Minnesota Ground Water Association

Volume 14, Number 1: March, 1995

Presidents Column

The newly elected 1995 MGWA Board is working hard planning MGWA's spring conference, which is scheduled for May 8. The subject of the conference is technical communication. The Board believes this topic will have broad appeal, and it seems especially pertinent given that the Minnesota Water Line, an information hot line for groundwater issues that will eventually be staffed by volunteers, many of whom may be derived from our membership, will soon be operating. More information about the conference and a registration form is presented on page 5 of this newsletter.

Out-going president Doug Connell and treasurer Rita O'Connell guided the MGWA through several important benchmarks in its 12th year of existence, most notably its application for a change to 501(c)(3) non-profit status (overwhelmingly voted for by members) and filing of a 1994 tax return, the first in MGWA's history. Their foresight and dedication in tackling these issues will serve MGWA well in the years ahead.

The ballot for 1995 MGWA president-elect resulted in a tie between candidates Gretchen Sabel and Eric Mohring, which was broken by a vote of the 1994 Board. (This task was made easy by Eric's admission that impending fatherhood made him question the wisdom of taking on this responsibility!) I am pleased to announce that Gretchen Sabel is the incoming president-elect and Paul Putzier is the incoming treasurer. Rich Soule will continue as secretary in the second year of his two-year term.

The MGWA entered 1995 in a very strong financial position. However, review of 1994 MGWA cash flow, which was made feasible by the computerization of MGWA's books (and by contracting out bookkeeping responsibilities, another Board decision in 1994), indicates that membership dues plus advertising revenue cover only about two-thirds of our annual administrative and publishing (newsletter, directory) costs.

High attendance at MGWA conferences has brought in additional revenue to cover the remaining third of these costs and the MGWA's annual field trip scholarships. Other public service activities, such as the purchase of two ground water flow models for loan to the public, were funded directly from MGWA's accumulated surplus from the past 12 years.

This year several requests for funding from a variety of sources have already been received by the Board. How does the membership feel about the MGWA's role in providing funding to projects that will enhance the understanding of ground water and ground water-related issues in Minnesota? Should dues (a bargain at $15 per year) and conference fees be raised to provide additional funds to support these activities, or should we continue to encourage wide membership with our low dues and conference fees? This is one issue that Board members will be considering in 1995.

We're currently also considering topics for the fall conference. Together with the newsletter and directory, the conferences constitute the main activities of the MGWA. Should we expand our activities from the current two conferences per year and newsletter duties? How much effort does our membership want to put into helping us? (The Board occasionally feels overwhelmed.) Should we add additional Board members to assist, or create

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Ground Water Ecology - What Is It and Why Should You Care?

Rita O'Connell, D. Env., Minnesota Pollution Control Agency

Do you ever wonder about what's living in that ground water you sample in your site investigations? Or what's in the untreated well water you drink? You may know that fecal coliform bacteria in well water is a no-no, but that's all we ever test for in the way of living organisms. So what else is in there? And who cares anyway?

Well, a surprising number of people care and want to know more about both what's living in the ground water and how knowing what's there can help us understand the complex nature of the biological and chemical interactions and reactions that occur in the subsurface. Research into this particular field has come to be known as ground water ecology, the study of the interaction between ground-water-dwelling organisms and their environment.

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Ground Water Ecology, cont.

Although the name is new, the concepts of ground water ecology have long been used to aid cleanup of ground water pollution. The most common example is the leach-field of a septic system, where soil-dwelling organisms treat household effluent as it is discharged from the septic tank to the subsurface. A more recently used technology based on ground water ecology is bioremediation, the use of biological organisms to clean up spills and other contamination. Early on, bioremediation often used populations of microbes specially raised under laboratory conditions to seed a bioreactor (large vessel with controlled growing conditions) or an in-situ contamination site. Recent technological advances have shown that naturally-occurring organisms can be just as effective at treating the contamination, if needed conditions are met (by adding oxygen or nutrients, for example).

I first heard about ground water ecology three or four years ago when the U.S. Environmental Protection Agency and American Water Resources Association announced cosponsorship of a 1992 international conference on the topic. Being originally educated as an ecologist, I was very intrigued by the very idea of ground water ecology. Although I didn't attend that conference, I began reading and hearing the phrase a lot. I was delighted, then, to be able to attend the Second International Conference on Ground Water Ecology in Atlanta in March 1994. It was an enlightening and very interesting experience. The following is some of what I learned at that conference.

What Is Ground Water Ecology?

As I stated above, ground water ecology is the study of the interaction between ground-water-dwelling organisms and their environment. The first response of many people to the previous statement is, "Oh, you mean blind fish in caves!". Well, yes and no. Yes, the study of water-dwelling organisms found in caves is part of the study of ground water ecology. But, no, not just cave-dwelling organisms. A surprising number of microbes are found to dwell in normal soil or rock-matrix aquifers, including bacteria, protozoans, and larger organisms. Any organism that spends either part or all of its life cycle in ground water is part of the local ground water ecosystem.

The field is so new that much of the work is being done by university researchers. Studies are quite far-ranging, including:

- defining the numbers and kinds of organisms found in a particular aquifer or type of aquifer,
- defining the specific chemical and physical conditions which are present when a defined assemblage of species is present in a specific aquifer or type of aquifer,
- defining how changing chemical or physical conditions affect the organisms present in a particular or type of aquifer,
- defining the normal, periodic changes in the chemical and physical conditions within a particular aquifer, and
- defining how changes in aquifer matrix or hydrological conditions across the vertical and horizontal expanse of an aquifer affect what assemblage of species is present.

And the new terminology being developed is a little mind-boggling. Here are just a few of the terms that are being used by ground water ecologists:

Speleobiology:*Biology/ecology of cave organisms/ecosystems*

Deep Stygobiosphere: *Ecosystems/communities in deep aquifers*

Phreatobiology: *Biology/ecology of vadose zone*

Hyporheic: *Surface water-ground water ecotone (blending zone) - it can extend 30 or more feet under a river or lake and up to 2 miles inland from the water-land boundary*

Terrestrial Ecotone: *The blending zone of ground water - vadose zone - soil surface*

The above questions and terminology sound complex. The research certainly can be, but here are some specific questions that a scientist might explore:

- What kind of organisms exist in a water-table aquifer beneath a pristine old growth forest? Or beneath a site with known long-term sewage contamination?
- Why are the species or kinds of organisms found beneath a forest site different from those beneath the sewage-contaminated site or between a prairie site and an agricultural site? What chemical and physical conditions are different?
- How do ground water and surface water which interact under and adjacent to a river change with time

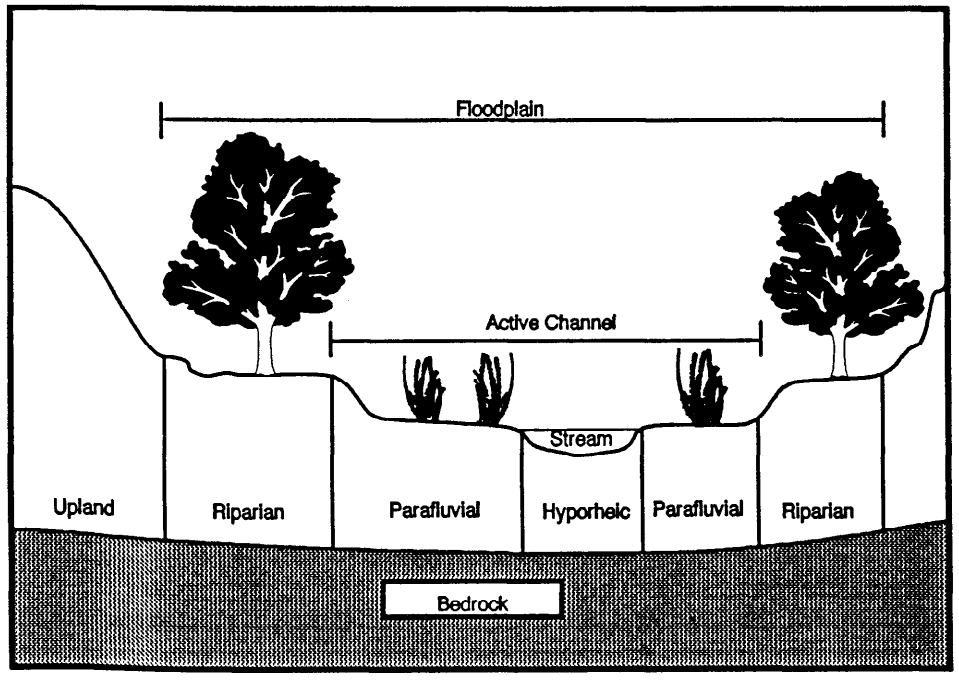

Illustration of stream ecosystem showing surface stream, hyporheic, parafluvial, and riparian components.

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and/or along the gradient of the river? Does the assemblage of organisms change as the physical and chemical conditions change with distance from the river? How do the ground water and surface waters interact chemically, physically, and hydrologically?

So Why Should Ground Water Resource Managers and Consultants Care?

As you may be able to tell from the kinds of questions above, it isn't a big leap from questions asked for "pure science" reasons to questions asked for environmental protection reasons. Some of the questions might change to the following:

- Do the assemblages of species (called a community) at contaminated sites differ significantly from those at uncontaminated sites? Are the differences dependent on aquifer type and hydrogeological, chemical, and physical conditions or are there any community differences that are consistently found and could serve as general indicators of contamination?
- What species are present, how many individuals of a given species are present, and do the species present have similar biological, physical, or behavioral characteristics or requirements?

What many of the questions being asked might lead to is enough data and experience to develop tests to monitor the health of an aquifer on an overall and ongoing basis. This type of monitoring is already being done for many terrestrial, aquatic, and marine ecosystems - by monitoring characteristics such as biodiversity (how many different species and types of species are present), biomass (what is the combined mass of all living organisms present), and individual species viability (can a species in that environment survive and reproduce). The data collected during ongoing biological and ecological monitoring can provide arguably the best measurement of environmental health. Why? Because unlike chemical and physical monitoring, which samples just a few of the almost infinite number of parameters which could impact a specific environmental setting, biological and ecological monitoring is measuring the impacts on the organisms themselves.

If, for example, we are to monitor a specific terrestrial ecosystem (say an old-growth forest) and find that the population of a given bird species is dying off or that one tree species is not reproducing as expected, we would know that some change is occurring which is negatively impacting the ecosystem. It might be that the change is or has occurred due to some physical or chemical parameter

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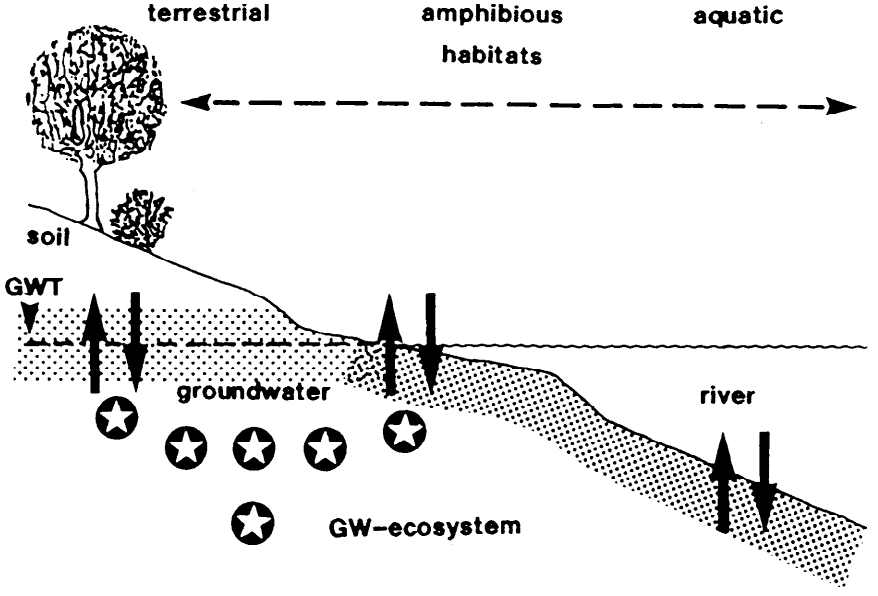

A ground water ecosystem with its surrounding environment; GWT - ground water table.

1995 Board of Directors

Metro Area Ground Water Alliance

Ground water is a vital resource for the residents of the Twin Cities metropolitan area and throughout the state. Efforts to protect this resource have been increasing over the last decade at all levels of government.

The seven metropolitan counties are playing a growing role in ground water protection and management issues. County ground water planners and other ground water managers in the metro area have increasingly felt the need for a forum to focus on regional ground water issues.

The Metro Area Ground Water Alliance (MAGWA) is an association of water resource professionals which is being organized through the efforts of county ground water planners and managers in the seven-county Twin Cities metropolitan area. The organization's focus is metropolitan ground water issues. Its purpose is to:

- identify priorities for regional ground water quality and quantity protection;
- be a forum for considering regional ground water issues;
- provide input on programs, standards, and other activities that impact ground water in the metro region; and
- provide information to policy makers on issues that impact ground water resources in the region.

The organization consists of ground water professionals from metropolitan counties and other public entities, with advisory participation from state agencies and the Metropolitan Council. Meetings are currently being held monthly.

For further information about MAGWA meetings or to make inquiry of the group, contact Eric Evenson of the Dakota County Office of Planning at (612)891-7018 or Eric Mohring of the Minnesota Board of Water and Soil Resources at (612)297-7360.

National Registration Examination for Geologists Described

Ron Baugh discussed the new national registration examination developed by ASBOG (Association of State Boards of Geology) at a meeting of the Minnesota Section of the American Institute of Professional Geologists (AIPG) held February 17 at the Ramada Inn, Roseville. Mr. Baugh discussed development of the test which has occurred over the last several years with the assistance of Subject Matter Experts (SMEs) and two psychmetricians. SMEs from a variety of disciplines of geology including mining, hydrogeology, environmental, and oil and gas assisted in development of the exam. The ASBOG exam consists of two parts. The first part (Fundamentals) consists of 100 multiple-choice items and part two (Principles and Practice) consists of 80 multiple choice items. It is a closed-book exam which is expected to take most applicants about four hours to complete. More information can be obtained from ASBOG, Box 11591, Columbia, SC 29211, phone (803)799-1047.

Currently, there are approximately 15 state members of ASBOG who either are using or intend to use the ASBOG exam as a part of their own registration procedures. Some states intend to supplement ASBOG with their own exam to test knowledge of local geology and state regulations. In Wisconsin, where geologist registration began January 1, 1995, the ASBOG exam is being used. Grandparenting is available through December 31, 1995. Information and application materials can be obtained from the Wisconsin Department of Regulations and Licensing, P. O. Box 8935, Madison, WI 53708, phone (608)266-1397. On the Minnesota front, the AIPG and CEC/M Ad Hoc Committee on Professional Practice of Geology continue to make progress toward reintroduction of the Professional Geoscientist Registration Bill during the current legislative session. Even as the session meets, Committee members continue to educate and update various agencies, colleges and professional societies on the Committee's activities. It is not yet clear if Minnesota will use the ASBOG exam if a registration bill passes, but it looks like a good possibility.

For more information about Minnesota's registration bill, contact Bob DeGroot (559-1900), Terry Swor (659-1305), or Rob Wahlstrom (227-6500).

1995 Birdsall-Dreiss Lecture

On Wednesday, April 12, Mr. Chris Neuzil of the United States Geological Survey in Reston, Virginia, will deliver the 1995 Birdsall-Dreiss Lecture at the University of Minnesota Department of Geology and Geophysics' Pillsbury Hall. The title of his talk will be, *Ground Water Hydrodynamics of Ultra Low Permeability Shale*.

The talk is scheduled for 5:00pm in Pillsbury Hall Room 110.

Ground Water Monitoring and Assessment Program Activities Are Priorities.

The MPCA Groundwater Monitoring and Assessment Program (GWMAP) is assessing results from 1994's sampling season in central and west central Minnesota, and is preparing for 1995. In its September 1994 Annual Performance Report, the MPCA identified the need to enhance the program. Improvements are needed to enable the state to better answer the questions, "Is groundwater quality improving or degrading? How, and where?" The report identifies program and funding needs to track groundwater quality trends over time, and to collaborate more with local governments on their monitoring needs.

If you have any questions about GWMAP, call Tom Clark at (612)296-8580, (612)282-5332 (TTY), or 1-800-657-3864 (voice or TTY).

MGWA 1995 Spring Conference

Technical Communication with the Public: Ground Rules for Scientists
Monday, May 8, 1995
Earle Brown Conference Center
University of Minnesota, St. Paul Campus

Agenda

12:30 pm - 1:00 pm	Registration
1:00 pm - 1:10 pm	Opening Remarks *Cathy O'Dell, MGWA President, Geraghty & Miller*
1:10 pm - 2:10 pm	Technical Communication: What Makes It Special? *Barb Liukkonen, Board of Water and Soil Resources &Minnesota Extension Services*
2:10 pm - 2:30 pm	Preparing for Public Meetings: Tips and Tools *Scott Hvidsten, MPCA, Public Information Office*
2:30 pm - 2:45 pm	Minnesota Water Line *Dan Sola, Conestoga-Rovers & Associates & Minnesota Water Line*
2:45 pm - 3:00 pm	Break (Refreshments included)
3:00 pm - 3:45 pm	Expert Witness Testimony: Do's and Don'ts *Frank Rovers, Conestoga-Rovers & Associates*
3:45 pm - 4:15 pm	A Reporter's View on Covering Scientific Issues *Tom Meersman, Star Tribune*
4:15 pm - 5:00 pm	Water Witches, Underground Rivers and Other Myths: the Scientist's Role in Public Education *Andrew Stone, American Ground Water Trust*

Cost:

Advance	$25 for MGWA members $30 for non-members $15 for students	**At the Door**	$30 for MGWA members $35 for non-members $20 for students

Advance registration and payment must be received by **May 1**. If you wish to join MGWA, annual dues are $15 for professional members and $10 for students. By enclosing your dues with this registration, you may attend for the member's fee. Make checks out to MGWA and mail with this form to: MGWA, c/o WRI, 4779 126th Street N, White Bear Lake, MN 55110

Registration for MGWA 1995 Spring Conference

Member? Yes ☐ No ☐ Joining Now? Yes ☐ No ☐

Name: _____

Affiliation: _____

Address: _____

_____

City, State, Zip: _____

Phone: _____

Fax: _____

Water Resources Conference

28th Annual
Water Resources Conference
October 24-25, 1995
University of Minnesota
St. Paul Campus

The planning committee of the Water Resources Conference is evaluating proposals for presentations for the 28th Annual Conference. The co-sponsors of this conference are the Minnesota Section, ASCE and the University of Minnesota.

Topics will include:

Minnesota Ground Water Issues:

- Wellhead Protection
- Impact on Fens, Wetlands, and Lakes
- Trout Streams
- Implementation of County Ground Water Plans

Storm Sewer Design Models and Methods

GIS/Remote Sensing Applications in Hydrology

Wetland Restoration, Creation and Enhancement

Presentation formats include case studies/practical design methods, problem-solving workshops, and lecture presentations. For more information, contact: Bev Ringsak (612)625-6689.

AIPG Spring Meetings

Tuesday, April 4, 1995

Professor Mark Person (University of Minnesota) *Computer Visualization of Hydrogeologic Data*

Tuesday, May 2, 1995

Professor Mary Savina (Carleton College) *The Wonders of New Zealand - A Geologist's Perspective*

Meetings are at 11:45 am, Ramada Inn Roseville (formerly Holiday Inn Roseville).

The Lead From Submersible Pumps Study- An Update

The Minnesota Department of Health (MDH), Well Management Unit, has recently conducted a study to determine the levels of lead in water systems of homes where submersible pumps containing brass components have recently been installed in wells. A previous study, conducted for the California-based Environmental Defense Fund by the University of North Carolina Asheville Environmental Quality Institute, concluded that submersible pumps containing brass components leach high levels of lead into water. It is important to note that the pumps tested were only evaluated in a laboratory setting and not in actual private wells.

The MDH study has targeted several different brands of submersible pumps installed in wells across Minnesota. Water samples were collected on the first or second day following pump installation and again after two, four, and six weeks. After shutting off the pump for 8 hours, the first 70 gallons of water pumped was analyzed for lead. Lead concentrations in "first draw" samples (first 3 gallons) ranged from 3.7 to 170 micrograms per liter (ug/L) on the first or second day after pump installation; from 1.3 to 20 ug/L after two weeks; from 1.1 to 490 ug/L after four weeks; and from no detection to 8.8 ug/L after six weeks. Lead concentrations in the samples collected after the first draw samples ranged from 1.3 to 73 ug/L on the first or second day following pump installation; from no detection to 35 ug/L after two weeks; from no detection to 34 ug/L after four weeks; and from no detection to 13 ug/L after six weeks.

On October 10, 1994, Peter Cook from the United States Environmental Protection Agency (EPA), Office of Groundwater and Drinking Water Protection, announced that all 14 U.S. manufacturers of submersible well pumps would stop production of pumps with leaded brass components by January 1, 1995.

It is important to note that submersible pumps with brass components may not have been the only source of lead in the water samples collected for the MDH study. Other potential sources of lead in the wells and water systems include brass check valves, brass pressure tank fittings, brass pitless adapter fittings, brass faucets, and lead solder in pipes. The Well Management Unit has suspended the study of submersible pumps containing brass components, but will continue to evaluate other brands of submersible pumps that do not contain brass components so that the amount of lead from other sources may be determined.

MDH Well Management Newsletter, December, 1994

New Publications

Farming Sandy Soils: Strategies for Managing Nutrients and Pesticides in the Upper Midwest.

Summary of Proceedings. March 1 -2, 1994, St. Cloud, MN. Organized and developed by Management Systems Evaluation Area (MSEA) Project Anoka Sand Plain Water Quality. Demonstration Project, USDA Water Quality Projects, the conference focused on the challenge of balancing agricultural productivity with risk of ground-water contamination in sandy soils. Copies are available at $5.00 per copy from Bruce Giebink, Dept. of Soil Science, UMN. Phone (612)625-4749.

National Wetland Mitigation Banking Study "Wetland Mitigation Banking Concepts"

IWR Report 92-WMB-1, July 1992. Presents the basic concepts and issues associated with wetland mitigation banking and the framework for conduct of the national study. **"Expanding Opportunities for Successful Wetland Mitigation: The Private Credit Market Alternative"** IWR Report 94-WMB-3, January 1994. Discusses private commercial banking as practiced to date, current wetland regulation and mitigation credit markets, and suggested policy reforms to promote and facilitate private credit markets. **"First Phase Report"** presents national inventory of wetland mitigation banks, detailed studies of 22 banks, and the results of other substudies. Other reports in this series are "Wetland Mitigation Banking: A Resource Document" and "An Examination of Wetland Programs: Opportunities for Compensatory Mitigation." U.S. Army Corps of Engineers, Water Resources Support Center, Institute for Water Resources, Alexandria, VA 22315. To obtain copies of these and future reports contact: Arlene Nurthen, IWR Publications (703)355-3042.

Quality of Ground Water Around Vadnais Lake and in Lambert Creek Watershed, and Interaction of Ground Water with Vadnais Lake, Ramsey County, Minnesota.

James F. Ruhl. 1994. 59 p. U.S. Geological Survey, Water Resources Investigations 94-4062. Prepared in cooperation with the St. Paul Water Utility and Vadnais Lake Area Watershed Management Organization. The study was undertaken to establish the role of ground water in the phosphorus budget of Vadnais Lake, a source of St. Paul's municipal water supply. Ground water seepage into the lake was found to be small, and ground water in the study area generally contained total phosphorus concentrations below 0.15 mg/L, consequently groundwater transport into Vadnais Lake probably makes up only a small part of the phosphorus budget of the lake.

Summary of Selected Computer Programs Produced by the U. S. Geological Survey for Simulation of Ground-Water Flow and Quality, 1994.

Charles A. Appel and Thomas E. Reilly. 98 p. U.S. Geological Survey Circular 1104. The circular contains a list of computer programs that involve saturated flow, saturated solute transport, saltwater flow, variable saturated flow, and solute transport, heat transport, saturated and unsaturated solute or heat transport, aquifer management, chemical mass balance, aqueous speciation, and mass transfer. Brief descriptions of each model, its uses, and where to obtain a copy are included. Contact USGS Map Distribution, Box

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New Additions to the 1995 MGWA Board

Gretchen Sabel — President Elect

Gretchen is a planner in the Ground Water Unit of the MPCA's Ground Water and Solid Waste Program Development Section. She is responsible for developing an effective educational/regulatory approach to address management of commercial/industrial wastewater in unsewered areas. Since joining MPCA, Gretchen's duties have included the "ambient" ground water monitoring program (1983-1986), the 1988 Ground Water Strategy, the 1989 Ground Water Protection Act, and participation in other more recent planning efforts involving ground water protection.

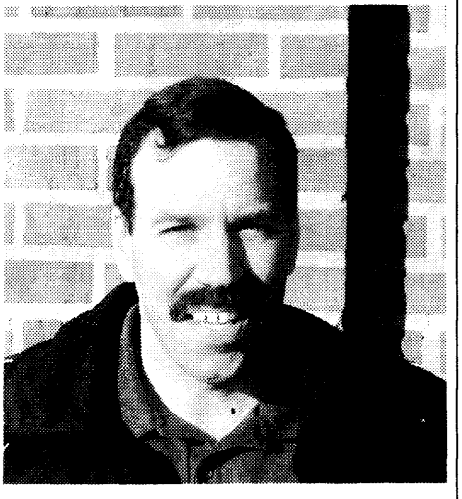
Gretchen Sabel

Gretchen is also active in other organizations. She is currently the chair of Division V of the Ground Water Protection Council, a national organization dealing with ground water issues such as underground injection and wellhead protection. She serves on the editorial board for the Izaak Walton League's state newsletter, and is a member of the Minnesota Chapter of the American Planning Association.

Ed. note: As this issue goes to press, Gretchen has been named supervisor of the Individual Sewage Treatment System (ISTS) Unit, MPCA Water Quality Division. She will begin her responsibilities in late April. Congratulations!

Paul Putzier — Treasurer

Paul is a native of St. Paul, received his BS in geology at the University of Wisconsin - Madison in 1982, and MS in geology at the University of South Florida. Paul is currently employed as a Senior Hydrogeologist for Remediation Technologies, Inc. (RETEC) in downtown St. Paul. He divides his time between technical issues related to soil and groundwater contamination, Project Management, and staff development.



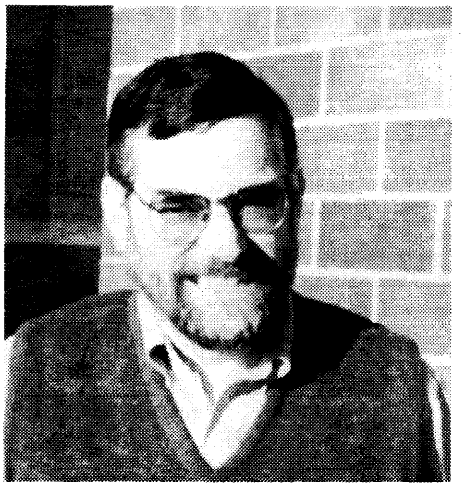
Paul Putzier

Paul is active in organizations other than MGWA. He is an officer in the Minnesota Section of the American Institute of Professional Geologists, and an active member of the Ad-Hoc Committee working toward Professional Registration of geologists in Minnesota. Paul is also a member of the Air and Waste Management Association, and the Minnesota Environmental Initiative. Paul is a member of another, non-professional organization: his family, which includes four small children. This "organization" provides more challenges than all the others and work combined.

Note from the Editor:

As I sit here, a blinking cursor confronts me. What to write? As Jan Falteisek, the departing editor noted in the last newsletter, maybe I've "taken my life in my hands" in assuming the editorial duties for awhile. Article VII of the Association's bylaws states that the editorship shall be a voluntary position for a two-year term. Jan extended that definition a bit as a look back through old newsletters shows she took over as editor from Lee Trotta in early 1990! She certainly deserves a round of thanks for a job well done during this extended term. I'm hopeful that when January 1997 rolls around, another of you with a desire to do this kind of thing for awhile will volunteer.

Since its founding in 1982, the MGWA has grown to over 600 members strong, protecting ground water quality interests in Minnesota and beyond. It's surprising to me to open the Membership Directory and see the number of members from outside our state's boundaries. The newsletter's strength has always been and must continue to be with you, the members. If you have a story to tell about your efforts to understand and protect Minnesota's ground water resources, confront the blinking cursor and tell it. Submit any articles and informational items you'd like to see in the newsletter to me in printed or electronic format at the Minnesota Pollution Control Agency. I can be reached at (612)296-8580, FAXed at (612)296-9707, or e-mailed at tom.clark@pca.state.mn.us.



Tom Clark

I'd like to acknowledge MGWA's publisher, Jeanette Leete and Watershed Research, Inc. for her continuing support. And to Jan, my sincere thanks in smoothing this transition. She will continue using her editorial skills on MGWA's behalf in the areas of corporate sponsorship and newsletter exchange, as well as guiding results of several of DNR's hydrogeologic studies into publication-no small tasks!

Ground Water Ecology, cont.

that we would never have thought of monitoring (such as one of the thousands of chemicals which are not routinely monitored) or due to a combination of slight changes in numbers of physical or chemical conditions which would not individually have been expected to have a negative impact.

The same information could be gained by monitoring ground water ecosystems. The health of an aquifer could be monitored chemically, physically, and biologically.

What Kind Of Changes in Monitoring Procedures Will Be Needed?

Most current methods for collecting samples are not adequate for ecological monitoring. Procedures are being developed to ensure that samples collected include viable organisms. Some changes that are being developed include:

- better pumping methods to avoid damage to microbes,
- sterile collection procedures
- collection procedures that don't kill anaerobic organisms by exposure to oxygen, and
- side-hole sampling procedures to collect sterile aquifer matrix samples.

What Kind of Information is Being Discovered?

Some of the data are fascinating and could be very useful in environmental protection:

Biological/Ecological Data

- Interesting biochemical characteristics in ground water
- Aerobic and anaerobic patterns of ground water can change across a basin
- Nitrates and ammonia patterns can also change
- Methane levels in ground water can change by 2 or more orders of magnitude during the year
- Ground water methane levels can be more than 200 times that of surface waters (based on expected equilibrium with methane in the atmosphere) so high levels might be expected where ground water is upwelling into surface waters
- Hyporheic and surface water diatom and algae blooms can be predicted by knowing how ground water discharge patterns change (due to nutrients in the ground water)
- Ground water oxygen saturation varies more than in surface waters
- In a "clean" aquifer, most organisms are attached to the substrate (aquifer matrix); in a similar contaminated aquifer, many free-swimming forms were found
- There are significant differences between organisms in "clean" sandy aquifers compared to similar contaminated aquifers; the differences could make development of a chemical test appropriate
- Immunology techniques are being developed to compare biochemical differences between organisms in "clean" and contaminated aquifers
- Viable populations of primitive microbes have been found 3800 feet down in coastal marine sediments - they appear to have been there since the sediments were originally deposited
- Many chemoautotrophic organisms (not phototrophs) are found in ground water
- Work is being done to classify species of bacteria, copepods, amphipods, shrimp, etc. by the type of subsurface they prefer (grain-size, caves, small fractures, capillary fringe)
- In fractured bedrock some wells show an increase in the number of species after surface floods
- Large swimming organisms are associated with fractures in the aquifer matrix
- Periods of high water can result in increased soil invertebrates in the ground water
- Low water periods result in active colonization of aquifers by organisms
- In sulfur-dominated caves in Romania, a cave ecosystem exists with absolutely no organic carbon contribution from the surface; energy comes from degradation of bedrock by sulfur and chemolithotrophic organisms
- Microbes have been discovered which convert selenium and uranium to insoluble forms

Chemical and Hydrogeological Data (needed in conjunction with above)

- Fifty percent of the input into Chesapeake Bay is ground water and 40-50% of the nitrogen input is from ground water
- There are interesting locational and temporal changes in gaining and losing streams (found by using shallow "wells" sunk in stream bed & and well transects)
- Diurnal changes (gaining is higher at night perhaps due to drop in evapotranspiration losses from the ground water)
- Gaining increases during snowmelt and following precipitation
- Gaining patterns coincide with outsides of curves, riffles, backups by obstructions, standing waves, etc.
- Depth to bedrock affects whether a stream is gaining or losing
- Sediment type affects whether a stream is gaining or losing

IT'S COMING!

Ground water ecology is a fascinating intermixing of fields: biology, ecology, chemistry, geology, hydrology. It has already brought changes to ground water resource management (remember bioremediation?). More changes will be coming. There will be more conferences, and textbooks have already been written about the topic. Now that you know a little about the topic, watch for it.

Presdient's Letter, cont.

committees?

I encourage members who have comments and suggestions to call me or other Board members; we are interested in your input. See you May 8!

Cathy O'Dell, MGWA President

MPCA Ground Water Guidance

Minnesota Pollution Control Agency Ground Water Sampling Guidance: Development of Sampling Plans, Protocols and Reports

January 1995 Version

This new Minnesota Pollution Control Agency Ground Water Sampling Guidance document replaces the 1986 "Procedures for Ground Water Monitoring: Minnesota Pollution Control Agency Guidelines". The new document contains simple recommended outlines for "Development of Sampling Plans, Protocols and Reports". The outlines are supported by recommendations for filling them out. An example of how an outline can be filled out to create a detailed, step-by-step sampling protocol is included.

The new guidance document focuses on sampling monitoring wells at contaminated sites. However, an entire chapter addresses sampling water supply wells. Other related topics are addressed in less detail.

Since sampling scenarios can vary substantially, detailed background information including alternative procedures, equipment, technical discussions and recommended reading are provided. Recommendations for submittal, review and approval of sampling plans for regulatory programs are also included. The extensive list of references is complemented by a thorough bibliography of "Important Ground Water Monitoring Considerations".

To order a copy, send a request by mail to MPCA, c/o Sandy Kamowski, 520 Lafayette Rd. N., St. Paul, MN 55155-4194 or fax your order to MPCA at (612)296-9707 or (612)296-8717. *Mail-in-orders with check enclosed will be given first priority.* Send a check for $19.75 made out to "Minnesota Pollution Control Agency". If you do not send a check, you will be billed $19.75 for the guidance document.

You may also call in your order to a voice mail system at (612)296-8570 beginning March 1, 1995. When placing telephone orders, speak slowly and clearly. Include your Name, Organization, and complete address. Spell out your name and address verbally to ensure accuracy. Please give your telephone number so your address can be verified if necessary.

25286, MS 306, Denver Federal Center, Denver, CO 80225. Phone (303)236-1411.

Catalog of Environmental Datafiles and Software

from the Environmental Protection Agency and other Federal agencies. NTIS, U.S. Department of Commerce, Technology Administration, National Technical Information Service, Springfield, VA 22161. NTIS wants your business. Call (703)487-4650 and ask for catalog PR-758NDT.

Presence and Distribution of Nitrate and Selected Pesticides in Surficial-Sand Aquifers and Selected Lakes, 1993-1994, East Otter Tail County, Minnesota

Shannon E. Smith and James F. Ruhl. 18p. U.S. Geological Survey Open-File Reports 95-116. Prepared in cooperation with East Otter Tail SWCD and MDNR. The report presents data collected during the dirst year of a three year study of selected shallow sand aquifers and lakes. Nitrate nitrogen in ground water exceeded 10 mg/L in 38 percent of wells sampled, and concentration of triazine herbicide sompouonds was above the detection limit, 0.10 ug/L, in water from 24 percent of sampled wells.

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