and in situ and extractive values of ground water is the job of applied economists.

Mark Bjelland, Gustavus Adolphus College, addressed the value of ground water by examining it at the intersection of nature, society, and meaning. From the viewpoint of natural science, water is essential for life, but ground water is also an important part of the hydrologic cycle. Currently, the condition of ground water is being used as a report card on land practices. From the viewpoint of the social sciences, he noted that economic and political power is connected to water and that legal and regulatory structures have been established in response to that power. He remarked that the symbolic meaning of water is often overlooked. To some, the value of water is absolute, not subject to negotiation.

Mary Renwick, University of Minnesota, Applied Economics, discussed valuing water when quality is an issue. She introduced some of the processes, methods, and techniques used to establish values. She referred anyone interested in more detail to the book “Valuing Ground Water: Economic Concepts and

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2001 Fall Conference, cont.

Approaches" from the National Research Council. Using two examples, Treasure Valley, OR, and Woburn, MA, she showed how economic analysis helps to reveal hidden benefits and values.

Steve Polasky, University of Minnesota, Applied Economics, addressed valuing ground water when quantity is an issue, starting out by noting that economics is the allocation of scarce resources, or "What are you willing to pay?" He noted the Ogallala aquifer as an example where conditions result in the incentive to pump as much as possible, resulting in over-use or loss of a resource. He commented on the difficulty in setting up the right institutions to provide the right incentives to conserve.

After the introduction to the science of economics, the legal and policy issues were examined.

Tibor Gallo, Minnesota Attorney Generals Office, reviewed the development of water rights and the legal framework for water management in Minnesota. Common law and riparian rights are the basis for Minnesota water rights, subject to reasonable use.

Michelle Beeman, Minnesota Department of Natural Resources, reviewed the political history in Minnesota of ground water protection by noting the 1980's were "heady" days of ground water. Those days were followed by the budget crunch of the 90's and an attitude toward ground water of "been there, done that". She noted a rather diminished interest in ground water. From her perspective, we seem to be moving to a time of site-by-site micro-management in water resources.

Gretchen Sabel, Minnesota Planning, provided a quick review of state-level water planning efforts. She acknowledged the importance of long-term data collection (i.e., monitoring), but noted that it's both expensive and hard to explain. She closed her remarks by saying that the demonstrated value of water doesn't always match funding priorities.

Doug Ewald, Minnesota Water Well Association, noted that there are 30

to 40 trade or other organizations with an interest in water, not counting legislators. He recommended the reinstatement of the Legislative Water Commission as body that could focus on water issues in a more comprehensive way than is otherwise currently possible.

After lunch, four speakers participated in a panel facilitated by George Garklavs, U.S. Geological Survey, to address the economic implications of water regulations.

Stephen Thompson, Minnesota Pollution Control Agency, reviewed the history of the petroleum remediation program. He noted that clean up of petroleum in Minnesota had moved to a risk-based policy a number of years ago, which was driven by the costs for petroleum clean up. The remediation action of leaving petroleum in place to naturally degrade has become more common.

Karla Peterson, Minnesota Department of Health, addressed the economic considerations of the new 10 ppb standard for arsenic recently set by the Environmental Protection Agency. She explained that when such standards are set both benefits and costs must be considered. She concluded by suggesting that more low-level exposure studies are needed.

James Maras, U.S. Department of Agriculture, described the funding available for rural utility systems, including water, waste water, electrical, and telecommunications. He described some of the decision criteria for water system funding that is intended to keep water affordable to rural users, approximately the same cost as cable TV.

Kelton Barr, Kelton Barr Consulting, described the history of Camp Coldwater as the original water supply to Fort Snelling. He noted that the spring and the nearby area of Morgan's Mound are sacred to the Dakota. Development and construction dewatering currently threaten the spring area. Although dye traces have been done in the area, the ground watershed of the spring area has yet to be fully determined.

The day ended with four case studies presented by Minnesota Department of Natural Resources, Waters

Division, staff that illustrated many of the issues presented earlier in the day.

— reported by Jan Falteisek, DNR Waters

PM Session 1

Water Use Priorities: the City of Crookston Experience, presented by Sarah Tufford, DNR Waters, Section Administrator, Ground Water and Climatology, moderated by Jan Falteisek, DNR Waters

The City of Crookston water supply had alternated between a surface water source from the Red Lake River, and ground water from wells within the city limits, when, in 1977, the city decided to pursue a ground water source outside the city limits. Based on the hydrologic investigation by the city, Crookston Cattle Company also submitted applications to use ground water in that area for agricultural irrigation. The 1976 statutory water use priorities were: 1) domestic use, including domestic uses of a municipal system, and agricultural irrigation; 2) low consumptive uses; 3) power production; 4) commercial and industrial uses; and 5) everything else. The Minnesota Supreme Court ruling upheld domestic uses as first priority and all other uses have lower priority. By 1977 the priorities had already been changed to list agricultural irrigation as third. The City of Crookston lobbied successfully to get processing of agricultural products included in priority number 3 to give the commercial/industrial establishments in the city (mostly agribusinesses) equal footing with the agricultural irrigation proposed by the Crookston Cattle Company. Additional changes have been made from time to time to address perceived inequities.

Discussions of the priorities have raised concerns for the following reasons.

- 1) Domestic uses as defined in common law include many "non-essential" or wasteful uses;
- 2) The priorities only apply to withdrawal uses; the non-withdrawal or instream uses are not included;
- 3) The primary use of the priority system has been to limit or not allow uses lower in priority where the water

2001 Fall Conference, cont.

supply cannot support more than one or a few users. A more pro-active approach might include across-the-board conservation first, before any uses are necessarily curtailed or discontinued.

4) As noted by the Supreme Court, the reasonableness of a use in a particular situation is a question of fact to be determined for each circumstance. Therefore judgment must be exercised in the application of the priority system.

Future adjustments to the priorities should consider:

- The importance of non-withdrawal or environmental uses of the resource.
- Renewability vs. non-renewability, which is ultimately dependent on climate.
- Use of water is tied to property ownership; riparian landowners have rights to "reasonable use".
- Return flows that are contaminated should not be considered non-consumptive.
- The common law basis for the water use priorities.

PM Session 2

Ground Water Mining in Minnesota — A Discussion of Safe Yield, presented by Jay Frischman, hydrologist with DNR, moderated by Tom Clark, MPCA.

Jay began with a discussion of the different definitions of safe yield, based on whether an aquifer is unconfined or artesian. He cited 11 examples of ground water mining in Minnesota, primarily in the southern and western parts of the state, and then focused on two examples, the city of Dilworth and the Lincoln-Pipestone Rural Water (LPRW) District. Dilworth basically dewatered the small buried drift aquifer they were using, but was able to address their problem temporarily by buying water from Moorhead, whose wells tap the larger, more reliable Buffalo Aquifer. Dilworth is now working with DNR to examine alternative water sources, including trying to locate their own wells in the Buffalo Aquifer.

LPRW is utilizing several unconfined aquifers in southwest Minnesota to supply a nine-county area via a rural water system. LPRW wants to expand its services beyond the nine counties and is working with DNR to look at ways they might do this without jeopardizing the viability of the aquifers they are currently using. The existence of a rural water system in this part of Minnesota and the newly-realized access to relatively abundant water supplies has changed the economy in parts of the southwest. Large hog farms have become viable where they never would have been possible before and irrigators are finding increasing conflicts with other water users becoming a fact of life.

PM Session 3

Straight River and Ground Water Appropriations; Straight Talk, A Piscatorial Perplexity, presented by Bob Merritt, DNR Area Hydrologist, Detroit Lakes, moderated by Jim Lundy, MPCA.

Development of irrigated potato farming in the watershed of one of Minnesota's premier trout streams led to concern about the ground water inputs to the stream. Simply put: whatever is pumped for irrigation is not available for streamflow. Bob discussed the more-than-a-decade-long history of Straight River studies, legal wrangling, and efforts to balance competing interests. Discussion centered around the difficulties of comparing jobs/profits/agricultural values to trout/recreation/natural habitat values. It is relatively easy to assign values to land and crops, but the value of the instream uses is more difficult to establish. The users of the water don't have to pay the market value of the water (as determined by the added value). The group discussed the ethics of impacting a natural system; what is the 'best use' of the water; whether priorities could be determined within the basin and include the instream uses; whether pumping could be restricted closer to the stream, and whether resources are available for watershed management.

PM Session 4

Lake Level Augmentation – White Bear Lake, presented by John Linc

Stine, Administrator for Water Management at DNR Waters, moderated by Leigh Harrod, Metropolitan Council.

Lakes possessing community-wide cultural, historic and recreational uses have significant value to the community. White Bear Lake in Northeastern Ramsey County is used as an example. The Ramsey County Board of Commissioners approved and funded a long term lake augmentation plan from 1930 through 1976, stopping due to energy costs of pumping. The 1988-1989 drought caused the community to question the decision to discontinue lake augmentation. DNR was asked to evaluate the causes of delayed recovery of the lake's level following the drought and give an opinion about lake augmentation.

The study showed that lake augmentation is not efficient in terms of water budget and confirmed that lakes are indeed not bathtubs. Lakeshore owners are typically the most vocal, but augmentation draws on the regional aquifer and thus on the regional drinking water supply and is usually paid for by all taxpayers, as the lake is thought to improve "community well-being" (not that "community well-being can be quantified").

Current rules restrict outlet modification and limit direct human intervention in lake levels to controlled situations. Lake levels are frequently expressions of ground water levels and thus may stabilize through aquifer management instead of lake level management.

Discussion included comments on the ethics of management without considering natural systems; of moving of water from basin to basin; and of allowing water uses to become established that are not sustainable. The group thought that impacts of uses should be studied (through modeling or testing) prior to issuance of permits. This would be more responsible than issuing permits and waiting to see what happened, especially since negative impacts on natural systems might not be reversible once they could be observed.

Students Learn by Doing at Annual Water Festival

Over 1500 metropolitan area fifth graders attended the fourth annual Metro Children's Water Festival on September 26th at the State Fairgrounds. It turned out to be a beautiful fall day for students and presenters alike to "get their hands wet" learning about stewardship of our valuable ground and surface water resources in Minnesota, as the pictures opposite show. As in previous years, the MGWA was proud to be a co-sponsor of the event. This year, the responsibility for sponsorship was given to the MGWA Foundation, which responded with a \$400 donation! Thanks to all who worked hard to make the Festival a success this year, and especially to the MGWA members who donated their time and talent to making it a great day.

These photos are provided courtesy of John Bilotta, Environmental Education Coordinator, University of Minnesota Extension Service, Carver County.

EPA launches new web site in response to September 11

EPA launched a new web site on EPA's involvement in New York City and Washington, DC following the terrorist attacks on the World Trade Center and the Pentagon. On this web site, EPA lists current air quality and water quality monitoring data for asbestos, particulate matter, PCBs, and drinking water at both the World Trade Center and Pentagon. EPA also answers frequently asked questions about air and water quality around these areas and provides a link to press releases and other new stories related to EPA's involvement in testing and clean up efforts at the World Trade Center and Pentagon. For more information, visit EPA's web site at <http://www.epa.gov/epahome/wtc/> on the Internet.



Fall Field Trip: Brainerd Area Geology

The Minnesota Ground Water Association along with the American Institute of Professional Geologists and the American Institute of Hydrology sponsored this year's fall field trip on October 12 and 13, 2001. Sixty-six people attended this year's trip to the Brainerd area. Stops made on the first day included an overlook of the Feigh and Mahnomen Mines and the Yawkey and Manual Mine Dumps located within the Cuyuna Iron Range. Although mining of the Cuyuna Range ceased in 1984, Mark Jirsa of the Minnesota Geological Survey discussed the more recent work such as geophysical modeling and test drilling, which has been conducted to better understand the stratigraphy of the area and the correlations with adjacent mining districts. Mark also noted that the mines in the area are some of the few iron mines in the world that were mapped using only geophysical methods and test drilling, as there are no natural outcrops along the Cuyuna Range. It was also interesting to note that the mines are considered an important source of manganese estimated to represent up to fifty percent of the domestic reserves.

We stopped at the Croft Mine near Crosby for lunch, where the mining museum was open for us to learn more about the history of the Croft Mine, mining in the area, and to see various mining tools. Following lunch, we stopped at Williams and Shingobee Lakes for an introduction to the Interdisciplinary Research Initiative study site at the Shingobee Rivers headwaters. These areas have been intensively studied for many years in an effort to better understand the relationship between ground water and surface water. Don Rosenberry with the US Geological Survey provided us with insight into the geology of the area and a discussion of groundwater discharge into the lakes as well as the types of equipment being used to monitor several hydrologic parameters. The last stop of the day was at Lake Belle Taine where Don discussed rising water levels in the lake and determining the variability in lake stages



Field Trip Group at Charlotte Park in Long Prairie, photo by Andrew Nichols.



Wayne Green describes ice contact deposits associated with the re-advance of the Rainy and Superior Lobes of the St. Croix moraine as well as the formation of Pillager Gap while at the Anderson Brother's Gravel Pit, photo by Andrew Nichols.

across Minnesota and the upper Midwest.

The evening program, designed to set the stage for Day Two of the trip, included dinner at the hotel and presentations on glacial stratigraphy and the geology of central Minnesota by Alan Knaeble and Gary Meyer of the Minnesota Geological Survey. On Saturday we stopped at the Baxter Sand Dunes where Howard Hobbs, also from the Minnesota Geological Survey, discussed the history of Lake Brainerd and the eolian deposits of the Lake Brainerd Plain. Wayne Green of Central Lakes College and Allan Knaeble led discussions at the Anderson Brothers', Mill Lake, Johnson, and Swanville gravel pits where we viewed and discussed the Pillager Gap, crevasse filling deposits of the St. Croix Moraine, the

composition of materials representing different source areas, the three types of till found in central Minnesota, and the formation of the ridge and valley terrain.

We also stopped in Long Prairie where Bill Bangsund with Barr Engineering outlined the source and distribution of tetrachloroethylene in the ground water beneath a significant portion of the City of Long Prairie. We viewed the ground water recovery system, which pumps a total of approximately 250 gallons per minute from nine recovery wells. The groundwater is treated in a two-vessel granular activated carbon treatment plant prior to being discharged to the Long Prairie River.

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2001 AIH International Conference and 20th Anniversary of AIH.

The American Institute of Hydrology (AIH) convened its annual meeting and international conference at the Thunderbird Hotel and Conference Center, Bloomington, October 14–17, 2001. This was like home coming since AIH was founded 1981 right here in the Twin Cities. The general theme of the conference was “Hydrologic Science: Challenges for the 21st Century”.

The conference was organized in cooperation with the U.S. Geological Survey, U. S. Environmental Protection Agency, U.S. Army Corps of Engineers, American Ground Water Trust, American Water Resources Association, American Society of Agricultural Engineers, Minnesota Ground Water Association, the National Chung-Hsing University, the University of Minnesota, and the University of Texas.

The conference program began with a keynote presentation by Dr. Mark Seeley from the University of Minnesota entitled: “Climate Trends: Implications for Hydrologic Science in the 21st Century”.

MGWA-AIPG-AIH Field Trip, cont.

The final stop was at the Ripley Esker, on the ground moraine of the Rainy Lobe till in the Ripley Esker Scenic and Natural Area, where we discussed how the features fit into the glacial geology of Central Minnesota and how the ridge affects natural communities.

Many thanks are due to those who gave the excellent presentations. Special thank yous are due to Brian Ross (Widseth, Smith, Nolting), who arranged the trip with help from others, including Wayne Green (Central Lakes College), Mike Hultgren (Pinnacle Engineering, Inc.) Sean Hunt (Minnesota Department of Natural Resources), and Rob Cahoon (Bergerson-Caswell, Inc.).

— *Contributed by Jon Pollock*
(Frontline Environmental, LLC)

In celebrating the 20th Anniversary of AIH, a special session: “Challenges in Registration/Certification of Professional Hydrologists” included eminent hydrologists P. Patrick Leahy, Chief Geologist and Deputy Director of USGS, L. Douglas James, Director, Hydrology Program, National Science Foundation, Peter O. Wolf, Past President of the British Hydrological Society, John E. Moore, Past AIH and IAH President as well as the three founders of AIH, Sandor C. Csallany, Roman Kanivetsky and Alexander Zaporozec.

Because water issues play a crucial role in long-term environmental, socioeconomic, and political stability around the world, the speakers of this special session stressed the need for establishing professional standards to assess the credentials and the ability of people dealing with hydrology to make sound judgments. Last year the State of Wisconsin became the first state to introduce licensing of hydrologists. The licensing and examination procedure was developed with the help of AIH. Speakers stressed that the vision of AIH is to go beyond establishing standards. AIH must be a driving force for reform at universities and colleges, campaigning for establishing hydrology departments, and breaking down fragmentation of the field by establishing a hydrological society. Due to compartmentalization and fragmentation, hydrology today plays second fiddle to other disciplines (e.g. engineering and geology).

Thought-provoking technical sessions included “We’ve Come A Long Way, But When Are We Going to Understand Hydrogeology?” by Alan Mayo, Brigham Young University, Provo and “Consilience: Civilized Living Within Finite Natural Resources” by T.N. Narasimhan, University of California, Berkeley. These speakers tried to present “a big picture”. Unfortunately, “a big picture” is relegated to cocktail party conversations. We have to learn not only to have narrow specialists, but also people whose specialty is to spot the interactions and entanglements. The session: “Status of Water Quality and Aquatic Biology” addressed the National Water Quality Assessment program of the U.S. Geological Survey and was

highlighted by the Chief of this program, Timothy Miller from Reston, VA. Critical Scale Issues in Hydrological Science was highlighted by Efi Foufoula, University of Minnesota. William Alley, U.S. Geological Survey, Reston, VA presented “Challenges in Sustainability of Ground-Water Resources”. Critical issues in water resources management were addressed in sessions such as “Role of Hydrologic Science in Watershed Management” and “The Minnesota and Mississippi River Basins: Flooding and Runoff Issues”.

AIH is promoting active communication and exchange of knowledge between surface and ground water hydrologists, as shown at the poster session. The posters addressed a wide range of topics on scientific issues, educational needs and policy in surface and ground water.

A pre-meeting two-day hydrogeology field trip sponsored by the Minnesota Chapter of the American Institute of Professional Geologists and the Minnesota Ground Water Association took participants to the Brainerd area to view and study glacial and bedrock geology as well as hydrogeology.

A special feature of the conference was the student paper competition. The winner was Jason Vogel from Oklahoma State University.

A luncheon and banquet honored past and present recipients of Ray K. Linsley and C.V. Theis Awards. In this trying and difficult time for our nation and indeed for an entire world, when one attendee at the meeting lost a sister on the plane that plowed into Pentagon, there were times that things lightened up a bit. One of the recipients of the Ray K. Linsley Award, John Cassidy, told the audience: “after this award some of you will probably recognize me. So if you meet me in the not so distant future in any part of the globe, please say “Hi” and maybe I’ll offer you a drink..... of pure water”.

Sincere appreciation goes to the Organizing Committee and its chair John Nieber, AIH Manager Helen Klose, speakers and all participants who made the meeting a success in spite of anxious times.

— *Contributed by Roman Kanivetsky,*
AIH co-founder

Report on the 2001 Midwest Groundwater Conference in Madison, Wisconsin

Ken Bradbury, Wisconsin Geological and Natural History Survey, opened the conference. Kathleen Falk, the county executive for Dane County, Wisconsin, talked about the difficulties in promoting groundwater resource management from her perspective and experience as a politician. In particular, she has worked to establish mechanisms for evaluating groundwater degradation in new, unsewered subdivisions. James Krohelski, USGS gave an overview of quality and quantity issues in Wisconsin, noting that total dissolved solids (TDS), pesticides, and arsenic are the quality issues of greatest concern and that surface and ground water interactions are getting more attention. Aquifer-surface water management options are being discussed at the state level.

The session on aquifer mapping showed that state and local agencies continue to be very interested in interpretive maps of aquifer sensitivity, which are now more often specialized to address pesticides and nitrate. Illinois reported on efforts to test their map of aquifer sensitivity to pesticide leaching. They noted that pesticide detects were less where the depth to the upper-most aquifer material was greater than 20 to 50 feet, compared to less than 20 feet. Incorporation of the statewide soil association coverage did not noticeably improve leaching predictions. In Ohio, their primary focus for sensitivity maps is the distribution of sand and gravel aquifers in buried valleys and where drift is less than 25 feet thick. Dakota County, Minnesota reported on efforts to collect historical contamination source information within a GIS to guide source water protection and remediation efforts. Minnesota DNR Waters described refinements to a county-scale karst groundwater basin map, first published in 1995 and originally based on 150 dye traces. Since then, 30 dye traces have defined new basins and refined boundaries of known groundwater basins.

The session on groundwater in the hydrologic cycle offered three talks on Minnesota hydrologic conditions, all of which examined the connection between water at the surface and water in the subsurface. Careful study of several lakes in Washington County, MN shows that knowing the source of lake water and its chemical quality can make a big difference in how a lake is managed. A study in Pine County, MN reported on karst-like features in a non-carbonate terrain. Rapid transport of surface water to the subsurface is similar to that in carbonate karst areas. Using data from several bedrock and glacial settings throughout Minnesota, a study is revealing the history of groundwater, as reflected in its chemistry and residence time. Two talks in this session reported on techniques for evaluating recharge, a parameter of great current interest, but very difficult to pin down or use appropriately.

Nitrate and arsenic were the contaminants of interest at the session on inorganic contaminants. Two papers reported on treatment efforts, which were reminders on how expensive dealing with arsenic can be. A paper comparing arsenic data from the USGS and Iowa municipal water samples reminded those listening to verify consistency of sampling procedures. A half-century of nitrate data in Iowa streams showed an increase to an annual mean of about 6 mg/L. A report on ammonia in Iowa groundwater described its distribution among the state's aquifers.

Two sessions on source water protection pointed up the current strong interest in this topic. From the papers presented, it seems most work in this area focuses on the application of ground water models to delineate source water areas. Of particular interest is the work in Wisconsin to develop cost-effective procedures for source water area delineation in fractured and karst areas that utilize hydrogeologic mapping and available water quality data to delineate protection areas. This work also suggests that protection areas in karst be extended to the area's ground water (water table) divide due to expected rapid travel times. The several modeling studies in these two sessions reported on efforts to better define

recharge rates, zones of contribution, and receptors.

The poster session presented a variety of posters from many states. Those from Minnesota included a study by Minnesota Geological Survey staff showing that ground-water flow in the Prairie du Chien can be dominated by well developed high permeability zones near the unconformable boundary between the Shakopee and Oneota. A dye tracing study near Camp Coldwater Spring in the Twin Cities that has been the subject of several high-profile news stories here in Minnesota (and is reprinted in this newsletter issue also) was presented with results that helped to characterize the groundwater flow conditions that affect the spring discharge. Other posters presented results characterizing fracture flow within the Platteville in the same general area near Camp Coldwater Spring. DNR Waters staff presented their map of ground water provinces in Minnesota.

The full program and abstracts of papers and posters is available on the conference's web site, http://wri.wisc.edu/Midwest_Groundwater_2001/

For those who plan ahead, the 2002 Midwest Groundwater Conference will be October 2-4, hosted by North Dakota at the Holiday Inn in Fargo.

— contributed by Jan Falteisek, DNR Waters

MGWA Welcomes Interpoll as New Corporate Member

MGWA's new corporate membership program has a second member, **Interpoll, Inc.** Look for their new ad in the first issue of the newsletter in 2002.

We would also like to congratulate our first corporate member, **Howard R. Green Company**, on their Ground Water Supply Award for the 2001 NGWA Outstanding Ground Water Project: New Siting Techniques Yield High Well Production, Waverly, Iowa. The award was presented at the NGWA Ground Water Expo in Nashville.

EPA to Adopt Clinton Arsenic Standard

by Katharine Q. Seelye, reprinted from NYTimes.com

WASHINGTON, Oct. 31 - The Bush administration, which prompted an outcry by suspending a Clinton proposal on acceptable levels of arsenic in drinking water, has now decided to adopt the proposed Clinton level after all.

Christie Whitman, the Environmental Protection Agency administrator, said today in a letter to Congress that the agency would allow a standard of 10 parts per billion, the equivalent of one teaspoon per 1.3 million gallons of water. The new standard substantially reduces the acceptable level from the current 50 parts per billion.

"Throughout this process, I have made it clear that EPA intends to strengthen the standard for arsenic by substantially lowering the maximum acceptable level from 50 parts per billion, which has been the lawful limit for nearly half a century," Mrs. Whitman wrote. "This standard will improve the safety of drinking water for millions of Americans and better protect against the risk of cancer, heart disease and diabetes."

The level of 10 parts per billion was proposed by the Clinton administration in January but blocked in March by the Bush administration. Mr. Bush has since admitted that it was one of the worst moves of his young administration because it allowed environmentalists and others to portray him as favoring arsenic, which for the most part has natural sources, in drinking water.

The administration's decision to accept the Clinton standard could remove a political irritant for Mr. Bush, but some environmentalists, citing studies that have come out since Mr. Clinton left office, say that 10 parts per billion, to go into effect in 2006, is still too high.

The Natural Resources Defense Council sued the Clinton administration in May 2000 to lower the level from 50 parts per billion, a level set during World War II. The Clinton administration initially proposed 5 parts per billion, but after mining and

wood-preserving industries and municipal water authorities objected, it proposed a level of 10 parts per billion just days before Mr. Bush took office in January.

In March, Mrs. Whitman suspended that level and directed the environmental agency to conduct a cost-benefit analysis of new standards, ranging from 3 parts per billion to 20 parts per billion. In settling on 10 parts per billion, the administration appears to have been influenced in part by testimony before Congress this month that lowering the standard below 10 would cost too much to justify a minimal health benefit.

The National Rural Water Association, which represents more than 20,000 small communities, estimated that a standard of 10 parts per billion could cost households \$100 to \$500 a year.

But a report by the National Academy of Sciences issued on Sept. 11 said that arsenic was "more hazardous than earlier thought" and that even tiny amounts could lead to an increased risk of lung and bladder cancer.

Senator Barbara Boxer, Democrat of California, said today that 10 parts per billion was "still too high, but in light of where they were before, it's a big improvement." Of the expense of further lowering the level, Ms. Boxer said, "It costs something to prevent cancer, and we spend a billion dollars a year on cancer."

She noted that the agency's own studies set a goal of one cancer death per 1,000 people and that 10 parts per billion would allow for three cancer deaths per 1,000. "The EPA is not meeting its own guidelines," she said, vowing to try to push the level down to 3 parts per billion.

This summer, the House, with strong Republican support, passed a bill calling for a level no higher than 10 parts per billion. The Senate did not specify a level but said the administration immediately needed to set a standard that protected vulnerable groups, including children, pregnant women and the elderly. The two chambers are in the process of reconciling their approaches and appeared likely to order the agency

to adopt a standard of nothing higher than 10, if not lower.

"That's what triggered this announcement, that they were trying to head this off," said Erik D. Olson, a lawyer for the Natural Resources Defense Council.

The report by the National Academy of Sciences led to speculation that

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Decorah Edge Study Continues in Rochester

As described in the March issue of this newsletter, the aquifers above the Decorah Shale in the Rochester area recharge lower aquifers at the terminal edge of the Decorah confining unit. USGS studies suggest that half of the City of Rochester's water recharge occurs in this setting.

According to Terry Lee, Olmsted County Environmental Services, further studies of the ground water recharge processes in the Decorah Edge area are critical to making good land development and water management decisions. Studies are underway to test models of mass loading of water, loading of nitrate, and interflow residence time. The studies will also test the remotely-sensed soil wetness data collected the past several years and described in the March issue.

Work underway this summer included testing models of recharge processes and water transfer in the edge area and modeling of nitrate loading and uptake. GIS is being used to identify sites along the edge that are representative of differing landscape positions, land cover, ground water recharge conditions, and bedrock dip and strike. Data collected will include soil wetness, soil nitrogen, nitrate and chloride in water samples, and vegetative cover.

For more information, contact:

Terry Lee
Olmsted County
Environmental Services
2116 Campus Drive SE
Rochester MN 55904

Mapping Arsenic in Ground Water — Minnesota data

Arsenic data from the Minnesota Pollution Control Agency's Statewide Baseline Network, as well as other arsenic data from Minnesota ground water, appears in the November 2001 issue of *Geotimes* on a nationwide point-map showing locations and arsenic concentrations for 31,000 wells and springs sampled between 1973 and 2000. The map is updated from Welch *et al.*, 2000, which was published by the USGS as Fact Sheet FS-063-00 (Arsenic in Ground-Water Resources of the United States). The map (one of three, actually) is part of an excellent article by Sarah Ryker of USGS, Denver, titled: Mapping arsenic in groundwater—a real need but a hard problem. The article shows why we sometimes simply don't have the right kind of data to answer all questions raised by policy-makers (using the new drinking water regulations for arsenic as an example), while other

times the problem is to communicate the data we do have in the right form. Another interesting observation from the point-map is to compare how states like Minnesota with broad geographic coverage of data points compare with others that don't. The MPCA library has a paper copy of the November *Geotimes*. The article should also be on the *Geotimes* website soon: <http://www.geotimes.org>

— Submitted by Tom Clark, MPCA

Minnesota Impact of New As Standard

In Minnesota, some 60 to 80 community public water systems are currently exceeding the standard in one or more wells. EPA plans to try to identify improved methods for arsenic removal. In addition, revolving loan funds funded by EPA are available in Minnesota to help systems finance improvements to their water supply by 2006. Information can be found at: <http://www.epa.gov/safewater/arsenic.html>

EPA reconfirms Arsenic Level, cont.

the agency would set the limit lower than 10.

Mike Keegan, an analyst for the National Rural Water Association, said that of the nation's 60,000 community water systems, about 4,000, serving less than 10,000 people each, would have to comply with the new rule, at onerous cost.

"It's going to be real problematic in rural America," Mr. Keegan said. "It won't be uncommon to see \$500-a-year rate increases."

Mrs. Whitman said her agency would provide technical assistance to the towns as well as grants to help them come into compliance.

Mr. Keegan predicted that some towns would sue the federal government for trying to tell them what to do. "When people get a letter telling them how much it will cost and how little benefit there will be," he said, "you'll see a grass-roots backlash."

2002 Minnesota Ground Water Association Newsletter Advertising Policy

Display ads:

Size	Inches Hor. x Vert.	Quarterly Newsletter	2002 Membership Directory
		Annual Rate; 4 issues	Annual Rate; 1 issue
Business Card	3.5 x 2.3	\$66	\$50
Quarter Page	3.5 x 4.8	\$121	\$99
Half Page	7.5 x 4.8	\$225	\$190
Full Page	7.5 x 9.75	\$425	\$360
Inside Cover	7.5 x 9.75	not available	\$395

Classified ads: Classified ads in the newsletter are charged at the rate of \$3 per 45 characters (including spaces and punctuation) per newsletter issue.

E-mail notices: A one-time e-mailing to the membership costs \$10 for an individual (e.g., seeking a job), and \$50 for an organization (e.g., announcing a new product, job opening etc.). A 200 word limit is imposed. The advantage of e-mail is the speed of dissemination.

The Advertising Manager has final determination on the acceptance of materials submitted. There are no commissions on ads. Copy must be received by the publication deadlines: 1 February, 1 May, 1 August, or 1 November. Advertisers should submit their material as a digital file in TIFF, JPEG or PCX format at 300 to 600 dpi. A set-up charge will be applied to non-digital ad material.

Please make checks payable to "Minnesota Ground Water Association" or "MGWA." Direct your orders and questions concerning advertising rates and policy to the Advertising Manager: Jim Aiken, Advertising Manager, c/o MGWA, 4779 126th Street, White Bear Lake MN 55110-5910; Phone (952)361-4944 ; jaiken@mn.rr.com.

Governor Commends Metro Model — Posthumously

The Twin Cities Metropolitan Area Groundwater Model (Metro Model) recently received a commendation award from the Governor's Council on Geographic Information - ironically coinciding with its elimination from the Minnesota Pollution Control Agency's (MPCA's) programs.

Every year since 1996 the Minnesota Governor's Council on Geographic Information (<http://www.gis.state.mn.us/>) has awarded Certificates of Commendation to exemplary projects in Minnesota that exhibit innovative and cost-effective means to use and manage geographic information and related technologies. This year, the MPCA is a recipient of a Certificate of Commendation from the council for its role in the development and application of the Metro Model.

The proclamation on the Certificate of Commendation, signed by Governor Jesse Ventura on October 1, 2001 reads:

In recognition of the dedication and creativity demonstrated by developing the Twin Cities Metropolitan Area Groundwater Model, which simulates regional multi-aquifer groundwater flow and has permitted dozens of public and private sector organizations to develop technically sound models more rapidly and at a reduced cost, this certificate of commendation is presented to the Minnesota Pollution Control Agency with the appreciation and respect of the people of Minnesota.

Metro Model staff wish to recognize the crucial role played by all those who have contributed their talents and time to provide critical technical review, as well as guidance on the direction of development and administration of the Metro Model. The Metro Model would not have reached its current state without the dedicated support of these individuals.

However, the Metro Model is being eliminated from MPCA's programs as the agency adjusts to reduced staffing levels. The Metro Model was supported by the Legislative

Commission on Minnesota Resources from 1996-99 with supplemental funding from the EPA and the MPCA. It has since been supported by the MPCA, which has experienced a three-year trend in decreased staff funding. As a result of cuts in federal funds and the most recent budget recommended by the Governor and passed by the Minnesota Legislature, the MPCA has lost about 10 percent of its former staffing level (over 70 positions). Therefore, the MPCA has had to reduce service in a number of programs to meet its highest environmental priorities. The Metro Model is one of the casualties of this action. Without a legislative appropriation expressly dedicated to the project, MPCA has no plans for future support of the Metro Model.

Prospects for funding the project through external sources are being pursued by project staff, but under such a scenario assigned staff may be limited to offering direct assistance to only those parties providing financial support.

Except during a yet undetermined transition period, MPCA staff will cease all support for Metro Model activities. If end-users require assistance in the application of project resources, project staff recommend that they retain a qualified consultant experienced in hydrogeology, Geographic Information Systems, and groundwater modeling and engineering. Resources available through the Metro Model website (<http://www.pca.state.mn.us/water/groundwater/metromodel.html>) will remain available until they become obsolete. Updates and revisions to the Metro Model will cease.

Project staff are planning to convene a User Advisory Workgroup meeting on January 8, 2002 to bring interested parties up to date with resources available, project status, and the likely end of the project, and to discuss potential options for continuing the project if there is interest. Interested parties who would like to contribute ideas or feedback regarding the project are urged to attend.

County Geologic Atlases Now Available for Pine and Wabasha Counties

Part A of the Minnesota Geological Survey County Geologic Atlas series is now available for both Pine and Wabasha counties. Part A includes plates that cover bedrock geology, bedrock topography, depth to bedrock, sink hole distribution, surficial geology, and Quaternary cross-sections. These atlases are available in the standard printed form, as well as on CD in Arcview format. The maps are also available online at the Minnesota Geological Survey website, <http://www.geo.mn.edu/mgs/>. If interested, contact the Minnesota Geological Survey Map Sales Division at (612)627-4782, or visit the MGS web page for ordering information.

These atlases will be joined in the future by Part B, Hydrogeology and Pollution Sensitivity, to be published by DNR Waters. Part B of the Pine County Geologic Atlas is currently underway and Part B of the Wabasha County Geologic Atlas will begin in 2002. For more information on Part B of these atlases, contact DNR Waters at (651)296-4800. A map of completed and in-progress studies is available at http://www.dnr.state.mn.us/waters/programs/gw_section/cgarha/status.html. The map also provides links to downloadable PDF's of map plates and links to GIS data.

Dues are Due

If you have not already done so, please pay your 2002 MGWA dues. If we had a good email address for you, you should have received a dues notice with a copy of your membership data. Send e-mail to office@mgwa.org with your email address if you did not receive one. We can receive credit card payments through the secure part of our web site (www.mgwa.org) or you could mail your check to:

MGWA c/o WRI
4779 126th St. North
White Bear Lake MN 55110-5910

MGWA Outstanding Service Award

The MGWA would like to institute an Outstanding Service Award, to be conferred annually, when deemed appropriate, upon any individual who has made an outstanding contribution to ground water in Minnesota, particularly as this relates to MGWA's primary objectives (see page 3).

The contribution may have been in the form of any undertaking that has furthered the cause of ground water in Minnesota as a vital resource. This includes, but is not limited to, technical or scientific achievements, efforts in disseminating information and education about ground water, and achievements in the public policy arena. Such an award would be particularly appropriate for individuals who demonstrate a cross-fertilization of leadership, sound science, education, and public policy.

Neither the awardee, nor the person nominating, needs to be a member of the association. Recommendations of the MGWA award committee will be forwarded to the MGWA board for approval. The MGWA award committee members are: Leigh Harrod, leigh.harrod@metc.state.mn.us, 651/602-8085, Roman Kanivetsky, kaniv001@umn.edu 612/627-4780 ext.209, and Sandeep Burman, sandeep.burman@pca.state.mn.us 507/280-2996.

Nominations should consist of:

1. Name of Nominee, occupation and affiliations, telephone, and email.
2. Brief resume/career details.
3. Contributions in the field of ground water that would merit the Outstanding Service Award.
4. Any other pertinent information.
5. Name of person nominating, phone number, email, and address:

There is no limit to the information provided in support of the nomination, but brevity is appreciated. Nominations may be mailed or emailed to: MGWA, c/o WRI, 4779 126th St N White Bear Lake MN 55110-5910, Office@mgwa.org

Nominations must be received by January 15, 2002 to be considered for the first annual award.

This Newsletter brought to you by:

Tom Clark, Editor-In-Chief

Steve Robertson

Jan Falteisek

Jim Lundy

Jon Pollock

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MGWA Newsletter Deadlines for 2002

Issue	Copy to Editor	Copy to Publisher
March (Vol. 21 No. 1)	02/15/02	02/22/02
June (Vol. 21 No. 2)	05/17/02	05/24/02
September (Vol. 21 No. 3)	08/16/02	08/23/02
December (Vol. 21 No. 4)	11/15/02	11/22/02

Geotechnical Engineering Conference

The University of Minnesota Annual Geotechnical Engineering Conference will be held on February 22, 2002. This will be its 50th offering, making it one of the longest running geotechnical engineering conferences in the U.S. The conference typically attracts 200 engineering professionals who convene to interact with peers, meet specialty contractors, and hear researchers and practitioners discuss theory and application of geomechanics. The keynote address, named the Kersten Lecture in honor of Prof. Miles Kersten, will feature Prof. Michele Jamiolkowski of Politecnico di Torino. Other speakers will include Prof. J. Michael Duncan of Virginia Polytechnic Institute, Prof. Charles Fairhurst of the University of Minnesota, Prof. James Graham of the University of Manitoba. Topics at the conference will cover the Leaning Tower of Pisa, factors of safety and reliability, tunnel support design, consolidation settlements, drainage, modern urban infrastructure projects, and pile capacity. Further information can be found at www.ce.umn.edu/mgs/conf.htm. The University of Minnesota 50th Annual Geotechnical Engineering Conference is cosponsored by the Minnesota Geotechnical Society, the Minnesota section of ASCE, and the Consulting Engineers Council of Minnesota.

Minnesota Water 2002

Working Together in a Climate of Change to Manage Minnesota's Water Resources

The 10th biennial conference on Minnesota's critical water issues offered in conjunction with the Minnesota Lakes and Rivers Conference

Dates: April 17-20, 2002

Location: St. Cloud Convention Center, St. Cloud

Plenary and breakout sessions will focus on changes in global conditions that affect research, planning, and management of Minnesota's waters. Abstracts are sought for oral presentations for breakout sessions formed around the themes listed below. Preference will be given to papers that emphasize how shifts or trends in the global environment, economy, technology, or policies will impact decisions about ground water, lakes, or rivers in Minnesota, but other topics will also be accepted.

Concurrent sessions on the following topics are anticipated:

New Tools and Technologies for monitoring or modeling

Human and Environmental Health related to contaminants of concern or safe drinking water

Agriculture and Water Quality, including aquaculture

— continued on page 18

Minnesota Ground Water Association Board Meeting Minutes

August 2, 2001

USGS, WRD office in Mounds View, MN, 7:30 a.m.

Attending: Jim Stark, President; Jim Lundy, Past-President; Rob Caho, President-Elect; Eric Hansen, Treasurer; Jan Falteisek, Secretary; Jeanette Leete, Sean Hunt, WRI; Tom Clark, Newsletter Editor.

Approval of Minutes – Jim Stark called the meeting to order at 7:30 a.m. The agenda was approved. Minutes for the regular Board meeting held July 5, 2001 were approved with corrections.

Treasurer's Report – Eric Hansen provided the financial update.

Web Page – Sean will set up the field trip pages on the web site when he has the details. Sean provided a list of past officers and will place the list on the web site.

MGWA Foundation – Jim L. reported that the Foundation meets on August 3. The Foundation sent a \$400 check to the Children's Water Festival.

Ground Water Education Committee – Jim L. noted that the Education Committee met on August 1. The committee met with Tracy Fredin from the Hamline University Center for Global Environmental Education, which primarily teaches teachers, but also provides some public education. The committee discussed with the CGEE representative ways to improve MGWA public education efforts. The committee plans to meet with the representative again in the future.

Corporate Membership – The details will be published in the newsletter and a web page will be posted.

Fall Field Trip – The brochure is in preparation. It is due now for mailing. Brian Ross has set up most of the details. Rob Caho has arranged the bus from the Twin Cities. Brian Ross will prepare the field guide. Rob and Eric will follow up with Brian on details. An e-mail reminder of the field trip will need to be sent.

MGWA Awards – Jim L. reported that Leigh Harrod and Sandeep Burman have considered comments received on the proposed awards and will revise the proposal for board consideration.

Fall Conference – Topics for the conference were discussed. The board chose "The Value of Water" as the conference theme. Talks could be grouped around availability, economics, and legal issues. The program should include a number of case histories as well. A preliminary list of suggested speakers was compiled. Jim S said he would start making some phone calls.

Science Museum – Jim S. said he had talked with Pat Hamilton of SMM about ground water programs at the museum.

Next meeting – The next Board meeting will be Thursday September 6, 2001, 7:30 a.m., at the U.S. Geological Survey office in Mounds View.

Meeting adjourned at 8:40 a.m.

September 6, 2001

USGS, WRD office in Mounds View, MN, 7:30 a.m.

Attending: Jim Stark, President; Rob Caho, President-Elect; Eric Hansen, Treasurer; Jan Falteisek, Secretary; Sean Hunt, WRI; Tom Clark, Newsletter Editor.

Approval of Minutes – Jim Stark called the meeting to order at 7:40 a.m. The agenda was approved. Minutes for the regular Board meeting held August 2, 2001 were approved with corrections.

Fall Conference – Most of the meeting was devoted to planning for the fall conference. A special planning meeting will be held September 25 at 7:30 a.m. at the USGS office.

Science Museum of Minnesota – Jim Stark noted that Pat Hamilton of SMM is interested in working with MGWA Education Committee on ground water programs at the museum.

Fall Field Trip – Rob Caho reported the field trip is on track.

Newsletter – Tom Clark reported that the September newsletter was being laid out.

Board Election – Nominations are needed for Secretary and President-Elect.

Next meeting – The next Board meeting will be Thursday October 4, 2001, 7:30 a.m. at the U.S. Geological Survey office in Mounds View.

Meeting adjourned at 9:00 a.m.

October 4, 2001

USGS, WRD office in Mounds View, MN, 7:30 a.m.

Attending: Jim Lundy, Past-President; Jim Stark, President; Rob Caho, President-Elect; Eric Hansen, Treasurer; Jan Falteisek, Secretary.

Approval of Minutes – Jim Stark called the meeting to order at 7:35 a.m. The agenda was approved. Minutes for the regular Board meeting held September 6, 2001 were approved.

Treasurer's Report – Eric reported he had no new information on the budget.

Foundation – The next meeting of MGWAF will be October 5.

Fall Field Trip – Rob Caho reported the field trip guidebooks will be ready the day of the field trip.

20th Anniversary – The Spring conference 2002 will include a number of activities to celebrate MGWA's 20th anniversary.

Web Page – Jim Lundy said the education committee would like to add some material to the MGWA web site. He will ask committee members to develop some ideas, ask Sean Hunt for a cost estimate to implement, and bring a proposal back to the Board.

Board Election – Nominations for Secretary and President-Elect were discussed.

Awards – Jim Lundy will contact Sandeep Burman and Leigh Harrod to provide a modified proposal for the November board meeting.

Children's Water Festival – A report will be in the December newsletter.

LCMR – Jim Lundy said he had been contacted by the LCMR staff to make a presentation on October 15 to the citizen's advisory committee.

— continued on next page

Board Minutes, cont.

Fall Conference – Details of the program and preparation for the conference were discussed.

Next meeting – The next Board meeting will be Thursday November 1, 2001, 7:30 a.m. at the U.S. Geological Survey office in Mounds View. Meeting adjourned at 9:00 a.m.

November 1, 2001

USGS, WRD office in Mounds View, MN, 7:30 a.m.

Attending: Jim Lundy, Past-President; Jim Stark, President; Rob Caho, President-Elect; Jan Falteisek, Secretary; Tom Clark, Newsletter Editor; Jennie Leete, WRI; Leigh Harrod, guest.

Approval of Minutes – Jim Stark called the meeting to order at 7:35 a.m. Minutes for the regular Board meeting held October 4, 2001 were approved.

Foundation – Jim Lundy reported that Gordy Hess is interested taking over for Paula Berger. The next Foundation meeting is November 2.

Education – Jim Lundy reported the teacher's institute begins November 2. Jim L. will present the sand-tank model and Mike Trojan will give a presentation on water quality. Jim L. would like Jim S. to announce the start of a speaker's bureau. He noted that AIPG is also organizing a speaker's bureau and an education committee. Coordination of these efforts could help both organizations. The Education Committee would like a few minutes at the fall conference to talk about the speaker's bureau.

Newsletter – Tom Clark reported that the December issue is in good shape. Tom will step down as editor-in-chief, but will still participate on the newsletter team.

Fall Conference – The MDH has provided 6 CEU's for the conference. Jennie Leete noted that registrations were at the break-even point. Jennie was asked to provide a list of attendees in future conference packets. Jim Stark is collecting material from speakers. Jennie will check with Earle Brown Center on the set up for the break out rooms. Additional details of

Water 2002, cont.

- Economics of Water and Policy Decisions
- Changing Structure of Water Management in Minnesota
- Landuse Impacts, particularly urbanization, stormwater management, bridges and dams
- Groundwater Remediation
- Global Climate Change
- Regional sessions on: ground water in the Twin Cities, the Straight River, the Red River Valley,
- Lake Superior and other large lakes of Minnesota

The poster session will emphasize new findings and recent advances in research, education and outreach activities related to Minnesota's water resources.

the program were discussed, including moderator assignments for the break out sessions.

Awards – Leigh Harrod provided a modified proposal for an annual outstanding service award. The conference packet will include a nomination form.

Fall Field Trip – Extra copies of the Fall Field Trip guidebook are available at \$15 per copy.

AIH Conference – Jim Stark reported briefly on the conference. He said the talks were good although the attendance was limited.

2002 Officer Nominations – Potential candidates were discussed.

Science Museum – Continued coordination and contact with SMM will be pursued. Since Jim Berg originally brought the issue to the Board's attention, he will be asked to participate in any ongoing coordination.

Spring Conference 2002 – Dates and ideas for the spring conference were discussed. Jennie will check for available dates.

Next meeting – The next Board meeting will be Thursday December 6, 2001, 7:30 a.m. at the U.S. Geological Survey office in Mounds View.

Meeting adjourned at 9:00 a.m.

The 2002 Midwest FOCUS Ground Water Conference

April 11-12, 2002 Congress Plaza Hotel, Chicago, Illinois

The National Ground Water Association's Midwest Focus Conference is coming to Chicago. The Midwest is experiencing a rapid population shift from rural to urban, and with it a growing thirst and a changing landscape. Changing landscapes have reduced recharge to aquifers, while overpumping of deeper aquifers has caused heavy drawdowns and geochemical changes at the same time that new, more stringent drinking water standards on arsenic and radium must be met.

Known as one of leading agricultural centers of the world, the Midwest has enjoyed fertile soils and abundant water resources. How will balance be achieved between maintaining high crop yields and protecting ground water from nitrate and pesticide contamination? Lake Michigan contains over 1000 cubic miles of water. Yet, people in the region are concerned about future water shortages. Rapidly growing northeastern Illinois is dangerously close to the legal limit it can pump from Lake Michigan and may need to rely on further development of ground water to keep up with the projected demand.

Will the aquifer systems handle further drawdowns? And, if not, who will pay the price? Cleaning up ground water contaminated by gas stations and industrial sites is more of a challenge as public funds are tapped-out. The 2002 NGWA Midwest FOCUS Ground Water Conference will address these issues and much more.

Some of the Conference Topics

- Large Capacity Wells
- Water Use Conflicts and Resolutions
- Delineating Recharge Rates

— continued on next page

Midwest Focus Ground Water Conference, cont.

- Occurance and Movement of Contaminants to Community Water Supplies
- Brownfields Redevelopment
- Nitrate in Ground Water
- Occurrence and Movement of Agricultural Chemicals
- Impacts of Large Animal Farms on Ground Water
- Arsenic in Ground Water
- Radium Occurrence and Treatment
- Risk-Based Closure
- Urbanization and Ground Water
- Ground Water Pollution and Baseflow
- Water Law
- 2001 Annex to the Great Lakes Charter

More information:
www.ngwa.org/education/midwest.html

Corporate Membership Rates for 2002

Membership Levels	Annual Package Cost	Annual per Item Cost	Annual Savings	Percent Savings
Basic Level	\$350	\$369	\$19	5%
Standard Level	\$505	\$583	\$78	15%
Industry Leader	\$735	\$886	\$151	20%
Corporate Sponsor	\$1530	\$1986	\$456	30%

Corporate Membership Features:

- Basic Level: Business Card ad in newsletter and membership directory, "Lobby Copy" of membership directory, web page sidebar, Certificate of Membership, and up to 4 employee memberships
- Standard Level: Quarter page ad in newsletter and directory, "Lobby Copy" of membership directory, web page sidebar, Certificate of Membership, and up to 9 employee memberships
- Industry Leader: Half page ad in newsletter and directory, "Lobby Copy" of membership directory, web page sidebar, Certificate of Membership, and up to 14 employee memberships
- Corporate Sponsor: Full sponsor acknowledgement in MGWA conference publications, full page ad in newsletter and directory, "Lobby Copy" of membership directory, Certificate of Membership, web page sidebar and up to 20 employee memberships

Please make checks payable to "Minnesota Ground Water Association" or "MGWA." Direct your orders and questions concerning corporate memberships and policy to the Advertising Manager: Jim Aiken, MGWA Advertising Manager, c/o MGWA, 4779 126 St N, White Bear Lake MN 55110; Email jaiken@mn.rr.com.

Join the Minnesota Ground Water Association!

If you are reading this newsletter second-hand, we'd like to take this opportunity to invite you to become a member of MGWA for 2002. Annual dues are \$25 for professional members and \$15 for students. Members are 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. Additional donations to the MGWA Foundation 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. The MGWA Foundation is a 501(c)3 non-profit and donations paid to MGWAF **are** deductible as charitable contributions.*

Just complete the form below and mail to: MGWA, c/o WRI, 4779 126th St. N, White Bear Lake, MN 55110-5910.

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Which Address should we use for Mailings and for Directory Listing? _____
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Minnesota Ground Water Association

MGWA 2002 Officer Ballot

Candidates for President-Elect

**Marty Bonnell**

Martin (Marty) Bonnell, P.E., Vice President and Senior Civil Engineer, has 25 years of consulting experience in the management of environmental, geotechnical, and civil engineering projects. His experience includes the preparation of construction plans and specifications to comply with numerous regulatory agencies, and compliance/environmental requirements. Mr. Bonnell has prepared and managed numerous construction plans and specification contracts for remediation systems to remediate soil and ground water contamination. He has also managed and conducted numerous remedial investigations and prepared corrective action plans for a variety of industries including automotive manufacturing, metal plating, and petroleum retail outlets.

**Write-In**

Candidates for Secretary

**Cathy Villas-Horns**

Cathy Villas-Horns has been a senior hydrogeologist in the Incident Response Unit and the Minnesota Department of Agriculture (MDA) since 1993. She received a B.A. in geology from Carleton College and an M.S. in geology from the University of Delaware. She is a Minnesota Licensed Professional Geologist. Prior to working at the MDA, she worked at the Minnesota Pollution Control Agency and for several environmental consulting firms.

**Jon Pollock**

I have been, and am volunteering to become Secretary of the MGWA in an effort to support the Association's objectives of promoting and encouraging scientific and public policy aspects of issues related to ground water, protecting the public health and safety through continuing education for ground water professionals, establishing a common forum for scientists, engineers, planners, well drillers, educators, policy makers and all others involved with ground water issues, along with educating the general public and disseminating information concerning ground water.

I am currently President of Frontline Environmental, LLC providing environmental consulting and management service to both the private and public sectors. Previous positions include eight years with the Minnesota Pollution Control Agency as a hydrologist, several years of laboratory experience, as well as environmental consulting and oil and gas exploration work. My formal education includes Bachelor of Science degrees in Geology and Geophysics and a Masters Degree in Geological Sciences. Other current volunteer positions include the Dakota County Solid Waste Management Advisory Committee, MGWA Newsletter Team, and Firefighter for the City of Lakeville.

Please copy the ballot, select one candidate for each position and send the ballot back by January 10th, 2002.

**Return to:
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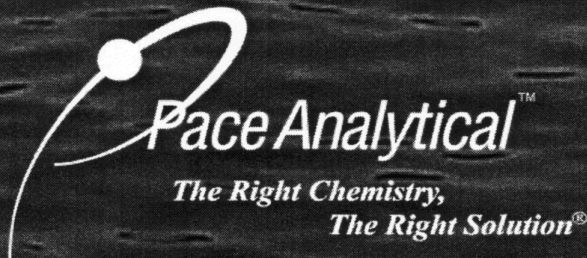
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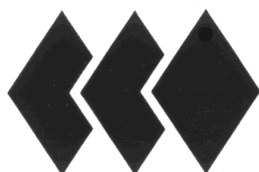


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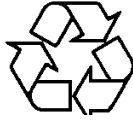
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