

Minnesota Ground Water Association

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Newsletter

September 2015
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MGWA President
Lanya Ross

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President's Letter

The year is beginning to wind down, and I am starting to pull out my cold weather gear. I want to be properly prepared for the field trips at our Fall Conference. Those caves are cool.

Speaking of cool, this is a year of big firsts for the Minnesota Ground Water Association.

For example, I have the very distinct pleasure of announcing that MGWA is releasing our first white paper! We began the White Paper Initiative two years ago, with the goal of using our members' expertise to create relevant, unbiased, science-based documents devoted to current groundwater issues.

Our first white paper topic is "Manganese in Minnesota's Groundwaters: Emphasizing the Health Risks of Manganese in Drinking Water,"

The White Paper Initiative – Updates on Past, Present, and Future

First White Paper

The MGWA's first White Paper is completed! In twelve months, the Work Group held monthly meetings and carried out the research of and writing for the completed White Paper on **Manganese in Minnesota's Groundwaters: Emphasizing the Health Risks of Manganese in Drinking Water**. The Executive Summary is the featured article in this newsletter, and the full report is available on the MGWA website at www.mgwa.org/whitepapers_01_manganese.php. Please feel free to download it and share it with other professionals with whom you work. We all owe a big thanks to the Work Group members, other contributors, and WPC liaisons listed below:

Manganese white paper work group:

- Dr. Mindy Erickson, USGS, chairperson
- Bill Bangsund, Barr Engineering
- Meghan Blair, Barr Engineering, lead writer
- Vanessa Demuth, Dakota County
- Dr. Sarah Johnson, MDH
- Linse Lahti, DNR
- Dave Lowell, retired
- Jim Lundy, MDH

and the Executive Summary is published in this newsletter. Special thanks go to the team that has labored so long on this subject. Their names are listed in the accompanying announcement of the White Paper Report. Work on the next white paper has now started, following the successful strategy outlined by the Manganese team.

Another first: The Sinkhole Conference is coming to Minnesota! From October 5-9, join MGWA and the National Cave and Karst Research Institute in Rochester, MN for a great combination of short courses, field trips and presentations by local, national, and international experts on karst. Meet me there and mention this newsletter article and I'll buy you a (root) beer or a hot chocolate, depending on the weather.

White Paper Committee liaisons:

- Mark Collins, retired
- Bruce Olsen, retired

Other contributors:

- Jeff Hill, Robert B. Hill Company
- Prof. Patricia McGovern, University of Minnesota
- Kate Sande, ECOLAB
- Rich Soule, MDH
- Lisa Yost, ENVIRON International Corporation

Second White Paper

On August 27, White Paper Committee Liaison Kelton Barr kicked off the first work group meeting for the second MGWA White Paper on **Minnesota's Groundwater Education Gap: Preparing students to effectively manage our groundwater resource in the future**. The work group consists of 10 MGWA members with a broad spectrum of groundwater education perspectives and experiences. They look forward to soliciting input from the full membership of MGWA on this topic, which aligns squarely with a key mission of our organization. Stay tuned for a membership-wide survey to gather information about your perspective on defining an entry-level groundwater professional and associated skills needed for such positions in Minnesota. The work group, chaired by

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Newsletter Deadlines

Issue	Due to Editor
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Minnesota Section of AIPG Congratulates Jane Willard on Receiving the AIPG Section Leadership Award

Saint Paul, Minnesota – The Minnesota Section of American Institute of Professional Geologists (AIPG) would like to congratulate Jane M. Willard, PG, CPG, Senior Geologist with American Engineering Testing, Inc. (AET), on being selected to receive the AIPG Section Leadership Award. The award is given to one or more members who have demonstrated a long-term commitment and have been long-term contributors to AIPG at the section level.

Jane started attending AIPG meetings in the Twin Cities in 1981. At the time, non-CPG membership did not exist and the section was actually formally known as the MN-WI Section of AIPG. Jane became a CPG in 1984 with the sponsorship of some key section members. Jane has held a number of positions in the Section including but not limited to: President (twice), Director, Sponsorship Chair, and most currently, editor of the MN Section of AIPG newsletter. For a number of MN Section of AIPG golf tournament fundraisers, she has organized some of the silent auctions. She helped organize the licensing committee in the early 1990s and was instrumental in helping make an established path for professional licensure of geologists in the state of MN. Jane also co-organized at least two half day seminars on environmental issues including petroleum and assessment back in the 1990s.

At the national level of AIPG, Jane was on the



Jane Willard

education committee in the mid 1980s and evaluated geology programs in Minnesota. She was a director on the National Advisory Board in 2005, and she co-chaired and then chaired the 2006 convention committee from about 2003 to 2006. Jane was also on the Foundation board for a year around 2005.

Jane has been so important to the MN Section of AIPG and has remained steadily involved through many changes of leadership, always maintaining at least one smaller role, and often larger ones. She has been a dedicated advocate of the geology profession throughout her 30 years with AIPG. Congratulations to Jane for receiving this honor and for her many years of service to the geological community.

(Printed with permission from AIPG)

Two New MGWA Officers Sought for 2016

The MGWA board needs to fill two officer positions – Secretary and President-Elect – for 2016. The Secretary is responsible for recording the meeting minutes and provides general oversight of membership services. The President-Elect takes a leadership role in the planning of one or more of the MGWA meetings while “learning the ropes” of MGWA leadership. Here is a chance for you or someone you nominate to get in on the front end of groundwater resource protection in Minnesota.

The Secretary serves a two-year term and the President-Elect serves a year before becoming President in 2017, followed by a year as Past-President.

E-mail nominations to the MGWA at office@mgwa.org.

What's in Your Well?

By Andrew Streitz, MGWA Newsletter Editorial Team Member

Many years ago while working on an irrigation well interference complaint, I was going door to door in a rural area, asking homeowners for permission to take water level elevations from their wells. At one house the door was answered by a nice couple who listened politely as I first identified myself, then described the project, and finally requested permission to check their well. They both smiled and said they'd like to help, but were on city water. I thought of the many miles to the nearest town, and then gently asked them if they knew what that four inch pipe sticking up in their backyard was. Why no they replied; what is it? You can guess the rest of the conversation that followed. They were newly retired, had moved from a large city a few years before and were still getting used to the house and their new life in the country. After bringing them up to speed on the care and feeding of a personal water supply, I moved down the road to continue my survey.

A few years later I told this story to a group of well owners at a public meeting, and everyone laughed to hear that a homeowner could be that unaware about something so important. I nodded and said something about how the worst of it was that the well had not been maintained or cleaned in years. The grins all disappeared. "Cleaned?" Several people asked. "Maintained?" Others croaked. Finding myself in another teaching opportunity, I then led a quick discussion on the importance of keeping the well area free of debris, checking the fit of the well cap, and disinfecting the well every few years.

It's unlikely that these stories would surprise many MGWA members, who have heard their share of strange beliefs surrounding the public perception of groundwater. Lakes and streams can be directly experienced, while groundwater remains a mysterious resource that defies easy characterization. And even though it's clearly unwise to ignore one's own drinking water supply system, this is not the worst of the pub-

lic's cavalier attitude toward wells; sometimes well owners actively threaten and degrade the groundwater quality around their wells. Talk to a few well drillers or Department of Health well inspectors and you'll come to realize that anything that CAN be leaked, poured or stuffed into a well HAS been leaked, poured and stuffed into a well.

Among wells it is dug wells that are most typically treated with disrespect. Following an inspection by the MDH, a well owner had been told that their old dug well needed to be sealed. When the driller showed up to do the job he discovered it was half full of garbage and roofing shingles. Other odd things pulled from dug wells include railroad ties and various automobile parts (rear differential, tires and wheels). Another driller reported that he was called out to a house because of a taste complaint. After finding the cover over the dug well broken and open, he fished around in the well, and then asked if the owner had cats. She did indeed have a cat, but it had disappeared several weeks before. The driller was able to solve two mysteries for her; the location of her cat, and why the water supply tasted bad.

Wells constructed to modern standards can also attract wildlife. In a story that has echoes of the B-Movie classic, Sharknado, about a super tornado that plucks hungry sharks from the ocean and drops them throughout Los Angeles, one driller described a call to a business that reported trouble with a well. The driller arrived on the scene, discovered the casing was cracked, and then tried pulling the pump from the well. It wouldn't move. After applying increasing levels of force to the effort, it finally jerked out of the well, showering the drill crew with writhing snakes, whole and shredded. Once blood pressures had returned to near normal, the driller determined that dozens of snakes had nested around the pump, effectively plugging the well. Most, if not all of these well problems could be averted through a simple routine of well maintenance. Assuming, of course, that you can convince homeowners that they have a well to maintain.

2015 MGWA Board

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The primary objectives of the MGWA are:

- ◆ Promote and encourage scientific and public policy aspects of groundwater as an information provider.
- ◆ Protect public health and safety through continuing education for groundwater professionals;
- ◆ Establish a common forum for scientists, engineers, planners, educators, attorneys, and other persons concerned with groundwater;
- ◆ Educate the general public regarding groundwater resources; and
- ◆ Disseminate information on groundwater.



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MGWA NEWS

White Papers, cont.

Jeff Stoner, also will be exploring alternatives for narrowing groundwater education gaps for K-12 students.

Changes on White Paper Committee

Two members of the White Paper Committee have relinquished their posts on the committee and moved on to the current Work Group for our second White Paper. **Jeff Stoner** is now Chair of the Work Group, and **Bruce Olsen** is taking on the role of Lead Writer. Both have been active members of the White Paper Committee and were critically important in getting this important initiative up and running. They will help ensure the successful completion of our second White Paper. We owe them our gratitude for their service to MGWA. **Thank you, Bruce and Jeff!**

Two long-time members have agreed to serve on the White Paper Committee to replace Jeff and Bruce. These are **Mindy Erickson** and **Andrew Streitz**. Mindy is a hydrologist and the groundwater specialist in the Minnesota Water Science Center of the US Geological Survey and an adjunct assistant professor at the University of Minnesota. She is also a past President of MGWA. Andrew is a Groundwater Modeler in the Environmental Analysis and Outcomes Division of the Minnesota Pollution Control Agency; Andrew is also on the MGWA Newsletter team. Both will be capable additions to the White Paper Committee. **Welcome, Andrew and Mindy!**

Second Ever MGWA Social Hour Held

There was a good turnout for MGWA's most recent social hour! This event was held on July 23 at the Caffè Biaggio in St. Paul, the second get-together held this year. The accompanying photo shows the happy participants, and eagle-eyed readers may recognize one past MGWA President, the current President, and the President-elect. Word has it that the incoming Prez dramatically raised the cool-factor for hydrologists everywhere by arriving on a sweet ride.

The next event is being planned for later in October. Members will be notified by email.

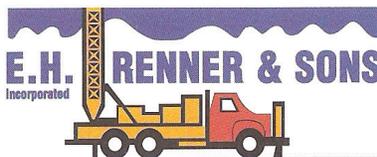


Abbreviations and Acronyms

- ◆ ASTM – American Society for Testing and Materials
- ◆ DNR – Minnesota Department of Natural Resources
- ◆ MDA – Minnesota Department of Agriculture
- ◆ MDH – Minnesota Department of Health
- ◆ MGS – Minnesota Geological Survey
- ◆ MPCA – Minnesota Pollution Control Agency
- ◆ USEPA or EPA – United States Environmental Protection Agency
- ◆ USGS – United States Geological Survey

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American Engineering Testing, Inc. (AET) welcomes Senior Geologist to expanding Environmental Division

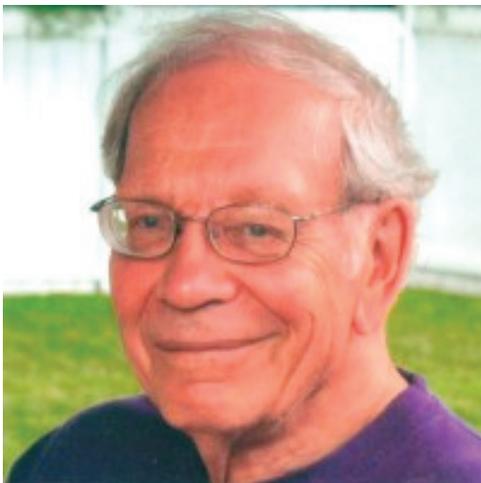
Saint Paul, Minnesota September 15, 2015—American Engineering Testing, Inc. announces the addition of Mr. Dennis McComas to the Environmental Division as a Senior Geologist. Managing Principal Gregory Beckstrom welcomes McComas speaking of his experience in the industry and markets, “He is a seasoned project manager with a sound technical background and a rich history of working in the greater Twin Cities and Upper Midwest markets. We are thrilled to have him as a part of the AET Environmental team!”

In his role as senior geologist with more than 26 years of experience, Mr. McComas will focus on hydrogeological and environmental projects including environmental site assessments (ESAs), underground storage tank investigations, and voluntary investigations and cleanups. Combining his skills and love for solving multi-layer problems with unique solutions, Mr. McComas has worked on a multitude of projects requiring intense review of the rules and regulations related to the environmental field. His past projects include work with railroad recovery services on an unpermitted dump where he coordinated with multiple agencies to develop response actions to accommodate the site and managing and



performing a portfolio of due diligence for a petroleum products bulk delivery over the course of a year. Along with his experience, Mr. McComas has a B.S. in Geology from the University of Minnesota, is a registered geologist in Minnesota and Wisconsin, and is a long standing member of the Minnesota Ground Water Association. You can reach him at dmccomas@amengtest.com

In Memoriam - Rudy Hoagberg



Longtime geologist Rudolph “Rudy” Hoagberg died on September 12, 2015. More information available at: <http://www.startribune.com/obituaries/detail/101111/?fullname=rudolph-hoagberg>

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New Geologic Atlas Available

Chisago County Geologic Atlas, Part B, Completed

by John Barry, Minnesota DNR

Part B of the Chisago County Geologic Atlas, completed by the DNR Ecological and Water Resources Division, is available to the public. The atlas includes four map plates that describe the county's groundwater conditions and pollution sensitivity. A more detailed discussion will be provided in the next MGWA Newsletter.

The Chisago County Geologic Atlas is the 22nd report in the County Geologic Atlas Series, a cooperative effort with the Minnesota Geological Survey (MGS). Part B completes the 2nd half of the atlas covering the hydrology of the county. This was built on and adds to the Part A information published by the MGS in 2010 on the surficial and bedrock geology.

To purchase a printed Part A and B County Geologic Atlas, contact: Minnesota Geological Survey, Publications Office, 2609 Territorial Road, St. Paul, MN, 55114, (612) 626-2969.

To download PDF images and data of the atlas: http://www.dnr.state.mn.us/waters/programs/gw_section/mapping/platesum/chisoga.html

For questions call: John Barry (651) 259-5660 or Jan Falteisek (651) 259-5665.

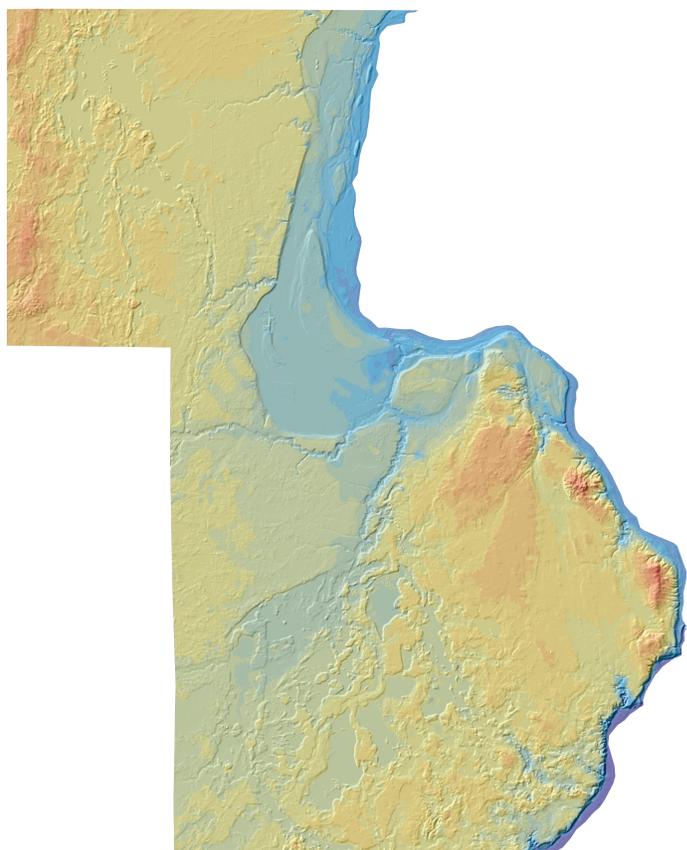
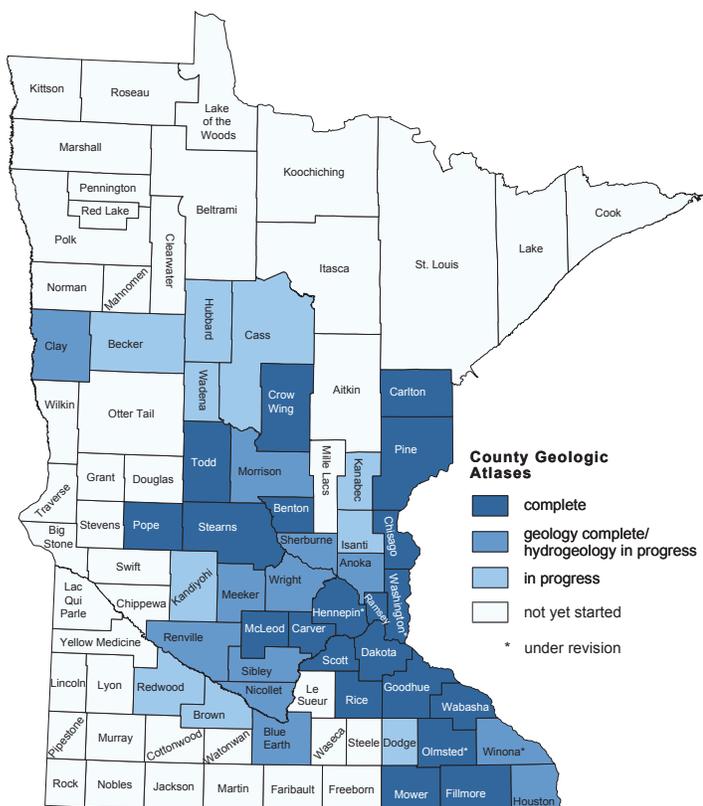
To see the progress of the County Geologic Atlas - Regional Assessment Program (**Figure 1**): http://www.dnr.state.mn.us/waters/groundwater_section/mapping/status.html

Water Rustlers: DNR Readies Stiff Fines for Those Caught Illegally Pumping Water

Minnesota Public Radio story on "Water Rustlers" features MGWA's own Julie Ekman: www.mprnews.org/story/2015/05/26/water-pumping-fines

The backstory: The 2014 Minnesota Legislature authorized DNR to issue an administrative penalty order (APO) for violations of Minnesota Statutes, sections 103G.271 and 103G.275 (Minnesota Statutes, section 103G.299). The APO authority is an enforcement tool to gain compliance with water appropriation law so that Minnesota's water resources are protected for current and future needs.

The law directed DNR to develop a plan for issuing an APO to a person who appropriates water without a required permit. A draft of this plan was announced in the State Register and published for a 30-day public comment period. Future plan revisions will also be shared with the public through a 30-day comment period. DNR staff carefully considered the suggestions shared by the public, so that this plan could be improved through public input. This document provides for clear and consistent application of the DNR's administrative penalty order authority. The primary goal is to ensure compliance with the state's water appropriation law, not to exact penalties. Thus, as described in this plan, all violators will have an opportunity to come into compliance before penalties are assessed. The plan is available at: http://files.dnr.state.mn.us/input/mgmtplans/water_appropriation/final_apo_plan.pdf



Chisago County. Use of LiDAR data enhances geologic atlases.

Figure 1. County Geologic Atlases in progress

The DNR Data Deli Retired! Now known as Minnesota Geospatial Commons

By MGWA Newsletter Team

Groundwater professionals, among them many MGWA members, have a long history of utilizing GIS data served from the DNR Data Deli. This data has now been migrated to a new location: the Minnesota Geospatial Commons <http://gisdata.mn.gov/>. Steve Lime and Robert Maki from DNR MNIT were the principal architects of the DNR Data Deli and had some interesting numbers to share on the volume of traffic that the Deli handled while in use. Steve stated that conservatively there were over 42,000 distinct users and they created over 380,000 data bundles that totaled over 20,4 Tb of compressed GIS data. Below is an article featured in the DNR Spotlight about the conversion.

DNR Data Deli retires, Minnesota Geospatial Commons becomes state resource for GIS data

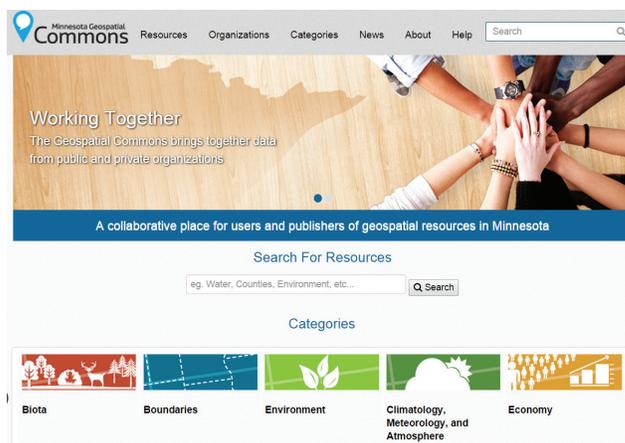
After providing geographic information systems (GIS) data for nearly 16 years, the DNR Data Deli was recently retired in favor of the new Minnesota Geospatial Commons.

The Data Deli began operating in 1999 and eventually became one of the premier systems of its kind, delivering up to two terabytes of GIS data each year to private businesses, government agencies and college students.

The new [Minnesota Geospatial Commons](http://gisdata.mn.gov/) provides statewide GIS data and replaces the DNR Data Deli, which was recently retired. Released publicly last summer, the Minnesota Geospatial Com-

mons includes land elevation data, native plant community locations, digital forest stand inventory, and many other types of GIS data. With a clean, user-friendly interface, along with improved search and download functions, it is intended to be the single place to find and share Minnesota geospatial data.

“It features full integration with the DNR’s geospatial data management and access infrastructure,” said MN.IT Chief Information Officer Robert Maki. “DNR IT staff were primary contributors to the development of the application. In effect, DNR technologies have served as the nucleus for this new interagency system.”



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Manganese in Minnesota's Groundwaters: Emphasizing the Health Risks of Manganese in Drinking Water

Manganese is a naturally-occurring element in the groundwater that is well known for causing aesthetic problems with drinking water. Much of Minnesota's soil, bedrock, and groundwater commonly contains manganese. Water professionals recognize that water supplies containing more than ~50 micrograms per liter (ug/L) dissolved manganese can be a household nuisance because atmospheric oxygen causes manganese in these water supplies to precipitate in water mains, leading to stained laundry and fixtures, and distinct aesthetic effects such as discoloration, odor, or taste (Figure 1). More than 60% of ambient groundwater measurements in Minnesota exceed 50 ug/L, suggesting that many water supplies contain excess manganese.

There is increasing recognition of human health effects caused by manganese. Acute neurological effects resulting from inhalation of manganese have long been recognized, and recent studies indicate that ingestion of excess manganese also poses a potential health risk. These studies demonstrate that although manganese is essential for body functions, subtle decreases in memory, attention, and motor skills are positively correlated with drinking water manganese concentrations, especially above 100 ug/L (Figure 2). Infants relying on powdered formula mixed with drinking water containing high levels of manganese are at highest risk; they are unable to excrete excess manganese and they absorb ingested manganese more readily than adults and children.

Non-enforceable guidance was developed to minimize the human health and aesthetic problems associated with excessive levels of manganese in water. Recognizing manganese as a potential public health issue, the Minnesota Department of Health (MDH) developed tiered health-based risk assessment advice (RAA) for manganese in drinking water in 2012: 300 ug/L for adults and children one year of age or older, and 100 ug/L for infants, especially those relying on reconstituted formula. The Environmental Protection Agency (EPA) advises public water suppliers to treat water to less than 50 ug/L manganese to maintain consumer acceptance of the water. However, these are not enforceable health-based drinking water standards. In fact, manganese levels in public and private water supplies are not currently regulated and not required to be monitored. Mitigation of the potential health risk through development of enforceable standards is unlikely, at least within the next five years. Instead, education, risk communication, testing, and treatment are potential approaches to mitigate the potential for health risks associated with manganese in drinking water.

The groundwater community in Minnesota can help educate the water supply industry, water conditioning contractors, public health professionals, educators, and community and political leaders. The distribution of manganese in ambient ground water is not a measure of manganese in tap water, which can change from source to tap. However, these measurements *can* be used to target risk communication, testing, and treatment efforts on regions of the state that have relatively high ambient manganese concentrations in groundwater. Manganese concentrations are variable, commonly exceeding 1,000 ug/L in Southwestern Minnesota while rarely exceeding 50 ug/L in Southeastern Minnesota (Figure 3).

Informing health care providers and consumers about naturally elevated manganese in groundwater can help them make better



Figure 1. Water containing elevated levels of manganese sampled from a toilet tank in a residence.

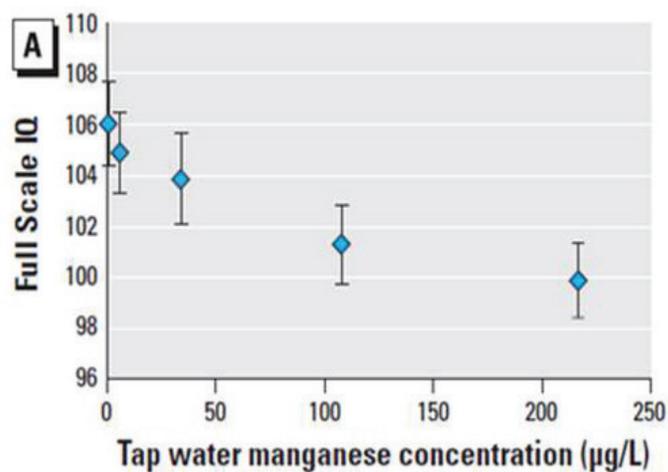


Figure 2. Full Scale IQ as a function of the range of median tap water manganese concentrations. Quintile groups are: 1st = 1, 0-2; 2nd = 6, 3-19; 3rd = 34, 20-66; 4th = 112, 67-153; and 5th = 216, 154-2700. Figure from Bouchard et al., 2011.

decisions about the health risk posed by the potential presence of manganese in their drinking-water supply. Awareness of manganese in drinking water is particularly important for families with infants who may reconstitute formula.

Observation of nuisance and aesthetic effects might be used as an indicator of potential health risk: using tap water that stains faucets to mix infant formula may not be protective of health. In addition, using this water as a drinking source also may not be protective of adult and child health. When properly treated to reduce nuisance and aesthetic effects, tap water manganese is likely to be below health guidance values.

Testing for manganese in drinking water provides a definitive method to assess the potential for manganese exposure. Water

— continued on page 9

Manganese in Minnesota's Groundwaters, cont.

samples can be tested at local labs for approximately \$20. The MDH provides [information on laboratories and sampling](#).

For water supplies containing excess manganese, there are many treatment methods. In public supplies, treatment systems are designed to maintain consumer acceptance of the water and meet enforceable standards for some chemicals. Treatment systems used to reduce iron in water through oxidation, a common treatment step in public water supplies, also reduces dissolved manganese concentrations. Information about the efficiency of treatment systems for reducing manganese to specific recommended health standards is sparse. However, common treatment methods such as carbon filtration, reverse osmosis, cation exchange or water softening, adsorption, oxidation and filtration all likely decrease manganese levels. A licensed [water conditioning installer](#) or contractor can help determine the appropriate water treatment device. Regardless of the treatment option installed, post-treatment testing for manganese and regular maintenance are essential to ensure that manganese levels are protective of health.

Alternatively, drinking water supplies containing excess manganese can be replaced with bottled water. Manganese in bottled water, which also can be sourced from groundwater in Minnesota, is enforced to contain less than 50 ug/L by the Federal Food and

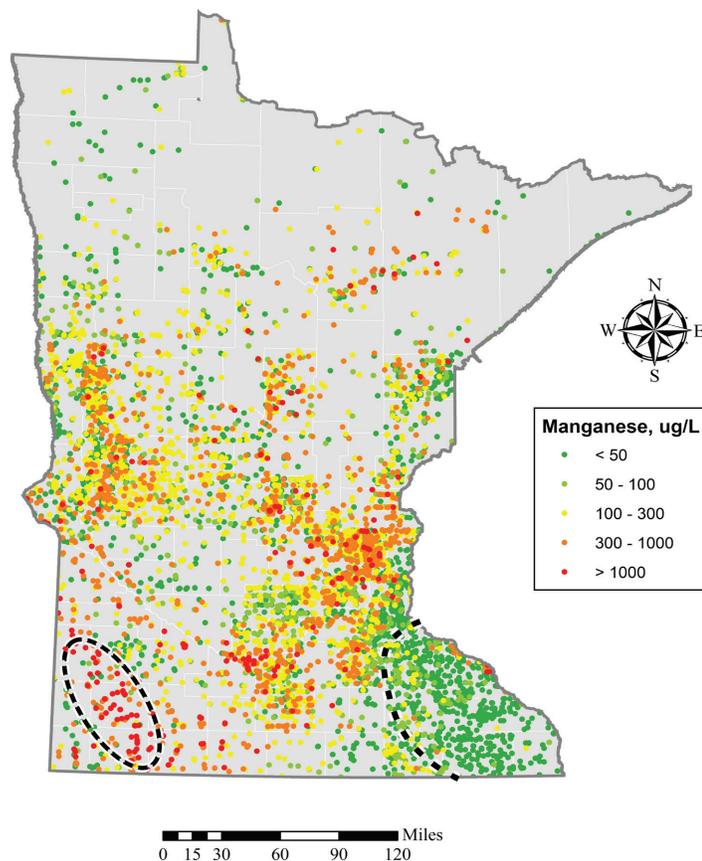


Figure 3. Manganese in groundwater measured at 7,574 wells. Samples collected at various times, for various studies. Data collated and map prepared by MDH, February, 2015. Dashed line encloses area of southeastern Minnesota with low (< 50 ug/L) manganese concentrations. Dashed ellipse encloses area of southwestern Minnesota where manganese concentrations exceed 1,000 ug/L.

Drug Administration or the Minnesota Department of Agriculture. Families relying on formula for infant nutrition also may choose to use liquid, ready-to-feed infant formula instead of powdered formula. In some cases, replacing a troublesome water supply with a new permanent water supply may be economical.

Understanding the potential health risk due to manganese in Minnesota's drinking water will take time and careful consideration by the public health, groundwater, and drinking water communities. Potential investigation activities could include:

- Additional health studies, including a study of the neurological effects of exposure in infants and children exposed to low levels of manganese, and a comparison of the effects of drinking water versus dietary exposure.
- Correlation of ambient groundwater manganese concentrations to tap water manganese concentrations to determine typical exposure concentrations.
- Additional assessment of the spatial distribution of manganese in groundwater. This provides an effective way to identify the populations that may be most at risk of exposure to manganese in drinking water. Coordinating between various ambient groundwater quality monitoring programs within state agencies and local governments is necessary. A concerted effort may be needed to increase the density of ambient groundwater measurements in rural areas, and to assess the adequacy of the data to develop geographical correlations based on geology.
- Evaluation of the effectiveness of manganese removal by water softeners and readily-available pitcher or faucet filters, with specific reference to health-based water quality concentrations.

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Wellsprings: A Natural History of Bottled Spring Waters (2005)

by Francis H. Chapelle. Rutgers University Press, New Brunswick, NJ. Hardcover, 279 pages, ISBN 0813536146, \$25.95. Reviewed by Greg Brick Ph.D.

Chapelle, a USGS hydrologist, sets out to answer questions about bottled waters in this book. Namely, why is it that people buy them, when they are so expensive relative to tap water? He then uses that as a peg on which to review the history of springwater usage from the earliest times to the present.

In Part I, “A History of Bottled Water,” Chapelle begins with some of the earliest, prehistoric water wells. The Stonehenge wells, up to a hundred feet deep and found under burial mounds, were veritable “speaking tubes” to contact subterranean spirits, at least as much as they were water wells. Sacrificial objects were tossed into them, giving rise to a cult of holy wells in Christian times.

What’s behind the notion of “healing springs”? Often, as Chapelle points out, they contain valuable minerals such as iron, iodine, calcium carbonate, and Epsom salts—used to treat anemia, goiter, indigestion, and constipation, respectively. But he suggests that springwaters were healthier for what they did not contain: contamination.

In Chapter 2, subtitled “The Geology of Springs,” Chapelle presents a basic discussion of spring types, but there’s no description of the hydrologic cycle until late in the book, on page 210. He doesn’t really plumb the historical scholarship in this field, however. He seems to suggest in Chapter 3, for instance, that a classic USGS study among the springs of the Sierra Nevada granites was among the first to propose that the mineral content of groundwater is related to its flowpath through rocks. While the researchers did a nice job of quantifying that relationship, the basic idea was very old, running back to the Greek philosopher Plato and was conceptually illustrated in Athanasius Kircher’s *Mundus Subterraneus* of 1664.

Chapelle asserts that humans share a “reverence for pure water.” But Christopher Hamlin’s book, *A Science of Impurity* (1990), argued that apart from sensory data, pure water is a surprisingly derived and contested notion that could not be agreed upon, even by scientists, until late Victorian times. Was the water full of disgusting microscopic “animalcules”? That was all the more proof of its purity, according to the hired guns of the London water companies, showing how well the little critters thrived in it.

In Part II, “The Business of Bottled Water,” Chapelle describes “the fashion cycles of water drinking,” a major theme of the book. We meet the surprising assertion that drinking plain water was a sign of poverty prior to 1700, because water would have been mixed with wine, or small beer would have been drunk instead, to avoid deadly bacteria (which were unknown at that time). After 1800, water drinking supposedly regained respectability because of the high fashion of “taking the waters” at wealthy spas.

Much of the therapy of going to the spa involved the prospect of taking a “mental” holiday, but there was a demand for bottled spa waters to be shipped to people who could not go to the spa. Chapelle emphasizes the role of Saratoga Springs, NY, in the history of American bottled spa waters. The bottling of springwaters was a late development that took place when glass finally became less expensive than the water inside it. Nowadays, of course, when afflicted with indigestion, we pop Alka-Seltzer or TUMS at home,

instead of resorting to a spring containing calcium carbonate to neutralize the stomach acid.

While springwater and spas gained ground in the nineteenth century, the year 1913 marked the chlorinated tap water revolution and the (temporary) eclipse of bottled water in the United States, according to Chapelle. But over ensuing decades, chlorination lost its associations of modernity and the disgust with tap water grew (I need only instance the city of St.

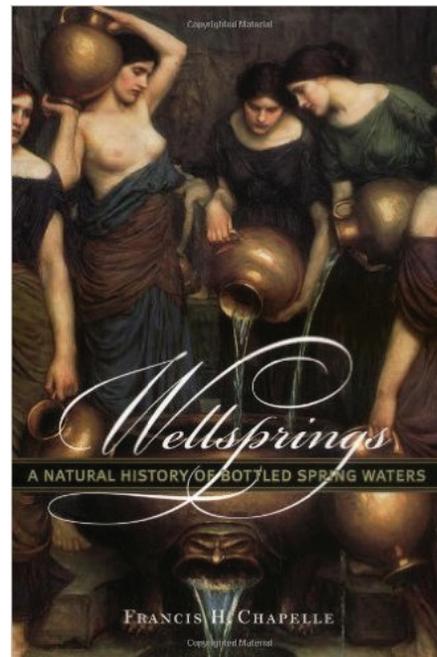
Paul’s reputed “swamp water” of years gone by). The other branch of the bottled water industry, represented by the bulk 5-gallon office watercooler, held its own during this time and was actually given a boost by the replacement of heavy glass carboys with light polycarbonates in the 1970s. We have our own local examples, Highland Springs in St. Paul (which lasted until 1965) and Greenwood-Inglewood Springs in Minneapolis, still with us today.

A central theme of Chapelle’s book is the dichotomy among bottled waters between American’s drinking water versus European’s mineral water. Mineral water is defined as water having >250 mg/L TDS (total dissolved solids). He sums it up on page 162 by quipping that “The joke is that Europeans drink water for what it contains (dissolved minerals), whereas Americans drink water for what it does not contain (dissolved minerals).”

The quintessential preferred American water seems to be a low-TDS drinking water in handheld PET (polyethylene terephthalate) bottles. Poland Spring, in Maine, played an important role in this regard, according to Chapelle, owing its diluteness to Maine’s glacial geology, characterized by insoluble rock types. Although not mentioned, I would have to say that the Midwestern equivalent is Lafayette Spring, near Chippewa Falls, WI, probably the greatest local source spring no one has heard of, unless you read the labels on the water bottles from our stores, as I frequently do.

So how did bottled water resurge in popularity after its near death at the hands of chlorinated tap water in 1913? In 1977, Perrier happened to reintroduce the single-serving bottle in the United States at just the right psychological moment of revulsion against tap water. By 1994 the two big warring waters of today, Pepsi’s Aquafina and Coke’s Dasani, appeared on the market—both merely purified tap waters.

Chapter 8, “The Battle for Ice Mountain,” deals with the contentious issue of water rights in the United States, involving riparian versus prior appropriation, and how bottling water has a lower legal status than irrigation uses. Perrier’s quest for Wisconsin



— continued on page 11

Book Review, cont.

groundwater is described, which has impacted that state's very definition of a spring.

In Part III, "An Endless Sea" (reprising the title of one of his previous books) Chapelle narrates a bottled-water "flyover" of the United States, describing by region the springs the airliner is passing over. Just as vintners have explained their wines in terms of terroirs, he explains American bottled springwaters in terms of their geologic setting. For example, in California, a state largely composed of exotic terrains, Plate Tectonics informs his discussion of mineral waters: the high magnesium accretionary wedge mélange on the West Coast explains high magnesium waters in that locality.

From the standpoint of the Upper Midwest, Chapelle's overflight is less satisfactory. We proverbially live in "flyover country," yet we are denied even this satisfaction in his book: there's no chapter covering Minnesota springs. Right in Minneapolis, we had Chalybeate Springs, nationally known, as it was patronized by the wealth of the South in pioneer days, before the American Civil War. In the twentieth century there was Excelsior Springs, an elaborate spa just north of Kansas City, Missouri, as another example.

Chapelle speculated that the cycle in water preferences might flip against bottles again by 2100, but a strange omission is any lack of mention of the big contemporary drive to reduce the quantity of plastic bottles that are being landfilled. "Ban the bottle" movements threaten bottled water more than anything else right now and it was well known at the time that his book was published.

The book has black and white illustrations, the most intriguing of which, for me, was a reproduction of the elaborate—almost medieval—taste and odor wheel used by the American Water Works

Association. Chapter references are placed at the end of the book, but without a separate bibliography.

Some may wonder why I'm reviewing Chapelle's book now, as it was published a decade ago. However, the additional time has lent some useful perspective, especially on the great historical cycle of bottled water that he proposes. While historians of science will find some deficiencies as instanced above, I recommend his book both for professionals as an insightful take on the bottled water issue and for laypersons as a palatable introduction to groundwater topics.

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NEW PUBLICATIONS

Hydraulic Conductivity and Hydrostratigraphy of the Platteville Formation, Twin Cities Metropolitan Area, Minnesota

In April, 2015, the MGS released this report that synthesizes a large body of data in order to provide a better understanding of the hydrogeologic characteristics of the Ordovician Platteville Formation in the Twin Cities Metropolitan area. The report is authored by Tony Runkel and others and can be found here: con.servancy.umn.edu/bitstream/handle/11299/171967/OFR15_1_Runkeletal.pdf

New USGS Groundwater Website

The new website is an online monthly public summary of recent USGS groundwater-related publications, software, and press releases. The site can be found here: <http://water.usgs.gov/ogw/highlights/>

2015 Earth Science Week

Resources are available for the public, for educators and students, and for the media. Visit www.earthsciweek.org and get involved!



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Mission and Theme

Earth Science Week... promotes understanding and appreciation of the value of Earth Science research and its applications and relevance to our daily lives.

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2015 Theme

"Visualizing Earth Systems." the theme of Earth Science Week 2015, explores what it means to see our planet through eyes informed by the geosciences. Using technologies ranging from on-site data collection to satellite-based remote sensing, scientists investigate conditions of Earth systems. And today's geoscientists display their findings in charts, graphs, diagrams, illustrations, photos, videos, computer-generated animations, and 3D-printed creations.

Objectives

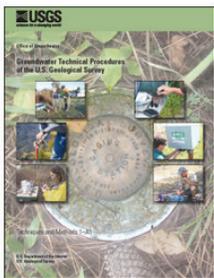
- To engage students in discovering the Earth sciences.
- To remind people that Earth science is all around us.
- To encourage Earth stewardship through understanding.
- To motivate geoscientists to share their knowledge and enthusiasm about the Earth.



[USGS Groundwater Information](#) > September 1, 2015 Highlights

USGS Monthly Groundwater News and Highlights: September 1, 2015

Featured Product: USGS Groundwater Technical Procedures



To promote consistent and accurate collection of groundwater-level data and related field practices, USGS scientists use a common set of technical procedures. These procedures are used by the USGS as guidance for field work, standardization of measurements and other tasks, training of staff, and quality assurance. In response to the need for citable standardized technical procedures of the USGS, a [report documenting some of the most common groundwater field procedures](#) was published and is freely available for download online. These technical procedures provide step-by-step instructions, diagrams, sample field forms, and more. The report compiles techniques for groundwater-site establishment, well maintenance, water-level measurements, groundwater-discharge measurements, and single-well aquifer tests. Making these standards publicly available also allows hydrologists, technicians, and data managers from outside the USGS to reference techniques used by the USGS. The documents can also be used to provide a consistent set of training materials for those new to the routine aspects of groundwater-data collection and handling.

Recently the USGS has also started to produce a companion set of groundwater technical procedure videos. In the videos, USGS hydrologists demonstrate the technical procedures in the field. Watch the example view below, which shows how to measure the depth to groundwater below land surface using a type of tape measure called an electric tape. Or, browse the growing [collection of groundwater technical procedure videos](#).



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MGWAF BOARD MINUTES

MGWA Foundation Minutes

June 30, 2015

Members Present: Scott Alexander, Cathy von Euw, Eric Mohring, Stu Grubb, Cathy Villas-Horns, and Amanda Strommer (via conference call).

MGWA Management Present: Sean Hunt and Jennie Leete (via conference call)

Current Business: **Review Minutes**

Minutes from February 12 meeting approved.

MGWA Board report

Eric provided report. Cathy von Euw made a motion to return a donation due to not being able to fulfill specific terms of request. Stu seconded; all in favor; motion approved.

Review finances

Total for the MGWAF fund is \$130,791.50 as of 6/29/15. Total for the HOP fund is \$28,616.03. New Highway Federal Credit Union account opened. Stu Grubb and Cathy von Euw will meet to discuss future options.

New grant applications

No applications have been received.

Offering a field camp scholarship

Scott will work with Calvin and Olaf to develop application, criteria, and committee. Goal is to have process in place to award scholarships for the 2016 field camp.

Setting up a committee to promote vendors at conferences

Vendor fees covered student registrations for the spring conference. The fall conference will be a separate process. For 2016 spring conference will start to solicit at the beginning of the year.

Future business: Discussion of board positions - who is looking at retiring and who might be potential new candidates. Cathy Villas-Horns will be retiring; Eric Mohring has offered to remain on the Board. There will be an announcement in the newsletter. Stu will take the lead on recruitment.

Next meeting: Will be scheduled in early September.

Seeking Volunteers to Serve on the MGWA Foundation Board

The Minnesota Ground Water Association Foundation (MGWAF) was formed to assist the MGWA in its mission to educate the general public regarding ground water resources. The MGWAF administers the funds set aside by the MGWA Board for educational activities, conducts fundraising events, manages growing endowment funds, and coordinates vendor displays at MGWA conferences.

The MGWAF has provided many scholarships, mostly to university groups for field trips, to assist in the education of future ground water professionals. Funds donated by the MGWA membership also have been used to provide assistance to the University of Minnesota Hydrogeology Field Camp, the Children's Water Festival, the National Ground Water Education Foundation, the Metro Area Ground Water Alliance, the Minnesota Water Line, and the Big Back Yard at the Science Museum of Minnesota.

The MGWAF is looking for motivated candidates to become involved on the Board. The Board meets 2-4 times per year, usually at noon. It is a great way to meet other groundwater professionals, support our industry, and help a good cause. Interested in becoming a member? Please send an email to office@mgwa.org or call Scott Alexander (MGWAF President) at (612)626-4164.

Save the Date



Give to the Minnesota Ground Water Association Foundation on Give To The Max Day November 12, 2015 www.givemn.org/project/MGWAF

MGWA Foundation Board of Directors

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University of Minnesota
(612)626-4164
alexa017@umn.edu

Secretary
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Minnesota Department of Health
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(651)351-1614
grubbss@aol.com

Director
Cathy Villas Horns
Minnesota Department of Agriculture
(651)297-5293
cathy.villas-horns@state.mn.us

The MGWA Foundation is a 501(c)3 charitable organization. Donations to the Foundation are deductible on your state and federal income tax returns.

MGWA BOARD MINUTES

Minnesota Ground Water Association Board Meeting Minutes

Meeting Date: June 03, 2015

Location: Fresh Grounds Café 1362 West 7th Street, St. Paul, MN
Attendance: Lanya Ross, President; Eric Mohring, Past President; Ole Olmanson, President-Elect; Secretary; Emily Berquist, Treasurer; Tedd Ronning, Newsletter Editor; Sean Hunt, WRI; Jeanette Leete, WRI

Past Minutes: Approved.
Treasury: Berquist provided the Board with copies of the financial report. Total income for the period of January 1, 2015- June 1, 2015 is \$70,145; total assets as of January 31, 2015 are \$133,389. Net income for the period of January 1, 2015- March 1, 2015 is \$30,170. Leete reported that most membership dues we expect to receive this year were paid. Historically, due increases occurred every five years; dues increased in 2010 from \$30 to \$35 per year membership. Membership dues are used to provide membership services such as ongoing website support, newsletters, and regular outreach about upcoming events. Because membership service costs have increased, membership dues are not sufficient. The Board discussed a potential due increase for professional and student members. The Board also discussed adding a new category for retired members. Leete will determine the current difference between membership dues and membership costs; this difference will be discussed with the Board during the July meeting.

Newsletter: Ronning reported that the newsletter is in progress and nearing initial review..
Web Page: Hunt is working on a several items such as the 2015 Fall Conference, 2015 Spring Conference, and White Paper Initiative. Email announcements were also sent out to members.

WRI Report: WRI reported that MGWA has received three new members in the past two weeks; totaling over 600 members. WRI filed for tax extension until August. An account was opened for the MGWA Foundation with HiWay Federal Credit Union. Approximately \$2,050 of unrestricted funds was transferred into this account from Affinity Plus.
A \$2000 check was submitted to the MGWA Foundation with the request to fund a specific individual's attendance to the Sinkhole conference. The Board discussed how best to handle this situation as the Foundation is not set up to receive dedicated funds to an individual. Rather, the MGWA Foundation receives funds for a scholarship and applications to receive funding are submitted. The Board decided that the check should be returned to the individual with an explanation about how the MGWA Foundation handles incoming funds.

Old Business: 2015 Spring Conference. The Board discussed the positive feedback from the 2015 Spring Conference. Ross thanked those involved in organizing the event.
Social Hour Event. Berquist suggested that MGWA host a social hour quarterly. Thursday, July 23, 2015 was proposed as the next social hour from 4:30-6:30 p.m. Caffè Biaggio was selected as the tentative location for this social hour.
2015 Fall Conference Deadline. Ross reported that only six abstract submittals were received for the "abstract-only" talks; more "abstract-only" talks should be actively pursued.
White Paper Initiative. Ten applications were received to participate on the White Paper work group.
Ethics Requirements. Nothing to report.
Member Survey. Nothing to report.

Meeting Date: July 01, 2015

Location: Fresh Grounds Café, 1362 West 7th Street, St. Paul, MN
Attendance: Lanya Ross, President; Eric Mohring, Past President; Ole Olmanson, President-Elect; Avery Cota-Guertin, Secretary; Emily Berquist, Treasurer; Sean Hunt, WRI; Jeanette Leete, WRI; Kelton Barr

Past Minutes: Approved.
Treasury: Berquist provided the Board with copies of the financial report. Total income for the period of January 1, 2015 - June 30, 2015 is \$72,020; total assets as of June 30, 2015 are \$133,341. Net income for the period of January 1, 2015 - June 30, 2015 is \$30,166.

Newsletter: Ross reported that the newsletter was sent out to members.
Web Page: Hunt updated the web page with 2015 Spring Conference audio files and 2015 Fall Conference registration submittal information.

WRI Report: WRI reported that the taxes will be completed by the extension deadline of August 15, 2015

MGWAF: Mohring discussed with the Board the MGWAF meeting on June 30, 2015. Discussion items include the field trip scholarship, the solicitation of more conference exhibitors and providing more notice prior to the conference, and the scholarship candidate selection criteria process and timeline.

Old Business: Membership dues. Leete discussed with the Board that membership dues should cover membership services and administration activities. The previous four years of membership dues and information was assessed to make a determination on

MGWA 2016 Membership Dues

Sustaining Member	\$65
Professional Member:	\$45
Retired Member	\$25
Full-time Student Member	\$20
Newsletter (printed and mailed)	\$20

Membership dues rates were revised at the July 1, 2015 meeting of the MGWA Board.

MGWA BOARD MINUTES

MGWA Board Meeting Minutes, cont.

potential due increases. Professional membership dues are currently at \$35 per year. Leete suggested offering a sustaining member option - some may give extra to help lower membership dues for students and retirees. Barr suggested that the summer newsletter thank sustaining members. Olmanson suggested a four-tier level, an incremental increase from student to sustaining member. Olmanson motions to add sustaining and retiree categories of membership. Motion prevails. Mohring motions to set the sustaining membership at \$65 per year, professional membership at \$45 per year, retiree membership at \$25 per year, and student membership at \$20 per year. Motion prevails.

Member Survey. The first white paper work group meeting will work on the member survey. Aiming for the survey to occur in Fall 2015.

2015 Spring Conference. The abstract deadline has past. Currently, working on session and poster groups and soliciting exhibitors for the conference. Sponsorships at the \$1,000 and \$2,000 levels are still open. Barr suggested that registration reminder emails be sent and suggested that we also include Iowa and Wisconsin water groups and the Minnesota Geotechnical group. Hunt requested that the Board send contacts to him for the registration reminder emails to be sent.

White Paper Initiative. The White Paper work group is in place.

July 23rd Social Hour Event. The MGWA has agreed to pay for appetizers and non-alcoholic drinks. Hunt will send an email announcement soon and again a few days before the event. The Board discussed holding a quarterly social hour to give people more time to work around schedules.

Meeting Date: Wednesday, August 05, 2015

- Location: Fresh Grounds Café, 1362 West 7th Street, St. Paul, MN
- Attendance: Lanya Ross, President; Eric Mohring, Past President; Emily Berquist, Treasurer; Avery Cota-Guertin, Secretary; Tedd Ronning, Newsletter Editor Jeanette Leete, WRI; Sean Hunt, WRI; Kelton Barr, Audrey Van Cleve
- Past Minutes: Approved.
- Treasury: Berquist provided the Board with copies of the financial report. Total income for the period of January 1, 2015 – August 4, 2015 is \$90,411; total assets as of August 4, 2015 are \$146,795. Net income for the period of January 1, 2015 – August 4, 2015 is \$45,590.
An addendum to the certificate of authority was resigned to grant Berquist authority to MGWA accounts. Van Cleve will continue to have signature authority through the 2015 Fall Conference.
- Newsletter: Ronning reported that work is continuing on the next newsletter issue. If possible, they would like to publish the white paper in the next newsletter. Barr reported that the white paper draft has received the first round of comments. The white paper work group is currently working through those comments. The next step will be for the Board's approval before it can go to the newsletter. Call for technical articles to include in future newsletters. Barr suggested that abstracts from conferences be included in the newsletters.
- Web Page: Hunt reported that work is continuing on the 2015 Fall Conference web page registration. The web page was updated with membership and the new dues structure.
- WRI Report: WRI reported that from now until the end of 2015, 2016 dues will show up as assets under 'Prepaid Dues'. For those members who paid for a printed membership directory, a refund will be issued with a letter explaining where the electronic directory is located. WRI reported that a majority of time was spent working on the 2015 Fall Conference registration and exhibitors.
- Old Business: July 23rd Social Hour. The Social Hour, held on July 23rd, had an attendance of 15. Total expense of the event came in under budget. The next social hour may be held later in the fall.
White Paper Initiative. The next White Paper work group will have 10 members. The first work group meeting will occur later this month. The work group met with two members in STEM to learn more about curriculum and standards in science education.
2015 Fall Conference. The Board discussed conference preparations. Help with packet assembly is likely needed. Need to determine the financial responsibility of MGWA for 'gifts' to attendees. Conference registration was extended to September 1st. Hunt suggested a weekly email reminder be sent to members. Ross will draft targeted emails with 'speaker highlights' and Barr will draft emails to the MN Geotechnical group (and possibly SME).
- New Business: Awards: The Board discussed the possibility of presenting awards at future conferences. Barr suggested possibly recognizing retirees and their contribution to the field.

The MGWA Board meets once a month, currently over lunch, on the first Wednesday at Fresh Grounds on 7th in St. Paul.

Members are welcome to attend and observe

*The Sinkhole Conference
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