

Minnesota Ground Water Association

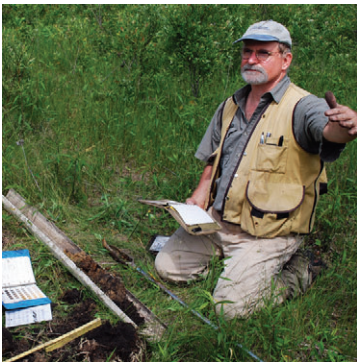
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Newsletter

March 2014
Volume 33, Number 1

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- Metro Model 3, page 14
- Geologic Controls on Groundwater and Surface Water Flow in SE MN - NO₃ Impacts, page 15



MGWA President
Eric Mohring

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President's Letter

It feels a little odd to be writing as president of MGWA having successfully resisted this line of duty for a quarter century or so. Having been a member almost since the organization's creation, I have certainly benefitted from the conferences, newsletters, field trips, and networking opportunities that MGWA has offered. So in response to a particularly convincing sales pitch from Bob Tipping, and perhaps to a bit of guilt for having taken so much from the organization over the years and not having given much back, I decided to offer my services, such as they are.

I remember the first solicitation I received to consider running for MGWA president was around 1988. Ground water seemed to be front and center in those days. We were in the midst of a major drought, and people

were recognizing, some for the first time, that ground water resources were perhaps not as unlimited as previously thought. The 1980s were also the heyday of Superfund activity. Ground water science was coming into its own as a discipline. Government agencies and consulting firms were hiring hydrogeologists. Headhunters were calling. Out-of-work petroleum geologists were re-inventing themselves as hydrogeologists. Lots of remedial investigations, cleanups, and consulting firms sprouting up. State agencies cooperated to put together the "Minnesota Ground Water Protection Strategy" in 1988, and 1989 marked the passage of the state's landmark Ground Water Protection Act. Heady times for ground water professionals.

— continued on page 4

Featured Photo

This photo was taken January 19, 2014, in the Apostle Islands National Lakeshore, on the south shore of Lake Superior a few miles east of Cornucopia Wisconsin. The area has been in the news as thousands of people have seized the opportunity of favorable conditions to walk out to the caves to see the many ice formations. To justify its inclusion in the MGWA newsletter, please note that the photo reveals frozen evidence of precipitation, overland flow, groundwater seepage, and surface water. And for the geologists, it also includes nice sandstone bedding planes.



Rock and Ice. Photo by Andrew Streitz, Newsletter Team

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Newsletter Deadlines

Issue	Due to Editor
June '14	05/02/2014
September '14	08/01/2014
December '14	11/07/2014
March '15	02/06/2015

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Jeff Broberg Reappointed to LCCMR

Jeff Broberg has been reappointed to serve as a citizen appointee to the Legislative-Citizen Commission on Minnesota Resources (LCCMR) by Minnesota Speaker of the House Paul Thissen. This four-year term began in January. Mr. Broberg is one of five citizen representatives on the commission and has served in this role for the past seven years.

Broberg stated, "I'm grateful for the opportunity to continue on the LCCMR and to provide my earth science perspective to this important funding source for Minnesota Resources. I'm also excited because LCCMR provides a preview to Minnesota's emerging environmental issues and helps me give my WSB colleagues and clients information on a wide range of subjects, as well as access to wide range of scientists, natural resource managers, and Legislators."

The function of the LCCMR is to make funding recommendations to the legislature for special environment and natural resource projects, primarily from the Environment and Natural Resources Trust Fund (ENRTF). These projects help maintain and enhance Minnesota's environment and natural resources. (source: LCCMR website, <http://www.lccmr.leg.mn/>).



Jeff Broberg

Mark Wettlaufer new Planning Program Supervisor at MDH

Mark Wettlaufer accepted a position as Planning Program Supervisor in the Source Water Protection (SWP) Unit at the Minnesota Department of Health (MDH). Previously, he was the MDH planner for East Central Minnesota assisting communities developing and implementing Well-head Protection (WHP) plans. Prior to joining MDH, Mark worked for the MN Rural Water Association for nine years assisting public water suppliers with WHP and SWP plans and activities. He has a background working for local government in land use planning and agriculture having worked in land use planning and water planning at Morrison County for almost ten years.



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MGWA LOSSES

Minnesota's Grandfather of Copper Mining Lehmann Dies at 84

By John Myers, Duluth News Tribune

Ernie Lehmann, sometimes called the grandfather of copper mining in Minnesota and a tireless promoter of the region's vast mineral wealth, has died.

Jim Kiehne, a business associate, said Lehmann died peacefully in his home Friday from congestive heart failure. He was 84.

Lehmann has been prospecting for, researching and promoting Northeastern Minnesota's mineral wealth for more than a half-century, especially focusing on the Duluth Complex and its deposits of copper, nickel, gold, platinum and other valuable metals.

"For those of you in the industry who knew his incredible drive and passion for his work, you will not be surprised to know that he was following the recent developments in northern MN and active in helping with business decisions up until the last few days of his life," said Kate Lehmann, Ernie's daughter and business partner, in a statement. "This is a great loss to the industry as well as our family. We will send you information about a memorial service after plans are finalized. We expect to wait until after the holidays."

Lehmann was born in Germany, but came to the U.S. with his parents at the outset of World War II. He earned a geology degree from Williams College and has worked out of an office in Minneapolis since 1958. But focused on and had been investing in and promoting mining projects in Northeastern Minnesota since the 1960s.

Lehmann, most recently the patriarch of Ernest K. Lehmann and Associates, North Central Mineral Ventures and Lehmann Exploration and Management Co., also helped start Mining

Minnesota, the copper-nickel mining trade group now headed by Frank Ongaro.

"Ernie was the father and grandfather of exploration and mineral development in the state of Minnesota. He has practiced his geology trade all over the world for five decades plus. On top of that, he was just a wonderful, wonderful person," said Frank Ongaro. "He will definitely be missed in this state and the world of mining, across the country."

Lehmann was the founding owner of Franconia Minerals, which owned key holdings in the Birch Lake area and has now been taken over by Duluth Metals and the Twin Metals copper mine project east of Ely.

Lehmann also owned Vermilion Gold, which is still prospecting for gold and other minerals across the region, and Beaver Bay Joint Ventures, which continues to hold the mineral rights to key copper-nickel deposits north of the Iron Range.

After a period of interest in Minnesota's copper deposits in the late 1960s and early 70s, most large mining companies turned to other regions and countries. But Lehmann continued to prospect in and push for mining of Minnesota minerals beyond iron ore.

Over the last decade, interest in the region has again piqued, and many in the industry credit Lehmann for the advancement of projects like PolyMet, the proposed copper-nickel mine near Hoyt Lakes now in the environmental review stage.

"In my opinion, without question, he was instrumental for anything that we will see come from PolyMet or Twin Metals or whatever project moves forward," Ongaro said. "We can credit Ernie."

MGWA Assistant Arlene Straus Dies after Brief Illness

Arlene Straus, 71, of White Bear Lake, passed away March 3rd, 2014. Arlene orchestrated registration at MGWA conferences. She lived next door to MGWA's business team and made herself available to assist with preparation of mailings and conference materials. She was in the background, making sure that our events ran smoothly and without fuss.

As Past President Gil Gabanski said, "Arlene was a quiet, dependable person, always willing to help out. She was there, but most would not have taken notice of her. I will miss her."

As will we all, even those who had no need to know how meetings came together!



Arlene Straus

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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, cont.

Association Officer Announcements

Lanya Ross is the President-Elect of the MGWA for 2014. Lanya is a Principal Environmental Scientist at the Metropolitan Council. **Avery Cota-Guertin** is the new MGWA Secretary. She is a Mining Hydrogeologist with the Minnesota Department of Natural Resources.

The Association would like to recognize and thank outgoing president **Bob Tipping** and outgoing Secretary **Julie Ekman**. As Past President, Bob will serve on the MGWA Foundation Board as the MGWA Liaison.

Please take the time to congratulate and thank all the new and outgoing officers. The MGWA could not exist without their service.



Lanya



Avery



Bob



Julie

President's Letter, cont.

Things move in cycles, and emphasis on ground water seemed to be waning by the late 1990s. Cleaning up ground water contamination sites was becoming relatively routine. The consulting boom was waning. Surface-water issues started garnering more attention. Watershed planning, non-point source pollution, impaired waters, total maximum daily loads, and wetland protection were all the rage. To some of us, ground water seemed to be getting short shrift.

Is the pendulum swinging the other way? Perhaps. Ground water seems to be in the news a little more these days, and getting more attention in the hallways of the capitol. (If it takes a large metro-area lake surrounded by lots of old money going dry to grab some attention, well, so be it!) The Clean Water Land and Legacy Amendment, though seemingly emphasizing surface water, has afforded some opportunities to get ground water protection – both quality and quantity – back on track. But it is up to us, from those of us working in the ground water resource field to those concerned with the political, social, and economic aspects of ground water, to educate, inform, and keep attention focused on ground water.

So – conferences! The MGWA 2014 Spring Conference is scheduled to be held Tuesday, April 22th, on the St. Paul Campus of the University of Minnesota. The spring conference's theme is “**recharge, infiltration, and drainage**”. We hope the conference will shed some light on recent efforts to answer the time-honored questions: Where does ground water come from (recharge)? What are the implications of human-induced modifications

to surface-ground water interaction (infiltration, drainage)? The speaker list is still being finalized, but will include:

- Lanya Ross (Met. Council) : Soil Water Balance (SWB) model and applications in the Metro area;
- Mike Trojan (MPCA): stormwater infiltration practices;
- Bill Cook (Met. Council): East Bethel wastewater recycling project;
- Ole Olmanson (Shakopee Mdewakanton Dakota Community): Stormwater and wastewater infiltration projects
- Greg Brick: Thermal pollution under Minneapolis
- Steve Robertson (MN Department of Health): Stormwater infiltration and source water protection
- Tim Gillette (Board of Water & Soil Resources): Drainage issues

The fall conference on November 12 will have the theme “**Superfund: Its Legacy and Future.**” Many of us “old dogs” came in to this line of work during the heady initial days of the Superfund. The conference will explore, from a perspective some 30 years later, the questions: what is the enduring legacy of these efforts? Where have they brought us? What have they morphed into? What have we learned? Where are we going? I think this will be timely as many of those in the workforce demographic that got its start during these times are nearing the end of their careers, and newer hires may not have much perspective on what it took to put these programs in place.

I look forward to seeing you there.

MGWA Newsletter March 2014

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

What Are Groundwater Management Areas?

By Jason Moeckel, Minnesota DNR

Minnesota may be heralded as the land of 10,000 sparkling lakes, but in some parts of the state it's the unseen, underground waters that are drawing increasing attention. Groundwater use in Minnesota has been increasing dramatically, and we are at risk of overusing and contaminating this vital natural resource.

This has led the Minnesota Department of Natural Resources to explore a new approach to groundwater management. Under statutory authority provided by the 2010 legislature, the agency has launched planning processes for three groundwater management areas. A groundwater management area plan looks at cumulative demands of individual users and across jurisdictional boundaries of cities and counties.

The three areas are in the North and East Metro (Ramsey, Washington, southern tier of Anoka Counties), the Straight River area near Park Rapids (in Hubbard County), and what's known as the Bonanza Valley, north of Willmar (parts of Stearns, Kandiyohi, Pope Counties). These areas are serving as pilot projects, so the DNR can work with interested parties to more effectively address groundwater management.

Each area kicked off its effort with a public meeting to allow stakeholders to learn about factors driving the growing concerns over groundwater and how the planning process will work. Common to all three areas is a significant increase in groundwater use. In the heavily farmed Bonanza Valley, for instance, groundwater use has increased 175 percent over the past 25 years – compared with a 35 percent average statewide increase. Such increases may not be sustainable.

To provide focused input on the planning process, the DNR has assembled a project advisory team in each of the three areas. In addition to DNR staff and other technical experts from government agencies, the teams will include major stakeholders, such as municipal officials, farmers, well drillers, and business interests. The teams will meet monthly, with all meetings open to the public. By the end of February, each of the advisory teams will have begun their work. One of their first tasks is to review the delineation of a working boundary for the groundwater management area.

The planning process for the groundwater management areas will use the goal, objectives, and strategies laid out in the draft strategic plan for groundwater management that the DNR released last

October. Groundwater management area plans will identify what DNR will do to implement those strategies in each of the areas.

Objectives in the statewide plan that will become the objectives for each area plan are:

- ◆ All aquifers are within sustainability thresholds for water levels.
- ◆ All appropriators of groundwater have the required permits.
- ◆ All permitted groundwater users employ water conservation practices.
- ◆ All aquifers are without water use conflicts and well interferences.
- ◆ Permitted groundwater appropriations do not adversely impact trout streams, calcareous fens, other groundwater-dependent surface water features, or other groundwater-dependent biological communities.
- ◆ Permitted groundwater appropriations do not adversely impact water quality.

Work on the three groundwater management area plans will continue over the course of this year, with draft plans for review and feedback expected to be available this fall.

For more information, or to get regular updates on the groundwater management area plans, visit the DNR website at <http://www.dnr.state.mn.us/gwmp/areas.html>.

Public Meetings Held on PolyMet's Proposed Mine

By Ralph Pribble and Sharon Kroening, MPCA

Three public meetings were held by the Minnesota Department of Natural Resources, U.S. Forest Service, and U.S. Army Corps of Engineers on the PolyMet Mining's proposed copper-nickel mine. The first meeting was held in Duluth on January 16, 2014. The other two meetings were held in Aurora on January 22, 2014 and in St. Paul on January 28, 2014. These meetings were designed for the public to learn more about the environmental effects of the proposed PolyMet, Inc., NorthMet mine project near Hoyt Lakes and Babbitt and to provide comments on the Supplemental Draft Environmental Impact Statement (SDEDIS).

More information about the NorthMet project is available on the Minnesota Department of Natural Resource's website at www.dnr.state.mn.us/input/environmentalreview/polymet/index.html.



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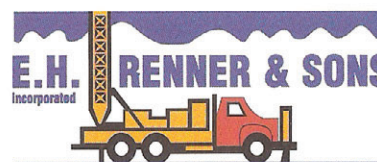
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White Paper Initiative - Update

The White Paper Committee has been spending February reviewing the many topics submitted by MGWA members and are working with the MGWA Board in the selecting and scheduling of topics to be undertaken later this year. It is our intention to announce our first topic for a White Paper at the Spring Conference, along with an invitation for MGWA members to participate on the topic's Work Group. More information will be provided at that time about the scope of the topic and work group processes.

Information will continue to be added to the White Paper Initiative portion of the MGWA website (<http://www.mgwa.org/white-papers.php>), which we invite you to peruse. We want to thank those MGWA members who submitted topics and look forward to engaging with the membership for the creation of our first Work Group!

White Paper Committee (Kelton Barr, Mark Collins, Bruce Olsen, Jeff Stoner)



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USGS Report published: Land-Cover Effects on the Fate and Transport of Surface-Applied Antibiotics and 17-beta-Estradiol through Sandy Soils

By Jared J. Trost¹

¹U.S. Geological Survey, Mounds View, Minnesota

Full report citation:

Trost, J.J., Kiesling, R.L., Erickson, M.L., Rose, P.J., and Elliott, S.M., 2013, *Land-cover effects on the fate and transport of surface-applied antibiotics and 17-beta-estradiol on a sandy outwash plain, Anoka County, Minnesota, 2008–09: U.S. Geological Survey Scientific Investigations Report 2013–5202, 51 p., <http://pubs.usgs.gov/sir/2013/5202/>.*

Abstract

A plot-scale field experiment on a sandy outwash plain in Anoka County in east-central Minnesota was used to investigate the fate and transport of two antibiotics, sulfamethazine (SMZ) and sulfamethoxazole (SMX), and a hormone, 17-beta-estradiol (17BE), in four land-cover types: bare soil, corn, hay, and prairie. Little to no SMZ, SMX, or 17BE was observed in perennial (prairie, hay) or annual (corn) aboveground plant tissues even though the antibiotics, SMZ and SMX, persisted in the soil for at least 8 weeks after application. These observations indicate that only small amounts of these chemicals might be removed from soil through biomass harvesting, regardless of perennial or annual land cover. Detections of SMZ in soil water and groundwater beneath perennial and annual land-cover types on sandy soils highlight the mobility and persistence of this chemical in the environment. This study only focused on the parent chemicals; further research is needed to understand the degradation and transformations of these chemicals within plant tissues, soils, soil water, and groundwater. The methods used in this study were not designed to detect such altered compounds.

Introduction

Chemicals of emerging concern are a broad class of anthropogenic or naturally occurring organic compounds present in the environment but usually are not routinely monitored and do not have regulatory limits. Examples of these chemicals include antibiotics and other pharmaceuticals, hormones, personal-care products, fire retardants, pesticides, and detergents (Kolpin and Furlong, 2002). Modern row-crop methods of food and energy production can release chemicals of emerging concern as to the environment (Boxall and others, 2003). Spreading liquid manure from animal feedlots on agricultural fields is a common practice for disposing of animal manure. Runoff water and water leaching from agricultural fields and manure stockpiles have been determined to contain antibiotics (Kay and others, 2005; Dolliver and Gupta, 2008a, 2008b). Veterinary pharmaceutical chemicals have been detected in manure (Tolls, 2001; DeLiguoro and others, 2003), soils (Tolls, 2001; Thiele-Bruhn, 2003; Kay and others, 2004), surface waters (Kolpin and Furlong, 2002), and groundwater (Hamscher and others, 2005). Human-use antibiotics also reach the environment. For example, near Helena, Montana, an area with a growing number of

septic tank and drainfield systems, the antibiotic sulfamethoxazole (SMX) was detected in 80 percent of groundwater samples (Miller and Meek, 2006).

One strategy to reduce the prevalence of some contaminants of emerging concern beyond their sources is to intersect agricultural or human waste streams with perennial bioenergy crops, such as prairie. Prairies comprising diverse mixtures of grasses, forbs, shrubs, and legumes possess properties that have been determined to provide beneficial water-quality improvements (Dijkstra and others, 2007) and a source of sustainable energy (Tilman, Hill, and Lehman, 2006). Prairies are more effective than row crops at reducing overland flow and downward flux of water through soils to groundwater, allowing for the interception of nutrients, pesticides, and other chemicals (Randall and others, 1997; Brye and others, 2000; Weber and others, 2001; Tilman, Hill, and Lehman, 2006; Dijkstra and others, 2007).

Few studies have focused on the ability of plants to take up antibiotics (Boxall and others, 2006). Prairie systems have the potential for substantially greater chemical uptake than annually harvested row crops because most of the biomass of a prairie is below ground (Fornara and Tilman, 2008) and prairie plants actively take up water throughout the entire growing season (Brye and others, 2000; Trost, 2010). Prairies also affect soil properties,

— continued on page 9

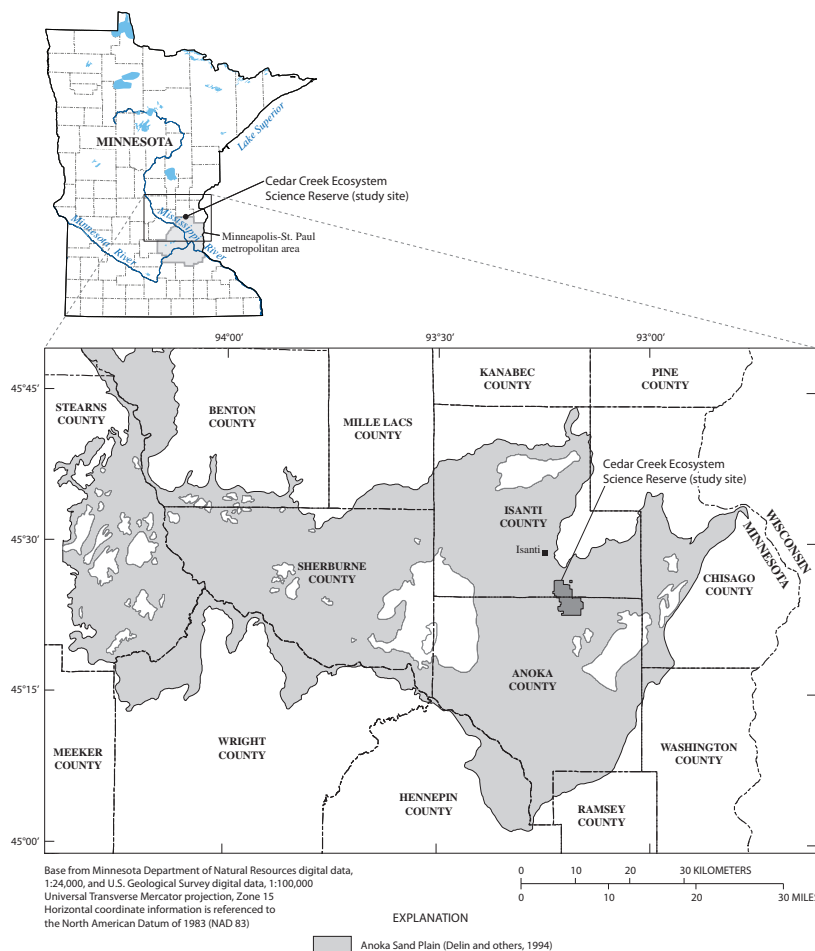
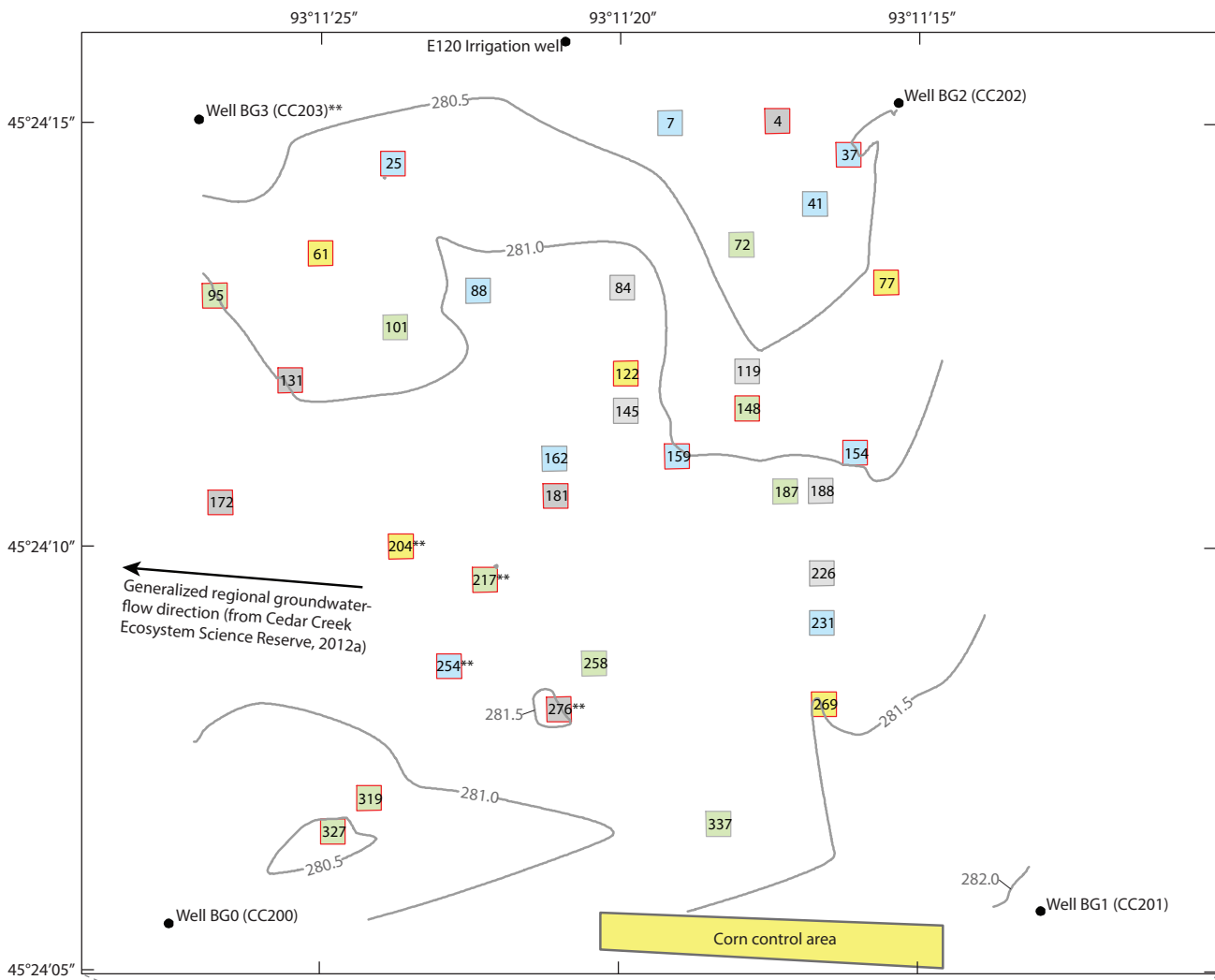


Figure 1. Location of Cedar Creek Ecosystem Science Reserve (CCESR) in east-central Minnesota and the approximate extent of the Anoka Sand Plain.



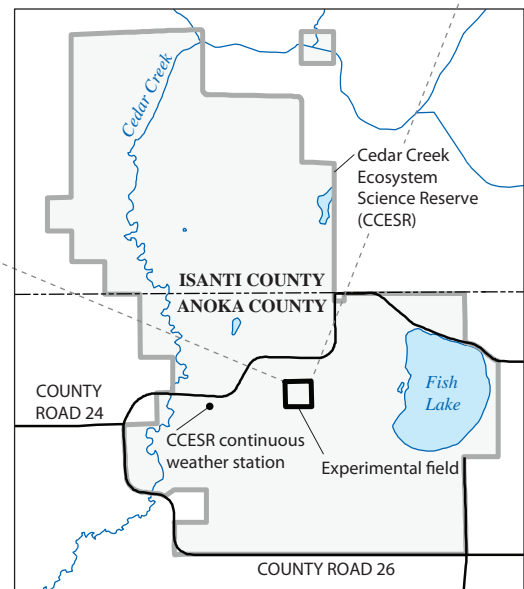
Base from Minnesota Department of Natural Resources digital data, 1:24,000, and U.S. Geological Survey digital data, 1:100,000
 Universal Transverse Mercator projection, Zone 15
 Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83)

EXPLANATION

—280.5— Land-surface contour, in meters above National Geodetic Vertical Datum of 1929. Contour interval 0.5 meter

Plot with number

- 226 Bare soil control (BC)
- 276 Bare soil treatment (BT)
- Corn control (CC)
- 269 Corn treatment (CT)
- 231 Hay control (HC)
- 254 Hay treatment (HT)
- 337 Prairie control (PC)
- 327 Prairie treatment (PT)
- ** Indicates continuous data collection site



0 1 2 KILOMETERS
 0 1 2 MILES

Figure 2. Layout of experimental field, land-surface topography, and regional groundwater-flow direction at Cedar Creek Ecosystem Science Reserve in east-central Minnesota.

Land Cover Effects on Fate and Transport of Antibiotics and 17-beta-Estradiol through Sandy Soils, cont.

including soil carbon content (Tilman, Hill, and Lehman, 2006; Fornara and Tilman, 2008), which is important in controlling the sorption of these chemicals on solids (Lai and others, 2000; Kummerer, 2004). Process-based studies on the movement and persistence of antibiotics and other chemicals of emerging concern through different land-cover types are necessary to determine the fate of these chemicals in the environment.

The U.S. Geological Survey (USGS), in cooperation with the College of Biological Sciences of the University of Minnesota and the Legislative-Citizen Commission on Minnesota Resources, completed a plot-scale field experiment on a sandy outwash plain in Anoka County in east-central Minnesota (fig. 1) to determine the effects of land-cover type on the fate and transport of surface-applied sulfamethazine (SMZ), sulfamethoxazole (SMX), and 17-beta-estradiol (17BE) in four land-cover types: bare soil, corn, hay, and prairie.

Description of Study Area

This study was done at the Cedar Creek Ecosystem Science Reserve (CCESR), a University of Minnesota research station in Anoka and Isanti Counties, Minnesota (figs. 1 and 2). The CCESR is situated on the eastern one-third of the Anoka Sand Plain (fig. 1), a nutrient-poor sandy glacial outwash plain (Typic Udipsamment soil) (Grigal and others, 1974). The surficial sediments at CCESR predominantly are very fine to fine sand with distinct textural variations evident in the subsurface (Grigal and others, 1974). A 35-plot subset of several hundred research plots originally planted in 1994 with varying levels of biodiversity (Cedar Creek Ecosystem Science Reserve, 2012b; Tilman, Reich, and Knops, 2006) was used in this field experiment (figs. 2 and 3).

Methods of Study

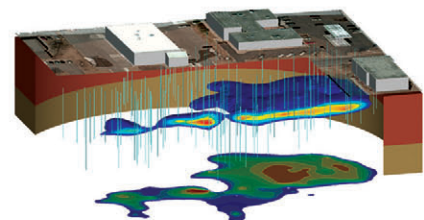
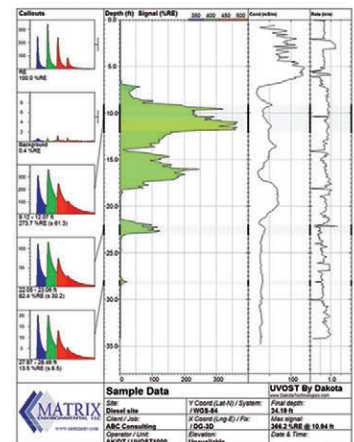
The experimental design included 35 plots [11 meters (m) by 11 m] with land-cover types of nonvegetative bare soil, corn, hay, or prairie. Five “treatment” plots of each land-cover type (20 plots total) received applications of SMZ, SMX, and 17BE (figs. 2 and 4). A solution containing SMZ, SMX, 17BE, and two conservative tracers, bromide and rhodamine WT, was applied to the 20 treatment plots in May 2008. A solution containing only SMZ, SMX, and 17BE was applied to the same 20 treatment plots in April 2009. In 2008, SMZ and SMX were applied at a rate of 5.6 milligrams per square meter (mg/m²), and 17BE was applied at a rate of 0.2 mg/m². In 2009, SMZ and SMX were applied at a rate of 11.2 mg/m², and 17BE was applied at a rate of 0.4 mg/m². Background levels of these chemicals in plant tissues, soil, soil water, and groundwater were determined in samples collected from bare soil, hay, and prairie control plots (15 plots total) that did not receive any chemical applications. Background levels of these chemicals in corn plants were determined in samples collected from a single large stand of corn that did not receive additions of these chemicals.

Concentrations of SMZ, SMX, and 17BE were measured with enzyme-linked immunosorbent assay (ELISA) kits in plant-tissue, soil [0–10 centimeters (cm)], soil-water [100 or 160 cm below land surface], and groundwater [200 to 400 cm below land surface] samples (fig.4). These samples were collected between October 2008 and October 2009 and used to compare the fate and transport of these chemicals through land-cover types of bare soil and three potential biofuel cropping systems: corn, hay, and prairie. ELISA kits have been used to determine concentrations of antibiotics in plants, soils, water, and manure in a number of — continued on page 10



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Land Cover Effects on Fate and Transport of Antibiotics and 17-beta-Estradiol through Sandy Soils, cont.

studies (Aga and others, 2003; Kumar and others, 2004; Dolliver, Gupta, and Noll, 2008; Dolliver, Kumar, and others, 2008; Dolliver and Gupta, 2008a, 2008b).

Quality Assurance

A quality-assurance plan was implemented in support of quantitation with the ELISA kits. Multiple check standards, blanks, and spikes were analyzed with each individual ELISA kit to assess the accuracy and precision of SMZ, SMX, and 17BE quantification within and between kits. A minimum reporting level (MRL) for each ELISA kit was assigned according to a protocol that minimized false positive detections. The antibiotic SMZ was detected at concentrations greater than the MRL in 2 of 26 deionized water and in none of 39 organic-free laboratory and field blanks. The antibiotic SMX was not detected at concentrations greater than the MRL in any field or laboratory blanks of deionized water (42 samples) or organic-free blank water (40 samples). The hormone 17BE was detected at concentrations greater than the MRL in 1 of 25 laboratory deionized water blanks and in 2 of 33 organic-free field blanks. Plant-tissue and soil-extract samples were analyzed as spiked-unspiked pairs to assess the recovery of each chemical through the processes of extraction and ELISA analysis. The recovery of SMZ, SMX, and 17BE in spiked samples through the extraction procedure generally was higher in soil samples compared to plant-tissue samples.

Land-Cover Effects on the Fate and Transport of Sulfamethazine, Sulfamethoxazole, and 17-beta-Estradiol

The areal concentrations of SMZ, SMX, and 17BE, in milligrams per square meter (mg/m^2), were compared among the land-cover treatments. Prairie plots tended to have the highest areal concen-



Figure 3. Experimental field plots at Cedar Creek Ecosystem Science Reserve, Anoka County, Minnesota, June 1997. Photograph by G. David Tilman.

trations of SMZ and SMX in the upper 10 cm of soil immediately following application. Areal concentrations of SMZ in the upper 10 cm of soil decreased in all 5 replicate prairie treatment plots and SMX concentrations decreased in 4 of 5 replicate prairie treatment plots during 8 weeks from April 2009 to June 2009. During these same 8 weeks, prairie plots had produced more aboveground biomass and had extracted more water from the upper 125 cm of the soil profile compared to all other land-cover types (Troost, 2010). A consistent increasing or decreasing pattern was not observed across the replicate plots of the other land-
— continued on page 11

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Land Cover Effects on Fate and Transport of Antibiotics and 17-beta-Estradiol through Sandy Soils, cont.

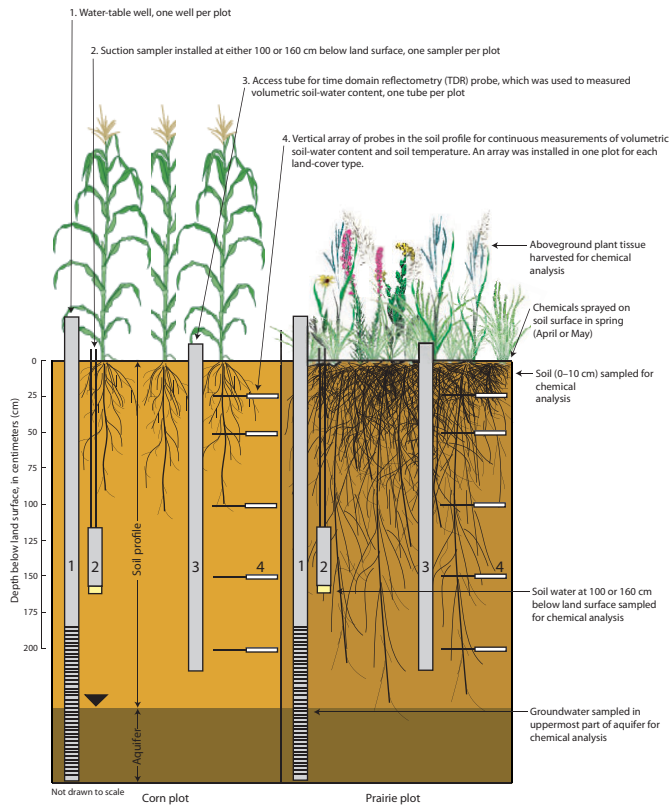


Figure 4. Cross-section diagram of sampling locations within the soil profile and field instrumentation used for measuring soil-water content, soil temperature, groundwater levels, and soil-water and groundwater quality.

cover types. The high root biomass in prairie plots may have contributed to the collection of soil samples in April 2009 and June 2009, which were more representative of the entire soil profile (0–10 cm) compared to soil samples collected from the other land-cover types. This issue of sample “representativeness” may explain the low initial SMZ and SMX soil concentrations and small concentration changes between April 2009 and June 2009 in bare soil, corn, and hay plots.

Areal concentrations of SMZ and SMX in prairie plant tissue did not explain the temporal changes in areal concentrations in soil of these chemicals. The areal concentrations of SMZ and SMX in the aboveground plant tissues in June 2009 and August 2009 were much lower, generally two to three orders of magnitude, than the areal concentrations of these chemicals in soil (fig. 5). Pooling all treatment plot data, the median areal concentration of SMZ and SMX in plant tissues was 0.01 and 0.10 percent of the applied chemical mass compared to 22 and 12 percent in soil, respectively. Furthermore, areal concentrations of SMZ and SMX in plant-tissue samples were variable, and did not differ significantly between control and treatment plots within each land-cover type.

Soil-water and groundwater samples collected periodically between October 2008 and October 2009 indicated that SMZ leached below the rooting zone to groundwater in all four land-cover types, whereas SMX rarely was detected in water in measurable quantities at those depths. The antibiotic SMZ was detected in 23 percent of soil-water samples and in 16 percent of groundwater samples collected from treatment plots. SMZ was detected most frequently in soil water beneath hay plots, followed

water from a hay plot. The chemical SMX was detected in only 1 percent of soil-water and groundwater samples collected from treatment plots.

In contrast to SMZ and SMX, 17BE was not detected reliably in soil samples. ELISA-determined 17BE concentrations in plant-tissue, soil-water, and groundwater samples indicated the presence of chemicals that were not applied as part of this experiment [17BE from an external source or other chemical(s) that interfered with the 17BE ELISA kits (fig. 5)].

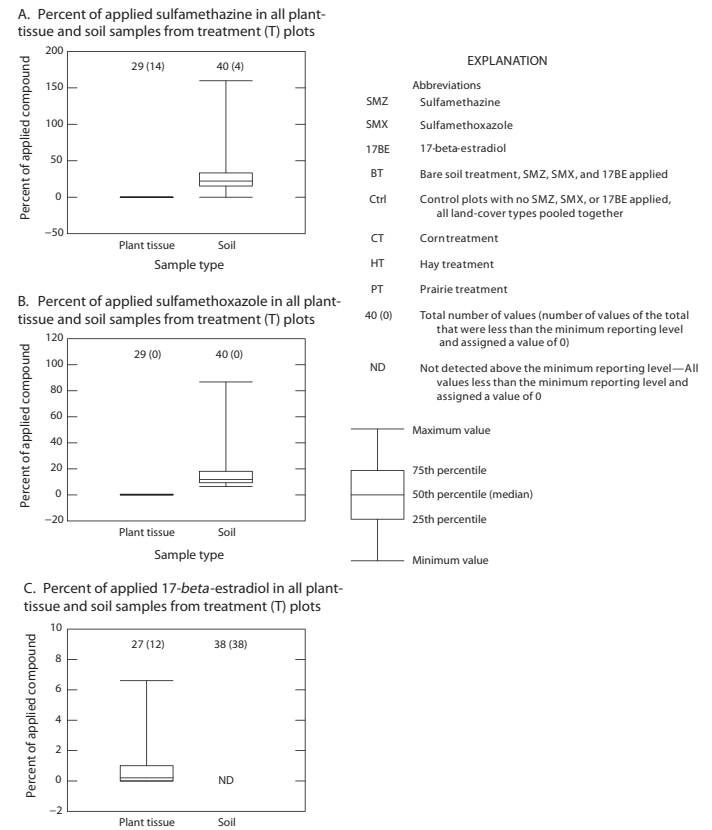


Figure 5. Boxplots of areal concentrations, as a percentage of the applied chemical, measured in treatment plots in the upper 10 centimeters of soil in April 2009 and June 2009 and in aboveground plant-tissue and soil samples in June 2009 and August 2009 for A, sulfamethazine (SMZ); B, sulfamethoxazole (SMX); and C, 17-beta-estradiol (17BE).

— continued on page 12



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Implications

The data collected during this plot-scale experiment provide information about the fate and transport of three compounds, SMZ, SMX, and 17BE, applied on the land surface. Little to no SMZ, SMX, or 17BE was observed in perennial (prairie, hay) or annual (corn) aboveground plant tissues even though the antibiotics, SMZ and SMX, persisted in the soil for at least 8 weeks after application. These observations indicate that only small amounts (less than 1 percent of the applied mass) of these chemicals might be removed from soil through biomass harvesting, regardless of perennial or annual land cover. Detections of SMZ in soil water and groundwater beneath perennial and annual land-cover types on sandy soils highlight the mobility and persistence of this chemical in the environment. Because SMZ was not taken up by plants in substantial quantities and was transported to groundwater in both perennial and annual land-cover types, a different strategy (other than changing vegetation from corn to prairie) might be more effective at preventing SMZ from reaching groundwater.

Quality-assurance data from chemical analysis with ELISA kits indicate that SMZ and SMX can be detected and quantified in soil, plant-tissue, and water samples if the chemicals are present at concentrations greater than a kit's minimum reporting level. With a properly designed quality-assurance plan, SMZ and SMX ELISA kits are a useful method for quantifying concentrations of these chemicals in environmental samples. Concentration data from the 17BE ELISA kits were less reliable than the SMZ and SMX kits and indicate that cross-reactivity with other chemicals in environmental samples hindered interpretation of results. A more robust analytical method is necessary for determining 17BE concentrations in environmental samples.

This study only focused on the parent chemicals; further research is needed to understand the degradation and transformations of these chemicals within plant tissues, soils, soil water, and groundwater. The methods used in this study were not designed to detect such altered compounds.

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LINKS OF INTEREST

MPR Series on Groundwater

By Dave Peters, MN Public Radio

Minnesota Public Radio (MPR) News' Ground Level project will be spending several months looking at groundwater issues in Minnesota. The project started on Wednesday, January 8, with a look at the issues surrounding the MDNR's groundwater management area in the north and east metro area. MPR News has created a collection page online for the reporting it produces and other background material on groundwater. Editors there are also looking for broad input from Minnesotans with knowledge or interest who can help shape a conversation on the topic, and the page includes a link for you to make contributions. You can find the material collected here: <http://minnesota.publicradio.org/projects/2014/01/ground-level-beneath-the-surface/>

State of Water Conference Notice

By Andrew Streitz, MPCA

A conference entitled, "The State of Water- Minnesotans Protecting our Lakes and Rivers", will be held May 1 & 2, 2014 in the Brainerd area. This conference brings together the organizations that protect our water resources along with those who use them to learn about and discuss the issues facing Minnesota's waters. Topics include aquatic invasive species, restoring aquatic habitat, watershed investigations, groundwater/surface water interaction, and groundwater management. Speakers include MPCA Commissioner John Linc Stine, DNR Assistant Commissioner Barb Naramore, BWSR Executive Director John Jaschke, and aquatic biologist Darby Nelson. Hosts for the conference are the Freshwater Society, Conservation Minnesota, University of Minnesota Extension, the MN Pollution Control Agency, the Department of Natural Resources, and the Midwest Glacial Lakes Partnership. More information at the link: www.conservationminnesota.org/state-of-water-conference/

USGS study on Land Subsidence in the San Joaquin Valley, CA

By Eric Tollefsrud, Geosyntec

The USGS recently completed a study of the effects of groundwater withdrawal and resulting aquifer compaction and land subsidence in the San Joaquin Valley, California. Below are links to an article published in The Fresno Bee and the Scientific Investigations Report by the USGS.

www.fresnobee.com/2013/11/21/3624593/usgs-over-pumping-of-valley-ground.html

<http://pubs.er.usgs.gov/publication/sir20135142>

Greg Brick on Assignment

By Greg Brick

Greg freelanced some karst-related travel writing to the Pioneer Press, which were then syndicated to several big East Coast newspapers.

www.twincities.com/travel/ci_25289844/escape-from-bubble-jamaicas-all-inclusive-resorts-and

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Metro Model 3 Update

By Lanya Ross, Metropolitan Council

What is Metro Model 2?

In 2007 the Metropolitan Council contracted with Barr Engineering Co. to develop and calibrate a regional groundwater flow model of the seven-county Twin Cities metro area to assist the Council with regional water-supply planning. This model used many of the datasets that were developed as part of a MPCA analytic element groundwater model for the region, commonly referred to as the “Metro Model”.

The Council’s “Metro Model 2” incorporated much of MPCA’s work as well as additional information. Metro Model 2 was designed to address a broad range of regional planning questions and to be as flexible as practical in order to accommodate new questions or scenarios. Some questions the model was intended to address include:

- ◆ Given projected water demands, what impacts may be expected on groundwater levels and groundwater-dependent surface-water features?
- ◆ What combinations of source aquifers, well locations, and withdrawal rates can be used to achieve sustainable water consumption?

The use of the Metro Model 2 has been a fundamental part of the Council’s legislatively mandated water-supply planning efforts, and it is key to the Metropolitan Area Master Water Supply Plan.

Why update the model to Metro Model 3?

While Metro Model 2 provides a quantitative tool for the Council’s regional water-supply planning work, certain model limitations limit its ability to answer new water supply questions about surface water impacts and the seasonal (transient) impacts of groundwater withdrawals.

Metro Model 2 uses the modeling code MODFLOW-96 which is considered a legacy code and is no longer supported by the U.S. Geological Survey. Also, numerous hydrogeological studies have been completed for the Twin Cities metro area since the construction of the Metro Model 2.1, much of it accelerated by the passage of the 2008 Clean Water, Land and Legacy Amendment to the Minnesota Constitution. Data from these studies have refined our understanding of the extent and properties of aquifers in the metro area and have provided data that can be used to help reduce uncertainty in model predictions.

What does the update include?

To achieve the Council’s legislative mandate to maintain a base of technical information necessary for sound water-supply decisions, the Metro Model 2 needed to be updated to include newly acquired information. The update expands the model domain to include the eleven-county metropolitan area, in order to consider the effects of growth in counties beyond the seven-county metro. Finally, the update adds transient capability to model predictions.

Update of the Metro Model is occurring in three phases:

- ◆ Phase 1: Update Soil Water Balance (SWB) model used to estimate infiltration & recharge (DONE)
- ◆ Phase 2: Update conceptual groundwater model (DONE)
- ◆ Phase 3. Calibrate model groundwater model

Update of the model includes:

- ◆ Expansion of the model domain from the seven-county metropolitan area to the eleven counties within and surrounding the Twin Cities area;
- ◆ Addition of transient simulation capabilities in which temporal variations in aquifer stresses (e.g., pumping rates) and changes in aquifer storage are accounted for;
- ◆ Inclusion of new geologic mapping information;
- ◆ Inclusion of up-to-date pumping data (i.e., data through 2011);
- ◆ Consideration of new groundwater-level information;
- ◆ Inclusion of additional rivers in the new model domain, and minor revision of some rivers in the Metro Model 2.1 model domain;
- ◆ Revisions to model boundary conditions resulting from expansion of the model domain;
- ◆ Revisions to hydrostratigraphic units in model layers;
- ◆ A new approach to defining aquifer properties in model cells representing Quaternary deposits;
- ◆ A new approach to capturing the effect of secondary porosity/permeability features near the bedrock contact with overlying Quaternary deposits;
- ◆ Inclusion of confining characteristics of some hydrostratigraphic units;
- ◆ A new approach for distinguishing the difference between infiltration of water below the root zone and groundwater recharge at the water table; and
- ◆ Use of the newly released MODFLOW-NWT instead of MODFLOW-96, which, among other attributes, provides for a much more stable and reproducible means of accounting for changes in saturated-unsaturated conditions.

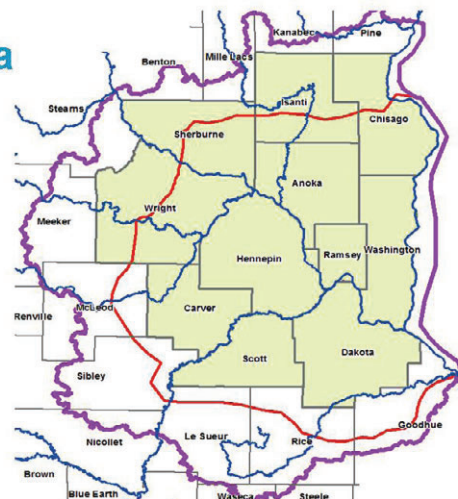
When will the update be complete?

The project schedule was designed to support metropolitan area communities as they begin their next round of local comprehensive planning, including water-supply planning, expected to begin in 2015.

— continued on page 15

Model Area

Red = Metro Model 2
Purple = Metro Model 3



Domain of the Metropolitan Council’s Metro Groundwater Model, version 3.

Metro Model 3 Update, cont.

The model calibration is currently being reviewed internally by Metropolitan Council staff. When that process is complete, the final draft model, model report, and user manual will be provided to the technical advisory committee for review. After addressing any issues raised by that group, the update model and supporting will be published on the Council's website.

The project is planned to be complete before June 30, 2014.

Who is on the project team?

The project is currently being managed by Metropolitan Council's Lanya Ross and Barr Engineering Co.'s Evan Christianson and Ray Wuolo. Tim Brown, formerly of Barr Engineering Co., managed the update of the Soil Water Balance (SWB) model.

Many others have contributed their time and expertise to the project, including several MGWA members who have attended technical advisory committee meetings and provided ad hoc input.

Where to get information:

The Soil Water Balance (SWB) model used to estimate recharge for the updated Metro Model is available on the Metropolitan Council's Metro Model 2 web page. A Google search for "Metropolitan Council SWB" will bring up the report.

For more information about the project or about technical advisory committee meetings, please contact Lanya Ross at (651) 602-1803 or Lanya.Ross@metc.state.mn.us.

Geologic Controls on Groundwater and Surface Water Flow in Southeastern Minnesota and Its Impact on Nitrate Concentrations in Streams

Anthony C. Runkel, Julia R. Steenberg, Robert G. Tipping, Andrew J. Retzler: Minnesota Geological Survey, 2642 University Avenue West, St Paul, Minnesota 55114, runke001@umn.edu

The Minnesota Geological Survey (MGS) recently concluded an investigation conducted for the Minnesota Pollution Control Agency (MPCA) designed to support watershed planning efforts in Southeast Minnesota. Specifically, it provided a better understanding of the geologic controls on nitrate transport in the region, including nitrate in groundwater that is the source of baseflow to streams. Nitrate contamination of surface water and groundwater is a long-standing issue in Southeastern Minnesota. We focused much of our investigation on an evaluation of nitrate (NO₃ ion) transport in the Root River watershed because of the relatively advanced understanding of the karstic conditions in that area. However, the overall scope of the project included the entire bedrock-dominated landscape of Southeast Minnesota. Our results therefore support a broader MPCA watershed planning effort that directly pertains to the Root River, as well as to other watersheds within the Lower Mississippi River Basin in Minnesota.

Our tasks included two approaches defined by scale. One was at the regional scale and included a compilation of geologic maps and databases relevant to nitrate transport for all of the bedrock

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Geologic Controls on Nitrate Concentrations in Streams, cont.

dominated landscape of Southeastern Minnesota. The database of nitrate concentrations included about 15,000 values for surface water (stream baseflow) and groundwater (springs and water wells) samples that were collected mostly since the mid-1980s. These nitrate data were evaluated in the context of the hydrogeologic attributes of the bedrock and surficial deposits depicted on the maps, focusing on hydrogeologic controls that accounted for the variability in concentrations that do not appear to be adequately explained by land use alone (Watkins *et al.*, 2011). Specific areas that best exemplified geologic controls on nitrate transport are portrayed in a large number of cross sectional views to support interpretations of how geologic setting impacts nitrate concentration in streams and groundwater (*e.g.*, Fig. 1). The results of the regional scale investigation are summarized in an MGS Open File Report (Runkel *et al.*, 2014).

The second approach, at a local scale, focused on a relatively small part of the Root River watershed where we conducted new mapping that provides a more detailed depiction of the geologic conditions in a three-dimensional electronic format suitable for groundwater-surface water modeling. In addition, we used existing maps and reports along with new field data collected during the course of this project to improve the hydrostratigraphic characterization of the bedrock. Cross sections within and near the local project area are used to demonstrate how nitrate transport occurs in the ground and surface water system. These results are also summarized in an MGS Open File Report (Steenberg *et al.*, 2014).

Our evaluation of the hydrogeologic system and geologic controls on the transport of nitrate in the bedrock dominated landscape of southeastern Minnesota concluded that:

- ◆ Nitrate is transported in a groundwater-surface water system that is fracture dominated, with the largest volumes of water travelling rapidly through a complex system of conduit networks.
- ◆ Aquitards between the major aquifers resulted in an anisotropic groundwater system, limiting the volume and velocity of vertical flow and promoting rapid lateral flow that discharges as baseflow to streams
- ◆ Groundwater in uppermost bedrock units, especially on the karstic plateaus that dominate the landscape of southeastern Minnesota, was typically nitrate-enriched, with concentrations commonly between 5-15 ppm.
- ◆ Nitrate concentration diminished across aquitards, typically in a stratified manner that correlated with groundwater age, reflecting the anisotropy caused by aquitards.
- ◆ The most important factor we have identified that impacts both the magnitude and variability of nitrate concentration in spring water and stream baseflow was the proportion of regionally sourced, nitrate-poor water contributed from deep aquifers relative

to more locally sourced, nitrate-enriched water from shallower aquifers.

- ◆ The relative proportion of these contributions to stream baseflow can commonly be correlated with the hydrogeologic setting.

The relationship between hydrogeologic setting and baseflow nitrate concentrations is exemplified in the upper part of the Whitewater River watershed in Southeastern Minnesota (Figs 1 and 2), where the degree of dilution from the introduction of

— Continued on page 18

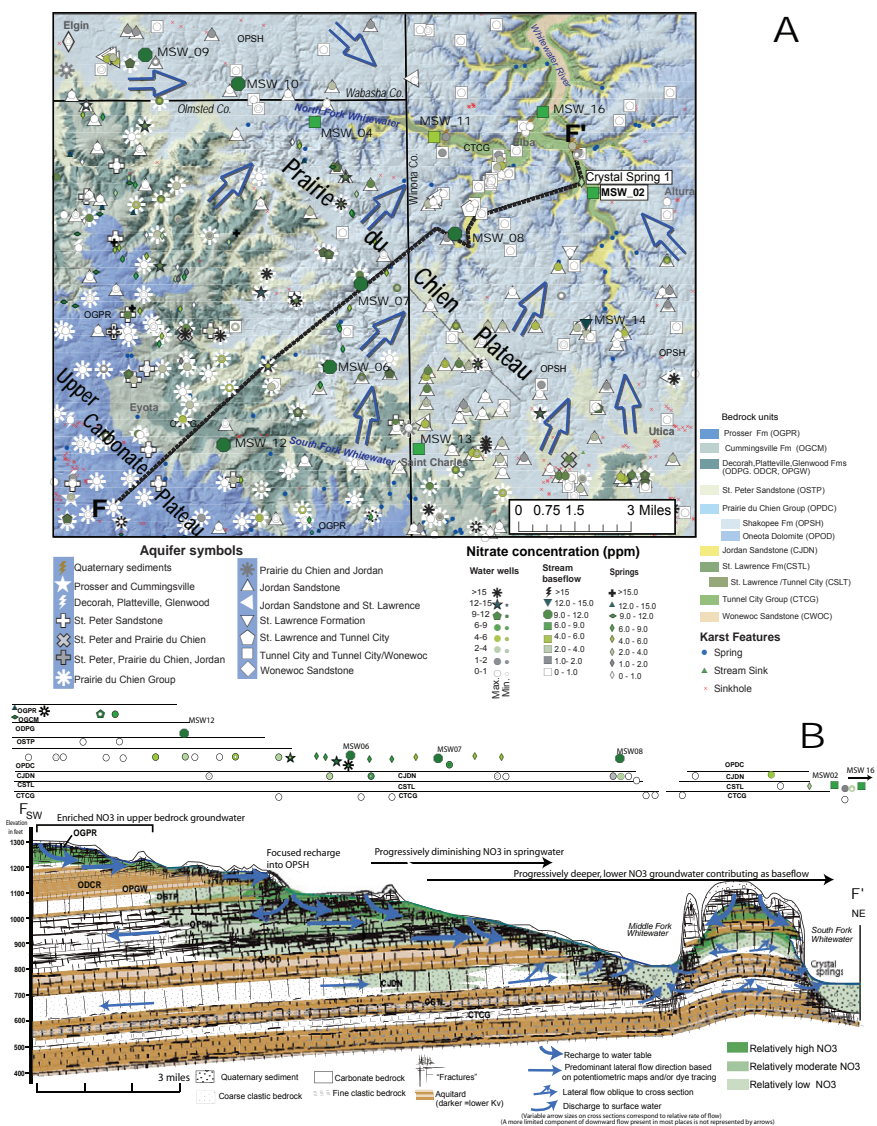


Figure 1. Bedrock geologic map (A) and cross section (B) showing ground and surface water nitrate concentrations in hydrogeologic context from outer edge of Upper Carbonate Plateau (southwest), across escarpment, to the Prairie du Chien Plateau (northeast). Eastern Olmsted, western Winona, and southern Wabasha Counties. Unconsolidated sediment on top of bedrock, not shown on map, is generally less than 50 ft thick in this area, except in deeper stream valleys. Blue arrows on map depict bulk dominant flow directions for combined St Peter, Prairie du Chien and Jordan aquifers.

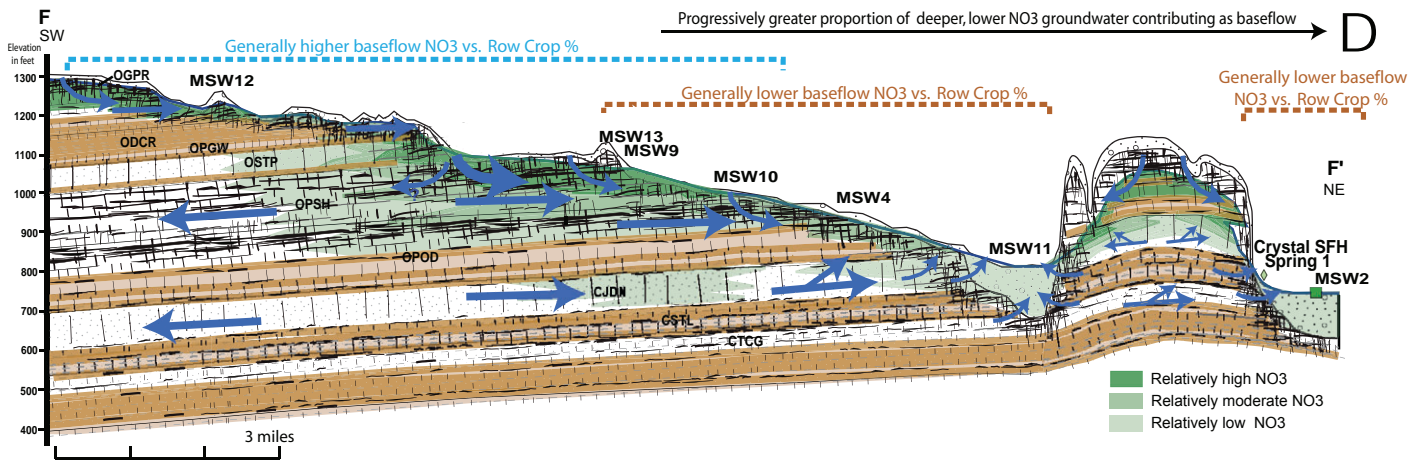
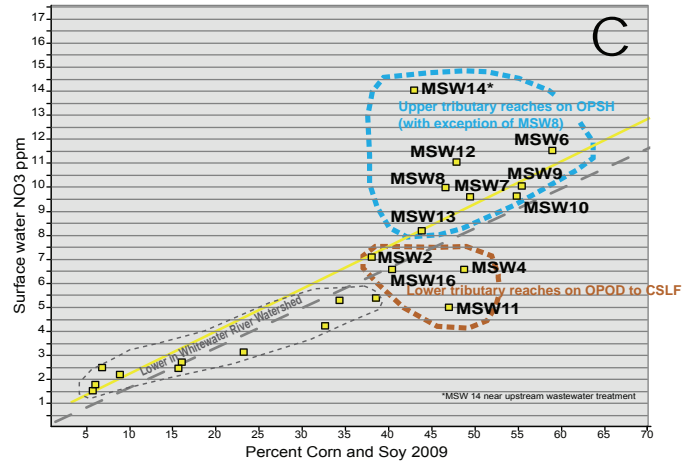
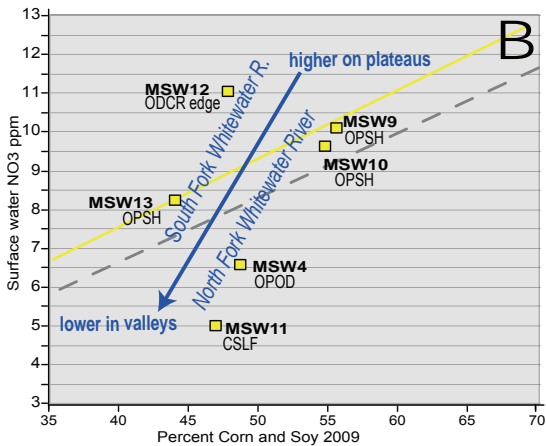
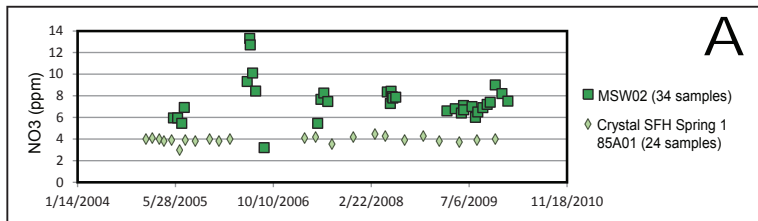


Figure 2. Evaluation of variability in stream baseflow nitrate concentrations in the upper part of the Whitewater River watershed. **A)** Comparison of stream baseflow nitrate concentration to nearby spring water nitrate concentration downstream. Measured over the same approximately five year period, the water from Crystal Springs Fish Hatchery Spring 1, with one exception, has a lower nitrate concentration than the nearby upstream surface water. Springs emanating from the lower parts of incised valleys, such as this one sourced through the St Lawrence Formation, commonly dilute the nitrate concentration of streams. **B)** Variability in stream water nitrate concentration relative to row crop production along two stream reaches in the upper part of the Whitewater River watershed. The downstream decrease in surface water nitrate concentration relative to row crop production along the North and South Forks of the Whitewater River likely reflect, at least in part, dilution via baseflow derived from progressively deeper groundwater. **C)** Variability in stream water nitrate concentration relative to row crop production, compared against hydrogeologic setting for all sampling sites in the upper part of the Whitewater River watershed. Relatively high concentrations are mostly (exception is MSW8) from stream samples high on the Prairie du Chien Plateau (OPSH and higher). Relatively low concentrations are samples from stream reaches lower in the plateau or in incised valleys (OPOD and lower). **D)** Cross sectional view showing relationships described above. North and South Forks of Whitewater River sampling sites are projected onto line of section based on landscape position relative to stratigraphy. Stream water baseflow nitrate concentration from Watkins et al. (2011). Plots of stream baseflow nitrate concentration versus 2009 row crop land use in (B) and (C) are modified from Watkins et al. (2011). Solid yellow line on plots is linear fit for all Whitewater watershed sites in Watkins et al. (2011) and dashed straight gray line is fit to combined data from all watersheds in the bedrock dominated landscape of southeastern Minnesota.

Geologic Controls on Nitrate Concentrations in Streams, cont.

relatively nitrate-poor water from deeper parts of the aquifer system is dependent upon location within the Prairie du Chien Plateau and its incised valleys. A site-specific example is along the lower reach of the South Fork of the Whitewater River, Winona County, within the upper part of the Whitewater watershed sampling area (Fig. 2 A, D). Nitrate concentrations from Crystal Springs State Fish Hatchery #1 spring, which emanates from the St. Lawrence Formation, averaged about 4 ppm measured over a five year period from early 2005 to late 2009. This water drains into the South Fork of the Whitewater, which over the same five year period averaged over 7 ppm nitrate at a surface water sampling station (MSW02) only 0.4 miles up the valley from the Hatchery. Water from the Hatchery spring, and likely most other baseflow (springs as well as distributed flow), sourced from the St. Lawrence and deeper stratigraphic levels in the lower part of the valley would serve to dilute the nitrate-enriched stream water derived from groundwater higher in the landscape in the upstream reaches of the South Fork.

A few miles west of the Crystal Springs Fish Hatchery, along the North Fork of the Whitewater River, variability in the correlation between agricultural land use and baseflow nitrate concentrations can be accounted for by varying proportions of dilution. Stream water nitrate concentrations systematically decrease relative to what would be predicted by row crop production in a downstream direction, corresponding to progressively deeper incision into the stratigraphic section (Fig. 2 B, D). The most upstream sampled locations are relatively high on the Prairie du Chien Plateau, on the Shakopee Formation, and the most downstream are located where the valley is incised below the level of the Jordan Sandstone. Progressively greater contribution from more deeply sourced, nitrate-poor groundwater likely accounts for this trend of downstream-decreasing stream water nitrate concentrations relative to row crop production. The upper reaches of the South Fork of the Whitewater River in this area has only two surface water sampling sites, but is analogous to the North Fork in that stream water in the far upper reaches of the tributary has a high nitrate concentration relative to row crop production, compared to the sampling point in the downstream location (Fig. 2 B, D). The upper sampling site is along the Cummingsville-Glenwood escarpment, where stream water may be dominated by nitrate-enriched water discharged from the Galena aquifer on the Upper Carbonate Plateau. The downstream location is on the Shakopee aquifer, which may contribute water with a relatively low nitrate concentration.

A broader-scale evaluation across the upper part of the Whitewater watershed shows some of the same relationships that can be explained through variable degrees of dilution from deeper sources of water with relatively low nitrate concentrations (Fig. 2 C, D). The three sampling locations with lowest nitrate concentrations relative to row crop production (MSW 4, 11, 16) are within relatively deeply incised valleys where the Oneota Dolomite through the St. Lawrence Formation (or Tunnel City Group) are uppermost bedrock. These reaches of tributaries can be expected to have a more significant baseflow contribution from deeper aquifers with nitrate-poor water. The relatively low nitrate concentration of water emanating from springs at the Crystal Springs Hatchery compared to nearby stream water concentrations is a representative example of such dilution in this area. In contrast to these areas where dilution is likely significant, locations with high baseflow nitrate concentrations relative to row crop production are, with one exception (MSW8), positioned farther upstream along tributaries. Baseflow along these

stream reaches is likely dominated by nitrate-enriched water that originated as local recharge into the Galena or Prairie du Chien Groups.

Several other watersheds in the bedrock dominated landscape of Southeastern Minnesota show the same relationships between hydrogeologic setting and baseflow nitrate concentrations. These and other results from our investigation have relevance for both surface and groundwater management efforts to mitigate nitrate loading. One implication is that the response time of nitrate concentrations to changes in land use practices will likely vary in different hydrogeologic settings. The most significantly lagged response in Southeastern Minnesota should be expected in the deep valleys incised into the Prairie du Chien Plateau, where significant baseflow is derived from deep, siliciclastic-dominated bedrock sources with one or more overlying aquitards (Fig 1). The quantity and chemical composition of baseflow in these settings is buffered from changes in anthropogenic and natural conditions at the land surface. In contrast, quicker changes in baseflow nitrate concentrations can be expected in areas where the geologic setting allows only a relatively minimal contribution of regional flow, such as along stream reaches high on karstic plateaus, where baseflow will be dominated by locally derived water with fast-flow pathways that are well connected to the land surface.

The distribution of nitrate in ground and surface water we depict in this report represents the advance of nitrate from the land surface into the ground and aquifer systems over about 60 years. The accuracy of predictions of future water quality will, in part, be dependent on an appreciation of the dynamic nature of the transport system. Particularly important is recognition that contaminants will be transported to progressively deeper aquifers and are likely to increase in concentration with time due to a number of natural and anthropogenic factors. In part this is because the relatively old water that serves to dilute contaminant concentrations is a finite resource that is diminishing with time, through natural discharge and from extraction by well pumping.

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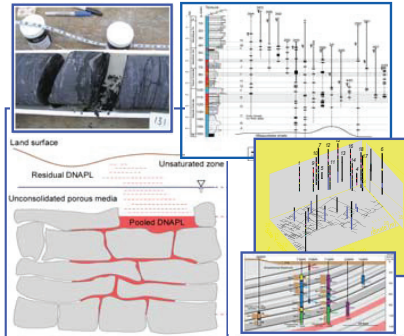
Maureen Muldoon, PhD, PG
University of Wisconsin, Oshkosh

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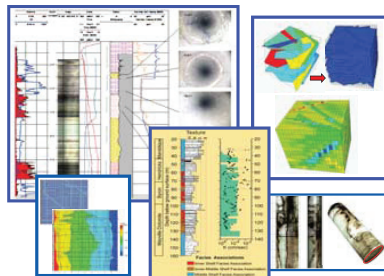
David Hart, PhD, PG
Wisconsin Geological and
Natural History Survey

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*For earlybird registration, payment must be received before March 31, 2014. Cancellations may be made up to June 1st, however 50% of the fee will be charged. No refunds. Maximum number of 40 registrations for this course. Liability waivers from each attendee will be required for this event. Questions? Call Customer Service at 763.607.0092 or email service@midwestgeo.com.

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(thru March 31, 2014)
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PROFESSIONAL INFORMATION

2014 is a License Renewal Year

Here is guidance on continuing education from "The Communicator", the newsletter of the Minnesota Board of Architecture, Engineering, Land Surveying, Landscape Architecture, Geoscience and Interior Design

As the time for license and certificate renewal approaches, it may be a good time to review the requirements spelled out in MN Statute § 326.107 on what constitutes continuing education activity as well as the requirements for supporting documentation.

Continuing education (CE) must consist of learning experiences which enhance and expand the skills, knowledge and abilities of practicing professionals, as well as benefit the health, safety and welfare of the public. CE may involve technical, nontechnical, regulatory, ethical, or business practice topics. The statute goes on to identify multiple CE activities, although not a limiting list of CE activities, which satisfy the professional development requirement. There is a broad range of CE activities that are inexpensive and may be overlooked or not considered when licensees or certificate holders are tallying their Professional Development Hours (PDH) or requesting an exemption for CE, including:

- ◆ Self-sponsored/in-house educational programs;
- ◆ Providing professional service to the public which draws upon the professional expertise of the licensee or certificate holder; and
- ◆ Participation in self-study activities presented by correspondence, internet, video, audio, etc., with a verification process.

Continuing education courses and activities must meet five basic criteria, including:

- ◆ clear purpose and objective of the activity to maintain, improve or develop new and relevant skills and knowledge;
- ◆ content of the activity is well organized and presented in a sequential manner;
- ◆ activity has been pre-planned and includes an opportunity for input by the target group or person attending;
- ◆ activity is presented by a person who is well-qualified by education or experience; and
- ◆ activity and participation is documented for record keeping and reporting.

The board conducts audits of a percentage of its licensees and certificate holders and requires those audited to submit documentation of at least 24 professional development hours of activity over the previous two years. Documentation must include what is required by the statute: a description of the activity, the date held, and the starting and ending times. It is much easier to maintain your records as you participate in continuing education activities than to hunt down the information to report for renewal or in an audit.

It's never too early to begin planning for your next 24 PDHs and make continuing education an ongoing process in your professional practice.

— reprinted from "The Communicator" October 2013

TIPS FOR A SUCCESSFUL CONTINUING EDUCATION AUDIT

The Board conducts random audits for proof of completion of the continuing education requirements. Important information to remember:

- You **MUST** be in compliance with the continuing education requirement **BEFORE** you renew.
- Renewals and continuing education are due by midnight on June 30 of even-numbered years.
- **DON'T** check the box stating you have completed continuing education if you do not have at least 24 hours accumulated.
- You **MUST** have supporting documentation of all of your continuing education activities showing the date and times of attendance.

For more information regarding continuing education, visit the Board's website at www.aelslagid.state.mn.us/conted.html.

2012 AUDIT STATISTICS

Number of Individuals Audited: 348
Percentage of EACH profession: 2%

As a result of the continuing education audit, the Board opened several complaints for reasons such as: lack of response to requests for documentation, lack of documentation and noncompliance with the continuing education requirements.

MGWA Conferences and PDHs

By Jeanette Leete, MGWA Business Manager

MGWA strives to help you meet your CE requirement. When you attend one of our conferences you are provided with the documentation of the Planning Committee's efforts:

- ◆ The conference description is posted online and printed in the conference flyer. Presentation abstracts are provided in your packet and most powerpoints are posted online after the conference.
- ◆ The agenda showing how the information is organized and detailing sequential presentation is in your packet.
- ◆ The biographical information that shows why the chosen presenters are qualified is in your packet.
- ◆ Q & A opportunities are provided at the conference to allow input and interaction.
- ◆ Your packet also includes your proof of attendance - a special copy of the receipt, available only to attendees, that states: "Save this receipt to document your attendance."

Our message - Save your notes and your conference packet!

MGWA Newsletter March 2014

MGWA BOARD MINUTES

Minnesota Ground Water Association Board Meeting Minutes

Meeting Date: November 1, 2013

Location: Fresh Grounds Café 1362 West 7th Street, St. Paul, MN

Attendance: Bob Tipping, President; Kelton Barr, Past President; Eric Mohring President-Elect; Audrey Van Cleve, Treasurer; Julie Ekman, Secretary; Sean Hunt, WRI; Jennie Leete, WRI; Jeff Stoner and Mark Collins, White Paper Committee members.

Past Minutes: Approved.

Treasury: Copies of the report were provided by Van Cleve. Income increased in October due to registrations for the fall field trip and conference; expenses also show an increase due to these events. Net income is \$39,163; total assets: \$98,341.

Newsletter: Tipping will prepare a summary of the fall field trip for the newsletter. Space will be set aside in each issue for information and updates on White Paper progress.

Web Page: Hunt has completed the web information for the field trip; the Foundation scholarship information is posted; other information is up-to-date (employment postings and fall conference materials).

WRI Report: Leete provided copies of the Business Manager's Report that summarizes activities since the last meeting. Activities include updating the membership database with renewals; reconciling accounts; mailing bills for 2014 dues; ensuring that all the necessary tasks for the Field Trip were completed (including baking cookies!); and ensuring that all the necessary tasks for the Conference were completed.

Old Business: Fall Conference: Registration is currently at about 190; three exhibitors are lined up – we'd like about three more; seven have registered to present posters. Board members and other volunteers are encouraged to meet at Leete's & Hunt's house at 6:00 p.m., November 11th to prepare materials for the conference.
Fall field trip: Thirty-four people attended. Hunt has created a photo album on the MGWA website; field trip photos will be posted.
White Paper Initiative: Mark Collins and Jeff Stoner, WP Committee members, reviewed the draft White Paper process and roles with Board members and will revise the process document and flow chart based on this discussion. The WP process will be revealed at the Fall Conference and a call for topics announced. By the end of January, the WPC will review the topics and make a recommendation to the Board. Volunteers to be on the WP work group will then be solicited. The WPC will nominate one of their own to act as liaison with the WP work group. After a work group is formed, the WP Committee will initiate the meetings of the WP work group for a given topic and may attend meetings. They will act as shepherds of the process but not actively contribute to the writing of the WP. Ultimately the document should be a consensus of the work group. Disagreements should be clearly discussed in the document. The majority view and dissenting view (if there is one) will be presented in the document. The audience of the WP's is the general public, legislators, city/county staff members. The work group will establish a schedule and will nominate a point person who will address questions about the WP for one year after it is published. The Board will ensure that the published WP has a continued life.
Opportunities for MGWA member participation once a topic is chosen:
1. Members can volunteer to be on a work group for a topic
2. Members can provide suggestions for the WP on a specific topic
3. Members can review and comment on the first draft of the WP
Other discussion: 1) the Board suggested that newsletter team members be asked if they would provide editorial review of the WP. 2) before the Fall Conference, a webpage for White Paper process and information should be established in the member's section of the MGWA website.

New Business: Discussed persons interested in Board openings for president-elect and secretary positions.

Meeting Date: December 12, 2013

Location: Fresh Grounds Café, 1362 West 7th Street, St. Paul, MN

Attendance: Bob Tipping, President; Kelton Barr, Past President; Eric Mohring President-Elect; Audrey Van Cleve, Treasurer; Julie Ekman, Secretary; Sean Hunt, WRI.

Past Minutes: Approved.

Treasury: Copies of the report were provided by Van Cleve. Net income is \$25,196; total assets: \$94,124.

Newsletter: It was noted that the White Paper initiative should be included in the Featured list on the front page to bring attention to this new opportunity. Hunt reported that the December edition is nearly ready.

Web Page: Barr recommended changes to the web page to make it easier to spot the White Paper Initiative and the process for submitting topics.

Old Business: Fall Conference: Mohring, as president, will take on poster solicitation for the next conference. Exhibits need to be solicited early in the year when businesses are arranging their annual schedules; exhibit solicitation is a MGWA Foundation responsibility. Tipping and Mohring will maintain communication with the

MGWA 2014 Membership Dues

Professional Rate:	\$35
Full-time Student Rate:	\$15
Newsletter (printed and mailed)	\$20
Directory	\$7

Membership dues rates were revised at the October 1, 2010 meeting of the MGWA Board. They remain unchanged.

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MGWA BOARD MINUTES

December 12, 2013 Minutes, cont.

The MGWA Board meets on the first Wednesday of the month from 11:30 am to 1:00 pm at Fresh Grounds., Café, 1362 West 7th Street, St. Paul, Minnesota. Members are welcome to attend. As appropriate, please forward agenda items to the President a week before the meeting.

Foundation and update Board members on exhibit solicitations as conference planning proceeds. Feedback from the fall conference was mixed on the number of speakers, length of their talks, and the length of the lunch period. Keeping the number of speakers to about 6 allows more time for conference participants to visit and talk with exhibitors.

White Paper Initiative: Committee members are Kelton Barr, Mark Collins, Jeff Stoner, and Bruce Olsen.

The Instructions to White Paper Work Group document is detailed; it could be rearranged for easier reading and quicker reference—the details could be moved to an appendix.

Board members discussed how a White Paper work group could be selected. Selection criteria should lead to an externally balanced group that represents various points of view. Individuals will need to be of a temperament that is conducive to working well as part of a team. The WP Committee, with Board concurrence, establishes the WP work group; the Board can limit membership on the group. Only MGWA members can submit an idea for a WP topic, but once membership has been verified, that person can be anonymous. Those who submit a topic idea do not need to commit to being on a WP work group if their topic is chosen.

The WP work group will need to self-manage and share work load since some members of the team might have more time for this effort than others. The Board will take this under consideration when setting up a timeline for a topic paper to be delivered.

White Paper Content document: We want a concise paper—about 10 pages long. It needs to be science based. This document should be ready for Board approval during the January meeting. Barr is a lead author of this document and is invited to the January Board meeting as a guest.

MGWA newsletter editors could provide an editorial committee for review of drafted white papers. Tipping will discuss with MGWA newsletter editor, Ronning, whether his team would be willing and able to take on this responsibility.

New Business:

Future conferences. The Board discussed topic ideas. For the spring conference the focus could be on recharge, infiltration, and storm water management—where does ground water come from? Potential speakers were discussed. A Superfund theme could be an appropriate topic for next fall's conference. The topic of ground water sustainability may be a conference focus in 2015.

Birdsall-Dreiss lecture series. The Board will send a request for the 2014 lecturer, Professor Larry Band (U of N Carolina), to present in Minnesota. We will coordinate with partners—MN Freshwater Society, the MN Dept. of Natural Resources, the University of MN, and Macalester College—on hosting this event should we be granted this opportunity.

Meeting Date: January 09, 2014

Location: Fresh Grounds Café, 1362 West 7th Street, St. Paul, MN

Attendance: Eric Mohring, President; Bob Tipping, Past President; Layna Ross, President-Elect; Audrey Van Cleve, Treasurer; Avery Cota-Guertin, Secretary; Tedd Ronning, Newsletter Editor; Sean Hunt, WRI; Jeanette Leete, WRI.

Past Minutes: Approved.

Treasury: Copies of the report were provided by Van Cleve. End of year report provided by WRI to Van Cleve. Year to date net income is \$11,760; total assets: \$87,958. Net income for 2013 was \$24,196.

Newsletter: Call for technical articles for the March newsletter and upcoming newsletters. Greg Brick resigned from the editorial board. Mohring will provide information on the spring conference for the March newsletter.

Web Page: Hunt published the December newsletter online and sent an email to paying members about its availability. Information on the Foundation scholarship application process and White Paper (WP) process is now located on the home page. Future electronic communications with members could include announcements for the WP initiative, Foundation scholarship, and a request for technical articles.

WRI Report: Leete provided copies of the Business Manager's Report that summarized activities since the last meeting. Board discussed pay increases for WRI, increase in membership dues, and calling a joint meeting with the Foundation to discuss finances.

Old Business: White Paper Initiative: The newsletter team will assume editorial responsibility. Tipping will continue to update the board on the status of the guidance documents. Birdsall-Dreiss lecture series The board sent a request December 19, 2013 for Professor Dr. Larry Band (University of North Carolina) to present at the 2014 lecture series. Should the request be granted the MGWA, MN DNR, Dept. of Earth Sciences (U of Minnesota-Twin Cities campus), Macalester College, and Freshwater Society will host Dr. Larry Band.

New Business: Spring conference. The board discussed topic ideas and potential presenters for the upcoming conference. Conference title was finalized to 'Recharge, Infiltration,

MGWA BOARD MINUTES

January 09, 2014 Minutes, cont.

and Drainage'. Tipping and Mohring suggested 6 or 7 presenters for conference to allow participants more time to visit with exhibitors. Tipping will maintain communication with the Foundation to line up exhibitors and solicit posters. Mohring will have a list of speakers by the next board meeting.

MPR groundwater story. Tipping suggested that the article questionnaire be sent to members. This project will be going on for the next few months. Information about the article may be included in the March newsletter.

HO Pfannkuch Fund Scholarship. The board discussed possible dedication of funds to a field camp scholarship.

Guidebooks from Past Field Trips. Field trip guides may become available on the web page for members in the future. Leete will bring extra printed copies of past field trip guides to the next meeting for students.

Meeting Date: February 5, 2014

Location: Fresh Grounds Café, 1362 West 7th Street, St. Paul, MN

Attendance: Eric Mohring, President; Bob Tipping, Past President; Audrey Van Cleve, Treasurer; Avery Cota-Guertin, Secretary; Sean Hunt, WRI; Jeanette Leete, WRI.

Past Minutes: Approved.

Treasury: Copies of the report were provided by Van Cleve. Net income is \$14,628; total assets: \$90,117.

Newsletter: Reminder to get technical articles to the newsletter team by February 7, 2014. Mohring submitted materials for the March newsletter. Leete suggested Ronning contact Greg Brick to check continuing interest in editing articles.

Web Page: Mohring provided feedback on proposed speakers list for the spring conference. Hunt sent email communications to MGWA member regarding the MPR groundwater story, White Paper, and Foundation Scholarship. Membership renewal emails were targeted to people who have not renewed their membership.

WRI Report: The Board discussed compensation increases for WRI. Tipping motioned to approve the revised schedule of compensation proposed by WRI; motion seconded by Van Cleve. Motion carried. WRI may now operate under the revised schedule of compensation effective January 1, 2014. WRI provided copies of the Business Manager's Report summarizing the activities since the last meeting. Second membership reminder email sent and paper notice will be sent out soon. Hunt provided copies of the Membership Report to the Board.

Old Business: Spring conference. Tipping is continuing work on poster solicitation. Mohring will have a tentative list of presenters/presentation titles and conference description finalized by February 14, 2014. The Board discussed conference fee rates. Early registration date is April 8, 2014. The Board discussed the need to find a new point person for the student mentorship program. Tipping will talk with the Foundation about exhibitor solicitation.

Birdsall-Dreiss lecture series. Tipping will report the response of the request to have Professor Dr. Larry Band present at the 2014 lecture series.

2015 Fall conference. The Board discussed coordination with other organizations to plan the conference; Hunt suggested Ross take lead to assist in event planning. Hunt is attending the monthly conference calls outlining the planning progress. Leete suggested Kelton Barr also be invited to the calls. Hunt informs the Board that MGWA involvement will be assisting with planning and taking registrations. The Board discussed possible format for online registration.

New Business: White Paper topic nominations. Topic ideas and materials for the White Papers need to be sent to Barr. Bruce Olsen developed a draft scoring form for selecting a topic each year.

NGWA invitation to support national groundwater monitoring. Tipping motioned to sign the NGWA letter supporting the national groundwater monitoring network; motion seconded by Van Cleve. Motion carried. Mohring will sign the NGWA letter.

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