

Minnesota Ground Water Association

Volume 16, Number 2: June, 1997

President's Column

— by Ray Wuolo

I had a dream last night. It was the year 2005 and I was still a practicing ground-water scientist (some would say that must be some dream!).

Here's about how my dream went:

I dragged myself, cup of coffee in hand, into my home office and checked my e-mail for messages. Some idiot had scheduled a video conference call for 8:30 this morning. As the conference started, I taped a piece of paper in front of the camera lens, mounted on top of my monitor. "My camera's broken," I lied. In reality, I was still in my bathrobe and my hairs (all four of them) were flying every which way. During the conference, we talked about the discovery of a contaminant release in the metro area. "We need to know where that contaminant is migrating and if any wells will be impacted," my client intoned. "When can you get me that?" "How about tomorrow?" I offered. "How about by noon today?" she commanded.

I poured myself another cup and sat down in front of my terminal. "Let me see," I said to myself. "I'll need to pull together all of the available well logs in the area, along with published literature on the geology and hydrogeology. Then, I'll have to develop a conceptual model of ground water flow. After, that, it's flow and transport modeling time.

That'll require determining boundary conditions, data sets, stress periods, calibration targets, and aquifer parameters. Once all that is pulled together, I'm gonna need to begin calibration, verification, and sensitivity analyses. After the flow model is calibrated and verified, I'll need to perform some transport simulations, followed by additional calibration and

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DNR Southwestern Minnesota Ground Water Exploration Project

— by Jim Berg, DNR Division of Waters

Often our jobs and projects flourish and decline on the edges of larger political and economic issues. During the summer of 1996 the Minnesota Department of Natural Resources (DNR) began a deep aquifer test drilling project at 27 locations in southwestern Minnesota. Although it will be the largest test drilling project of its kind in the state, the Minnesota Legislature and southwestern communities will view the results as only a part of the total regional water resource equation. The origins and potential consequences of this drilling project are as interesting as the geological and hydrological problems we are investigating.

The Sioux Falls Connection

In 1989, the last water appropriation permit for the Big Sioux aquifer in the Sioux Falls area was issued by the South Dakota Department of Environment and Natural Resources. Full appropriation of the most important aquifer in the area had domino effects that eventually extended to the state capitals of adjoining Iowa and Minnesota. Other water sources were available in the Sioux Falls area. But they were expected to be fully utilized within 15 to 20 years, and the area population and water consumption needs were expected to grow as far into the future as anyone cared to imagine. The solution to the projected water shortage crisis may have been obvious to certain major water users in Sioux Falls: pipe water approximately 60 miles from the Missouri River into the area.

The idea of large scale surface water diversion projects may come easily to major water users in the western states, but it strains our minds, at least

for those of us live near the lakes, rivers, and easy-to-use aquifers in the greater Twin Cities metro area. In April 1990, various public water supply utilities and companies from southeastern South Dakota met in Sioux Falls to organize a new rural water system unlike any other that had been proposed in the upper Midwest. They tried on the obvious, but lackluster name, "South-eastern South Dakota Water Supply System", but as the plan drew additional eager participants from southwestern Minnesota and northwestern Iowa, the flashier and less restrictive "Lewis and Clark Rural Water System" name was assumed.

The newly-recruited entities (municipalities and rural water systems) located on the margins of the original proposed system were attracted by genuine need and the prospect of generous government support. The Minnesota entities included the City of Worthington, the City of Luverne, Rock County Rural Water System, and Lincoln-Pipestone Rural Water System. The decision makers within these entities knew only too well that regional surface water sources were limited, shallow aquifers (used heavily in the region) can be vulnerable to the effects of drought and agricultural contamination, and the natural quality of water

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verification. Finally, I'll have to pull together the graphics and write a report. I know the client's lawyer is going to want to know something about the uncertainty of all of this modeling so I'll need to discuss that in the report."

A daunting task? By today's standards, yes. In my dream, however, I began by calling up a detailed map of the release area from a home page on the Internet. With my cursor, I delineated the detailed study area. On the menu bar was a tool option that read, "Flow and Transport Simulation". I double-clicked this tool and a window popped up, asking me for particulars on the date of release, the volume, and the type of chemical. I typed in this information and clicked the button marked, "Begin". Then, I took my shower and drove the kids to school.

It was 10:12 a.m. when I sat back down in front of my computer. The printer has just finished spewing out the text and graphics of the modeling report. On my screen was a three-dimensional, animated depiction of the contaminant plume from date of release to today. I hit "enter" and the plume migration progressed further into the future. In a small box at the bottom of the screen, the uncertainty parameters of the plume migration were ticking away. I could see that this modeling result had the lowest level of uncertainty but I knew that the computer had also generated simulations for other potential alternatives. The uncertainty in the simulation was not too high but the sensitivity statistics would be useful in designing a focused investigation to collect the data that would substantially reduce that uncertainty.

The client, her attorney, and I had another conference call (this time I didn't cover my camera lens). Both had received copies of the report, as well as the animated plume. It was clear that some further investigation would be required before we had a public meeting. My remaining task was to focus on how to best present this information to the public in a clear, concise manner. "No acronyms this time," the attorney reminded.

A wild dream, you say? Perhaps a nightmare? It's 1997, and I'm here to tell you that most of that dream is possible today. The ability to manage and integrate diverse types and sources of data, maps, and models; to quantify uncertainty; and to graphically depict complex results using three-dimensional graphics is a reality. Smart systems are being developed that will automate much of the modeling process. In eight years, I predict much of my dream will be commonplace (but I can't give you any sensitivity statistics on that yet).

SW Ground Water Exploration, cont.

from deep aquifers is generally not good. The estimated cost of the system in 1993 for a treatment system, easements, and 376 miles of pipe, was 282 million dollars. The system is expected to deliver 23.5 million gallons per day from an intake location near Vermillion, South Dakota. The proposed cost share formula was 10 percent of the capital costs from participating entities and 90 percent from state and federal governments. This was clearly a proposal no one could refuse.

The Lewis and Clark advocates have tried to be very clear that none of the diverted water will be used for irrigation. Very likely, however, a significant portion of the water will be used for agriculture-related uses.

A major portion of the water supplied by the two Minnesota rural water systems is used for livestock production.

Regional Renovation

Both Iowa and South Dakota have passed legislation committing funds for the project, contingent on an acceptable federal package. To date, Minnesota appears to have been more reluctant to lend full support to the project. The phrase 'conditional support' was used to characterize the position of the 1995 Legislative Water Commission. This group, composed of state senators and representatives, chose to look at the regional water supply issue in the context of important associated issues such as agricultural contamination of shallow aquifers, water conservation,

interbasin water transport, and ground-water exploration. The Commission saw the interest in the Lewis and Clark project as a good opportunity to reassess the bare framework of these water issues, and to begin rebuilding it in a more efficient, integrated manner.

Water from deep aquifers was recognized as a potentially important component in the region's mix of water resources, but very little was known about the distribution and capacity of the deep aquifers, or the quality of the water from them. Few communities or rural water systems in the region use deep aquifers as their primary water supply source. The deep aquifer water generally contains high concentrations of sulfates and some of these entities have had bad luck finding the necessary capacity. These factors and the agricultural degradation of some shallow aquifers in the area drove many farmers to rural water systems for their water supply. Consequently little or no deep subsurface information is available for relatively large portions of Rock, Pipestone, Lincoln, Yellow Medicine, Lyon, Murray and Nobles Counties. Therefore, with support from the 1995 Minnesota Legislative Water Commission a proposal that was initiated by the Minnesota Water Well Contractors Association resulted in the Minnesota Legislature appropriating \$50,000 of matching funds for drilling deep test holes in southwestern Minnesota.

Exploring the Unknown

The DNR was given the responsibility of coordinating the test hole drilling project. An additional \$10,000 for test drilling was supplied by each of the Minnesota Lewis and Clark participants (Worthington, Luverne, Rock County Rural, and Lincoln - Pipestone Rural) and the City of Marshall for a total of \$100,000 in test drilling funds.

Our strategy was to search for the most productive aquifers in areas close to the participating water appropriators, and to obtain geological information to help predict the locations of the best aquifers for future use. The gross stratigraphy beneath the region is simple: Quaternary silt and clay rich glacial sediment overlying Cretaceous sandstone and shale. The Cretaceous formations sit on top of Precambrian
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SW Ground Water Exploration, cont.

metamorphic bedrock. Very few wells and test holes had penetrated the Cretaceous, so our exploration strategy was to prospect for buried sand layers in the shallower glacial sediment where more data was available for mapping. After evaluating our target units in the Quaternary we continued to drill most of the holes through the Cretaceous to the Precambrian.

Some of the general exploration areas were suggested by the Minnesota Geological Survey (MGS), the U.S. Geological Survey (USGS), and the project cooperators. Glacial sand prospecting was based on regional sand thickness maps and Pre-Quaternary topography maps that were assembled by the DNR from available drillers logs, a few USGS and MGS test hole logs, limited geophysical information, and published maps from the MGS and adjoining states.

By the end of November 1996 the DNR had drilled 17 mud rotary test holes using contract drilling services at selected locations in Rock, Nobles,

The primary objectives of the MGWA are:

- Promote and encourage scientific and public policy aspects of ground water;
- 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.

Yellow Medicine, and Lincoln Counties. The test holes drilled during the summer and fall of 1996 ranged in depth from 400 to 979 feet. Ten additional test holes are planned for the 1997 field season. These test holes will be located in Yellow Medicine, Lyon, and Pipestone Counties.

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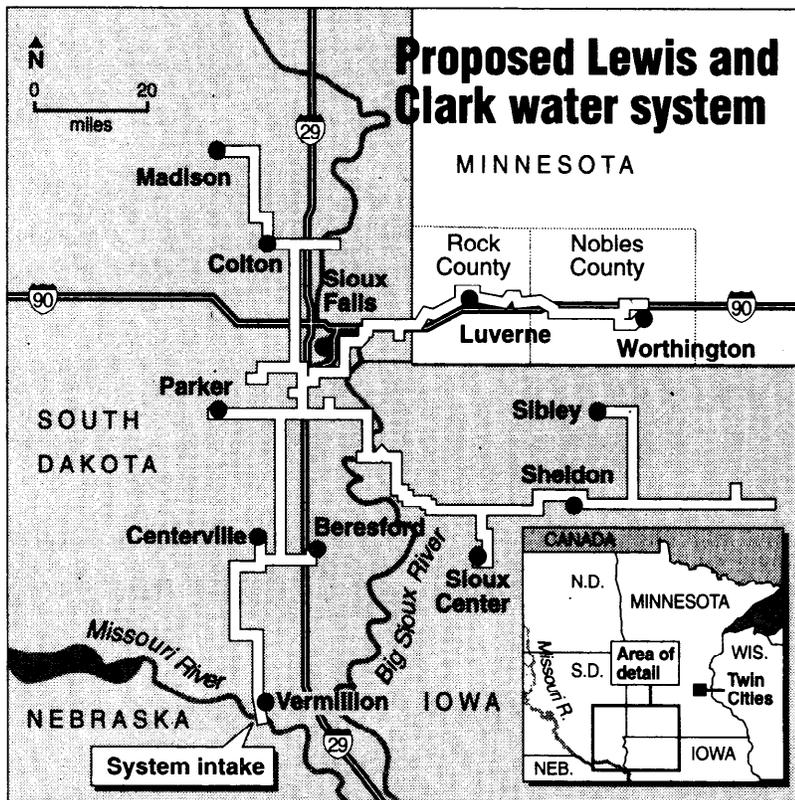
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SW Ground Water Exploration, cont.

Sand and Sandstone

The project is only partially completed but we have found many sand layers in the Quaternary at different stratigraphic intervals. Many of the sand layers were found at expected locations and depths suggesting that the regional mapping approach works. We also found some significant sandstone units in the Cretaceous that were mostly unexpected.

In the Worthington area (Nobles County), potentially productive sand layers (thickness of 20 feet or more) were found in the Quaternary section at depths of 134 to 426 feet below ground surface at thicknesses ranging from 20 to 37 feet. Maximum Cretaceous sandstone thicknesses ranged from 68 to 124 feet at depths of 363 to 744 feet below ground surface. The Worthington area appears to have several options for future groundwater exploration and development.

Rock County appears to have fewer options for groundwater supplies than Nobles County, since the area is underlain by a thinner section of Quaternary materials and Cretaceous bedrock. However, even with these limitations, this study has shown that additional groundwater resources may be available in this area. Two new potential large capacity aquifers were discovered by this project consisting of 20 to 46 foot thick sand layers at the base of the Quaternary section at depths of approximately 200 to 250 feet. Additional drilling, aquifer testing, and water quality testing, is required to determine if these units can supply the capacity and quality demands of the water appropriators in the area.

Thick buried outwash units (20 to 80 feet) in the Lincoln-Pipestone Rural Water Burr Well Field area (Yellow Medicine County) were found in DNR test holes at depths of 70 to 312 feet below ground surface. In addition, 35 to 38 foot thick accumulations of sand were found at the base of the Quaternary section (Altamont aquifer) at depths of 365 to 461 feet below ground surface.

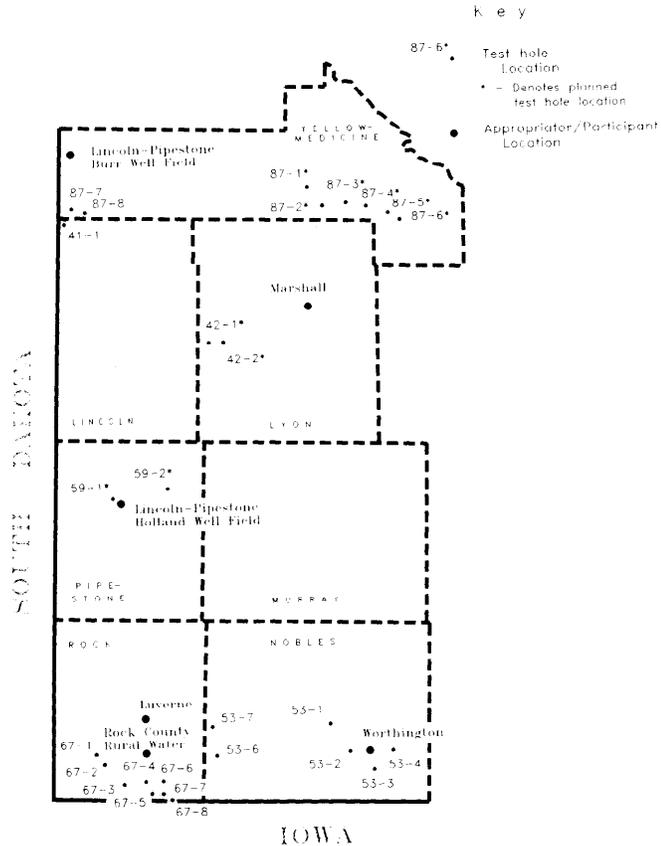
We would like to find thicker Quaternary sands in Rock and Nobles Counties. Maybe we will in the future if a proposed extension of the project is approved. In addition, the Cretaceous sandstones that have been found tend to be fine-grained. As we learn more about the depositional circumstances of these sandstones perhaps we will be able to predict the locations of coarser grained facies.

After the Beginning

Dakotans already know what they have underground in many areas; Minnesota is only beginning to learn. Large portions of South Dakota's Minnehaha County, which is due west of Minnesota's Rock County, have a test hole density of approximately 20 deep bedrock test holes per township. Even after our current project is completed we will have nowhere near the deep test hole density in geologically-equivalent portions of Minnesota. For years both North and South Dakota have owned their own mud ro-

tary drill rigs and have had aggressive aquifer exploratory drilling programs. North Dakota's program is very strong. Last year a State of North Dakota drill rig completed 14 monitoring wells east of the Red River near Breckenridge, Minnesota, in cooperation with the Minnesota DNR, to delineate the Wahpeton aquifer and help resolve borderline water appropriation disputes.

It's too early to know what effect our test drilling results will have, if any, on decisions made regarding the Lewis and Clark Project. Regardless of the political discussions and federal funding scenarios, the questions surrounding the Lewis and Clark project have provided the catalyst for investigations that should fill huge gaps in the deep stratigraphic picture of southwestern Minnesota. With any luck these investigations will lead to new water resource alternatives for the region.



Test hole and planned test hole locations

MGWA Calendar

Contact information for the major event-holders is listed at the end of the column.

July 1, 1997. Abstract deadline for Midwest Ground Water Conference (October 22-24, 1997). Contact: Robert Buchmiller, P.O. Box 1230, Iowa City, IA 52244, email: mwggwc@usgs.gov

July 8, 1997. Abstracts due for Geological Society of America (GSA) Annual Meeting.

July 15, 1997. Ground Water Hydrology, Dayton, OH. Wright State University

July 31-August 20, 1997. University of Minnesota Hydrogeology Field Camp, Lake Itasca area, Minnesota. Contact Dr. E. Calvin Alexander, Jr., University of Minnesota Department of Geology and Geophysics, 310 Pillsbury Dr. SE, Minneapolis, MN 55455. (612) 624-3517, (612) 625-3819 (fax) email: alexa001@maroon.tc.umn.edu

August 18-19, 1997. Applied Pollutant Fate and Transport Principles in Parameter Estimation and Modeling Risk-based Soil Screening. Columbus, OH. NGWA

August 20-21, 1997. Computer Aided Cleanup for Risk-based Soil and Ground Water Cleanup. Columbus, OH. NGWA

August 18-22, 1997. PC Applications in Risk Assessment, Remediation, and Modeling. Las Vegas, NV. NGWA

August 26, 1997. Contaminant Hydrogeology, Monitor Well Design and Construction, Aquifer Test Analysis/Well Hydraulics, Ground Water Flow using MODFLOW, Dayton OH. Wright State University

September 3-6, 1997. 49th Annual NGWA Convention/Expo. Las Vegas, NV. NGWA

September 9-11, 1997. Visual MODFLOW: The Standard Modeling Software Package for the USGS's MODFLOW/MODPATH and MT3D. Salem, MA. NGWA

September 19-20, 1997. Joint AIPG/MGWA/AWG Fall Field Trip, southeastern Minnesota, possibly visiting some Wisconsin or Iowa locations. More information later. AIPG is

leading, contact Bill Johnsen, Wenck & Associates, (612) 479-4200, email: bjohnsen@wenck.com

September 22-25, 1997. Analysis and Design of Aquifer Tests Including Fracture Flow. Columbus, OH. NGWA

September 22-23, 1997. Natural Attenuation for Remediation of Contaminated Sites. Columbus, OH. NGWA

October 19-23, 1997. Conjunctive Use of Water Resources: Aquifer Storage and Recovery. Long Beach, CA. Contact: American Water Resources Association, 950 Herndon Parkway, Suite 300, Herndon, VA 20170-5531.

October 20-23, 1997. Geological Society of America (GSA) Annual Meeting. Salt Lake City. Preregistration by September 19, 1997.

October 22-24, 1997. Midwest Ground Water Conference. Coralville, IA. Contact: Robert Buchmiller, P.O. Box 1230, Iowa City, IA 52244, email: mwggwc@usgs.gov

November 3-4, 1997. Fundamentals of Ground Water Geochemistry. Boston, MA. NGWA

November 5-7, 1997. Applications of Ground Water Geochemistry. Boston, MA. NGWA

November 12-14, 1997. NGWA Petroleum Hydrocarbons Conference/Expo. Houston, TX. NGWA

November 16-19, 1997. International Conference on Advances in Ground Water Hydrology—A Decade of Progress. Tampa, FL. AIH

December 8-10, 1997. Principles of Ground Water—Fate, Transport and Remediation. Salt Lake City, UT. NGWA

December 15-19, 1997. Princeton Remediation Course. Las Vegas, NV.

January 13-17, 1998. PC Applications in Risk Assessment, Remediation and Modeling. Orlando, FL. NGWA

February 9-13, 1998. Princeton Ground Water Pollution and Hydrology Course. Orlando, FL. <http://www.princeton-groundwater.com> or email: info@princeton-groundwater.com

February 15-19, 1998. Princeton Ground Water Pollution and Hydrology Course. San Francisco, CA.

March 12-14, 1998. Visual MODFLOW: The Standard Modeling Software Package for the USGS's MODFLOW/MODPATH and MT3D. Denver, CO. NGWA

Contacts:

for NGWA events:

1-800-551-7379 or <http://www.h2o-ngwa.org>

for GSA events:

<http://www.geosociety.org>

for Princeton's events:

<http://www.princeton-groundwater.com> or email: info@princeton-groundwater.com

for Wright State University events:

WSU, Center for Ground Water Management, 3640 Colonel Glenn Hwy, 056 Library, Dayton, OH 45435. (513) 873-3648, IRIS@desire.wright.edu; http://biology.wright.edu/cgwm/cgwm_home.html

for AIH events:

AIH, 2499 Rice Street, #135, St. Paul, MN 55113-3724. (612)484-8169. (612) 484-8357 (fax). e-mail: AIHydro@aol.com

New Postal Regulations Require Database Update

To qualify for bulk mailings, MGWA has always had to jump through a few hoops. The Post Office has just come up with a new one — we are required to check the accuracy of our mailing database on at least an annual basis and we are required to subscribe to a zip-code checking service or use the "forwarding and address correction requested" endorsement.

So — please check your address on this newsletter and let us know at WRI, 4779 126th St. North, White Bear Lake, MN 55110-5910, if anything is wrong. While you're at it, please send us your email address, too! For that matter, if you have email, you can avoid using the Post Office to send us your update. The email address to use for this purpose is jennie-leete@msn.com.

Thank you.

MGWA Board Meeting Minutes

February 6, 1997, Egg & I, University and 280, 7:30 a.m.

Attending: Gretchen Sabel, Past-President; Ray Wuolo, President; Paula Berger, President-Elect; Paul Bulger, Treasurer; Jan Falteisek, Secretary; Tom Clark, newsletter editor; Jim Almendinger, advertising; Jeanette Leete and Sean Hunt, WRI.

Approval of Minutes— Ray Wuolo called the meeting to order at 7:40 a.m. Minutes for January were approved with corrections.

New Board Members- Election results for President- Elect were 69-69. Paul Putzier declined before a run - off election was required. Ray welcomed new board members Paula Berger, President-Elect and Paul Bulger, Treasurer.

P.O. Box — It was noted that Paul Putzier has the only key to the MGWA box at the St. Paul Main Post Office. It was also noted that the legal address for MGWA is WRI's address. Tom Clark and Paul Bulger will check with Paul Putzier about continuing to check the P.O. Box.

Postmortem Birdsall-Dreiss Lecture — It was noted the Birdsall-Dreiss lecture went "OK".

Darcy Lecture — The MGWA will sponsor the Darcy lecture this spring.

Post- Mortem Ground Water 101 for Elected Officials — Gretchen explained that she e-mailed individual invitations to legislators and thought it was the most effective contact method. She noted that about 30 legislators stopped by. She said that groups such as the MGWA were not allowed to feed legislators. Total cost was about \$225. On a related note she mentioned that moving annual programs to locations other than Earle Brown might be effective. It was noted that the sand tank model seemed helpful and the slide show seemed to work. Due to noise, any audio program (to support a slide program) probably would not have been effective.

Newsletter/Directory Update — Tom said the newsletter was on schedule and just about ready for layout on the

16th. It was noted that the second notice for membership renewals was going out next week: directory would be assembled after renewals were received. Tom said he had an intern updating the referral section of the directory.

Scholarship Requests — Ray noted that a couple of scholarship requests had been received. Scholarship letters are to go to Paula Berger. The current scholarship fund balance is about \$200. Scholarship awards are currently funded out of the general operating account.

Spring Meeting — Plans were discussed for a half-day presentation on the new Geoscientist Licensing legislation and rules. Ray indicated that he would be able to check with some possible presenters (Terry Swor, Greg Larsen, Jim Balogh, Rob Wahlstrom, Jane Willard) for availability. Gretchen said she would find a room/date in April for the spring meeting.

Outreach to Non-Metro Members — It was noted that with more and more people having Internet e-mail, this could be a possibly effective approach for contact/outreach.

March 6, 1997, Egg & I, University and 280, 7:30 a.m.

Attending: Gretchen Sabel, Past-President; Ray Wuolo, President; Paula Berger, President-Elect; Paul Bulger, Treasurer; Jan Falteisek, Secretary; Tom Clark, newsletter editor; Jim Almendinger, advertising; Sean Hunt, WRI.

Approval of Minutes — Ray Wuolo called the meeting to order at 7:35 a.m. Minutes for February were approved.

Spring Meeting — The spring meeting on Geoscientist Licensing legislation and rules is set for April 28th at the Thunderbird in Bloomington. Tom Clark noted that Mike Convery had been selected to represent geologists on the Board. Ray said that he will finish calling possible speakers so a draft meeting program can be mailed to the Board. By April 3rd the program must be final in order to meet the pre-registration schedule.

Committee for Conferences — Ray Wuolo suggested using a committee

structure to handle the work load of developing and holding conferences. The next newsletter will include an item soliciting committee members for future conferences.

Fall Field Trip — It was noted that AIPG had started an ad hoc committee to plan the Fall Field Trip. Bill Johnson of Wenck is the primary AIPG contact. This year AWG will be a co-sponsor; Kate Kleiter will be the main contact. Tom Clark and Sean Hunt indicated they would like to be involved in developing the program. Jan Falteisek is to contact Bill Johnson to discuss program ideas.

Newsletter/Directory Update — Sean Hunt will modify the Darcy column from future to past tense. He will also make sure the newsletter copy includes the spring meeting announcement. Tom noted the newsletter should be out next week.

Scholarship Requests — Paula noted scholarship letters received to date. In the past the Board has awarded up to five \$300 scholarships, usually for field trips. Jan moved that \$300 be awarded to St. Cloud State Univ. geology program for their spring field trip. Paula seconded. All in favor. Paula will send a letter and the check, and asking for a report and picture for the newsletter.

Darcy Lecture — Olaf Pfannkuch contacted Ray Wuolo to provide snacks for the Darcy lecture. Ray said it was all arranged.

Program for 1997 — Gretchen reviewed the 1996 program activities briefly and then went on to 1997 activities. It was noted that although sponsored by the MGWA, there was not much to do at this time for the UM Geology Aquifer Test or Field Camp programs. AIPG is primarily in charge of the Fall Field Trip this year. A suggested topic for the Fall meeting was source water protection (including surface water): specific items might include applications in Washington County, springsheds in Fillmore County, geo-ecological mapping by Roman Kanivetsky, lake/ground water interactions, Clean Water Partnership case studies. The summer pig roast was mentioned. Sean noted little movement in MGWA t-shirts and mugs.

Meeting adjourned 8:35 a.m.

April 3, 1997, Egg & I, University and 280, 7:30 a.m.

Attending: Ray Wuolo, President; Paul Bulger, Treasurer; Jan Falteisek, Secretary; Tom Clark, newsletter editor; Jim Almendinger, advertising; Jeanette Leete, Sean Hunt, WRI.

Approval of Minutes — Ray Wuolo called the meeting to order at 7:35 a.m. Minutes for March were approved.

Spring Meeting — Ray discussed preparations for the spring meeting. Jim Balogh will be the main speaker. George Iwan will explain how the Lic. Board functions. Other speakers (Ray said he would have the final speaker list today) will discuss ethics, continuing education, and preparing an application. After a break, a panel will take questions. Jennie will check on seating capacity and suggested selling MGWA products at break. Speakers would be presented mugs. Paul said he would contact Kate Kleiter for AIPG mailing labels.

Newsletter/Directory Update — Tom summarized the content of the next newsletter, noting that Jim Lundy is issue leader.

Fall Field Trip — Bill Johnsen (Wenck) is the main AIPG contact. AIPG decided to pursue a karst-oriented field trip to SE MN and possibly to IA and WI. Paul Bulger will meet with Bill Johnson next week, Sean (AWG) and Jan offered to be second-level contacts.

Wisconsin AWRA — Ray noted that Wisconsin AWRA had invited the MGWA to a joint meeting next year. Jennie suggested they should invite the MN AWRA and Tom Clark suggested they contact the Wisc. Ground Water Assoc. Jan suggested holding the meeting as next year's spring meeting.

Income Report — Sean distributed an income report for the first quarter.

Membership Report — Sean Hunt distributed a membership summary for 1992 to 1997. A decline in membership was noted for the last several years compared to 1992-1994.

Meeting adjourned 8:35 a.m.

Respectfully Submitted,
Jan Falteisek
MGWA Secretary

MGWA Spring Conference Report: Licensing Geoscientists in Minnesota

The Association's Spring Conference, held April 28, 1997 at the Thunderbird Hotel in Bloomington, proved to be very popular, with over 70 attending. Four guest speakers and a panel made up of several of the speakers, plus representatives of various agencies employing geoscientists, discussed status of the new rule (*Minnesota Rules*, Ch. 1800) governing licensure of geoscientists and how to get ready for licensing.

George Iwan, executive secretary of the Board of Architecture, Engineering, Land Surveying, Landscape Architecture, Geoscience, and Interior Design (the board), briefly discussed the history and structure of the board. It was established in 1921, is one of the oldest licensing boards in the country, and currently consists of 21 members, including 16 practitioners of the fields represented and five citizens. Geologists and soil scientists (collectively called "geoscientists") were added to enabling legislation in 1995.

Doreen Frost, board investigator, discussed her work with the complaint committee, which consists of five board members. **Terresa Hirsch**, a board member, heads the continuing education task force, which will be proposing new rules for continuing education requirements this fall.

Next, **Jim Balogh**, soil scientist representative to the board, reviewed the details of the new rules. Jim emphasized that the purpose of the board isn't to protect professions, but to help ensure public health and safety and set standards of accountability. Practicing geoscientists meeting education and experience requirements will be eligible to apply for licensure during a one-year grandparenting period beginning in June 1997, in lieu of taking an examination.

The education requirements for licensure as a geoscientist in Minnesota include a BS/BA degree in geology or soil science, or a closely related field, an official transcript, and a minimum number of credits in either geology or

soil science. For geologists, 30 semester or 45 quarter hours of geology courses are required. For soil scientists, 16 semester or 24 quarter hours of soil science courses are required. A minimum number of hours must be selected from core courses within each subject area. Qualifying experience must include a minimum of five years doing verifiable geoscience work. Experience must be varied, progressive and nonrepetitive and must be documented on verification forms available from the board.

The examination consists of two phases, a fundamentals phase which would normally be taken as a senior in college, prior to a person's becoming a "geoscientist-in-training" while gaining experience. The professional phase of the exam is taken after the required five years of experience has been obtained. Minnesota is using the national exam for geologists administered by the Association of State Boards of Geology (ASBOG). On the soil science side, the exam administered by the Council of Soil Science Examiners (CSSE) is used.

Exemptions from licensing are provided for federal employees (performing federal work), university employees, and those engaged in mining/energy extraction fields. The initial fee for licensure is \$70, with a license renewal fee of \$35/year. The CSSE examination fee is \$100.00 per exam, while the ASBOG fee is expected to be between \$150-200 per exam.

Once the grandparenting period officially begins, the board and its staff will begin reviewing applications submitted by prospective licensees and will issue licenses based on education and experience (see above). The board is taking requests for application materials at 612-296-2388.

Following Jim's presentation, a panel discussion featuring state agency representatives (**Don Jakes, MPCA; Mike Convery, MDH; Sarah Tufford, MDNR**) and the consulting community (**Rob Wahlstrom, DPRA; Lisa Lee, Dames and Moore**) discussed implications of the new rule on their organizations.

— Tom Clark, MGWA Editor

Annual Well Conference Held April 2, 1997

Once again this year, the Minnesota Department of Health (MDH) annual well conference drew a large audience of water well contractors, consultants and ground water regulators to the Thunderbird Hotel in Bloomington.

Ron Thompson began the morning plenary session with an overview of the Well Management Unit's activities in 1996. The well sealing program continues in high gear, with over 11,000 wells sealed in 1996. Ron noted that the 1778 monitoring wells installed last year were down from 1995, but that increased use of geoprobe and other "non-intrusive" exploration methods may have accounted for some of the downturn.

On the legislative front, MDH is proposing its first fee increases since 1993. Under proposed legislation, both the well construction and variance fees would be increased from

\$100 to \$120. MDH is mounting greater efforts to reach and educate well owners in 1997. Included are a public information campaign on flooded wells and publication of a well "owner's manual" scheduled for later this year (watch for an announcement in a future MGWA newsletter).

One of the highlights of the annual well conference is when MDH district hydrologists report on field experiences and case histories from the previous year's work. Featured this year were Bob Nielsen of Marshall, Pat Sarafolean of St. Paul, and Chris DeMattos of Rochester. Each had a different story of well sealing experiences they had encountered, but the guiding principle of each of their cases was, "It's not sealed until the MDH says it's sealed!"

The morning session concluded with presentations by Paul Ellringer, Tamarack Environmental Consultants, on confined space hazards and Mylon Stark, Minnesota Department of Labor and Industry (OSHA

Division) discussing trenching, excavation and site safety.

Afternoon concurrent sessions were held for full, environmental and limited contractors. All three sessions included a segment on well code compliance issues for the particular area of specialty. In addition, full contractors learned about vertical heat exchangers, hydrofracturing, and sealing unconventional wells.

Environmental contractors had segments on geotechnical borings, site investigation and remediation (a Minnesota Pollution Control Agency presentation on several remediation sites in St. Paul Park), and a summary of MPCA's brownfields program.

Finally, limited contractors heard about pump electrical systems and elevator construction.

— Tom Clark, MGWA Editor

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Thanks from St. Cloud State University

On behalf of the 34 students in attendance on our Spring Break field trip to the Big Bend, Texas area and the faculty of the department of Earth Science I would like to thank the Minnesota Ground Water Association for your generous support of this important activity. The students were most impressed with the float trip down the Rio Grande through Santa Elena canyon and the irrigation activity taking place along the Pecos River in west Texas and the Rio Grande.

While we have completed this year's field trip you can rest assured that the support you have given us will be forwarded to the 1998 annual trip which will most likely take place in Death Valley, California.

These trips are very important for the academic development of our students. We are very pleased that your organization has the insight to support and encourage these types of activities.

The group spent the first four days in the Big Bend park region looking at the hydrology, structural geology, volcanology and stratigraphy. The last half of the course consisted of examining the agriculture, petroleum geology and the development of caverns in the west Texas and southeastern New Mexico area. Enclosed is a group photo taken in the Chisos Mountains of Big Bend Park.

I hope that you continue to offer assistance to groups like ours in the future. I would be happy to talk about our trips to the MGWA at some future meeting. I look forward to hearing from you in the future.

Sincerely, Garry G. Anderson, Professor and Chair, St. Cloud State University
Department of Earth Sciences



MGWA Seeks Advertising Manager

Jim Almendinger has announced that he will be stepping down as advertising manager for the newsletter, effective in August. If you like keeping in touch with the consulting community and helping foster their support for your association through the advertising dollars they generate, this could be the job for you.

The advertising manager has the opportunity to actively participate in MGWA board decision-making. The time commitment required is an hour or two per week. If interested, contact one of the board members or Jim Almendinger at the St. Croix Watershed Research Station (612-433-5953).

Wisconsin Issues Groundwater Quantity Report

In April, 1997, the Wisconsin Department of Natural Resources (DNR) issued a report entitled Status of Groundwater Quantity in Wisconsin. The DNR was asked to prepare the report by the Wisconsin Groundwater Coordinating Council, which was acting because of concerns about the effects of high capacity wells and water resource conflicts. The report was prepared for a non-technical audience, and, as a result, covers some of the obligatory background material on the hydrologic cycle and a simplistic depiction of the aquifers in Wisconsin.

Problems identified in the report are classified in two broad categories as follows:

- Natural problems (e.g., seasonal fluctuations, drought effects);
- Human effects (e.g., withdrawals, reduced recharge, quality-induced quantity problems, infrastructure interference).

Following the discussion about the groundwater quality problems is a description of the types of information sources that are used to manage groundwater quantity issues. In Wisconsin these include water use information, observation wells, gauging stations, and research. Existing management strategies and regulatory authorities are also examined as they pertain to groundwater quality issues and the report contains information about the legal framework and various agency responsibilities. Finally, the report concludes with a series of recommendations to improve the management of groundwater quantity issues. The report is available from the Wisconsin DNR as PUBL-DG-043-97.



Tracers in Groundwater

— by Jim Walsh, Minnesota
Department of Health

A groundwater tracer is anything that can be used to determine the direction or rate of groundwater flow, or the age (residence time) of groundwater. Tracers may occur naturally, such as the heat introduced into an aquifer by a relatively warm lake or river; or they can be introduced accidentally, such as chloride leaching from a septic drainfield, or they can be introduced intentionally, such as dyes placed in groundwater to map flow pathways and flow rates in aquifers. In order for tracers to be useful:

- the chemical and physical behavior of the tracer in groundwater has to be understood;
- the tracer should move at the same velocity and in the same direction as groundwater;

- the tracer should be nontoxic, relatively inexpensive and readily detectable;
- the tracer should be present well above background concentrations; and
- the tracer should not modify the hydraulic properties of the aquifer.

(S. N. Davis and others, 1985).

Uses of Tracers

Direction of Groundwater Flow

Which direction is groundwater flowing? This is one of the most frequently asked questions in hydrology, and one which tracers are uniquely qualified to answer. An example is the use of naturally occurring tracers for tracking the movement of surface water as it recharges an aquifer. Surface waters commonly are composed of oxygen-18 and hydrogen-2 (deuterium), the relatively rare stable isotopes of oxygen and hydrogen. These isotopes are heavier than their more abun-

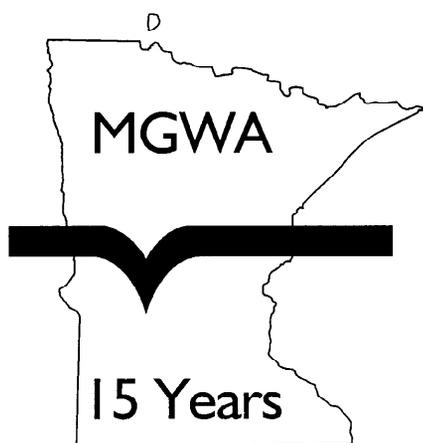
dant cousins, oxygen-16 and hydrogen-1, and as a result are concentrated in surface waters that are exposed to evaporation. By sampling "background" or upgradient groundwater unaffected by lake water recharge, the lake itself, and other wells, the signature of the surface water can be traced and the percentage of that water in a well can be determined.

Rate of Groundwater Flow

Flow rates can be determined by injecting a tracer into an aquifer at a known place and time, followed by frequent sampling at monitoring sites to determine how long it takes for the first pulse of tracer to appear at a monitoring site. Examples of some commonly used tracers for this type of application include strongly colored dyes, such as rhodamine (red) and fluorescein (green), and soluble salts such as

—continued on page 12

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Format:

Oral presentations will be limited to 20 minutes including discussion. Presentations should be arranged for use on a single screen. A separate poster session will be held along with the evening mixer. To maximize the exchange of information in a more relaxed setting, poster presentations are encouraged. Authors should state their preference for oral or poster format.

Abstracts are limited to 1 page, single spaced (margins R 1.2"; L 1.2"; B, T 1.0") in Times New Roman 11 point. Abstracts will be bound and distributed as conference proceedings.

Abstract Deadline: July 1, 1997

Abstracts can be submitted by mail on disk (ASCII format) or electronically (via E-mail). Electronic submissions (ASCII format) should be followed by a hard copy of the abstract. Submission should be sent to:

Robert Buchmiller — USGS — MWGWC
P.O. Box 1230
Iowa City, Iowa 52244
mw-gwc@usgs.gov

Field Trip:

A *free* pre-meeting field trip will be offered on October 22. We will look at weathering profiles and fractures at a 100-foot Pre-Illinoian till exposure and discuss the hydrologic implications. We will also visit a flood-related exposure of Devonian rocks and look at flow features left behind.

Suggested Session Topics:

- NPS pollution prevention
- Watershed protection/monitoring
- Groundwater modeling/computer applications
- Point source case studies
- Solid waste/animal waste contamination
- Groundwater contamination/remediation
- Wellhead protection
- Aquifer studies
- Till hydrology
- Legal/policy issues
- Groundwater monitoring issues
- Groundwater/surface water interactions

Tracers, cont.

potassium bromide. Injection sites may include wells, sinkholes, or even septic systems via toilets. Monitoring sites are typically wells, springs, or surface water bodies.

Age of Water

The age of groundwater (the length of time water has been in an aquifer) can be used to evaluate the susceptibility of an aquifer to contamination from activities at the land surface. The most commonly used tools to determine the age of groundwater are tracers that were accidentally introduced into the atmosphere, such as tritium, carbon-14 and chlorofluorocarbons (CFC's).

Tritium is the heaviest, rarest, and only radioactive isotope of hydrogen. It is produced naturally at very low levels in the upper atmosphere. Beginning with the onset of atmospheric testing of thermonuclear weapons in the early 1950s, tritium concentrations in precipitation have increased significantly over pre-1953 values. As a result, groundwater that contains greater than 1 tritium unit (a tritium unit equals one tritium atom for every 10^{18} atoms of hydrogen-1) can be determined to contain some component of post-1953 water. Such rela-

tively young groundwater is considered susceptible to contamination when compared with groundwater that contains less than 1 tritium unit.

Minnesota Rules, part 4725.2050 prohibits the injection of tracers into wells or borings. Persons interested in injecting tracers into wells for hydrogeologic studies may submit a written variance request to the Minnesota Department of Health (MDH) Well Management Unit for consideration.

Minnesota Rules, part 7060.0600 prohibits the discharge of wastes and other pollutants into the saturated and unsaturated zones below the land surface.

Persons interested in introducing tracers into the saturated and/or the unsaturated zones via sinkholes, surface water bodies, or by other routes should obtain approval from the Minnesota Pollution Control Agency.

Reference:

Davis, S. N., Campbell, D. J., Bentley, H. W., and Flynn, T. J., *Ground Water Tracers*. Published by the National Ground Water Association, 6375 Riverside Drive, Dublin, Ohio, 1985.

Support Your Association



Risk-Based Site Evaluation Manual Under Development

The MPCA Site Response Section is in the process of developing a Risk-Based Site Evaluation Manual outlining a risk-based approach to decision making during site investigation and cleanup. The manual will provide a streamlined and consistent process for determining risks to human health and the environment, and will provide policies and procedures to assure that adequate site investigation and appropriate remedy selection under the state's Superfund and the Voluntary Investigation and Cleanup (VIC) Programs take place. One section of the manual, "Draft Site Screening Evaluation Guidelines," dated April 26, 1996, is available for review, and for use on individual sites with the approval of Site Response Section staff. Other sections will be available in the near future.

To receive a fact sheet on the manual development process, or to be on a mailing list for information on the availability of draft sections for review, please mail or fax a request to:

Roxanne La Plante, MPCA, Ground Water and Solid Waste Division, 520 Lafayette Road, St. Paul, Minnesota 55155-4194; Fax (612)296-9707.

Join the Minnesota Ground Water Association!

If you are reading this newsletter second-hand, we'd like to take this opportunity to invite you to become a member of **MGWA** for 1997. Annual dues are \$20 for professional members and \$15 for students. Members are entitled to purchase the annual membership directory for \$7. Additional donations toward our scholarships and/or the use of recycled paper will be gratefully accepted.

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

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

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Stakeholder's Meeting Held for Source Water Protection

The ramifications of last summer's reauthorization of the Safe Drinking Water Act (SDWA) are beginning to become more apparent. In particular, the source water assessment program is starting to be better defined than it was in the few months following the reauthorization because the U.S. Environmental Protection Agency (EPA) has produced (draft) written guidance on the program. One of the chief objectives of the Stakeholder's Meeting, held April 22, 1997, in St. Cloud, was to provide a forum for discussion of issues related to the source water assessment program. The meeting was moderated by staff from the Minnesota Department of Health (MDH), who sponsored the meeting in conjunction with the American Water Works Association, the Mississippi River Headwaters Board, and the Mississippi River Defense Network. The primary responsibility for instituting source water protection programs in Minnesota will fall to MDH.

Gerald Mahon (City of St. Cloud) made a short presentation in which he summarized some local concerns and questions about source water protection. Afterwards, two representatives from EPA, Tom Poy and Tom Davenport, talked about federal issues and perspectives, and briefly discussed some of the contents of EPA's draft Source Water Assessment and Protection Guidance. The morning was rounded out by speakers representing many of the state agencies talking about state issues and perspectives. These mainly involved discussions of current efforts to cooperate with MDH on wellhead protection and existing programs that are germane to source-water protection. The afternoon sessions were dominated by discussions of local issues and perspectives and provided an opportunity to pose questions for consideration as EPA and MDH work to develop the program further. Expect final guidance from EPA in August 1997, after which Minnesota will have 18 months to submit plans for its source water assessment program to EPA.

Ionizing Radiation Rules to Change

The public comment period for the final proposed amendments to rules relating to ionizing radiation was scheduled to end on May 28, 1997. These rules, Minn. Rules 4717 and 4730, are administered by the Minnesota Department of Health. It is expected that the rule amendments should become effective by July or August 1997.

How does this affect me? The new rule language does address the following two activities that may be of interest to a few MGWA members:

- nuclear logging (testing with a radioactive material performed in a well, boring, or drilled hole)
- use of x-ray fluorometers, moisture or soil density gauges and other active naturally occurring and accelerator produced radioactive material (NARM) devices

For information on the new rules, contact: Judith A. Ball, Manager, Section of Radiation Control, MDH, 121 East Seventh Place, P.O. Box 64975, St. Paul, MN 55164-0975; Telephone numbers (612) 215 0945 or 1-800-627-3529



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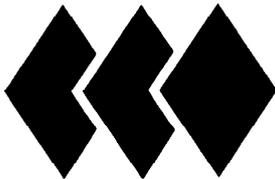
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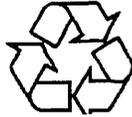
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