

Minnesota Ground Water Association

www.mgwa.org

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President's Column

Rob Caho, MGWA President

Welcome to 2002! I'm looking forward to serving as the MGWA President in the coming year.

As you may know, we are celebrating the 20th Anniversary of the formation of this great organization. As we look to the next 20 years we remember and learn from the challenges and triumphs that we have faced in the past.

Congratulations to Jim Stark and his Board of Directors from the past year. They did a super job coordinating and developing the many facets of this group. Special "hats off" to them for last year's conferences, which were educational and fun for everyone who attended.

There has been a lot of great leadership in our group over the past 20 years. This year's board looks to continue that tradition:

President-Elect **Marty Bonnell**,

Treasurer **Eric Hansen**,

Secretary/Membership Director
Jon Pollock,

Past President **Jim Stark**

and I are committed to working together to ensure that MGWA continues to grow and expand.

We are looking for someone to take over as the Newsletter Editor at this time. **Tom Clark** has graciously handled this responsibility for the past seven years. He has done an exceptional job and for that we thank him.

Please consider getting more involved in our organization and contact Tom or myself about this position.

We have already begun to plan the 2002 activities, beginning with the Spring Conference, which is scheduled for April 23, 2002 at Johnson Screens in New Brighton. It will be an outdoor action-packed conference

called *Effective Drilling & Well Technology in Minnesota*". This will include drilling demonstrations such as Cable Tool Drilling, Diamond Core Drilling, Rotosonic Drilling, Large Rotary Drilling, Probing & Sampling, Well Development, Production Well Screening, Grouting and Case Studies.

This is one conference you will not want to miss. REGISTER EARLY! See our web site (www.mgwa.org) to register electronically.

Our plans for the rest of 2002 include bringing back an Oldtimer's favorite, the Summer Pig Roast party. The timing of this revival is planned to celebrate our 20th Anniversary. We will also continue with the great Fall Field Trip and the Fall Conference. If you would like to help on any of the projects, please contact me at (763)479-3121 or rwc_bc@yahoo.com.



Rob Caho, MGWA President

Capillary Fringe

Laurel Reeves, PG, Observation Well Manager, DNR Waters

When dealing with brownfields, it's builder beware. However, the site at Grove and Lafayette in Saint Paul was the location of several on-going businesses. To the unsuspecting, this area east of the Capitol and northeast of downtown Saint Paul is mostly a small cluster of refurbished warehouses. The offices of several state agencies, including the MPCA, OEA and DNR are located there in refurbished warehouses. The view to the west of the DNR building at 500 Lafayette was a cluster of other old warehouses and an intriguingly huge pile of concrete and dirt to the north. In the last few years the huge pile of dirt has been replaced with low-profile commercial businesses and office buildings. Not until last fall did progress stumble onto the old warehouses on the west side of Lafayette Road south of University. These warehouses had been used by a produce distributor and by a gas company's office. Prior to this, the building where the produce company was located housed a dairy processing facility. This wasn't exactly a

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Capillary Fringe, cont.

brownfield situation, yet similar problems appeared.

Way back in the mid-1800s this area, the Trout Brook valley, was the site of Minnesota's first rail line and the transfer point between Mississippi River transport and the rails. Saint Paul became the rail hub for this part of the continent. Trout Brook valley was transformed from a marshy back water with an adjacent upper class neighborhood of mansions and churches, called Lafayette Park, to a mix of large railroad warehouses and long freight terminals – a common urban development pattern.

In October 2001, demolition work began in earnest at Lafayette and Grove in preparation for construction of a new Ramsey County Law Enforcement Center. As you might expect, this demolition was the topic of many conversations in the DNR building across the street. The conversation that encouraged action though was the question of what became of the wells on this site for which water appropriation permits had been issued. This started a series of events the first of which was a call to the MDH's Environmental Health Division. They had no record of sealing and had not yet been contacted about these wells. A little digging through DNR and MDH records and through the County Well Index revealed that at least two production wells had been drilled on the block in question. One of the DNR's hydrogeologists recalled a trip into the basement of the produce company for the purpose of locating the well. He never really got close because of an overwhelming ammonia odor, but he did know the general location of one well in the corner of a building. The other's location was fairly obvious: in the wellhouse near a gas station.

Always on the watch for possible network additions, DNR Waters' ground water level monitoring well team was looking for a Prairie du Chien/Jordan ground water level monitoring well to replace another well in this area that had been sealed by the owner. They worked with Bergerson-Caswell Well Drilling to gamma log the wells. In addition, the MGS logged the well

with their new flow logging equipment.

This project has several of the common pitfalls of well work in a demolition area. Finding oil in a well might be a good thing in North Dakota or Texas, but not in Saint Paul. However, oil was found in the well located in the basement. And, of course, one of the wellheads was damaged during the demolition process. This action caused so much damage that it wasn't certain the object in question actually was the well. Additional pump part retrieval was necessary after that.

In the end, it was determined not to try to keep either well as a water level monitoring point due to the wells' casing construction and the limited time available to complete the well sealing. The oil was removed and both wells successfully sealed. Even though the outcome wasn't as hoped, valuable data was obtained on the aquifer characteristics.

This whole scenario begs the question, why wasn't the presence of the wells known in the early planning stages of the project? And further, what can our profession do to help developers, demolition and construction contractors and the general public be more aware of unused and abandoned wells?

This construction has also provided a benefit for history buffs and for those interested in the urbanization process. Paul E. Nordell, DNR Adopt-a-River Program, has compiled a considerable history of the Trout Brook Watershed. The entirety of the historical events in this area chronicles the changes that have shaped this watershed and are similar to those that have occurred throughout the metropolitan area. In a paper he has written Paul writes, "Hopefully, it (the historical review) will enrich your appreciation of what has gone before and may challenge you to consider how the future could be shaped to preserve valuable vestiges of that natural as well as cultural past." (This compilation may be obtained by email to paul.nordell@dnr.state.mn.us.)

As we say, the past is the key to the future.

MGWA Needs a Newsletter Editor

Tom Clark has announced that he is retiring as MGWA Newsletter Editor effective with this issue, although he will remain a part of the Newsletter Team. MGWA is actively seeking a replacement for Tom for this two-year volunteer position. The newsletter is produced quarterly (March, June, September and December) by the team of volunteers who share the responsibility. The Editor guides this team as well as serving as an active participant. Publication of the newsletter is handled under contract by WRI Association Management Inc.

The Newsletter Team normally meets as a group once a month for about 90 minutes. We bring ideas for articles to the table for discussion, including items written by team members of current interest to ground-water professionals. Primary responsibility for assembling each newsletter for submission to the publisher rotates among the team members quarterly. The Editor will generally devote an additional 3-5 hours per month in newsletter preparation beyond what the other team members spend. The Editor or another team member also attends the monthly MGWA Board meetings to keep the Board updated on progress of the current issue and receive input and ideas for future articles.

The strength of the MGWA newsletter over the years has always been and must continue to be with you, the members. If you'd like a chance to serve your Association as Newsletter Editor, contact Tom Clark or any member of the Newsletter Team or MGWA Board of Directors.

Meet Your New Officers

President-Elect:
Marty Bonnell, PE



Martin (Marty) Bonnell, Senior Civil Engineer and Vice President at DPRA, 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' compliance and environmental requirements. Marty has prepared and managed many contracts for corrective action plans and remediation systems to address soil and ground water contamination.



Secretary: Jon Pollock, PG

Jon Pollock is President of Frontline Environmental, providing environmental consulting and management services to both the private and public sectors. Jon's previous positions include eight years as a hydrologist with the Minnesota Pollution Control Agency, several years of laboratory experience, as well as environmental consulting and oil and gas exploration work. He has Bachelor of Science degrees in Geology and Geophysics and a Masters degree in Geological Sciences. Jon serves on the Dakota County Solid Waste Management Advisory Committee, the MGWA Newsletter Team, and he is a volunteer firefighter for the City of Lakeville.

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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.

First Annual MGWA Outstanding Service Award Goes to Matt Walton

Dr. Matt Walton, Director of the Minnesota Geological Survey from 1973-1986 will be awarded the first annual MGWA Outstanding Service Award at the Spring Conference on April 23. The Outstanding Service Award program was developed by a committee of Sandeep Burman, Leigh Harrod, Roman Kanivetsky and Jim Stark. As reported in previous MGWA newsletters, the award is meant to recognize those who have furthered the cause of ground water in Minnesota including but not limited to: technical or scientific achievements, efforts to disseminate information or educate people about ground water, and achievements in the public policy arena.



Dr. Walton during his tenure as MGS Director

Matt Walton was born September 16, 1915 in Lexington, KY. He received a Bachelor's Degree in Economics from the University of Chicago in 1936, where he studied under Milton

Friedman, Nobel Prize winner in Economics.

He received both his Masters and Doctorate Degrees in Geology from Columbia University in 1946 and 1951 respectively. He worked for the U. S. Geological Survey during World War II and after graduating from Columbia, taught at Yale University for 17 years.

He also headed his own consulting company and taught at UCLA before accepting the position of Director of the Minnesota Geological Survey and Professor in the Department of Geology and Geophysics at the University of Minnesota in 1973.

The Survey grew and matured under Matt's leadership. His contributions to programs in hydrogeology, Quaternary geology, urban geology and geophysics were numerous including development of the County Well Index (CWI), the County Geologic Atlas series, and the Aquifer Thermal Energy Storage (ATES) program at the University of Minnesota's St. Paul Campus. He also contributed many technical papers on environmental geology and ground water with respect to underground energy storage and engineering use of underground space. Matt was influential at the Legislature, too, never missing an opportunity to educate our elected officials on the importance of geology in decision-making.

Once during budget talks, he was asked by a legislator how long it would take the MGS to "finish doing the geology of the state"? As the story goes, Matt responded by asking how long it would take the Legislature to finish making laws for the state.

In summary, Dr. Matt Walton has demonstrated a cross-fertilization of leadership, sound science, education and public policy that make him eminently well-qualified for the Annual MGWA Outstanding Service Award.

The award will be presented to Dr. Walton at the Spring Outdoor Action Conference. April 23, 2002, which will be held at Johnson Screens in New Brighton. Dr. Walton may honor us with a few remarks following the presentation.

Clarification of MGWA Policy on Continuing Education Credits for Geoscientist Licensure in Minnesota

MGWA has received a number of questions regarding continuing education credits allowed for our conferences and field trips toward renewal requirements for the geoscientist licensure program operated by the Minnesota Board of Architecture, Engineering, Land Surveying, Landscape Architecture, Geoscience and Interior Design (Board of AELSLAGID, or the Board). Although the Board has published its criteria for continuing education (see www.aelslagid.state.mn.us), it has chosen not to pre-certify educational events as meeting its criteria for continuing education. This is very different from other continuing education programs such as those run of the Minnesota Department of Health and the University of Minnesota where training events are commonly pre-certified as applicable for continuing education to meet various requirements. The bottom line is that the Board of AELSLAGID leaves the decision of each licensed geoscientist to determine if a particular event satisfies its published criteria.

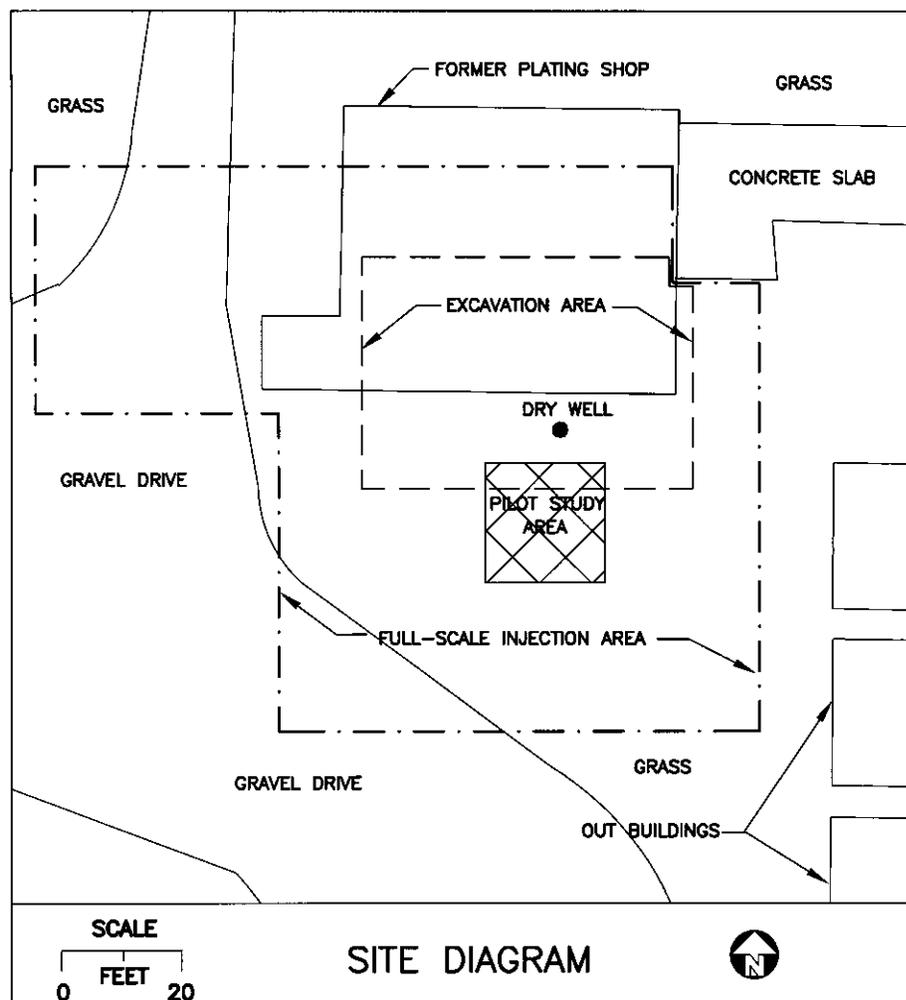
Therefore, the MGWA does not provide certificates indicating the number of continuing education credits from the training experiences we provide. We do provide receipts at registration for our conferences and field trips as documentation of attendance. These receipts, along with such materials as conference agendas and field trip guidebooks we provide may be used by applicants for license renewal in their dealings with the Board. The following is a quote from the web page: *The licensee or certificate holder shall maintain a file in which records of courses and activities are kept, including dates, subjects, duration of programs, sponsoring organization, professional development hours earned, registration receipts where appropriate, and other pertinent documentation, for a period of two years.*

In-Situ Oxidation Of Chlorinated Organics

Mark D. Millsop, PG, GME
Consultants, Inc.

Recently our consulting firm had the opportunity to design and oversee the implementation of a unique in-situ oxidation remediation method that may interest other groundwater scientists practicing in Minnesota. It is my understanding that it is the first large scale project of this type approved by the MPCA and MDH. The method involves using a chemical solution delivered in-situ via direct injection to oxidize chlorinated organic compounds. In 17 years of managing remedial investigations and clean-ups, I have not observed such an expedient remediation of these contaminants. However, there likely is a need to be judicious in using this potential "magic bullet", due to several key variables and because in many direct injection applications there may be little opportunity for adjustments.

I first learned of this remediation technique at a course in June, 1999, entitled "Monitored Natural Attenuation and In-Situ Remediation of Groundwater", presented by Waterloo Educational Services in Toronto, Ontario. Instructors included Dr. John Cherry and Dr. Beth Parker, who led the class on a one day field trip to view a variety of outdoor demonstrations at the Borden Air Force Base. One of the demonstration areas that we observed was a sheetpile-contained surficial, saturated sand unit overlying a clay layer. Investigators had injected a known volume of tetrachloroethene (a.k.a., perchloroethylene or PCE) into the sand and then treated the contamination by injecting the oxidant potassium permanganate (KMnO_4). The class had an opportunity to review some of the chemistry results and also viewed a core sample in which, due to the resulting oxide's darker color, we were able to observe the oxidant's migration pathways. This demonstration, coupled with case studies and theory presented in the classroom, first piqued my interest in this technique, especially because I concurrently was the project manager for a brownfield project involving a



relatively large trichloroethene (TCE) plume in the north part of the Minneapolis-St. Paul metro area. Although we currently cannot mention project contact, contractor names or the site's location, the following general information can be provided.

The subject TCE plume has emanated from a small former plating operation and has migrated approximately 1500 feet downgradient. It has a narrow width and has a depth within the sand aquifer of approximately 30 feet at the source and up to 70 feet below the groundwater table as it migrated to its current length. The primary source was a dry well, approximately 15 feet deep, which was located just outside of the former plating shop as shown on the site diagram (Figure 1). Adjacent downgradient of the source is an

open parking and driveway area. The former plating shop was removed as part of the remedial design. This is important, because when using this direct injection remediation technique, the primary source must be identified and that area must be open and available to drilling equipment to allow adequate definition of the stratigraphy and contaminant distribution, and to allow oxidant delivery.

The geology at the source generally consists of approximately 15 feet of surficial sand, which is underlain by five feet of silt, 10 feet of silty sand, and then a cleaner fine to medium sand to the base of the contamination observed at that location, which was

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In-Situ Oxidation, cont.

approximately 45 to 50 feet below grade. The water table is typically at about 20 feet below grade, approximately at the base of the silt. Other remediation techniques that were evaluated include: air sparging and soil venting, which was not selected due to the silt layer's location; groundwater pump and treat, which was not selected due to the potential length of time required to achieve adequate cleanup, and enhanced natural attenuation, which was not selected due to the potential length of time for adequate cleanup and the apparent lack of existing favorable conditions based on our previous site monitoring of natural attenuation parameters and TCE breakdown products. Therefore, a combination of building demolition, source excavation, and oxidant injection was proposed as a remediation method for the source area. The remaining lower level contamination downgradient would be monitored for attenuation through dilution and dispersion until no further action status is achieved.

In June 2000, a pilot study plan was submitted for MPCA review. Prior to the pilot study, a laboratory bench scale demand test was conducted on samples from the source area to determine the appropriate KMnO_4 solution strength. Based on these results, it was found that a 3% solution would be adequate for oxidation of the organics (including the natural organics) at the project site; this was consistent with other data that I have reviewed in case studies. The pilot study was conducted during July 2000 by using a three by three injection probe grid just south of the dry well area, which had yet to be excavated. The probes were placed 10 feet apart and pre-injection soil and groundwater sampling was conducted over multiple vertical intervals at each location. Six piezometers were installed to monitor potential mounding. A 1/4-pore space injection volume was selected to assess the injectants' migration area and the TCE oxidation; this volume did not cause significant mounding between the probes.

Post-injection soil and groundwater sampling was conducted at the same

intervals at the same probe locations (one-foot offsets), as well as between several of the injection probe locations. The results generally indicated that, where the oxidant was able to be delivered or migrate, nearly complete destruction of the TCE had occurred. For example, initial TCE groundwater concentrations of 109 ppm, 46 ppm, and 31 ppm became non-detectable. Low concentrations of PCE and dichloroethene (DCE) also were destroyed. The kinetics of this process are very fast; most oxidation occurs within the first 24 hours of oxidant introduction. The stoichiometry of the process is given by the equation: $2\text{KMnO}_4 + \text{C}_2\text{Cl}_3\text{H (TCE)} = 2\text{CO}_2 + 2\text{MnO}_2 + 2\text{KCl} + \text{HCl}$. The chloride concentrations at the above three locations before/after injection were 10 ppm/220 ppm, 40 ppm/140 ppm and 20 ppm/100 ppm, respectively. The manganese concentrations were 0.180 ppm/36 ppm, 1.3 ppm/2400 ppm, and 0.620 ppm/1600 ppm, respectively. Although these inorganic concentrations are higher than desirable for drinking water, in this case there are no drinking water wells within 6000 feet downgradient.

A primary observation from the pilot study was that injection of more KMnO_4 solution was required for a more complete treatment over the targeted portion of the plume. The pilot study also indicated that the silt layer likely was not going to be adequately remediated by this technology; therefore, a larger source area excavation would be required to remove the more contaminated area of the silt. (This source excavation also was completed to remove heavy metal contaminated soils that were above action levels.) Also, excavation through the silt down to the groundwater table provided an ideal opportunity for "flooding" the horizontal interval of the aquifer that was the most contaminated.

In September 2001, a full scale injection plan was submitted to the MPCA; a variance request also was submitted to the MDH. The plan was based on the results from 17 probes, 13 borings and six monitoring wells in the source area, plus the 27 probes and six piezometers used for the pilot study. It is very important with oxidant

direct injection to understand even micro-variations in the stratigraphy, because they will control the effectiveness of the delivery and the subsequent migration of the solution; the same stratigraphic heterogeneities also controlled the migration and distribution of the contaminants initially. The design must be able to deliver the oxidant to the contaminants via the initial injection pressures or subsequent density flow, advection and diffusion, because there is little opportunity to adjust the system as can be accomplished with other conventional remediation techniques; one cannot add another well or vent or sparge point, cycle the system, or change the operating parameters unless using a recirculating process, such as with injection and extraction wells.

The injection and source area excavation plans were approved and the source area was excavated in November 2001. Upon completion of the excavation, with approximately one to two feet of groundwater in its base, 6000 gallons of a 3% KMnO_4 solution were pumped directly into the base of the excavation prior to backfilling. Within a couple of weeks after the excavation flooding, KMnO_4 injection was commenced over the plan view of the source area plume; the site diagram (Figure 1) shows both the excavation area and the injection area.

It was important to inject soon after the flooding so that the flooded area would not be re-contaminated by TCE that still existed in some upgradient groundwater. This potential pitfall was evident in the pilot study results as monitoring wells that were "clean" soon after the pilot study showed a significant TCE concentration rebound within months due to recontamination via natural groundwater flow. Therefore, the whole area that is desired to be treated must be treated over a relatively quick timeframe in a manner so that upgradient contamination will not re-contaminate treated areas. Once the KMnO_4 solution has been "used up" by oxidizing organic contaminants and natural organic matter (the

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In-Situ Oxidation, cont.

amount of which should be determined prior to using this method), no more treatment will occur. However, if enough solution is injected such that it isn't all used to oxidize the organics (but not so much that the plume is significantly mobilized), some diffusion will occur into lower permeability areas. Also, if the majority of the organic contaminant can be destroyed, especially residual DNAPL, subsequent dilution and dispersion should occur, further attenuating the remaining plume concentrations. There will never be "complete" treatment, because it would not be possible to uniformly disperse the oxidant solution throughout the geologic formations; some stratigraphic zones will allow more injection than will others due to variations in grain size and permeability, even within the same general stratigraphic horizon.

Based on the contaminant distribution, the area proposed to be treated at this site was approximately 8000 square feet in plan. Injection was proposed from approximately 14 to 30 feet below grade over the non-excavated area. Within the back-filled excavation area, which was in the approximate middle of the injection area, the plume had migrated deeper, and injection was proposed from 24 to 40 feet below grade. Treatment consisted of injecting a 3% KMnO_4 solution through 173 push probes on 7.5 foot centers, with injection at two-foot intervals over the desired vertical extent. A 1/2-pore volume of KMnO_4 solution (about 180,000 gallons) was proposed to create "coalescing disks" that would intersect about 4 feet away from each injection point; I expect that this plan may be different for every site.

The approximately 11 weeks of injection work was finished on February 13, 2002 and about 155,000 gallons of solution actually were injected. Less KMnO_4 solution was used than estimated, because certain areas of the site were less permeable and adequate migration of the solution appeared to be occurring based on weekly "color checks" of the groundwater in eight groundwater table

monitoring wells and three deeper monitoring wells installed in and around the injection area. Also, weekly water level measurements indicated that some local mounding was occurring.

It will be several months before significant post-treatment chemistry data are available. The MPCA requested a more rigorous monitoring program, including six additional monitoring wells and a higher frequency of monitoring (i.e., monthly initially), than typically would be required for other common remediation methods. Early monitoring results for wells in the injection area indicate that KMnO_4 migration and TCE treatment has occurred by the varying degrees of purple groundwater observed in those wells (a nice observational monitoring opportunity when using KMnO_4).

In summary, there is a remarkable opportunity for groundwater remediation of chlorinated organics by using oxidants. However, there are more variables than with common remediation methods. For example, the designer must select an appropriate oxidant, have the site more highly characterized than usual, employ a more rigorous monitoring program than usual, understand potential adverse effects of the oxidant process (e.g., aquifer clogging, byproduct formation, metals mobilization, etc.), and be able to envision the solution delivery method that will destroy enough of the contaminant. Also, the field crew must be relied upon to deliver the injectant to the areas called for in the design. If used in the typical mode of direct injection (versus long term solution recirculation), this technique cannot be easily adjusted if implemented incorrectly.

With consideration to cost, in-situ oxidation is not an inexpensive remediation technique. For this site the amount spent on the design, pilot study, monitoring, and full scale treatment process could have purchased several groundwater extraction wells in the source area, fully outfitted with pumps, plumbing and a treatment building, or could have purchased an extensive air sparging and soil vapor venting system in the same area. However, as mentioned above, these

latter methods did not appear as technically appropriate for this site.

We hope to have enough success stories among us that this expedient method of destructing chlorinated organics finds a place as one of the commonly used remediation methods. I'd like to thank the many people involved in this project to date, and especially MPCA and MDH staff for their on-going willingness to try new approaches. I may be able to obtain permission to release the site data in 9 to 12 months to write a follow-up article on the results of the full scale implementation. Until then, feel free to contact me at 1-800-967-2054 or mmillsop@gmeconsultants.com, if you would like to discuss this technique further.

Mark D. Millsop, P.G., is Principal Hydrogeologist and Environmental Department Manager at GME Consultants, Inc., with offices in Plymouth, Duluth, and Crosby, Minnesota and Chicago, Illinois.

Living With Karst - A Fragile Foundation

The American Geological Institute produced *Living with Karst* in cooperation with the National Speleological Society, American Cave Conservation Association, Bureau of Land Management, Illinois Basin consortium, National Park Service, USDA Forest Service, U.S. Fish and Wildlife Service, and the U.S. Geological Survey. The authors, G.Veni, H. DuChene, N.C. Crawford, C.G. Groves, G.N. Huppert, E. H. Kastning, R.Olson, and B.J. Wheeler are experts in karst-related issues.

Living With Karst, the 4th booklet in the AGI Environmental Awareness Series, discusses karst-related environmental and engineering concerns, and guidelines for living with karst.

Copies of the booklet are available from AGI, Publications Center, 4220 King St. Alexandria, VA 22302; www.agiweb.org/pubs

Hastings Area Nitrate Study: Preliminary Results

Jill Trescott, Dakota County

The City of Hastings is a historic Mississippi River town, about twenty miles downstream from St. Paul. Hastings is in the northeast corner of Dakota County, of which it is the county seat. The City's population of 18,000 and the 2,000 residents of the surrounding townships rely on groundwater for their drinking water. Dakota County's Environmental Management Department has been conducting a Clean Water Partnership study, funded through the Minnesota Pollution Control Agency (MPCA), to investigate the sources of nitrate in the drinking water in the Hastings area and develop approaches for reducing the levels of nitrate. Additional funding and technical assistance have come from the Minnesota Department of Health (MDH), Minnesota Department of Agriculture (MDA), Minnesota Department of Natural Resources (DNR), the City of Hastings, the Dakota County Soil and Water Conservation District (SWCD), and the Metropolitan Council.

Project Background

Over the past few years, both the City and private well owners have had problems with increasing levels of nitrate in the drinking water. When the City started the siting process for a new municipal well in 1997, both test wells, completed in the Jordan aquifer, showed levels of nitrate at approximately 8 mg/L. The city tested five private wells within the search area for the new municipal well and found elevated nitrate levels ranging from 12 to 16 mg/L. In May 1999, the MDH closed Hastings Municipal Well #6 for several weeks, after samples contained average nitrate concentrations of 10.5 mg/L. Existing municipal wells in Hastings are also showing increasing levels of nitrate: although nitrate levels are below the recommended Health Risk Limits (HRLs), over the last ten years all of the wells producing out of the Prairie du Chien and Jordan aquifers have shown increases of 1 to 2 mg/L of nitrate.

In addition, Dakota County, MDA, and MDH have cooperated to conduct free nitrate testing clinics for Dakota County residents. Through these clinics (1997-1999), 387 samples from private wells have been analyzed for nitrate; of these, 17.5% contained nitrate concentrations greater than 10

mg/L (1997-1999 results). Consequently, water resource managers, planners, and elected officials at county and local levels of government are concerned about the continued health and safety of the water supply as a result of this apparent trend toward increasing nitrate levels in the groundwater.

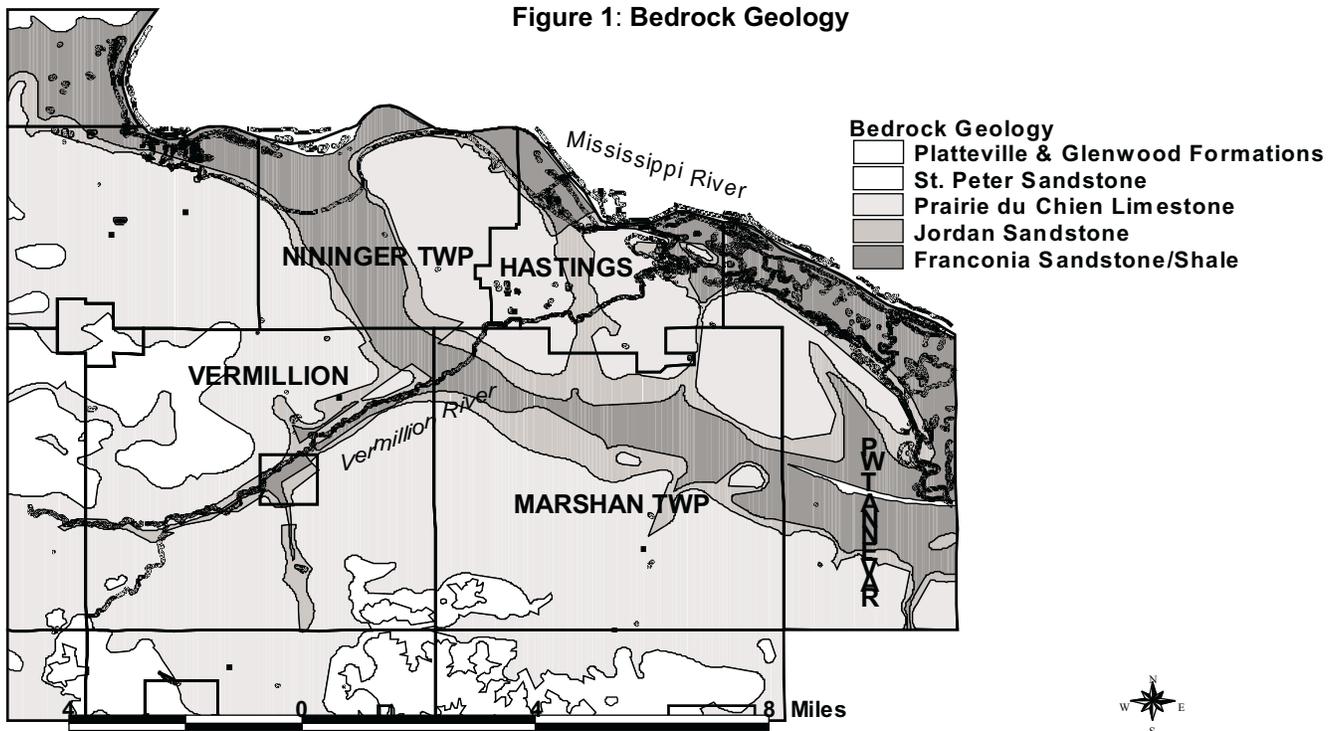
The study is intended to evaluate the extent of the area's nitrate problem, sources of nitrate, groundwater flow patterns, and interactions between the Vermillion River and the groundwater. While the results are still being analyzed, the preliminary results are discussed below.

Bedrock Geology (Mossler, 1990)

The underlying geology consists of a thin layer of outwash on top of the Prairie du Chien and Jordan Formations, but the bedrock is criss-crossed by two notable features, as can be seen in Figure 1. The buried valley of an ancient precursor to the Mississippi River cuts through the Prairie du Chien and Jordan Formations, crossing the area from the northwest to the southeast, so that the City of Hastings sits on

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Figure 1: Bedrock Geology



Hastings Nitrate Study, cont.

three bedrock "islands." The buried valley, which is filled with mixed outwash from the St. Croix moraine, has depths-to-bedrock of more than 500 feet, compared to less than 50 feet in the areas outside the buried valley. The Empire Fault of the Mid-Continental Rift System cuts across the area from the southwest to the northeast. The bedrock north of the Empire Fault is about 100 feet higher than the bedrock south of the fault.

Quaternary Geology (Hobbs et al, 1990)

The oldest glaciers for which there is evidence within the study area originated in the Keewatin ice center to the northwest; they advanced and receded during the pre-Wisconsinan period, leaving "Old Gray" tills on top of the northernmost of the bedrock "islands" in what is now Nininger Township and western Hastings. After a long period of weathering and erosion, the Labradorean Superior lobe advanced from the northeast into Dakota County during the Illinoian glaciation, depositing reddish till and sediments of the River Falls formation, some of which remains near the surface in Nininger Township and Hastings. The Superior lobe advanced to cover much of Dakota County during the late Wisconsinan period, retreated, then advanced to an equilibrium position where melting of the ice front kept pace with the flow of ice, building the extensive St. Croix moraine, the southern tip of which covered northern Dakota County. Layers of outwash from the St. Croix moraine formed the Rosemount outwash plain, which buried the bedrock valley in the eastern part of the County.

Later, the Des Moines lobe of Keewatin ice advanced from the northwest, reaching its equilibrium point in western Dakota County. As it melted, the meltwater cut into the Superior lobe sediment and laid down new layers of outwash, forming the modern valley of the Vermillion River in the center of the County and the Rich Valley, through the Rosemount outwash plain, further north. These two streams of Des Moines outwash

met and completed the filling of the bedrock valley in the Hastings area, covering most of the southern bedrock "island," about half of the middle "island," but little of the northernmost "island." Well drilling restrictions apply to most of the project area because the Prairie du Chien is so near the surface, with only a thin layer of coarse material over it.

Vermillion River

The Vermillion River flows through the study area from the southwest to the northeast, crossing over the buried bedrock valley. The river follows the path of the Empire Fault for much of its course, but bends southward of the Fault where the underlying geology changes as it enters the City of Hastings. There are sinkholes near the river within Hastings. According to the Dakota County Groundwater Model, the general direction of groundwater flow in the area is parallel to the flow of the Vermillion.

In 1990 and 1991, the USGS conducted a study to explore the relationship between the hydrology and the water quality in the Vermillion River watershed (Almendinger and Mitton, 1995). This study showed a reduction of stream flow east of the City of Vermillion, indicating that surface water was discharging into the surficial and bedrock formations in this area. The USGS study also concluded that there might be a relationship between groundwater quality

and water quality in the Vermillion River.

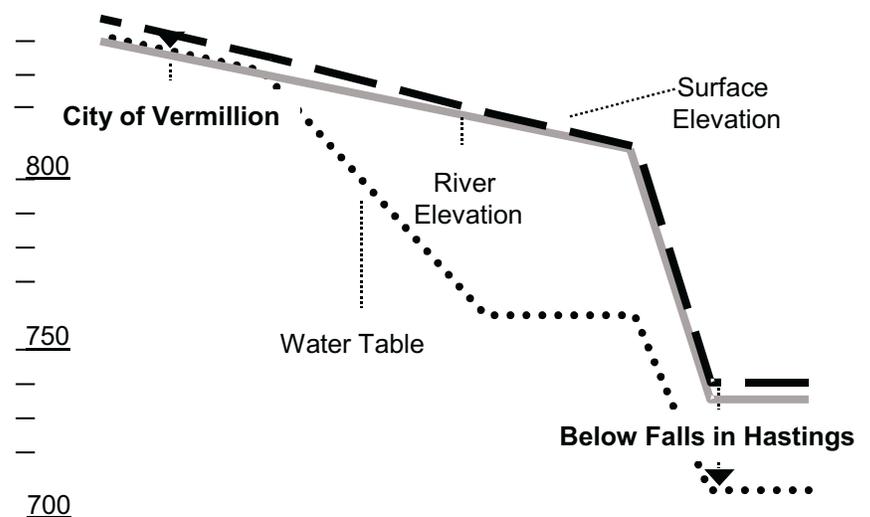
In November 2000, Dakota County Environmental Management installed three sets of monitoring wells along the Vermillion River: one set just downstream of the City of Vermillion, a second set in the center of the buried bedrock valley, and a third on the other side of the buried bedrock valley, just within the Hastings city limits. The results from these wells are sketched in Figure 2. The data indicate the Vermillion has a gaining reach upstream of the bedrock valley, where the water table intersects the river. As the river crosses the bedrock valley, the river is perched above the water table, with little interaction between the river and the water table 60 feet below. At the monitoring wells within Hastings, the river loses water. A flow study is currently underway that will help map the gaining and losing stretches of the river in more detail. In addition, isotope analysis of water from the City of Hastings municipal wells will help quantify the contribution of river water to the drinking water supply.

Farm Nutrient Management Assessment Program (Bruening, 2001)

In conjunction with the Hastings Area Nitrate Study (HANS), the Minnesota Department of Agriculture conducted

— continued on next page

Figure 2 – Vermillion River and Water Table Levels in the Buried Bedrock Valley (not to scale)



Hastings Nitrate Study, cont.

a Farm Nutrient Management Assessment Program (FANMAP) survey in the study area. This MDA program evaluates the farming practices within a given area and compares them to Best Management Practices recommended by the University of Minnesota. Forty-two farm operators, representing about 25% of the acreage being farmed within the study area, participated in the FANMAP in July and August 2000; the results were released in June 2001. The FANMAP found strong evidence that producers in the study area are voluntarily adopting the educational materials and recommended nitrogen strategies developed by the University of Minnesota.

To summarize the report, field corn and soybeans were the dominant crops, with 69% of all acres planted with these crops. Irrigation was prevalent, with 63% of acres under irrigation. Forty-two percent of the crop acreage was planted with field corn; 68% of the 1,100,000 pounds of commercial nitrogen fertilizer was applied to those acres. Most of nitrogen fertilizer applied in the study area was applied as a spring preplant. Less than 1% of nitrogen was fall applied. Nitrogen inhibitors were applied with spring preplant applications of nitrogen and 44% of field corn applied with anhydrous ammonia used nitrogen inhibitors. While some livestock is raised in the area, the numbers are not large enough for manure to represent a significant source of nitrogen.

Pesticide use was prevalent in the study area, with 90% of all crop acres receiving herbicides, insecticides, and/or fungicides. Fifty-two separate compounds were used, totaling 37,000 pounds of active ingredient. Herbicide use was primarily on field corn, representing 47% of all active ingredients applied; atrazine was the most used herbicide compound. Potatoes received the most fungicides, with 99% of all active ingredients applied to potatoes; chlorothalonil was the most used fungicide compound. Potatoes also received the most insecticides, with 62% of all active ingredients applied to potatoes; phorate was the most used insecticide compound. It also

appears that applications of pesticides are at or below recommended rates.

Nitrate Sampling

In September 2000, 20 representatives of Dakota County and its HANS partners sampled 146 domestic wells, plus five City of Hastings municipal supply wells. The Dakota County Well and Water Management System (adapted from the County Well Index, Wahl and Tipping, 1991) and Parcel Query database were searched to identify domestic wells for which the County had construction and geologic data, such as depth, static water level, year constructed, aquifer, and construction details. The Well and Water Management System has records for very few wells constructed prior to 1975, but the study area has been settled for 150 years (and is home to a number of "Century Farms" that have been farmed by the same family for at least one hundred years). Therefore, the wells sampled may generally be younger than the total population of wells in the area. Well owners were contacted beforehand for permission to sample, and after the sample analysis was completed, they were notified by letter of their results.

While the representatives were sampling, they drew sketches estimating the locations and separations of

wells, septic systems, and structures at each site where such features could be seen. In most cases, the faucet was run for 15 minutes before the water sample was taken. All samples were analyzed for nitrate. Twenty percent (29) of the 151 wells were selected for additional analyses, including a time-series comparison of the number of minutes the faucet was run (5, 10, 15, and 20 minutes); caffeine; and pesticides. The 29 wells were selected to represent different aquifers, depths, and geographic (horizontal) locations.

Nitrate Results: Descriptive Statistics

The samples were analyzed for nitrate (as nitrogen) using a Hach DR 4000 photospectrometer, calibrated with 1.0 mg/L, 3.0 mg/L, and 7.0 mg/L standards to ± 0.5 mg/L accuracy. (Accuracy as stated applies to samples with nitrate-nitrogen concentrations as high as 10.4 mg/L. Samples with initial results of 10.4 mg/L or higher were diluted by a factor of ten and re-analyzed.) Of the 151 samples analyzed (from the 15-minute sampling interval), nitrate results ranged from zero to 40.0 mg/L. The median result was 3.70 mg/L; the mean 6.31 mg/L; and the standard deviation was 7.66. The results were skewed and not normally distributed

Table 1: Nitrate levels by classification (MDH, 1998):

Nitrate Level (mg/L)	Count	Percentage
Non-detect (0.0)	51	34%
Background (>0 and < 1.0)	10	7%
Transitional (>= 1.0 and < 3.0)	11	7%
Elevated (>= 3.0 and < 10.0)	40	26%
Exceeds standards (>= 10.0 mg/L)	39	26%
Total	151	100%

Table 2: Nitrate Results by Aquifer

AQUIFER	Number of Wells	Nitrate Results: Range	Nitrate Results: Median	Depth of well (feet bgs): Range	Total Depth of Well (feet bgs): Median
Quaternary	34	0-29.0 mg/L	8.7 mg/L	125-340	178.5
Prairie du Chien	13	0-40.0 mg/L	15.0 mg/L	125-321	200
Jordan	88	0-26.0	1.85 mg/L	180-500	320

Hastings Nitrate Study, cont.

(Shapiro-Wilk $W = 0.8135$, $p < 0.0001$).

The samplers took samples at 5-, 10-, 15-, and 20-minute intervals from 29 of the wells. The nitrate results from the 29 wells in the multi-analysis subset were representative of those found in the full sample set. (Means, medians, and variances were not found to be unequal.) The amount of time the faucet had been run was not found to make a difference in the nitrate results for each well (Friedman's ANOVA (rank sum) $\chi^2_r = 1.1304$, $p = 0.7697$).

As shown in the table below, the results were significantly different between wells completed in unconsolidated materials, the Prairie du Chien, and Jordan aquifers (Kruskal-Wallis $H = 31.72$, $p = 0.0000$), but the highest results were from the Prairie du Chien. The buried bedrock valley in the study area complicates the relationship between the aquifer in which a well was completed and the depth of the well; because of the depth of unconsolidated material in the buried bedrock valley, the deepest Quaternary wells in the study area are deeper than the shallowest Jordan wells.

The major risk factors significantly associated with high nitrate results are the depth of the well (Spearman's $\rho = -0.4727$, $p = 0.0000$), the age of the well (Spearman's $\rho = -0.4312$, $p = 0.0000$), and the type of soil in which it is located (Kruskal-Wallis $H = 4.3297$, $p = 0.0375$). It should be noted that well depth and age are cross-correlated, since newer wells are also deeper wells. Nitrate results

by depth interval, regardless of aquifer, are shown below.

The median nitrate result for wells in areas of loam or clay loam was 2.05 mg/L, while the median result in areas of sand or sandy loam was 4.65 mg/L. Once these factors are taken into account, there were no geographic areas within the study area that had higher or lower nitrate results than others. For instance, the results for wells constructed over the buried bedrock valley were not significantly different than the rest (Kruskal-Wallis $H = 1.5319$, $p = 0.2158$).

Caffeine Results

The 29 wells selected for the time-series comparison of nitrate results were also analyzed for caffeine (as a tracer for domestic wastewater) and pesticides (as a tracer for row crop agricultural impacts). Medallion Laboratories analyzed the samples for caffeine using a proprietary HPLC analytical method with a detection limit of 0.001 mg/kg. Low levels of caffeine were detected in 26 of the 29 samples (90%), with concentrations ranging from 0.001 mg/kg to 0.051 mg/kg. The median result was 0.005 mg/kg; the mean 0.007 mg/kg; and the results were not normally distributed (Shapiro-Wilk $W = 0.5114$, $p < 0.0001$).

The caffeine results were not significantly correlated with the nitrate results (Spearman's $\rho = -0.3311$, $p = 0.799$); however, they were significantly correlated with the age of the well (Spearman's $\rho = 0.4770$, $p = 0.0126$). Caffeine results were not significantly correlated with the aquifer of the well (Kruskal-Wallis $H =$

0.8670 , $p = 0.8334$), the depth of the well (Spearman's $\rho = 0.2913$, $p = 0.1319$), or the soil type (Kruskal-Wallis $H = 3.1746$, $p = 0.0748$).

Pesticide Results

Minnesota Valley Testing Laboratories analyzed the samples for Minnesota Department of Agriculture List 1 pesticides (reference method U.S. E.P.A. SW 846-8081-8141A-3510), with detection limits from 0.2-0.5 $\mu\text{g/L}$. The MDA List 1 includes the pesticides most commonly used in the corn-soybean crop rotation in Minnesota. Also, the pesticides found most frequently in groundwater in the United States Geological Survey's National Water Quality Assessment program (atrazine, deethylatrazine, simazine, metolachlor, and prometon) (Kolpin *et al*, 1998) are included in MDA List 1. From this initial sampling, a single sample contained a detectable quantity of atrazine (0.5 mg/L).

When the Minnesota Pollution Control Agency studied groundwater quality in Cottage Grove, which is adjacent to the Hastings study area, their pesticide analysis was done with lower detection limits than above and they analyzed for pesticide degradates as well as parent compounds (MPCA, 2000). In order to have the Hastings study results be comparable to the Cottage Grove results, in August 2001 Dakota County re-sampled 27 of the wells above, as well as three additional wells. (The wells were re-sampled for nitrate at the same time; the 2001 results were not significantly different from the 2000 results, $t = -0.22$, $p = 0.8279$.) The United States Geological Survey's Organic Geochemistry

Table 3: Nitrate Results by Depth of Well

WELL DEPTH INTERVAL (feet below ground surface)	Number of Wells Sampled	Nitrate Results : Range (mg/L)	% Background	Nitrate Results : Median (mg/L)	% Over Drinking Water Standard
120-159	14	0.0 – 40.0	14%	16	57%
160-199	22	0.0 – 27.0	18%	11.2	55%
200-239	14	0.0 – 18.0	29%	6.1	21%
240-279	20	0.0 -- 26	35%	4.3	25%
280-319	21	0.0 – 18.0	48%	3.3	19%
320-359	36	0.0 – 19.0	64%	0.1	11%
360-399	11	0.0 – 17.0	55%	0	9%
400+	7	0.0 – 3.8	57%	0	0%

Hastings Nitrate Study, cont.

Research Laboratory analyzed the samples for low levels of herbicides using GC/MS and herbicide breakdown products using HPLC/MS, with a detection limit of 0.05 µg/l. Herbicides or their degradates were detected in 22 (73%) of the wells, and 20 wells (67%) had multiple herbicides detected. The most frequently detected compounds were Alachlor and Alachlor degradates (16 wells, or 53%) and metolachlor and metolachlor degradates (16 wells, 53%). The MDH recommends that, when a pesticide and/or its degradates are detected in a water sample, the mass of that family of compounds be summed for comparison to the HRL. Two wells exceeded the 4.0 µg/L HRL for Alachlor, with combined quantities of 9.50 µg/L and 7.19 µg/L, respectively. Atrazine and atrazine degradates were detected in 12 wells (40%). Acetochlor was introduced to the market in 1994; Acetochlor or acetochlor breakdown products were detected in 8 wells (27%); Dimethenamid was introduced in 1993, and a dimethenamid breakdown product was detected in one well.

The low-level herbicide results (summed mass of all herbicides and degradates in µg/L) were highly correlated to nitrate results (Spearman's rho = 0.793, p = 0.0000). However, the herbicide results were not significantly correlated to the aquifer of the well (Kruskal Wallis H = 2.6333, p = 0.4517), the depth of the well (Spearman's rho = -0.3073, p = 0.1050), the age of the well (Spearman's rho = -0.3337, p = 0.0771), or the soil type (Kruskal Wallis H = 0.1419, p = 0.7064). The herbicide results were also not correlated to the caffeine results (Spearman's rho = -0.3311, p = 0.0799). It should be noted, however, that of the 27 wells that were analyzed for both caffeine and low-level herbicides, 16 (59%) had detectable levels of both caffeine and herbicides; 8 (30%) had detectable levels of caffeine but not herbicides; and 3 (11%) had detectable levels of herbicides but not caffeine. Every well had something.

Pending Data and Analyses

In August 2001, six wells within the study area were sampled for helium and tritium isotopes, and an additional four wells were sampled for tritium alone. Results of this analysis are currently being used to calibrate the groundwater flow model, estimating the groundwater flow paths within the study area. Additional wells in the vicinity of the Vermillion River have been sampled for oxygen isotopes, to determine the proportion of river water within the groundwater at those locations. These results are pending. In addition, the data for pesticide detections in the groundwater were quite different from the FANMAP information on pesticide use in the area, so this will bear further investigation.

Conclusions

The nitrate sampling conducted for this study confirms that nitrate is a problem in the area's drinking water supplies, with one-fourth of the samples exceeding the drinking water standard and another one-fourth showing elevated levels of nitrate. However, the higher nitrate is found in shallower groundwater (the surficial aquifer and the Prairie du Chien) and in older (less well constructed) wells. Once the modeling of the groundwater flows in the area has been calibrated, a better understanding will be developed of how elevated nitrate might affect the Jordan aquifer and deeper groundwater resources in the future.

While surface water resources have been examined for multiple human impacts through programs such as the National Ambient Water Quality Study, the Hastings Area Nitrate Study is one of the first to analyze groundwater for the non-point source pollution represented by caffeine and pesticides and to examine their relationship to elevated nitrate. Caffeine detections were ubiquitous, but the statistical relationship between nitrate and pesticide levels was very strong, and the relationship between nitrate and caffeine was not. While the presence of both caffeine and pesticides suggest both domestic wastewater and row crop agriculture as sources, it is difficult to quantify their relative contribution of nitrate to the

groundwater. However, the strong statistical relationship of pesticides to nitrate suggests that row crop agriculture is the dominant contributor.

Acknowledgments

Funding for the Hastings Area Nitrate Study has been provided by a Clean Water Partnership grant through the MPCA. Additional funding and technical assistance have come from the Minnesota Department of Health, the Minnesota Department of Agriculture, the Minnesota Department of Natural Resources, the City of Hastings, the Dakota County Soil and Water Conservation District, and the Metropolitan Council.

— continued on next page

New health-risk information on alachlor ethane sulfonic acid (alachlor ESA):

As this issue of the MGWA newsletter was going to press, new health-risk information related to alachlor ESA became available. This information may be important relative to the accompanying article on the Hastings Area Nitrate (HAN) Study.

In mid-February the Minnesota Department of Health issued a memorandum to the Minnesota Department of Agriculture providing a Health Based Value (HBV) for alachlor ESA of 100 µg/L. The HBV, an unpromulgated exposure value, serves as interim advice to protect the health of individuals potentially exposed through drinking water where a contaminant has been detected. The HBV does not serve to protect the groundwater resource.

An analysis of HAN Study pesticide health-risk data using the alachlor ESA HBV of 100 µg/L is being undertaken by the study's author and will be included in the final report. For more information on the alachlor ESA HBV, contact the Health Risk Assessment Unit of the Minnesota Department of Health. For more information on the HAN study final report, contact author Jill Trescott.

Venture into the St. Croix Basin *Challenges in a Diverse Landscape* 2002 Local Water Planners Conference

CALL FOR PAPERS and POSTERS

Conference Date: **September 23-25, 2002**

Location: **Grand Casino Hinckley, Hinckley, MN**

DEADLINE FOR ABSTRACTS: **March 31, 2002**

The planning committee will rely on contributed papers to develop concurrent sessions for the conference. Presentations may describe research or monitoring results, case studies or success stories, development of new technologies and analytical tools, or management strategies.

Breakout sessions will focus on:

- shoreland protection or restoration, riparian buffers
- development pressures and solutions (Smart growth, green corridors, etc.)
- working across boundaries (interstate work, urban-rural issues)
- landuse decision making
- new tools or technologies (GIS, web sites, models, treatment alternatives)
- involving citizens (innovative water planning strategies, youth, volunteers)
- managing disasters (droughts, floods, spills)
- exotic species management or education
- wastewater management (onsite systems, alternatives, community systems)

Topics should be applicable to the work of water planners, introducing programs that can be adapted or transferred to other areas. Success stories and lessons learned are always helpful. Minnesota/Wisconsin initiatives that further the work of local water planning are appropriate.

Abstracts also are requested for the Poster Session, which will be a prominent feature of the conference. Posters will be set up with displays and vendors in the entry to the conference where breaks will be held. Please note whether you want to do an oral or poster presentation.

ABSTRACT REQUIREMENTS. Abstracts should be 100-150 words long and contain the paper's title, author's name, address, phone, fax, e-mail, affiliation, and a brief description of the presentation.

Abstracts should be submitted electronically or by mail by March 31, 2002.

MGWA Welcomes Environmental Strategies Corp. as New Corporate Member

MGWA's new corporate membership program has a third member, Environmental Strategies, Corp. Look for their new ad in this issue of the newsletter. Our list of corporate members:

**Howard R. Green
Interpoll, Inc.
Environmental Strategies Corp.**

Arsenic Maps Online

— from Sarah J. Ryker, USGS

The Geotimes arsenic maps with MN data are now on line:

<http://co.water.usgs.gov/trace/arsenic>
In the "Data" section of the page, we provide the USGS arsenic data, with a link to the MPCA data. Within the next few weeks the equal-area map will become a layer of the National Atlas (www.nationalatlas.gov), so users will be able to pan, zoom, and add other layers to create their own maps. USGS will add that link as soon as it goes "live" in the Atlas.

Hastings Nitrate Study, cont.

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MGWA Foundation Corner

Groundwater, Geology, and Environmental Science at UWRF

Editor's Note: In response to a request from the MGWA Foundation and the MGWA newsletter team, this article describes the current status of groundwater and geology education at the University of Wisconsin-River Falls.

Dr. Kerry L. Keen, Univ. of Wisconsin-River Falls

In 1997, after a number of years with various Twin Cities' environmental consulting companies (most recently Summit Envirosolutions, Inc.), I accepted a position with UW-River Falls (UWRF). With ties to the Twin Cities, I stayed put in Minneapolis, joined a carpool and began my daily journey across the St. Croix to western Wisconsin. Although I had taught one evening hydrogeology class at UWRF a few years earlier, and had attended a sister undergraduate school (UW-Whitewater), I had lots to learn about the area, the university, and the earth and environmental science programs. I also learned that I need to push outside of my comfort zone to try new ways of teaching to achieve my goal of developing and stretching each student. I have added inquiry projects into my teaching, active teaching methods into large lecture introductory classes, and simulations of actual projects that students would encounter after completing their undergraduate training.

Overview of Water-Related Programs at UWRF

The Geology and the Environmental Science and Management (ESM) Units at UWRF are part of the Plant and Earth Science Department, housed in the College of Agriculture, Food, and Environmental Science (CAFES). My position is split between Geology and ESM. And like my position, most students who are interested in groundwater come from either the Geology or ESM programs.

Three years ago UWRF combined a number of environmental options into a new interdisciplinary Environmental Science major. This major requires students to take a core sequence of math and science classes, calculus, physics, chemistry, geology, biology; and key classes in the college, such as soils and agricultural engineering. Beyond those classes, the student selects a sequence of courses in their areas of interest. With this recent change, the ESM Unit now includes three majors: Land Use Planning, Conservation, and the new Environmental Science Major.

The Geology Program includes the Geology and Earth Science Education Majors. Hydrogeology is one of the minors in this program. The Hydrogeology Minor includes the following 'core' classes: Hydrology and Water Quality, Hydrogeology, and Soil Physics; and selected chemistry and environmental analysis/chemistry classes, plus various electives in chemistry and geology, such as organic chemistry, chemical

instrumentation lab, geomorphology, and sedimentary geology. A number of students majoring in geology or other sciences pursue the Hydrogeology Minor.

The introductory water class Hydrology and Water Quality is a junior-level class and provides a broad introduction to principles and processes involved in the hydrologic cycle. This class draws a mix of students with majors in conservation, environmental science, biology, geology and other fields. It includes substantial hands-on activities and field projects. I have tried to connect students with the variety of hydrologic features in the River Falls area, this includes trout streams (both on and off campus), such as the Kinnickinnic River, detention basins, storm sewer outfalls, and reservoirs. Two major field team projects are completed each semester. These include a two-month-long water-quality monitoring project, and a streamflow project, which is conducted in the South Fork, a trout stream running through campus.

Hydrogeology at UWRF

The hydrogeology class is more theoretical and quantitative, but also involves substantial applied field and hands-on components. My principal goals in this class are to provide a solid theoretical foundation and to expose students to the practical side of hydrogeology. I think this mix is the best way to prepare students for groundwater positions with state agencies or environmental



UWRF Hydrogeology Students installing temporary monitoring wells



UWRF Hydrogeology Students completing a soil boring

UW River Falls, cont.

consulting firms, or for graduate training. As part of this class, students design and conduct a 10-week field project, which is similar to an actual environmental consulting project. Several years ago, Summit Envirosolutions participated by donating use of their Geoprobe and its operators (Chris Rydell and John Dustman) for a day. Last year's project involved students installing a number of shallow observation wells by hand to assess the baseline groundwater conditions in an area along the South Fork. This is an area where wetland restoration is being proposed and evaluated. We now have 4 permanent observation wells, and 11 additional temporary observation wells. Much of the material for these wells was donated by US Filter, Goodin Company, and Timco. We continue to benefit from their donation of materials. Last year the students' monitoring revealed complex temporal and spatial variations in the water-table configuration and flow associated with flood events of the

South Fork. This year's class is just beginning their project, building on the results of last year.

The hydrogeology class takes an annual one-day field trip to the Twin Cities area to visit TCAAP, Soil-Engineering Testing, Savage Fen, and Boiling Springs. We sincerely thank Dan Sola, Jim Price, and Jeanette Leete for sharing a Saturday with us each year!

Dr. Laine Vignona joined the ESM unit at UWRF two years ago, and has added several important classes to the Environmental Science Major: Fate and Transport of Chemicals in the Environment, Environmental Analysis, and Environmental Impact Assessment. She has experience

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— UWRF Summer Research; Stream Gaging Rush River

2002 Minnesota Ground Water Association Newsletter Advertising Policy

Display ads:

<i>Size</i>	<i>Inches Hor. x Vert.</i>	Quarterly Newsletter <i>Annual Rate; 4 issues</i>	2002 Membership Directory <i>Annual Rate; 1 issue</i>
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.

Overview of Environmental Quality Board Water Resources Management Activities

— by Michael Tietz, Water Planner, Environmental Quality Board

In 1983, the Minnesota Legislature merged functions of the Water Planning Board into the Environmental Quality Board (EQB), assigning a set of duties now codified in Minnesota Statutes, Section 103B.151. This language specifies that the board is responsible for developing of the state's 10-year water plan, including coordination and integration of policy, planning and programs related to Minnesota's water. In 1985, the board established the Water Resources Committee to help it carry out these duties.

The water committee is staffed by a policy representative from each state agency that manages water resources, as well as the Metropolitan Council, Minnesota Geological Survey, University of Minnesota, and two EQB citizen members and advisors from federal agencies.

The board appoints agency commissioners or directors, however, agencies are permitted to designate an alternate to represent them on the water committee. Today, most water committee representatives are agency division directors.

The committee's purpose is to provide the focus necessary for effective integration of water programs and policies. Each member looks at water issues from a different angle — drinking water, agriculture, recreation, pollution — and coordinates their concerns through the committee to create a unified, coherent plan for Minnesota's water. The Legislative Water Commission, which sunsetted in 1996, provided a similar focus within the legislative branch and allowed legislators to further their understanding of water-related issues.

In the Ground Water Protection Act of 1989, the Legislature assigned the water committee responsibility for a series of biennial water reports. These reports are an extension of the work that is done in developing the

This Newsletter brought to you by:

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Jim Lundy

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Remaining MGWA Newsletter Deadlines for 2002

Issue	Copy to Editor	Copy to Publisher
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

state water plan, and examine topics such as statewide water research needs and state ground water policies. The Legislature also directed the state to evaluate trend information and other issues related to the quality and quantity of the state's surface and ground waters.

The EQB plays an important role in state water management

The Environmental Quality Board and Minnesota Planning currently have three major projects underway, which will impact water resources management for state agencies as well as local governments.

Minnesota Watermarks: Gauging the Flow of Progress 2000-2010 is the state's 10-year plan to protect and conserve Minnesota's water, and the first big product of the Governor's Water Unification Initiative. The report was a collaboration of seven basin teams established around the state. Now in phase two of the initiative, the basin teams are working to answer a series of questions including: "What are the priority information needs? What new approaches should federal, state and local governments take to focus, coordinate or unify efforts to attain basin goals and objectives? Are funds for local government actions effectively achieving desired outcomes?" The basin teams are also identifying key indicators for measuring the success of their efforts, and setting targets for at least some of these indicators.

The basin teams' work will be included in the upcoming biennial

water priorities report. The EQB water staff are also reviewing other statewide and regional plans and gathering input from the state agencies through the water committee to develop the water priorities report. This report will provide the policy framework and priorities for the water-related portions of the Governor's 2003-04 budget.

A second major effort, planning for the reorganization of state water agencies, was assigned as part of the Omnibus Agriculture and Environment Funding bill, House File 10 for the 2001 Special Session. This provision directed the Office of Strategic and Long Range Planning (Minnesota Planning) to develop and present to the Legislature a plan for the reorganization of state water programs and functions. The charge required two work products: a chart showing all agency water programs, was completed August 15, 2001; and, a final report with legislative language, was completed on February 15, 2002. Because the chart and subsequent plan required detailed knowledge of water agency operations, water staff worked with the committee to complete the work.

The third project focuses on sustainable development. Minnesota Planning, in consultation with the Department of Natural Resources and appropriate and affected parties, was asked by the Legislature to prepare urban rivers sustainable development draft guidelines for urban

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EQB Activities, cont.

central business districts on rivers. In meeting this charge, Minnesota Planning is evaluating existing state, municipal and federal laws; the need for the DNR to adopt rules to implement the Mississippi River critical area order (Executive Order 79-19); and the technical and administrative procedures to guide urban river development. The urban rivers report will be completed in March.

Charting a Course for the Future: State Water Program Reorganization Project

Charting a Course for the Future is the final report of the State Water Program Reorganization Study ordered by 2001 Legislature and conducted by Minnesota Planning and EQB. The report has been submitted to the Legislature.

The Omnibus Agriculture and Environment funding bill (Laws of Minnesota 2001 First Special Session, Chapter 2, section 155) required the director of the Office of Strategic and Long Range Planning to develop a plan for the reorganization of state water programs. The Legislature defined three criteria to be considered when developing a plan for reorganization: all specific plans and implementation projects should be coordinated with and related to an overall water management plan; similar programs and functions should be assigned to a single agency when feasible; and inherent conflicts of interest should be avoided.

Input to the study came from a survey of state government "partners" in water management, input and review by the EQB Water Resources Committee and review of past reorganization studies. Minnesota Planning staff involved in the project were Peder Otterson (on mobility from DNR), Gretchen Sabel, Michael Tietz and John Wells.

Findings

The concept of steering water management agencies in an overall direction, as opposed to moving its parts around, became the focus of the report. The findings included:

Coordination and relation to overall water management plan. Coordination between agencies appears to be effective at the operational level – crises can be dealt with efficiently and initiatives developed that span agency lines. The Ventura administration has tailored the Water Unification Initiative to build synergy between the planning efforts of various levels of government (local, regional, state and federal).

Overlap and duplication. Overall, the study finds that agency interactions are generally complimentary and allow for people with different backgrounds and perspectives to work together for a common goal. The example cited in the report is the work done by the Department of Natural Resources, the Minnesota Geological Survey and Minnesota Department of Health in defining the state's geology, and then documenting the conclusions in maps and guidance to local units of government on ground water concerns. One area where two state programs clearly overlap is in the flood damage reduction programs administered by DNR and the Board of Water and Soil Resources.

Conflict of interest. Conflict of interest by state agencies in administration of water programs does not appear to be a significant problem.

Legislative coordination. The current committee structure in the Legislature does not put any single group of legislators in charge of all water policy and programs. Responsibilities are split between committees of Agriculture and Environment, Higher Education, Health and Human Services and State Government in both houses.

The report recommends recreation of the Legislative Water Commission or some other coordinative body (such as a bicameral task force) to review all water program budgets holistically and to deal with policy issues such as lake development, ground water withdrawals, drainage law and integration of water planning with comprehensive planning.

Executive Branch coordination. According to MS 103B.151, executive branch coordination on water issues is to come through the

Environmental Quality Board. This coordination has varied in effectiveness, but is critical.

The report recommends that the EQB review the charge, role and representation on the Water Resources Committee and evaluate whether it can be an effective coordinative body. Two other coordinative approaches are suggested – a committee of the EQB, and a water subcommittee of the Governor's cabinet.

Greater support to local governmental units. Local governments are taking an ever-larger role in water management and protection, acting as agents of the state in delegated programs, and as contractors to the state in providing water management services. This involvement is focused through local water plans, now in their third generation. The state needs to recognize and support this role with appropriate funding and technical support. The state also needs to provide incentives to encourage the linkage of local water plans with comprehensive plans.

Comprehensive water monitoring and data management revamping. Water monitoring is essential to understanding the resource and the

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UW River Falls, cont.

with both consulting firms and regulatory agencies in the New York area. Students pursuing the Environmental Science Major can focus their studies to emphasize water and other applied topics. In addition to classes discussed above, students may select classes, such as wetlands and hydric soils, freshwater biology, ichthyology/ fisheries management, remote sensing, several classes (or a minor) in GIS, and soil and water conservation. Our department also sponsors a HAZWOPER (OSHA 40-hr training) class each winter. This has been very beneficial in preparing students for entry into consulting and agency positions.

Other interesting parts of our program include an annual regional

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EQB Activities, cont.

pressures that threaten its health. There are many agencies – federal, state and local – as well as citizens that collect water data. The report recommends that a strategic plan for monitoring be developed, as well as water monitoring plans (including ground water) for each of Minnesota's water basins to inform and guide water management. These plans are in various stages of completion now, and are being developed with varying degrees of detail. When complete, the plans need to be detailed enough that anyone who wants to get involved in monitoring can tell where their efforts would be most useful.

The report also recommends that an independent study be conducted on water monitoring, with an eye to whether structural change in the organization of state water monitoring programs would improve the situation. The study would evaluate the need for an independent water monitoring and research agency, and consider the various state activities that it might be assigned.

Review of enforcement tools.

Enforcement tools used by state agencies vary and the funds available for conducting enforcement activities are stretched. The availability of administrative penalty order authority for use by all agencies should be examined.

The report also provides a functional description of state water programs. The areas described are: research, monitoring, data management, regulation and enforcement, financial and technical assistance, education and outreach, and planning and policy development. The agencies involved are listed as well as a description of the current situation, a vision, needs and an example of interagency coordination in each area. The report describes state water agency missions, further examples of interagency coordination, a review of past reorganization studies and examples of water management initiatives from other states.

MGWA Spring Conference

Effective Drilling and Well Techniques in Minnesota

April 23, 2002, 8 am - 5 pm

Johnson Screens
1950 Old Hwy 8 NW, New Brighton

This outdoor action conference will demonstrate drilling, direct push sampling, laboratory and investigation techniques. Complete information is available at www.mgwa.org.

Keynote

Mr. John Schnieders, the National Ground Water Association's McElhiney distinguished lecturer, will be speaking on the Chemical Rehabilitation of Wells.

Outdoor Drilling Sessions

Cable Tool – Bergerson Caswell
Rotasonic – Boart Longyear
Directional – Layne Christiansen
Large Diameter Rotary – Mark Traut
Well Drilling
Direct Push Probing – MATRIX
Hollow Stem Auger – Braun
Environmental

Other Demonstrations

Factory Tour of Johnson Screens facilities and screen; slot sizing

tutorial; Aquifer Testing Demonstration/Datalogging at Johnson Screens' experimental well field; Vendor Exhibits

Location (map below)

Johnson Screens, 1950 Old Hwy 8 NW, New Brighton, MN

Registration

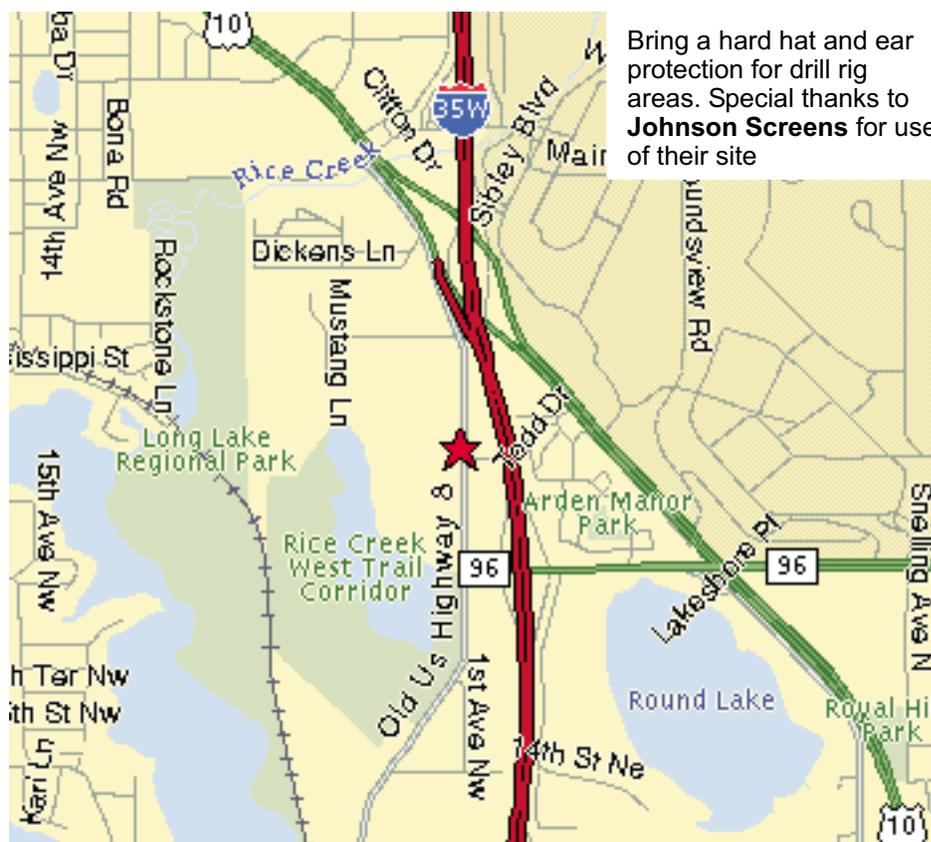
MGWA Members	\$ 70
Nonmembers	\$ 90
Full-Time Students	\$ 20
Vendor Booth	\$200
Late Registration (after April 15) or at the door	+\$30

Space is limited and registration will close after all spaces are full. Deadline for pre-registration is 4-15-2002.

Registration includes continental breakfast, breaks, and box lunch.

To register, mail payment and contact information to Minnesota Ground Water Association c/o WRI, 4779 126th St N, White Bear Lake, MN 55110-5910, or register online: www.mgwa.org/order.html

This conference is designed to meet the criteria for continuing education for Professional Geologists as specified by the MN Board of AELSLAGID and is approved for continuing education credits for Minnesota Well License.



UW River Falls, cont.

geology field trip. We have appreciated and benefited from the support that the MGWA has given to support several of these field trips. We (or students in clubs, such as the Geological Society) routinely schedule outside speakers to present talks. Last fall's speakers included Geoff Delin (USGS-MN) who talked about recharge estimation and field methods. Perry Jones (USGS-MN) will talk in March about his research on malformed frogs. We also routinely travel with current students or recent graduates to conferences. To receive a geology degree, students must complete a senior research project, commonly a field research project. Over the past few years, there have been several water-related research projects completed.

How MGWA and its Foundation and Members can help

The request for this article suggested that I indicate what equipment UWRF has and what we could use in the way of equipment. Our existing equipment is rather limited, but includes some of the following: Solinst electronic water-level meter, YSI-85 Water Quality Field probe, mini-potentiometer, pH meters, Hach meters (colorimeter and spectrophotometer), flow velocity probe, pygmy current meter, older float-chart water-level recorders, waders, and surveying equipment (mostly levels, tripods, rods).

If a company is considering donating instrumentation, our young program would benefit by receiving several categories of devices. One category includes non-working (but not really old) field monitoring or sampling instruments (these may be very useful for 'opening up' to reveal how they work - for example: tipping bucket rain gages or ???). Another category consists of items related to piezometers or well installation/monitoring, such as filter sands, seal material, well materials (casing, screen, protective casing), water-level meters, pressure transducers, data loggers. Yet another category consists of purchased copies of software that you are not using, but that are not too out-dated.

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.

Another category would be donation of time and demonstration of current state-of-the-art techniques, instrumentation, etc. Finally, coring equipment, additional current meters, etc. would be very appreciated. Please be sure to contact me (Dr. K. L. Keen, 715-425-3729) prior to sending us any equipment.

I have found a little time to work with several students on water-related projects. These include stream sediment load analysis and analysis of delta formation in a Wisconsin reservoir, interaction of groundwater with surface water at a barrier island in northwest Florida, and delineation of runoff areas in upland catchments in Pierce County, Wisconsin. The last project is a current McNair program undergraduate scholar project.

If there is a way for the Foundation to foster/encourage members to sponsor internships, and perhaps host an afternoon or evening session where firms and agencies met or were matched with intern candidates, that would be a wonderful thing. This could be open to all interested area universities. To be successful, this

would require having a critical mass of willing company sponsors/mentors for the interns. There are a number of capable, eager to learn, young scientists who would like to find out about what types of jobs are out there, and contribute to your organization's success at very reasonable hourly rates. Beyond this, if the Foundation would make available funds to support student travel to present research at conferences, that would also be very helpful.

Program Successes

Students from our programs have moved into positions in both Wisconsin and Minnesota State Agencies, including the DNRs and MPCA. Other students are working with a variety of environmental consulting firms. Others are working at the county level with water or environmental programs. Some students are working in laboratory settings. Several students have gone on to graduate programs at institutions including Univ. of Florida, Univ. of Wisconsin-Madison, and SUNY-Buffalo.

Don R. Albin Memorial

— Joe Sterling, one of Don's grandchildren

Don R. Albin, District Chief of the St. Paul office of the U.S. Geological Survey during the 1970's and 1980's, suffered a heart attack and passed away on the morning of February 4, 2002, during a goose-hunting trip with his grandson, David. To those who knew and loved him, Don was a loving and faithful husband, a caring, wise, and supportive father, a proud and instructive grandfather, a joyful great-grandfather, a devoted friend, and a respected colleague and mentor.

Donald Royalty Albin was born on February 10, 1934 in Bloomington, Indiana, the eldest of two boys. His family soon moved to Vincennes,

Indiana, where he attended elementary school, and later to Evansville, Indiana, where he attended Bosse High School. Both of Don's parents were English teachers, and his father was the high school football coach. Don led the Bosse Bulldogs as the varsity quarterback. In high school, Don became enamored with a beautiful girl, Elsie Pace, who he told his friends he was destined to marry. After graduating from high school, Don was accepted to the Colorado School of Mines, where he also was quarterback on the football team, and moved to Golden, Colorado while Elsie remained in Evansville.

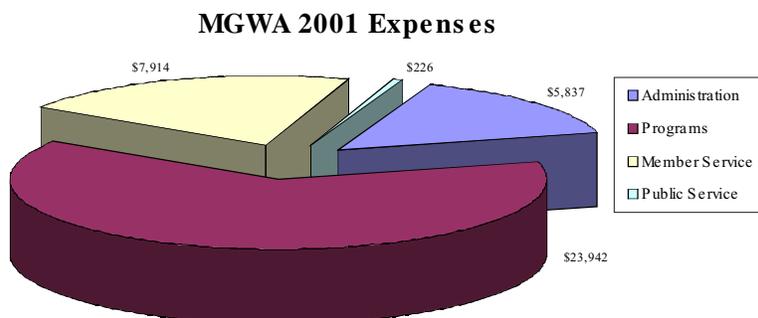
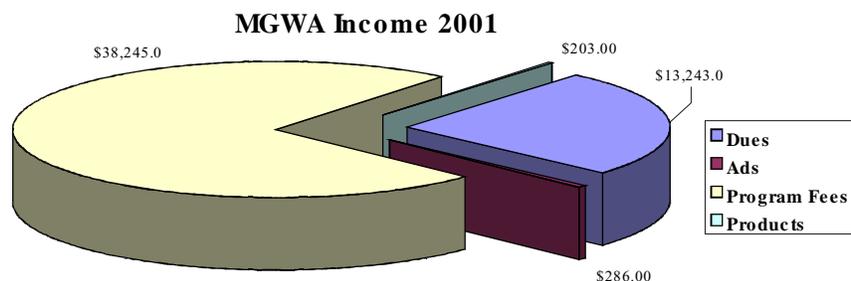
Following his sophomore year at the School of Mines, Don enlisted in the Navy, hoping to become a combat pilot. In December 1953 he was ordered to report for duty at Naval Air Station Pensacola, Florida for

preflight training. Don quickly stepped forward as a leader of his company, becoming a cadet officer. By the end of preflight training he was the Regimental Commander, in charge of all cadets in all classes, and received the Outstanding Student Award. At this time, Elsie got an apartment and a job in Pensacola so they could be together during off-hours; they could often be found cruising about in their 1946 Mercury convertible. In the spring of 1954, Don began flight training in the Navy SNJ airplane, equivalent to the Air Force T6 trainer. Don remained a cadet officer and was the first of his class to fly solo. During mock dogfights, Don was the only member of his class to beat the instructor, who qualified Don's efforts as "overly aggressive". Don was thereafter the cadet equivalent of "Top Gun".

During the three-day leave for July 4, 1954, Don returned to Indiana where he and Elsie were married on July 3, 1954, beginning a joyous 48-year marriage. While originally intending to pursue jet-fighter training following basic flight training, Don's perspective changed slightly after marriage and he decided to head to multiengine school instead. Don excelled here as well, and the Navy prepared a flight training film showing Don and his instructor performing preflight briefings, taxiing, take-offs, and landings, and showing Don taking off solo after a salute from his instructor. Within six weeks of completing advanced training, Don went to have his final physical exam prior to receiving his gold wings and being commissioned a Naval Officer. The doctor identified a tumor in Don's temple, it was determined to be malignant, and Don was discharged from the Navy. Don was devastated, and would later write, "Thus I came to the end of a short, but happy, Naval career. At least I learned to fly and experienced the freedom and sheer joy of rolling around those clouds. However, I still can't walk around airplanes or visit an airfield without feeling a twinge of sorrow and a vague longing." Despite this setback, it was at this time that Don and Elsie's first daughter, Janet,

MGWA Finances for 2001

MGWA ended 2001 in the black by over \$13,000, due to enormously successful Spring (\$8,156) and Fall (\$5,980) conferences. This allowed the MGWA Board to transfer \$10,000 of MGWA assets (money) into the endowment for the MGWA Foundation while still maintaining a cushion in our bank account. Dues for 2002 remain at 2001 levels, though dues do not cover all expenses of Member Services, the most expensive of which is the MGWA newsletter. It is anticipated that 2003 dues will need to be set higher, because our conferences cannot be expected to reliably generate such profits, especially during the "off-years" with regard to PG Continuing Education reporting deadlines.



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MGWA Board Meeting Minutes

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; Jeanette Leete, WRI; Leigh Harrod, Service Award Committee.

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.

Treasurer's Report – No report this meeting.

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 after March 2002, 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 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. The award proposal will be approved at the December meeting.

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.

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Don Albin, cont.

was born, bringing new focus and joy to Don.

Don returned to the Colorado School of Mines and completed a professional degree as a Geological Engineer. Following graduation, Don went to work as a hydrogeologist for the United States Geological Survey and was transferred to Little Rock, Arkansas. It was here that the other two gems in Don's life, his daughters Donna and Peggy, were born. Don authored numerous ground- and surface-water resources reports while in Arkansas, including reports on the Murfreesboro area, Jackson, Independence, Bradley, Calhoun, and Ouachita Counties, and the Ouachita Mountains. The leadership skills that Don exhibited in the Navy were quickly put to use within the USGS. Don moved to Lakewood, Colorado where he served as an up-and-coming hydrologist in the Hydrology Division in Denver. He was later transferred to Lawrence, Kansas as the Assistant District Chief, gaining new leadership responsibilities. In 1977 Don was transferred to St. Paul, Minnesota where he served as District Chief of the Minnesota District during the height of his career, and was known as a great "friend of ground water". Don also acted upon his civic duty and served as Chairperson for the Combined Federal Campaign of the United Way, both in the Twin Cities metropolitan area and later in the

Denver metropolitan area. Deciding to retire in Colorado, Don transferred a final time to Littleton, Colorado and opted for an "early" retirement in 1990, after 32 years of dedicated service with the USGS.

Don thoroughly enjoyed his retirement, and started off his first week with a six-week trip to Alaska with Elsie. Over the next 10 years, Don and Elsie would go on 14 cruises, and trips to China, Turkey, Hawaii, and Rome. Don enjoyed spending time with his daughters, grandchildren, and great-grandchildren, and the family frequently went on camping and boating expeditions. Don always enjoyed golf, fishing, and hunting, and there was never a shortage of salmon, venison, elk, antelope, goose, pheasant, or duck in his freezer. Don was an avid music-lover with a gift for singing. He sang in the Colorado Symphony Chorus during his retirement, and also with the Colorado Chorale, performing in many castles and cathedrals while on tour through Europe. Don was an active member of his church, Columbine United Church, and was a valuable member of the choir.

While family and friends were shocked by Don's sudden death, he had once remarked to his daughter Donna that, "When I go I just hope it will be quick, and if at all possible...while hunting." Don got both of his wishes, perhaps just reward for a life so richly lived and filled with selfless acts of kindness, mentorship, and love. He is survived by wife Elsie E. Albin, brother Richard Albin and wife Myrna, daughter Janet Vertrees and husband Joseph, daughter Donna Parks and husband Michael, daughter Peggy Bearth and husband Doug, grandchildren Joe Sterling and wife Jenny, Dave Ragan and wife Megan, David Sterling, Susie Ragan, Dalen Ragan, Pamela Bearth, Sarah Vertrees, John Bearth, Michael Bearth, and Laura Bearth, and great-grandchildren Brendon, Mikaila, and Michael Dean.

We will miss Don greatly, but will remember him fondly, as a loving family man, a dear friend, a mentor, and an example to live by.

Rocks And Water: Understanding Minnesota's Limestone Country

A Ground Water Education Project of the Minnesota Pollution Control Agency and the Minnesota Department of Natural Resources (Funded through the United States Environmental Protection Agency-Environmental Education Program)

5/14/2002	Eagle Bluff Environmental Center, Lanesboro
5/15/2002 & 5/16/2002	VFW, Zumbrota (Includes ½ day field tour)
5/21/2002	Minnesota Valley Regional Library, Mankato
5/22/2002 & 5/23/2002	Dakota County Conservation and Extension Center, Farmington (Includes ½ day field tour)

The workshops are made possible by the Environmental Education Program of the United States Environmental Protection Agency (EPA). State agencies conducting this workshop are the Minnesota Pollution Control Agency (MPCA) and Department of Natural Resources (DNR). Several other state and local agencies and organizations provided major support. This project is part of an ongoing, multi-agency effort to educate and involve the public in effort to protect water resources and human health located in the unique and sensitive karst region of southeastern Minnesota.

These workshops are directed towards the population residing in the karst (underlain by soluble rocks, chiefly limestone) region of Minnesota with the purpose of enhancing their understanding of the vulnerability of ground water resources in this sensitive geologic setting. Karst areas are characterized by the rapid introduction of surface and near-surface generated contaminants into ground water and surface water, and the subsequent rapid and unpredictable migration to potential points of human exposure, such as water wells and recreational surface waters. This project also intends to promote and facilitate, through education and discussions, the adoption of decisions and practices at the local government and community levels aimed at protection of the environment and human health in these vulnerable areas.

Citizens and groups concerned about the environment; school teachers and other educators; local government staff and elected officials; legislators and legislative staff; business owners and employees from the agricultural, industrial, and real-estate sectors; and the community at large are invited to learn the basics of karst landscape, geology, and ground water in simple terms.

In order to be accessible to the entire region, the project will consist of four separate workshops, at locations selected for optimal geographic coverage, while at the same time representing a geologic and economic cross section of the region. The workshops will each accommodate an audience of 50-75 and consist of a combination of classroom presentations, demonstrations and exercises, field trips, exhibits and displays, and group discussions.

The contents of each workshop will focus on the basics of karst landscape, geology, and ground water, in simple terms. The special characteristics of karst areas that set them apart from other regions will be explained, and their environmental vulnerability highlighted. Local examples and case studies will be used at each workshop location to make it easy for the audience to grasp and relate to the concepts. Two of the workshops will include a half-day field trip to nearby sites where karst geology and ground water flow are apparent, karst problems are occurring, and are being remedied. The workshop locations will have displays and exhibits for the attendees to view. Each attendee will receive a workshop manual, which will include complete lecture and presentation notes, as well as a wealth of applicable and relevant reference materials. The workshop manual will act as an excellent continued reference or teaching aid for the attendees. Panel discussions will be used to encourage independent and creative thinking by the audience, and especially to aid them in arriving at conclusions and decisions they could apply in their own immediate arenas.

Technical and policy experts from state and local agencies, as well as academic institutions will present at the workshops. The presenters will mainly be from Minnesota and neighboring states so that the audience can relate to the issues and concepts being described, but a national perspective on the occurrence of karst and associated issues will be presented as well.

Attendance may be used to obtain continuing education credits for some professional licensing and certification requirements. Educators at the local level can play an important role in promoting education on environmental problems and possible solutions in the karst regions of the state; therefore, the workshops are free to teachers and students, and limited financial assistance may be available to school districts for substitute teachers during the workshop days.

For additional information on the workshops, please contact either of the following MPCA staff:

Melanie Miland, 507/285-7151, melanie.miland@pca.state.mn.us or Sandeep Burman, 651/296-7717, sandeep.burman@pca.state.mn.us. Brochures and registration information will be available towards the end of March 2002. Please contact Amy DeBruyckere at 507/285-7343 (amy.debruyckere@pca.state.mn.us) to be placed on a mailing list for the brochures.

MGWA members are encouraged to pass along information regarding these workshops to clients, groups & organizations they work with in southeast Minnesota

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 at the fall conference for available dates.

Meeting adjourned at 9:00 a.m.

December 6, 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; Tom Clark, Newsletter Editor; Jeanette Leete, Sean Hunt, WRI; Dave Kill, Gordy Hess, MGWA Foundation Board.

Approval of Minutes – Jim Stark called the meeting to order at 7:40 a.m. Minutes for the regular Board meeting held November 1, 2001 were approved.

Treasurer's Report – Eric reviewed the budget. Jeanette Leete provided updated Profit/Loss and Income/Expense printouts (see attached). Subject to some outstanding bills, the fall conference made over \$5,000; the fall field trip made nearly \$300, which will be split with AIPG. Transfer of a portion of MGWA 2001 net income to the MGWA Foundation was discussed. Jim Stark and Eric Hansen will talk further about cash transfers to the MGWA Foundation.

Web Page – Sean Hunt noted that the MGWA domain registration has been renewed. He also noted that the on-line merchant service is now charging for the service. Web service is paid through May. Sean said he had met with Mike Trojan, Education Committee, who provided some material for the site.

Membership Renewal – Sean Hunt reported that e-mail renewal requests had been sent. Paper notices will be sent to those that did not renew from the e-mail announcement.

Foundation – Gordy Hess, MGWAF, reported that the foundation had met several times to discuss purpose and objectives for future use of available funds. It was noted that the MGWA Education Committee could request funds to pursue committee programs, such as support of speaker's bureau. It was suggested that an inventory of educational resources and contact information be placed on the web site. It was also noted that the MGWA Education Committee needs to stay in touch with the MGWA Foundation.

Newsletter – The December newsletter will include the officer election ballot. If possible, the back of the ballot will have a short membership survey.

Fall Conference – The fall conference will be summarized in the newsletter. Jim Stark asked about the possibility of doing a fact sheet, similar to the outcome of the spring conference.

Science Museum – Continued coordination and contact with SMM will be pursued through the Education Committee.

Awards – Jim Stark will send by e-mail the final version of the Outstanding Service Award policy from the Awards Committee.

Meeting adjourned at 9:00 a.m.

January 3, 2002

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; Tom Clark, Newsletter Editor; Jim Aiken, Advertising; Jeanette Leete, Sean Hunt, WRI; Gordy Hess, MGWA Foundation Board; Jon Pollock.

Approval of Minutes – Rob Caho called the meeting to order at 7:30 a.m. Minutes for the regular Board meeting held December 6, 2001 were approved.

Treasurer's Report – Eric reported that the details for transferring funds from MGWA to MGWAF are being worked out. A sizeable transfer is planned for March. Eric said he would report further on transfers at the next Board meeting.

Membership – *Corporate:* Jim Aiken said that the policy was in place but that couple of details remained. He noted that the basic level was most popular. Jim said he needed the final corporate membership forms. Jim said he needed to send out advertising renewals/invoices. *Individual:* Sean Hunt reported on renewals and provided a summary (attached).

Web Page – Sean Hunt noted that two newsletters from 2001 were ready to be posted.

Foundation – Gordy Hess, MGWAF, said he would be talking with Jim Lundy about future educational opportunities.

MN Water 2002 – Minnesota Water 2002 will be in April. Jim Stark thought the MGWA/MGWAF should have booth at the conference. Jim S. said he would ask Pat Brezonik about space.

Newsletter – Tom Clark noted that the December had gone out and that the newsletter team will meet next week.

Children's Water Festival – A certificate of appreciation and several t-shirts were received from festival organizers in recognition of MGWA sponsorship.

Elections – Balloting will close January 10th.

20th Anniversary. – Eric Hansen said he is continuing to prepare a list of ideas.

Awards – Jim Stark will compile final comments and send out.

Fall Field Trip – Jennie reported all income and expenses have been accounted for; \$544 will be split with AIPG.

Fall Conference – Jennie noted that some income remained to be collected, but the program netted about \$5,000.

Spring Conference – The spring conference will be April 23rd. Rob Caho said he will need help organizing the conference, which will be on drilling and field techniques. A planning meeting will be scheduled.

Next meeting – Thursday February 7, 2001, 7:30 a.m. at the U.S. Geological Survey office in Mounds View. Meeting adjourned at 9:00 a.m.



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Address Service Requested

Dues are Due

If you have not already done so, please pay your 2002 MGWA dues. If we did not have your payment recorded in the membership list by the time this newsletter's labels were printed, the label will say: **LAST ISSUE**. Final notices were mailed in mid February.

We can receive credit card payments through the secure part of our web site (www.mgwa.org).

Is Your Ad Missing?

See pages 15 and 19 for information about how to place or renew an ad. MGWA keeps dues low with the help of the advertisers who help offset printing and postage costs.

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