# WISCONSIN GROUND WATER ASSOCIATION

## 2014 Annual State Conference

***"The Water M's - Monitoring & Modeling"***

Friday, March 7th, 2014

Milwaukee Marriott West, Waukesha WI

WGWA

**2014 WGWA Annual State Conference**

Friday, March 7th, 2014
Milwaukee Marriott West - Waukesha WI

| | |
|---|---|
| 8:00 - 8:30 | *Sign-In & Registration* |
| 8:30 - 8:45 | President's Welcome<br>**Jodie Peotter - WGWA President** |
| 8:50 - 9:20 | "An Evaluation of the Distribution and Sources of Dissolved Strontium in the Groundwater of Eastern Wisconsin, with a Focus On Brown and Outagamie Counties."<br>**Dr. John Luczaj - Geoscience Chair, University of Wisconsin - Green Bay** |
| 9:30 - 10:00 | "Strategies to Address VOC Contamination of Groundwater Supplie for Municipal Use"<br>**Christopher Hessler - Treatment and Custom Products Manager, QED Environmental Systems Inc.** |
| 10:10 - 10:20 | *Break* |
| 10:20 - 10:50 | "Revised DNR Guidance Document: Reducing or Terminating Groundwater Monitoring at Solid Waste Landfills"<br>**Gerald DeMers - Environmental Engineer, Wisconsin DNR** |
| 10:50 - 11:20 | "LNAPL Assessments - How Are they Practical/Useful"<br>**David Swimm - Hydrogeologist, Wisconsin DNR** |
| 11:20 - 11:45 | *Poster Presentations & Break* |
| 11:45 - 12:00 | *Lunch Served* |
| 12:15 - 12:45 | **Keynote: Cathy Stepp, Secretary of the Wisconsin DNR**<br>*Sec Stepp served as a state senator & was also a member of the Natural Resources Board from '98 to '01* |
| 12:50 - 1:30 | "This is Not Your Father's Hydrogeology! - Evolving Hydrogeological Concepts at the Remediation Project Scale"<br>**James Bannantine - (WGWA, Past President) Environmental Consultant at Geosyntec Consultants** |
| 1:30 - 1:45 | *Break & Poster Presentations* |
| 1:45 - 2:20 | "Strategic Analysis for Understanding Surface Water and Groundwater Use and Management for the Little Plover River Basin of Wisconsin"<br>**Maribeth Kniffin - PhD Candidate, University of Wisconsin-Madison** |
| 2:25 - 2:55 | "The Public Trust Doctrine and Groundwater Law in Wisconsin"<br>**Carl Sinderbrand - Partner/Attorney, Axley Brynelson, LLP** |
| 3:00 - 3:30 | "Green Tier: Has it Improved Water Quality"<br>**Gregg Breese - Business Sector Specialist, Wisconsin DNR** |
| 3:30 - 5:00 | Networking & Social Conversation |

## The 2014 Board Members and Committee Chairs:

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Annual Conference Committee
Open

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WGWA Members Enjoy:

- You will automatically be sent an informative WGWA Newsletter each Quarter. The newsletter contains a mix of technical articles, breaking news, and calendar events.

- The Newsletter gives you the opportunity to publish your own articles on projects you've worked on, problems you've solved, conferences you've seen, or places you've been.

- You will be sent timely bits of critical information in the form of a WGWA Notes between newsletters.

- Additional educational opportunities exist in our events and resources. Annual Conference (hear the industry's best speakers), our Fall Field Trip (gain hands-on knowledge of hydrogeology), and access to our groundwater sand models are just a couple examples available to our membership.

- Discounts to events hosted by WGWA and sometimes invites to events hosted by WGWA sponors.

- Events that create networking opportunities. Meet with the best and brightest to advance your work and your knowledge.

- Participation on our Committees and Task Forces also presents the opportunity for networking, while accomplishing something good for the groundwater industry.

- Possible selection for Board positions, Committee Chairs, or Area Coordinator positions helps to develop your leadership skills and gain recognition in the community.

**Ground Water Sand Model Reservations**

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WGWA

# TWO GREAT COURSES !

An intensive two-day short course

Course Venue Inside
TARGET FIELD
with Evening Reception in Luxury Suite
During Twins vs. Brewers Rivalry Showdown

## Fate and Transport of DNAPLs in Fractured Rock Aquifers

**June 4 & 5, 2014**
**Minneapolis, MN**

Instructors:

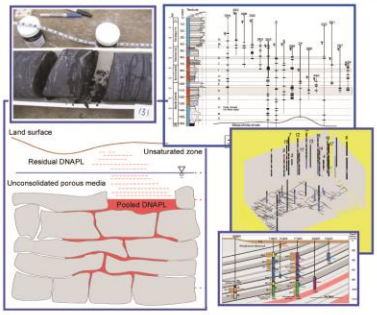
**Allen Shapiro, PhD, PG**
National Research Center
United States Geological Survey

**Maureen Muldoon, PhD, PG**
University of Wisconsin, Oshkosh

Continuing Education
**16.0 Contact Hours**
CEUs by Northern Illinois University

An intensive one-day short course

### Advances in Characterization, Monitoring, Remediation, and Recent Regulatory Updates




This 2-day course begins with recent updates about delineation of groundwater contamination in fractured rock aquifers through the synthesis of hydrogeologic and biogeochemical information. Although geomechanical and hydrologic conditions of each fractured rock site are unique, this course highlights the common attributes that are to be anticipated in all fractured rock sites. New and faster tools coupled with more realistic recovery objectives in fractured bedrock are impacting remedial results. Get updated on the current state of the practice along with the vision for the future of DNAPL remedial strategies.

## Emerging Technologies and Conceptual Approaches

NEW COURSE!

**June 3, 2014**
**Minneapolis, MN**

Instructors:

**Ken Bradbury, PhD, PG**
Wisconsin Geological and
Natural History Survey

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

Continuing Education
**6.0 Contact Hours**
CEUs by Northern Illinois University

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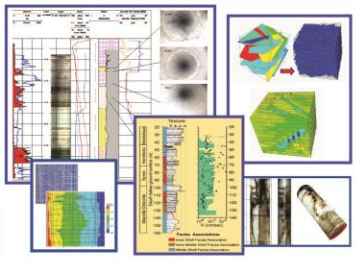
### for Hydrogeologic Characterization of Complex Bedrock Systems



Recent advances in field equipment and modeling software, along with new conceptual approaches, are rapidly improving our understanding of groundwater flow and contaminant transport in fractured bedrock systems. Fractured bedrock sites are sometimes perceived as so inherently complex that unmanageable uncertainty remains even after an investigation is complete. This 1-day course is dedicated to those emerging technologies and field approaches that help unravel hydrogeologic complexities in these complex settings.

***Discover New and Trending Technologies for Bedrock Investigations***

Advanced registration is necessary for participation in this limited-enrollment short course. Pre-registration is required to reserve space and receive course materials. A confirmation letter and map will be sent within 10 days following your course registration. Accommodations at Crowne Plaza Hotel - Northstar Minneapolis located 6 blocks from Target Field. Evening Reception is June 4, 2014. Access to reception is restricted to June 4 & 5 course registrants. Sponsorship opportunities are available, in cooperation with Target Field.

**REGISTRATION**

Last Name: _____ First Name: _____
Position: _____
Company: _____
Address: _____
City, State, Postal Code: _____
Phone: _____
Email: _____

*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.**

***Course Fee (June 3):***
*Pre-Sale Discount: $199 (USD)*
*(thru March 31, 2014 combined with Course 1)*
*Register Now: $399 (USD)*
*Register after 23 May 2014: $699 (USD)*
*Multiple-Person Discounts Available.*

***Course Fee (June 4 & 5):***
*Pre-Sale Discount: $499 (USD)*
*(thru March 31, 2014)*
*Register Now: $649 (USD)*
*Register after 23 May 2014: $980 (USD)*
*Multiple-Person Discounts Available.*

**Mail completed form with payment to:** Midwest GeoSciences Group, 6771 County Road 8 SW, Waverly, MN 55390

**Or On-Line:** www.midwestgeo.com

**Sponsorship Opportunities:** www.midwestgeo.com or call 763.607.0092

**On-Site Access & Registration:** Follows Registration

☐ *Check Enclosed*
☐ *VISA* ☐ *MasterCard*
VISA / MC NUMBER _____ EXP _____
CARDHOLDER NAME _____
☐ *Purchase Order* _____

WGWA

**PRESENTATION:**

"An evaluation of the distribution and sources of dissolved strontium in the groundwater of eastern Wisconsin, with a focus on Brown and Outagamie Counties."
Dr. John Luczaj, Geoscience Chair - Department of Natural & Applied Sciences - University of Wisconsin - Green Bay

Groundwater in parts of eastern Wisconsin contains dissolved strontium (Sr) levels that exceed lifetime and short-term EPA Health Advisories of 4 mg/L and 25 mg/L, respectively. Hundreds of wells are impacted throughout this region, including an area of anomalously high dissolved Sr in parts of Brown, Outagamie, and Calumet counties, which could potentially lead to health effects such as tooth enamel mottling or strontium rickets.

Regionally, the distribution of dissolved Sr in the Cambrian-Ordovician aquifers varies dramatically from well below 1 mg/L to as high as 30 mg/L or more. Over 60% of the samples collected in our study had dissolved Sr values over the lifetime Health Advisory Level. Elevated dissolved strontium occurred in wells open to all Paleozoic stratigraphic units below the Maquoketa Shale. The likelihood that any particular stratigraphic unit would yield water with high dissolved strontium varied regionally in a complex way. Although some wells located west of the Maquoketa Shale subcrop have lower dissolved Sr-concentrations, as might be expected, this is not always the case.

Strontium isotopic analysis of mineral, whole-rock, and groundwater samples has revealed the source of dissolved strontium in northeastern Wisconsin. The primary source is heterogeneously distributed celestine ($SrSO_4$) and possibly strontianite ($SrCO_3$) that occurs as mineral cement in vugs and fractures in carbonate rocks, and in intergranular pores in sandstone aquifers.

**Notes:**

**PRESENTATION:**

"Strategies to address VOC contamination of groundwater supplies for municipal use"
Chris Lawn – Pure Element Resources

The occurrence and persistence of volatile organic compounds (VOCs) in groundwater resources are shown to have significant impact on both the environment and public health. In perhaps the majority of sites with known contamination issues, an environmental management & treatment strategy can be implemented to mitigate potential environmental & health impact. However, the time and cost required to treat impact groundwater to safe levels can be considerable. While these burdens are manageable within the framework of environmental management, the impact of VOCs on groundwater sources intended for potable use requires a far more decisive management strategy to continue providing safe drinking water resources.

While no one management strategy will encompass every occurrence of impacted municipal source water, two general options can be deliberated: 1) discontinuing use of the impacted ground water, and 2) treating the impacted ground water to potable standards. A solid list of pros and cons can be discussed for either strategy. However, as acceptable groundwater resource become scarcer and water demand increases, the economic limitations of avoiding or developing new water resource can quickly eclipse the cost of treating water for potable use. In this regard, the Wisconsin DNR has outlined several "best available technologies" for treating VOCs from potable water supplies. Activated carbon & aeration have both been evaluated for mitigation of VOCs in municipal drinking water, where the applicability & economic drivers behind these technologies can be readily compared. As sanctioned through DNR regulation, both technologies offer appropriate process efficiency to reduce VOCs below actionable levels; however, this paper will address key differences in the implementation & operation of these technologies, including case studies of recent municipal VOC removal projects in Wisconsin.

**Notes:**

**PRESENTATION:**
"Revised DNR Guidance Document, "Reducing or Terminating Groundwater Monitoring at Solid Waste Landfills"
Gerald DeMers - Environmental Engineer, Wisconsin DNR

In 2006, the Wisconsin Department of Natural Resources (DNR) published a guidance document, Reducing or Terminating Groundwater Monitoring at Solid Waste Landfills. DNR developed this guidance for landfill owners and operators considering reducing or terminating monitoring at solid waste landfills. It described how requests should be prepared and what criteria we would use in reviewing these requests. While that guidance provided a means to reduce monitoring frequencies at closed landfills, it did not encourage sampling frequencies less frequent than semiannually.

DNR is currently revising the guidance document to provide greater flexibility in groundwater monitoring frequencies for closed landfills. There are currently over 500 closed landfills in Wisconsin that are monitoring groundwater. Nearly all of these sites closed prior to enactment of the federal Subtitle D landfill requirements in 1993, and therefore have performed groundwater monitoring for at least 20 years since closure. Landfills that are currently operating today generally conduct groundwater monitoring semiannually. However, some closed sites are still monitoring on a quarterly basis, and most others are sampled semiannually. Considering these sites have over 20 years of data to indicate their effect on groundwater quality, a reduced sampling frequency may be appropriate at many of these sites.

DNR has reviewed the current sampling frequencies at all the closed landfills and plans to contact facilities about possibly modifying their frequencies after the guidance is completed. DNR would like to obtain input from facilities and consultants today to help us provide as valuable a guidance document as possible.

**Notes:**

**PRESENTATION:**

"LNAPL Assessments – How Are They Practical/Useful"
David Swimm – Wisconsin DNR

The presentation uses a case history to demonstrate the usefulness of light non-aqueous phase liquid (LNAPL) assessments and how different data sources are integrated to provide a more meaningful depiction of the LNAPL present. Geophysical information from Laser Induced Fluorescence (LIF) surveying is integrated with geologic information, LNAPL bail down test results, and LNAPL mobility modeling to focus the future remedial selection and design, establish estimated in-place LNAPL volumes, and establish realistic expectations regarding LNAPL hydraulic mobility and closure-related criteria.

**Notes:**

**POSTER PRESENTATIONS:**

**Monitoring the Effects of Road Salting on Chloride Concentrations in Surface Water and Groundwater in Eau Claire, WI -** Kate Beaton, Mike Chang, and Katherine Grote

**Evaluation of factors influencing nitrate concentrations in groundwater in Eau Claire County -** Anastasia Burns and Katherine Grote

**Geophysical Investigation of Bedrock Depth at the WRR Superfund Site in Eau Claire, WI -** Travis Lindberg, Ryan Conway, Brett Shand, and Katherine Grote

**(Additional Space for Notes on Pages 16, 17, 18 of Program)**

**KEYNOTE ADDRESS:**

## Secretary, Cathy Stepp – Wisconsin DNR

**Notes:**

**PRESENTATION:**

"This is Not Your Father's Hydrogeology! Evolving Hydrogeological Concepts at the Remediation Project Scale"

Jim Bannantine - (WGWA, Past President) Environmental Consultant at Geosyntec Consultants

Classical hydrogeology was developed as a science to deal with large scale issues such as drinking water and petroleum reserves. Hydrogeology classes teach flow concepts using simplified math for ease of learning, and many of the simplifying assumptions work well for large-scale applications.

Remediation hydrogeologists typically deal with smaller scales, typically the size of a commercial or industrial development. As the size of the project decreases, so too the scale of hydrogeology decreases. With reduction in size, many of the simplifying assumptions taught in classical hydrogeology do not hold true.

In addition, classical hydrogeology was only concerned with the ability to move the fluid itself (water, oil gas, etc). The remediation hydrogeologist must understand the behavior of solutes within the fluid (contaminant fate and transport), as well as the behavior of the fluid itself.

Scientists and practitioners have been recently begun studying contaminant fate and transport along with fluid behavior at the project scale (low flow rates, fine grained soils), and a new understanding of remediation hydrogeology has evolved. In this presentation, Mr. Bannantine will discuss the evolution of remediation hydrogeology and introduce some of the new concepts that have evolved from study of remediation scale hydrogeology and contaminant fate and transport.

**Notes:**

**PRESENTATION:**
"Strategic Analysis for Understanding Surface Water and Groundwater Use and Management for the Little Plover River Basin of Wisconsin"
Maribeth Kniffin - PhD Candidate, University of Wisconsin-Madison

In recent years, interest in the impacts of high-capacity water-supply wells on groundwater and surface-water resources has increased, especially in Wisconsin's Central Sands, where thousands of irrigation wells serve agricultural industries. Under current Wisconsin law, the cumulative effects of multiple high-capacity wells are not considered in the permitting process for new wells. As concern grows over management of groundwater resources connected to surface water, the State of Wisconsin has commissioned a study exploring tools for basin-scale groundwater management, which explicitly consider groundwater use, connections to surface water, and interactions among multiple extraction sources. The Little Plover River basin in Portage County, which has a long history of groundwater/surface water interactions studies, was chosen as the study area for this effort.
A state-of-the art groundwater flow model using the USGS MODFLOW code builds on existing work by including explicit representation of extraction wells, calibration to current conditions, and streamflow routing. Inherent trade-offs between competing groundwater uses will be illustrated by applying the optimization code GWM (groundwater management) to the MODFLOW model. GWM provides optimal solutions for groundwater withdrawal and land use subject to hydrologic constraints such as minimum flow rates in streams or water levels in or near lakes. Other constraints, including costs and benefits of various agricultural practices, can also be applied to the management scheme.
While the primary goal of this project is to provide a path forward for resolving water-management issues in central Wisconsin, our broader goal is to educate non-scientists in how groundwater systems operate, and to produce an example decision-making tool that can inform groundwater management decisions across Wisconsin.

**Notes:**

**PRESENTATION:**

"The Public Trust Doctrine and Groundwater Law in Wisconsin."
Carl A. Sinderbrand, Partner/Attorney - Axley Brynelson, LLP

The Public Trust Doctrine is a provision in the Wisconsin Constitution that requires the State to protect and maintain navigable waters for the benefit of the public. Over time, the Wisconsin Supreme Court has used this doctrine to manage non-navigable and upland resources, recognizing that navigable waters are intertwined with and dependent upon non-navigable natural resources, including shore lands, wetlands and groundwater. This presentation will explore recent court cases and legislation relating to the use of the public trust doctrine to enhance management of groundwater and other non-navigable resources.

**Notes:**

**PRESENTATION:**
"Green Tier: Has it Improved Water Quality"
Gregg Breese, Sector Development Specialist, Wisconsin - DNR

**Notes:**

**POSTER:**

**Monitoring the Effects of Road Salting on Chloride Concentrations in Surface Water and Groundwater in Eau Claire, WI**

Kate Beaton, Mike Chang, and Katherine Grote

In cold weather regions, road salting is often employed to improve the safety of roadways impacted by snowfall events. Runoff from these roadways can negatively impact surface water and groundwater supplies through high chloride concentrations, which can harm aquatic ecosystems. This project investigates chloride concentrations in surface water and groundwater in Eau Claire, Wisconsin. Previous work in this area has shown that there is a strong positive correlation between chloride concentrations and electrical conductivity (EC) measurements in surface water, so EC measurements were acquired frequently, and chloride samples were collected less often to verify the accuracy of the chloride-EC relationship. Measurements were taken from nine stream sites and two groundwater wells. Samples were acquired to capture both background chloride concentrations (no recent precipitation) and chloride concentrations soon after road salting had occurred. Similar data had been acquired at a subset of the sampling sites in the winters of 2011-2012 and 2012-2013, so comparing data from multiple years provides a better understanding of the fluctuations in chloride concentrations as a result of variable weather conditions over a longer time period. In addition to analyzing longer-term trends in chloride concentrations, this project also investigates the connection between chloride concentrations in surface water and shallow groundwater and the delay time between road salting and peak chloride concentrations in a subset of streams. Possible relationships between temperature gradients, precipitation depths, and chloride concentrations in streams are also being investigated.

Data acquisition for the 2013-2014 season is still underway, but preliminary results show some expected trends. Streams located in more urban areas show chloride concentrations that are higher and have greater variability than chlorides in more rural waterways. Similarly, smaller tributaries show more impact from road salting than larger streams. Finally, large variations in chloride concentrations have been observed along relatively short stretches of a stream, reflecting rapid input of chloride from urban development along the stream.

**Notes:**

**POSTER:**

**Evaluation of factors influencing nitrate concentrations in groundwater in Eau Claire County**

Anastasia Burns and Katherine Grote

In Eau Claire County, about 6.4% of private wells have nitrate concentrations exceeding the Enforcement Standard (ES) of 10 mg/L. This project investigates whether high nitrate concentrations can be correlated to geologic and hydrologic parameters or to land management. If such correlations are found, they can be used to develop a risk assessment map for Eau Claire County that could be used to predict areas that are at an elevated risk for nitrate contamination. To aid in this study, the Eau Claire County Health Department provided nearly 6,000 nitrate concentrations from groundwater samples acquired in private wells over a period from 1999 to 2004 and again from 2005 to 2009. Using GIS, these data sets were joined to maps of depth to bedrock, depth to water table, soil texture, soil taxonomy, geomorphology, and land use. The resulting data sets enabled correlations to be made between these parameters and nitrate concentrations, and to observe how these correlations changed with time between the two data sets. The factors which appeared to have the most impact on nitrate concentrations were land use, depth to the water table, and depth to bedrock. Agricultural land typically had the highest nitrate values, although the nitrate concentrations in urban areas increased significantly with time. Areas with higher bedrock tended to have higher nitrate values, while areas with shallow water tables had lower average nitrate values.

To better investigate the factors controlling nitrate contamination, combinations of factors that independently appeared to influence nitrate concentration were considered. These analyses helped to show which combinations of natural and anthropogenic conditions were most likely to result in high nitrate concentrations. Although analysis of different combinations of factors is ongoing, the areas which seem most likely to have high nitrate concentrations are rural areas with intermediate water tables (5-50 ft beneath the surface), highly developed (more urban) areas with shallow bedrock, and areas with both shallow bedrock and shallow water tables.

**Notes:**

**POSTER:**

**Geophysical Investigation of Bedrock Depth at the WRR Superfund Site in Eau Claire, WI**

Travis Lindberg, Ryan Conway, Brett Shand, and Katherine Grote

Near-surface geophysical methods can provide valuable information for understanding the stratigraphy of sites with groundwater contamination. In this study, geophysical techniques were used to better characterize the soil-bedrock interface of a Superfund site in Eau Claire, Wisconsin. The study area was the Lowes Creek County Park that lies downgradient of the WRR Environmental Services facility outside of Eau Claire. Decades of manufacturing at this facility have resulted in several types of groundwater contamination, including dense non-aqueous phase liquids (DNAPLs). For remediation efforts to remove the DNAPLs to be effective, bedrock depth must be established. Limited borehole data available at the site indicate an unconfined sandy aquifer overlying sandstone bedrock, with a highly variable bedrock surface. Bedrock in some portions of the site is at a depth of 17 m below the ground surface, while other boreholes nearby show bedrock depths greater than 45 m. The borehole data are insufficient to adequately characterize the bedrock topography, but suggest that a complicated system of buried valleys may be present.

Four types of geophysical measurements were acquired to provide additional information on the bedrock topography. Geophysical data collection was concentrated in the areas where greater depths to bedrock were suspected, and data were acquired using seismic refraction, microgravity, resistivity, and electromagnetic induction techniques. Standard data processing techniques were used for all data sets, and the seismic data were analyzed using reciprocal delay-time methods. Analysis of the different types of geophysical data showed good agreement between the four techniques and with the borehole measurements of bedrock depth. While all techniques provided information on the site stratigraphy, seismic refraction and microgravity techniques had the greatest penetration depths and were most useful for estimating bedrock depth and understanding variations in bedrock topography. When these techniques were used to supplement borehole data, the bedrock structure could be better understood as two roughly parallel bedrock valleys running through the site. These valleys can then be targeted for drilling and DNAPL remediation.

**Notes:**