Minnesota Ground Water Association Fall Conference
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University of Minnesota Continuing Education & Conference Center
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Addressing Ground-Water Issues for the Next Generation

Abstracts and Biosketches of Presenters

Hydrogeologic Frameworks--Unfolding the mysteries of karst

A Borehole Perspective

Roger Renner, EH Renner & Sons Well Drilling and B.J. Bonin, WSB & Associates, Inc.

Abstract:

Proper development of high capacity municipal wells is based on the knowledge and understanding of the formational characteristics. Hydraulic responsiveness can be optimized with the utilization of proper development that can provide not only higher capacity (sand free) water, but also higher pumping capacities. Downhole video, caliper logs, drill cuttings, gamma log are all tools to help determine how to properly develop a well. Knowledge of vertical and horizontal fracturing can determine the emphasis on the use of explosives, sandstone removal, decompressing, over pumping and surging during the well development phase. A case study of the new Mt. Simon well for the City of North Branch Well No 5 will be reviewed that may change the way wells are developed in the next 25 years to provide less impact on the aquifer yet provide more water for the municipalities.

Biosketches:

Roger E. Renner is president of E.H. Renner & Sons, Inc. with 32 years of experience in water production. B.S. Degree from St. Cloud State University in Bus. Admin. and minor in Accounting, 1971. He served in US Army USARAL command 1971 – 1973.
Roger has served on the Minnesota Dept of Health Advisory Council and has recently re-joined the council in 2007 serving his fourth 4-year term as Vice Chair. Roger is Past President of the Minnesota Water Well Association in 1990. Roger is also Past President of the National Ground Water Association in 2001. He is currently serving as Chair of the NGWA Rural Water Subcommittee and member of Government Affairs Committee. Roger was an invited guest speaker at the Australian Drilling Industry Association in Melbourne Au in 2001. He is also a speaker for the Pacific North-West Conference and South Atlantic Jubilee. He also was the lead instructor for the NGWA training inspectors with the U.S. Department of the Interior {Indian Health Services, National Park Service} and for several course studies locations with the U.S. Department of Agriculture.

B.J. Bonin is a Project Engineer and Geologist for WSB & Associates, Inc.
BS in Geology for Bemidji State University, 1994.
MS in Infrastructure Systems Engineering from University of Minnesota, 2005.
Member of the Geological Society of American (GSA) and American Society of Civil Engineers (ASCE)

Hypogenic Karst and its Implications for Minnesota Hydrogeology

Kelton Barr, Braun Intertec and Alexander Klimchouk, Ukrainian Institute of Speleology and Karstology

Abstract or talking points:

Recent advances in karst research have provided a better understanding of hypogenic speleogenesis, or the formation of caves and other solution-enlarged permeability structures by upwelling waters, and of how it integrates with hydrogeologic processes. This upward groundwater movement can be driven by hydraulic gradients, or other sources of energy. Within a multi-aquifer setting hypogenic speleogenesis is usually caused by upward, cross-formational hydraulic communication that allows deeper groundwaters in regional or intermediate flow systems to interact with shallower and more local groundwater flow

systems. This is in contrast to epigenic speleogenesis which is dominated by shallow, recharging groundwater systems.

This cross-formational communication commonly evolves. Initially, groundwater flow between permeable, non-soluble aquifers can initially occur through aquitards with low matrix permeability via fractures. For soluble aquitards such as limestones and dolomites, these fractures can become conduits with solution enlargement. Flow from the underlying aquifer ("feeding formation") to the overlying aquifer ("receiving formation") through the dissolving aquitard ("cave formation") is determined by the conductivity of the least permeable formation. This limits enlargement of particular conduits and promotes the enlargement of fracture networks into a conduit system, creating maze-like cave networks and converting the soluble unit into an aquifer that can be more prominent than the adjoining non-soluble aquifer units. This system can undergo further evolution through geologic time with uplift and erosion bringing the hypogenic karst into progressively shallower flow systems. Ultimately the hypogenic karst can be reworked by epigenic karst processes and/or exposed at the land surface.

The hydrogeology of southeastern Minnesota, with its alternating sequences of sandstones, limestones, and shales, provides several apt examples of hypogenic karst. The hydrostratigraphic positions of Ordovician and Devonian carbonate units within the regional and intermediate groundwater flow system have been conducive for hypogene speleogenesis. The operative mechanisms of hypogene speleogenesis can provide important insights on the distribution and characteristics of the conduit networks within these units, especially those deeply buried.

Biosketch:

Kelton Barr is Principal Hydrogeologist of Braun Intertec Corporation with nearly 34 years of consulting experience. During this time he has participated in and overseen karst investigations in seven states and two foreign countries. He has a bachelors degree in geology from Carleton College and a masters degree in hydrogeology from the University of Minnesota.

Using Geochemistry to Sort Out Bedrock Aquifer Frameworks

Bob Tipping, Minnesota Geological Survey

Talking points:

- Local to regional flow systems
- Identifying zones of preferential flow
- Importance of bedrock valleys

Biosketch:

Bob Tipping, Minnesota Geological Survey

Education
M.S. (Geology), University of Minnesota, 1992
B.A. (History), Carleton College, 1981

Experience
1989-present, Minnesota Geological Survey

Affiliations
Minnesota Ground Water Association
Minnesota Professional Geologist

Ground-Water Issues Continuing into the Future

Lasting Effects of the Hastings Area Nitrate Study

Jill Trescott, Dakota County

Abstract:

Dakota County conducted Phase I of its Clean Water Partnership project, the Hastings Area Nitrate Study (HANS I), from 1999 until 2003, but the project has had lasting effects on how the County addresses water quality issues. With funding from the Minnesota Pollution Control Agency, Dakota County partnered with the City of Hastings, the Minnesota Department of Health (MDH), the Minnesota Department of Agriculture (MDA), the Dakota County Soil and Water Conservation District (SWCD), and the Metropolitan Council to determine the cause and extent of nitrate contamination in the Jordan and Prairie du Chien aquifers in Hastings and the surrounding townships (Figure 1). The project also developed an implementation plan to reverse the trend in nitrate contamination and restore water quality through a combination of education, management practices, and other activities. The project has demonstrated to County staff and others that combining the County's own expertise, data, and resources with those of other agencies to address water quality problems enables us to achieve better, faster, and more creative solutions than would be accomplished if the various stakeholders attempted the work separately. The National Groundwater Association recognized HANS I as its Outstanding Project in Groundwater Protection in 2003.

Biosketch:

Jill V. Trescott is an Environmental Scientist with the Dakota County (Minnesota) Water Resources Department. She has a bachelor's degree from Wellesley College and a master's degree from the University of North Texas. She manages non-point source groundwater pollution monitoring and prevention efforts for Dakota County, including the Hastings Area Nitrate Study (Phases I and II) and Ambient Groundwater Quality Study (co-manager with Vanessa Demuth). She is also the County's point person for emerging drinking water issues, such as perfluorochemicals.

Planning For Ground-Water Supplies in the Twin Cities Metropolitan Area

Chris Elvrum, Metropolitan Council - Environmental Services

Abstract:

The Twin Cities metropolitan area is fortunate to have abundant supplies of generally high-quality water. However, these supplies are not limitless and they are not always located where needed most. There have been instances where withdrawals have adversely impacted sensitive natural resources or other users. Groundwater or surface water contamination has led to limits on supplies or increased costs for treatment. In addition, there is a lack of sufficient information on the extent, capacity and vulnerability of groundwater systems, which has led to delays in the water supply decision-making process in the region. Many of these issues cut across community boundaries; however, municipalities typically make water system investments and conduct resource evaluations on a local level without consideration of regional implications. As the region continues to grow, demands on supplies will continue to increase and a coordinated planning effort is necessary to ensure that resources are developed in a sustainable, efficient manner.

The 2005 Minnesota Legislature directed the Metropolitan Council (Council) to "carry out planning activities addressing the water supply needs of the metropolitan area" (Minnesota Statutes, Section 473.1565). The Council is undertaking several efforts to address the legislative charge including projecting water demands, analyzing water availability, and evaluation of safety, security and reliability and institutional issues. Results of these efforts will be used to develop a regional master water supply plan which is expected to be completed by the end of 2008.

Biosketch:

Chris earned a B.S. in Geology from the University of Wisconsin – Eau Claire and an M.S. in Geology from the University of Kentucky. Chris is currently the Water Supply Planning Manager at the Metropolitan Council where he has worked for the past 8 years. Prior to this, Chris worked as an environmental consultant for 5 years in Wisconsin. He is a former President of the Minnesota Ground Water Association and currently serves on the Minnesota Ground Water Association Foundation Board.

The Life Hydraulic: Fluid Ethics Amid Uncertainty
Ray Wuolo, Barr Engineering

Abstract:

Groundwater professionals know a lot more (hopefully) about the resource than developers, corporations, lawyers, politicians, and the public. We understand that groundwater can be a useful and valuable water supply that makes possible the accomplishment of many economic and political goals, such as irrigation, power generation, reduced dependency on foreign oil, and the promotion of commercial development. We also recognize groundwater as an integral part of our natural environment that provides for wetlands, base flow in streams, drinking water, and a buffer in times of drought. Every one of us, whether we work for public agencies or as consultants to private enterprise, has a responsibility to our employer, to our fellow citizens (born and yet to be), and to the resource itself. The societal friction caused by simultaneously rubbing together the sticks of protection and exploitation generates heat that all of us at one time or other must endure. The substantial limits on our ability to know with any degree of certainty, "what is the right thing to do?", is the burden that we must bear – sometimes alone. What we do has ramifications that directly affect the course of peoples' lives and the fate of a natural resource that may not be renewable. How can we best function in this environment? What does it mean to act ethically? To whom (or what) do we owe our allegiance to? How (or should) our value systems enter into our judgments? Is conforming to laws and rules enough? There are no easy answers in the Life Hydraulic.

Biosketch:

Ray Wuolo has been with Barr Engineering Company in Minneapolis for 19 years, where he is a principal hydrogeologist specializing in the computer simulation of groundwater flow, surface-water-groundwater interaction, and water-supply evaluation. Over the course of his career, he has had the fortune to work on a wide variety of projects, such as mine dewatering and seepage interception, power-plant siting, regional water-supply planning, contamination remediation, and the raising of four sons (a work in progress). Ray obtained a BS in Geological Engineering from Michigan Tech in 1983 and an MS in Geological Engineering from South Dakota School of Mines in 1986. He is licensed as a professional engineer and professional geologists in several states. Ray is also adjunct professor of geology at the University of St. Thomas and a past-president of the Minnesota Ground Water Association.

Keynote

Global and interconnected trends on social and technical development for the future
Jack Bacon, futurist

Biosketch:

Jack Bacon has often been called "A New Carl Sagan." He is an internationally-known motivational speaker, a distinguished lecturer (emeritus) of the American Institute of Aeronautics and Astronautics (AIAA), and one of the most requested speakers in the country for topics concerning technology and the factors that shape human society. A noted futurist and a technological historian, he has written three popular books entitled *"My Grandfathers' Clock," "My Stepdaughter's Watch,"* and "*The Parallel Bang."* His lectures have captivated tens of thousands of all ages in twenty-eight countries on five continents, and he has appeared on numerous radio and television broadcasts. In his daily work, he is on the management team overseeing the construction and operation of the most complicated technical project in history: the International Space Station.

A graduate of Caltech (B.S. '76) and the University of Rochester (Ph.D. '84) his extensive career includes roles in the development of many cutting edge technologies, including controlled thermonuclear fusion, the development of the electronic office, factory automation, and the globalization of business. He pioneered the deployment of several artificial intelligence systems, learning his craft at the famed Xerox Palo Alto Research Center.

He was the United States' lead systems integrator of the *Zarya*-the jointly-built spacecraft that forms the central bridge and adapter between all U.S. and Russian technologies on the Space Station. This landmark in technological history was built in Moscow by American and Russian engineers and launched from the Baikonur Cosmodrome in November 1998.

Jack is a fellow of the Explorer's Club, a member of the AIAA and of the National Speakers Association, and was a founding member of the board of directors of the Science National Honor Society (www.ScienceNHS.org). Among his numerous awards, he is a recipient of NASA's Exceptional Achievement Medal, the Director's Special Commendation, and the coveted Silver Snoopy award-the only award to fly in space. He routinely advises numerous academic programs and institutions, and he is a champion of education throughout the world.

Tools and Dollars

Integrating Hydrogeologic Tools in Unconsolidated Aquifer Settings: Finding the Tortuous Pathways

Jim Berg, MDNR

Abstract:

In buried sand and gravel aquifer settings groundwater flow pathways can be surprisingly complex. The original sand and gravel distribution of single glacial event deposits can be discontinuous and anastomosing. Subsequent erosion and superposition of equally complex deposits creates focused recharge areas at some locations but not others. Hydraulic connections to associated bedrock aquifers are often important recharge and discharge areas. Finding the tortuous groundwater pathways in these geologic settings commonly requires interpreting and integrating all available hydrogeologic tools such as three-dimensional sand distribution, potentiometric surfaces, and geochemical information. Understanding the tortuous pathways can be important for designing successful monitoring plans for remedial investigations and water supply evaluations.

Examples from east-central and west-central Minnesota (Pine County Geologic Atlas, Part B, 2004, and the Traverse-Grant Regional Hydrogeologic Assessment, Part B, unpublished, respectively) are used to illustrate possible groundwater flow pathways through multiple interconnected sand and gravel aquifers. The sand distribution and pathway interpretations are supported by CWI water level data and selected chemical constituent data. The well log, water level, and geochemical datasets of both projects were supplemented and improved by information from several other investigators and agencies. These integrated datasets, as well as the integrated hydrogeologic tools methods, should provide a useful approach for addressing issues of the next generation, such as water supply and pollution sensitivity.

Biosketch:

Education

M.S. Geology, University of Kansas, Lawrence, KS	1981
B.A. Geology, Carleton College, Northfield, MN	1977

Work Experience

Hydrogeologist/Geophysicist, Minnesota DNR 500 Lafayette Road, St. Paul, MN 55155	1995-Present
Project Manager/Hydrogeologist Twin cities area environmental consulting companies	1987-1995
Exploration Geologist Champlin Petroleum, Denver, CO	1981- 1986

Professional Certification and Affiliations:
Minnesota Professional Geologist #30501.
Minnesota Ground Water Association.

Understanding The Fate of Ground-Water Contaminants: Redefining Natural Attenuation

Mark Ferrey, Minnesota Pollution Control Agency

Abstract:

Monitored natural attenuation is an effective means of addressing sites with ground water that is contaminated with chlorinated solvents. Reductive biological dehalogenation is normally considered an essential component of effective natural attenuation remedies. However, at some sites, chlorinated solvents are breaking down at high rates under geochemical conditions that are not considered conducive to effective natural attenuation. Laboratory studies of the ground water sediment from these sites show that the solvents are degrading non-biologically. Dichloroethene, vinyl chloride, and ethene intermediates are not generated The mechanism responsible for this degradation is not known, but probably involves the iron oxide magnetite. Natural attenuation studies for chlorinated solvents should include an evaluation of non-biological degradation in addition to screening for biological reductive dehalogenation processes.

Biosketch:

Mark works at the Minnesota Pollution Control Agency, where he has focused on soil and ground water cleanup through biological remediation and understanding the fate of contaminants in the ground water environment, with an emphasis on chlorinated solvents and perfluorinated chemicals. He is currently involved in identifying and evaluating emerging environmental issues in Minnesota.

Continuing Evolution of Minnesota's Ground-Water Legislation

John Helland, MN Legislative Analyst (retired)

Talking points:

- Introduction and initial goals of the 1989 Groundwater Act

- Subsequent legislation action:
a) Within the immediate decade;
b) Since 2000

- Ongoing issues needing attention

- Future concerns to be addressed.

Biosketch:

John Helland was a non-partisan legislative analyst for the Minnesota House of Representatives for 35+ years, specializing in environment and natural resources legislation. His work involved serving as chief research staff for the policy and finance committees on environment, and aiding any House member who needed assistance in the area.

He worked extensively on the 1989 Groundwater Protection Act, the Environmental Policy and Rights Acts, the Wetland Conservation Act, the Environment and Natural Resources Trust Fund, Reinvest in Minnesota, Clean Water Legacy, the Outdoor Recreation Act, the Forest Resource Management Act, the Waste Management Act, the Local Water Management Act, and many other major pieces of environmental legislation over the past four decades.

He has degrees in history from the University of Minnesota, and is recently retired.