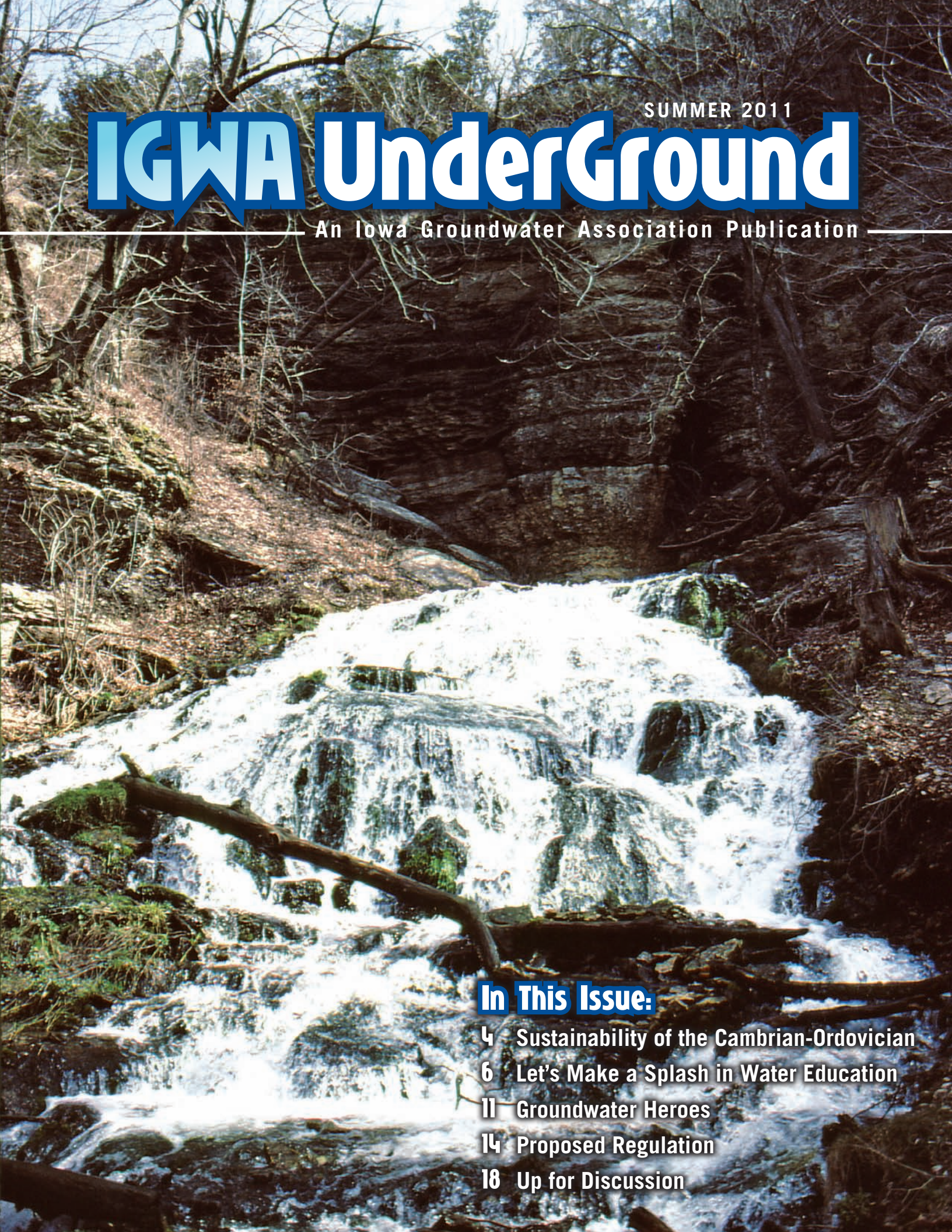


SUMMER 2011

IGWA UnderGround

An Iowa Groundwater Association Publication

In This Issue:

4 Sustainability of the Cambrian-Ordovician

6 Let's Make a Splash in Water Education

11 Groundwater Heroes

14 Proposed Regulation

18 Up for Discussion

SAVE THE DATE!!

WHO: Attention all groundwater professionals, well drillers, water operators and interested persons in geology and groundwater.

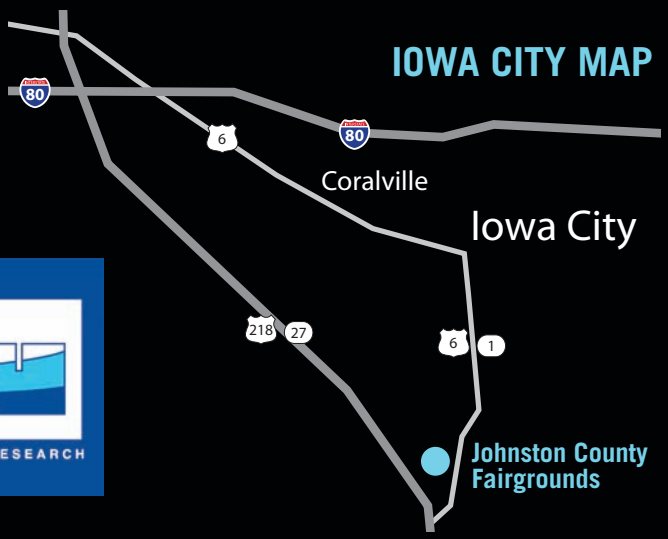
WHAT: Iowa Groundwater Association Fall Meeting

WHEN: Wednesday, October 26, 2011

WHERE: Iowa State University Extension Building,
Johnston County Fairgrounds
4265 Oak Crest Hill Rd SE
Iowa City, Iowa

Continuing education units will be available for Well Contractors, Groundwater Professionals, and Water Operators.

IOWA CITY MAP



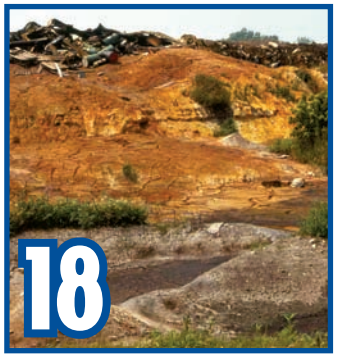
IOWA GROUNDWATER ASSOCIATION
COMMUNICATION • EDUCATION • RESEARCH

2011 IGWA Board Members

SUMMER 2011

IGWA UnderGround

An Iowa Groundwater Association Publication



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Objectives

- Promote education and research on Iowa groundwater issues.
- Foster cooperation and information exchange throughout its membership.
- Improve communication among state regulatory officials, professionals, and technicians working with groundwater.
- Cooperate with the activities of various state and national associations organized in the interest of groundwater use, conservation, management, and protection.

IOWA GROUNDWATER ASSOCIATION
COMMUNICATION • EDUCATION • RESEARCH

We are a not for profit organization.

Iowa Groundwater Association
PO Box 5602 • Coralville, IA 52241-0602
www.igwa.org

the President's message

Keith Schilling - President, Iowa Ground Water Association

It is my great pleasure to present the launch of our inaugural Iowa Ground Water Association magazine *IGWA UnderGround*. While new, the magazine actually represents the continuation of IGWA's commitment to communicate groundwater issues with its membership that began with the organization's inception back in 1984. Long-term members will recall receiving the Iowa Ground Water Quarterly every few months and immediately devouring its contents. The Quarterly, so capably executed by Nancy Hall, served our membership for more than two and half decades. I can assure you that our new magazine, with a slightly different format and a professional glossy appearance, carries forward this impressive heritage. Our magazine features new developments in groundwater research, highlights new and emerging groundwater technologies, provides legislative updates and keeps the IGWA membership abreast of the comings and goings of groundwater-related activities. Combined with our ongoing IGWA listserv, we are committed to enhancing communication and awareness of groundwater issues among Iowans dedicated to protecting and promoting Iowa's groundwater resources. I hope you enjoy our first issue, and as a work in progress, we welcome your comments and suggestions to make future issues even better.

"We are committed to enhancing communication and awareness of groundwater issues among Iowans dedicated to protecting and promoting Iowa's groundwater resources."

WE HEAR YOU!

The Iowa Groundwater Association board sent a survey out summer of 2010 to gauge its members about what its members want. Here's what was said out of 44 responses to the survey.

1. **How would IGWA members prefer to be contacted?** ***(more than one answer was allowed)***

   21% would like to be mailed letters and meeting announcements.

   16% would like to visit www.igwa.org for membership information, meeting documents and speaker presentations.

   91% would like to be emailed with all the latest news and events.

2. **Is www.igwa.org useful?**

   Yes: 84% No: 16%

   Comments: "Stay contemporary by adding more content and keep the website up-to-date."

   "Add in legislative tracking to keep members apprised of the current issues."

3. **IGWA Spring and Fall meetings: Have they been interesting?**

   Yes: 79% No: 21%

   Comments: "Have a keynote speaker to bring in the crowds."

   "Have presentations on cutting edge technology, especially in the work of remediation, contaminant transport, and groundwater modeling."

Modeling the Sustainability of the Cambrian-Ordovician Aquifer in Iowa

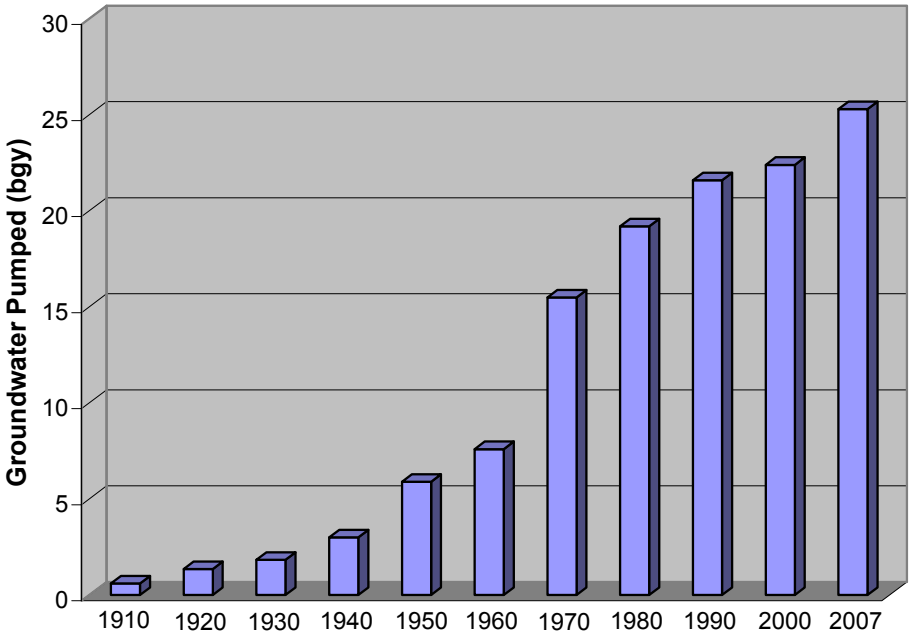
Mike Gannon - Iowa Geological and Water Survey

Increased demands for groundwater by agriculture, industries, and municipalities have raised concerns about the future availability of groundwater. As a major regional aquifer supplying large volumes of water to both industry and municipalities across the state, the Cambrian-Ordovician aquifer is one the most dependable, yet threatened, sources of groundwater in Iowa.

The amount of groundwater withdrawn from the Cambrian-Ordovician aquifer has increased through time ***(Figure 1)*** mainly due to increased water use by eastern Iowa municipalities and newly constructed ethanol plants across the state. Interestingly, the Cambrian-Ordovician aquifer is one of two Iowa aquifers protected from overuse (the other is the Dakota Formation in northwestern Iowa). Iowa Administrative Code Chapter 52.4(3) states that water levels are not to decline more than 200 feet from the 1975 baseline water level map developed by Horick and Steinhilber (1978). Since 1975, groundwater level declines of 50 to 150 feet have been recorded in major pumping centers. Large-scale pumping may also alter natural groundwater flow directions in the aquifer and cause poorer quality water to move into the pumped area.

The Cambrian-Ordovician aquifer, or more commonly referred to as the "Jordan aquifer," is actually composed of three separate water-bearing units. The uppermost unit is the St. Peter Formation comprised of fine to coarse grained, poorly cemented sandstone. Beneath this unit lies the Prairie du Chien Group, which consists of the Shakopee Formation (dolomite and sandstone), and the Oneota Formation (primarily dolomite). The base of the aquifer is the Jordan Sandstone, which consists of fine to medium grained, well sorted sandstone and dolomite.

FIGURE 1. Water-use for the Cambrian-Ordovician aquifer from 1910 to 2007. Data include total yearly volume pumped in billion gallons per year (bgy).



The Cambrian-Ordovician aquifer is confined above by a series of laterally extensive shales, shaley-dolomite, and dolomite units, and includes the Maquoketa Formation. The low permeability of these upper units control the downward leakage of groundwater entering the aquifer. Siltstone, dolomite, and glauconitic sandstone of the St. Lawrence and Lone Rock Formations confine the Cambrian-Ordovician aquifer from below. Groundwater in the aquifer generally flows southeast towards Missouri and Illinois.

Recently, an intensive investigation was initiated to provide a comprehensive assessment of groundwater resources in the Cambrian-Ordovician aquifer by the Iowa Department of Natural Resources Geological and Water Survey. A three-dimensional numerical model of the Cambrian-Ordovician aquifer was developed to evaluate groundwater availability and sustainability using historical water use, current usage, and several future usage scenarios. The MODFLOW model consisted of a model grid of 400 columns and 300 rows (1600 m2 cell size) superimposed on three model layers. Layer 1 consisted of aggregated regional confining beds above the aquifer, layer 2 was the aquifer itself and layer 3 consisted of lower confining beds. Aquifer parameters used in the model were collected from various pump tests, specific capacity measurements, and other historical geologic and aquifer reports.

In order to evaluate future usage scenarios, the first step was to model the pre-development conditions in the aquifer as a steady-state condition. Since this was not known, the first recorded water level depth in a well was gathered from old reports and records and assumed to represent the original potentiometric elevation in

the Cambrian-Ordovician aquifer. From this baseline condition, current production well information was then added to the model, including withdrawls from public wells, industrial wells, and other permitted users with daily usage greater than 25,000 gallons. The model-simulated potentiometric map of the Cambrian-Ordovician aquifer for 2007 indicates drawdowns near major municipal pumping centers in Coralville, Marion, Fairfield, Washington, Fort Dodge, and Mount Pleasant, as well as new ethanol plants in the Mason City, Dyersville, Fairbanks, Cedar Rapids, Ackley, and Albia areas ***(Figure 2)***. Overall, an increase of almost 3 billion gallons .of groundwater withdrawal was observed from 2000 to 2007 (13% increase), including major increases in the Fort Dodge-Webster City area (54% increase) and the Johnson-Linn County (46% increase).

The computer simulation model was used to predict future impacts to the Cambrian-Ordovician aquifer based on various pumping scenarios. A "low future" usage scenario assumed a relatively slow population and industrial growth and a 25% increase in groundwater use in the aquifer over a 20-year time period. In this scenario, water levels in the Cambrian-Ordovician aquifer show a significant decline from the 1978 baseline over much of Iowa ***(Figure 3)*** and exceed the 200-foot limit established in the Iowa Administrative Code in the Fort Dodge/Webster City and Marion areas. In a "high future" scenario, groundwater use was assumed to increase by 100% and water levels in the aquifer indicate a significant decline from the 1978 baseline over much of Iowa, exceeding the 200-foot limit in several counties across Iowa.

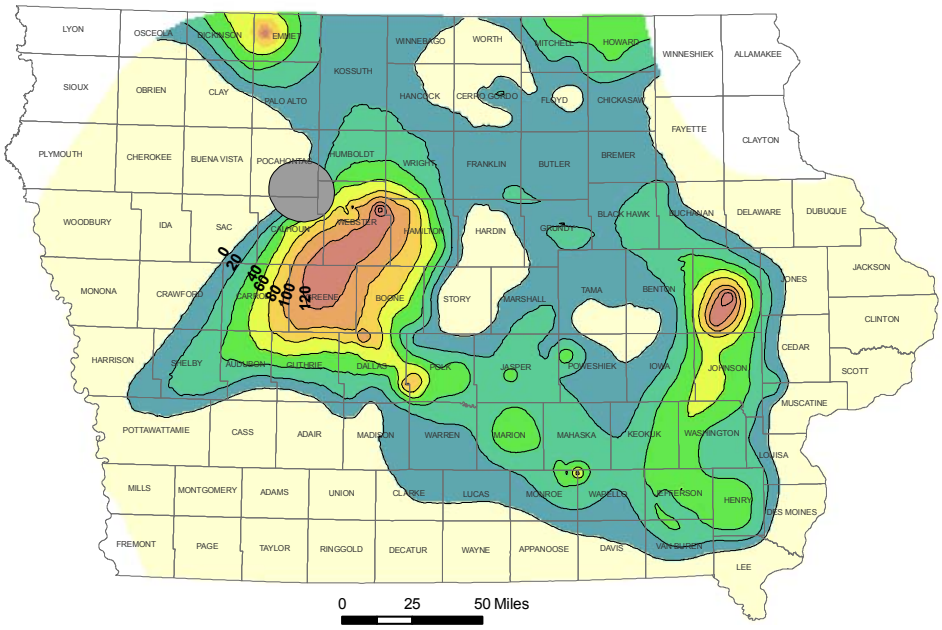


FIGURE 2. Declines in water levels in the Cambrian-Ordovician aquifer from 1978 to 2007.

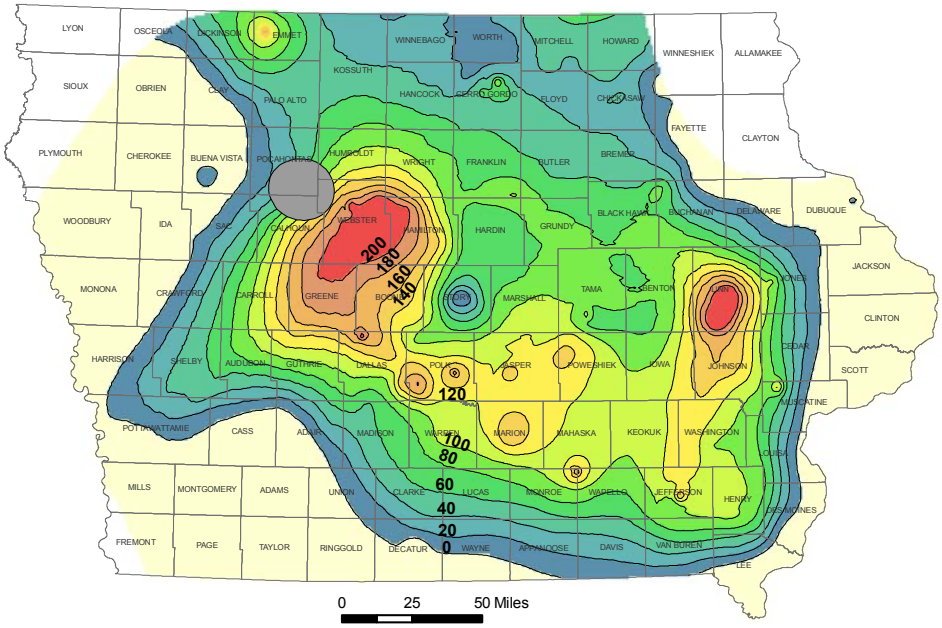


FIGURE 3. Simulation of future declines in water levels in the Cambrian-Ordovician aquifer by the 2029 assuming a 25% increase in pumping rates.

Overall, the computer simulation model for the Cambrian-Ordovician aquifer provides a powerful tool for water resource managers to evaluate the long-term sustainability of the aquifer. More detailed information about the Cambrian-Ordovician aquifer and its computer simulation model can be found at www.igsb.uiowa.edu/StateMap/StateWaterPlan.htm. Water resource management activities of the Iowa Department of Natural Resources are funded by Iowa Infrastructure – Environment First Fund appropriations.

Let's Make a SPLASH in Water Education

Jill Soenen - Iowa Municipal Utilities

"Our first year, how fun, well worth the drive. Great day! Very organized, thankful for the guides! Wonderful field trip to participate in. Thank you!"

Sally Oldham, Iowa Christian Academy

The forecasters had predicted thunderstorms, but after a dreary start, the sun came out and it was a beautiful day for the 15th Annual Iowa Children's Water Festival held on May 12, 2011.

The festival is a free one day event open to all 5th grade classes throughout the State. This year there were over 2,100 students from 42 schools representing communities from across Iowa. After arriving at the DMACC Ankeny campus at staggered times, the children participated in 3-4 classroom presentations, played one group game (Recycling Relays, Environmental Bingo, Water Words, Dripial Pursuit, and Dripmatics), visited the exhibit hall and ate lunch. All presentations, exhibits, and games are centered around teaching young people about water. This can include: supply and treatment, quality, habitat ecosystem, use, safety, wastewater, conservation, recreation or the water cycle. Educating kids about water helps them change the way they think of it and use it so they can become water heroes.

Once again this year, the Iowa Groundwater Association (IGWA) was a proud supporter of the festival. As in years past, IGWA made a donation to the festival's general fund for use wherever necessary. In previous years, IGWA has also sponsored the pizza parties for the classes that win the Scavenger Hunt contest. The Scavenger Hunt has become increasingly hard to score and there's no way of verifying the students are the ones completing the forms; for those reasons IGWA made the decision this year to dedicate the money used for the Scavenger Hunt to help fund transportation expenses for those schools that requested it. Because of this, IGWA made it possible for schools that otherwise may not have been able to attend to experience the Children's Water Festival.

One vital component to the festival is the volunteers. Over 200 volunteers were involved in this year's festival. Because of these dedicated individuals the festival continues to be a huge success and goes off year after year without any noticeable glitches. Volunteers come from a variety of places: associations, utilities, area high schools, government agencies and private businesses and perform a wide array of duties at the festival.

If you would like to be a volunteer, exhibitor or classroom presenter at next year's festival, please watch the IGWA (www.igwa.org) or Festival (www.iowachildrenswaterfestival.org) websites for more information later this year.

Thank you to everyone that played a part in educating our 5th graders about our most important resource… WATER!

"So well organized, great volunteers, variety of activities, love the shirts and other 'stuff', sure hope we can come back next year! Thank you for doing this! I just can't put into words how much our students loved the day. Our guide was great!"

Lindsay Schroeder,
Kirkwood Elementary

IOWA GEOLOGICAL & WATER SURVEY ROCK LIBRARY

Raymond R. Anderson and Jason A. Vogelgesang - Iowa Geological & Water Survey

Located on the University of Iowa's Oakdale Campus in northwest Coralville is one of the state's most unusual libraries. The Iowa Geological and Water Survey (IGWS) Oakdale Research Facility houses the IGWS Rock Library, a collection of rock samples and its associated GEOSAM library database. The Library contains site specific information on Iowa's geologic materials and constitutes the primary resource for our understanding of the geology of the state. As of the first week in April, 2011, the library included information from 73,479 locations around the state, most of which were water wells but also including research wells, exposures, and written information. These data include 1,423,793 actual rock drill (chip) samples from 36,381 wells, totaling 9,874,840 feet (1,870 miles) of drilling. Additionally, the library includes 464,122 feet (80 miles) of drill core (cylinders of rock) from 1,697 sites. Most of the information in the IGWS Oakdale Rock Library is available at no charge to the public via the GEOSAM database, accessible on the Survey's web site at http://www.igsb.uiowa.edu/webapps/geosam/. Figure 1 portrays the flow of information in and out of the IGWS rock library.

DRILL CHIP SAMPLES

The most important data in the IGWS Oakdale Rock Library are drill chip samples. These samples are small chips of rocks that are washed out of a drill hole during rock-bit drilling, the most common technique for drilling water wells. The samples (sometimes called "cuttings") are collected by well drillers at successive five-foot depth intervals. Samples are placed in special bags (provided by the IGWS) and each is labeled to identify the well and sample depth. The drillers also prepare and submit a drill log on which they note information on the rock intervals penetrated, casing used, depth of water, and other pertinent information. IGWS personnel regularly visit well drillers to collect the samples and logs. When these samples arrive at the Rock Library, the information from the drillers' logs is entered into a digital sample tracking database and the well is assigned a unique number called a "W-number." Next, a portion of each sample is washed and prepared for microscopic study. The washed sample is placed in a coin envelope which in turn, is placed inside a larger envelope that also contains samples of the unwashed material from that interval. Both envelopes are labeled with the W-number and depth interval, and when all samples from the well have been processed and missing interval samples or other anomalies noted, the samples are boxed and shelved for future study and the well's computer database information updated. A cataloging system similar to that used in traditional libraries allows IGWS staff to keep the samples organized and searchable. The saving of well samples by drillers is voluntary for most wells; however, samples are required for all permitted wells (municipal wells, wells that will produce in excess of 25,000 gallons of water per day, and oil, gas, and mineral exploration wells).

STUDY OF CHIP SAMPLES

Selected sets of well samples are studied by IGWS staff geologists, and written logs are produced. Each sample is examined under a binocular microscope to identify the "lithologies" (rock types), fossils, mineral grains, and other characteristics of the sample. This information is recorded on a long strip of cardboard called a "striplog" using both written descriptions and colored graphics. When the study of all of the samples from a well is completed, the "stratigraphy" (the names of the various geologic units encountered in the well) is identified and indicated on the striplog. Finally, the striplog is completed by filling in the "header" information at the top of each striplog, including the well location, owner, driller, dates drilled and studied, and other important information. To date, IGWS geologists have produced striplogs for 21,688 of the 36,381 sample sets (60%) and additional logs are being produced

(article continued on page 10)

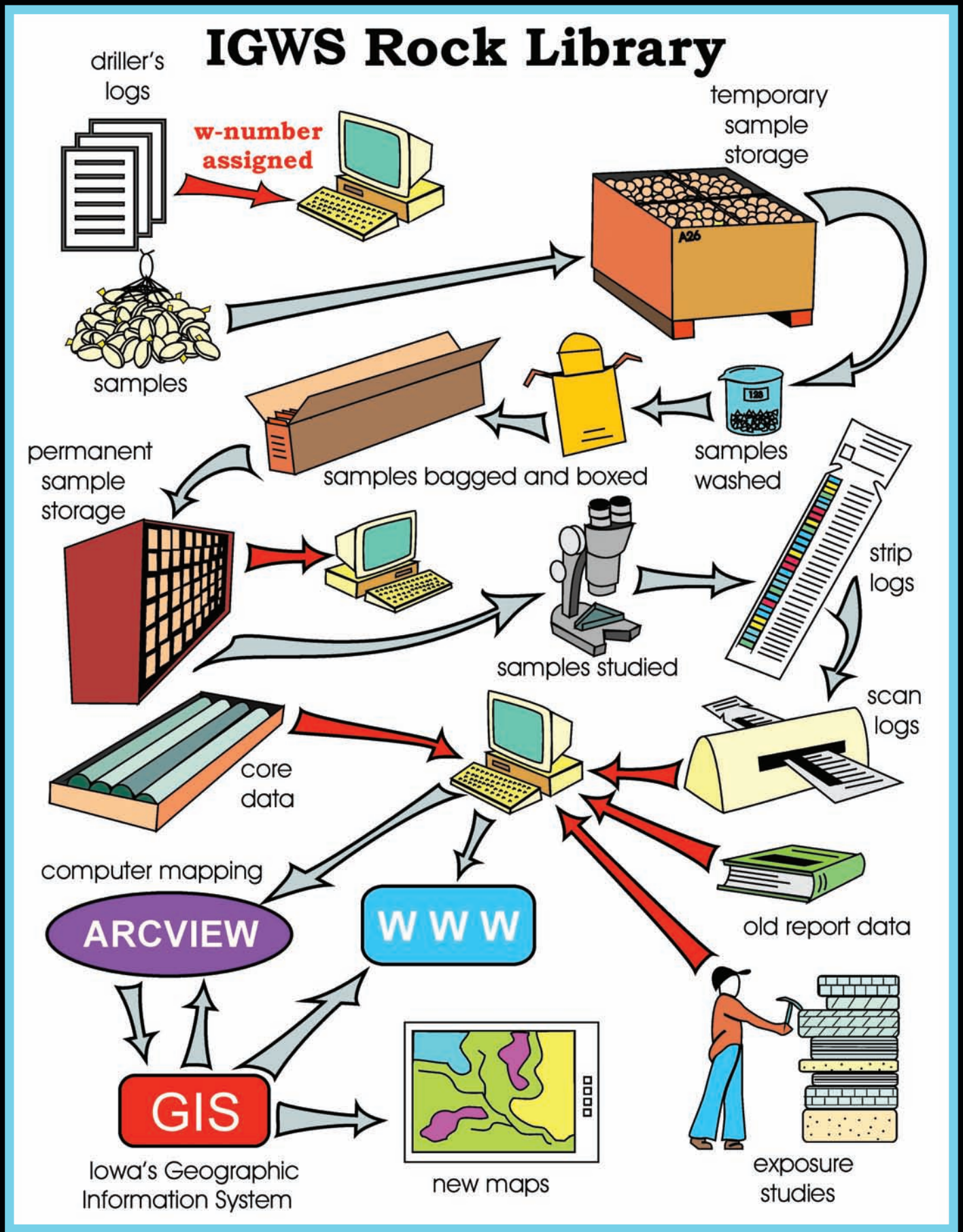
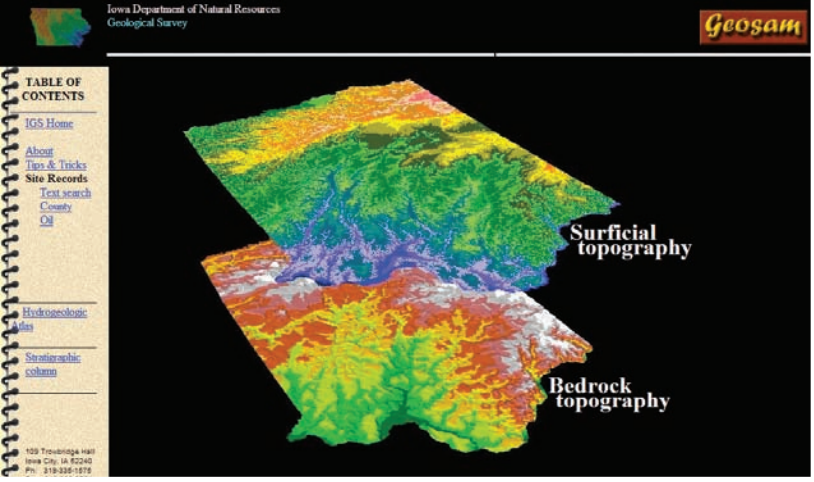
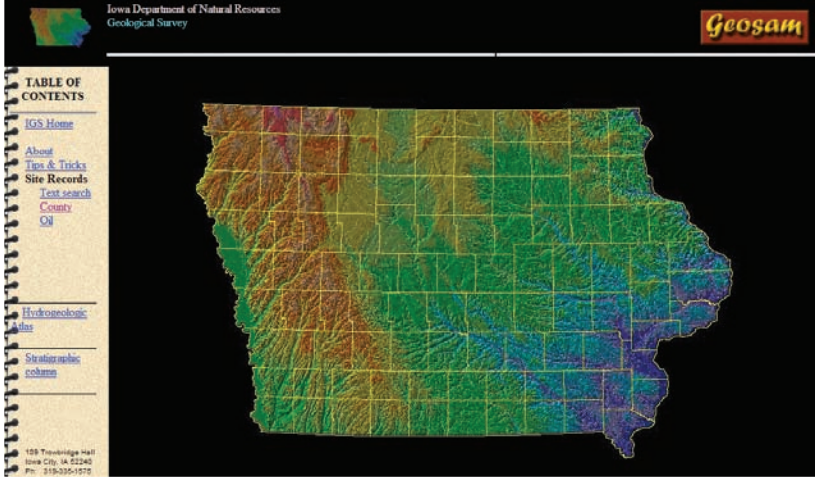


FIGURE 1. Diagram showing flow of IGWS Rock Library information into and out of the GEOSAM database.





(article continued from page 8)

every week. Information from these striplogs and scans of the logs are entered into the GEOSAM database where they are accessible to geologists, drillers, or the general public along with other scanned information on the wells.

DRILL CORE SAMPLES

The Rock Library also contains cores from over 1,697 research wells, totaling over 464,000 feet of rock section. These cores are drilled using a special drill bit that looks like a short length of pipe impregnated with diamonds on one end. These diamonds bore through rock, cutting out a cylinder which is recovered through the center of the hollow drill pipe. These cores are especially valuable for geologists, since they provide a virtually continuous sample of rocks which normally lie deeply buried, some not exposed anywhere in Iowa. Many of the cores in the IGWS Rock Library were drilled and donated by mineral and petroleum research companies, who drilled cores to access and evaluate underground storage facilities, mine and quarry operators in Iowa, and consultants who collected the cores in the course of environmental studies. These cores range in size from over 4" to about 1" in diameter, and provide researchers with material to test the rock for minerals, collect and identify fossils which are used in stratigraphic identification, test the rock's "porosity" (its ability to hold water, oil, or gas) and "permeability" (the ability of water, oil, or gas to move through the rock), and its structural properties. Additionally, the IGWS collects hundreds of feet of cores of unconsolidated materials (loess, glacial till, and river sediments, etc.) which are studied and logged in detail at the library but not usually preserved.

ACCESSING DATA ON GEOSAM

An important component of the IGWS Rock Library is the GEOSAM database, which serves as the access to library information and is available to anyone without a charge. GEOSAM can be accessed with the **GEOLOGIC DATA** link on the IGWS home page (http://www.igsb.uiowa.edu/). To find a specific record click on **County** under **Site Records** on the **Table of Contents**. Click on the county of interest, then further delineate the search area using one of the parameters under County on the menu. Clicking on the specific area of interest will bring up a list of all of the library's data points in that search area. The wells are listed in Township-Range-Section order. More assistance for using GEOSAM can be obtained in the Tips & Tricks link in the menu of the GEOSAM homepage.

A RESOURCE FOR TODAY AND TOMORROW

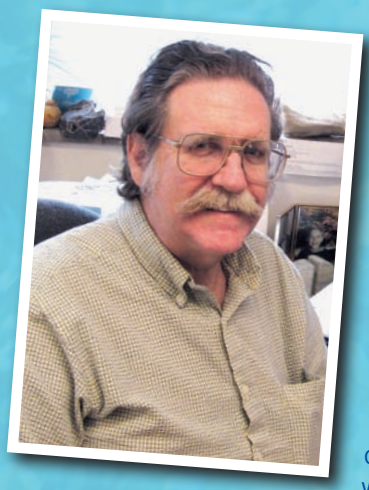
The IGWS Rock Library contains rock samples that have been collected and studied almost continuously since 1933. It would cost over $185 million to commercially drill and recollect the cutting samples reposited in the library today. Preparation and study of these samples would cost an additional $13 million. To drill the core samples in the rock library today would cost $50 million, with an additional $2.0 million required to prepare and study the cores. **The total replacement value of the drill samples in the IGS Rock Library is over $250 million**. The library represents an irreplaceable resource for the citizens of Iowa!

With geologic information from over 73,000 sites in Iowa, it would seem that coverage of the state would be relatively complete, but the distribution of these data is not uniform. The library includes information from **less than 50%** of the 1 mile-square sections in Iowa. Only **34%** of the sections have a well with samples, and only **26%** have one or more wells with samples that reach bedrock. **That means that almost 75% of the sections in Iowa do not have even one well to bedrock in the database**. So the IGWS will continue to collect well samples to improve this coverage. To continue to expand the Library's coverage the IGWS staff asks all well drillers to consider saving quality drill samples, and all new well owners to ask their drillers to save samples and submit them to the IGWS library. **Your assistance will insure** that the State of Iowa and its residents will have access the geologic information needed to enrich, protect, and conserve our groundwater resources, model and characterize our aquifers, locate mineral deposits, identify underground structures that could store natural gas or wind energy, sequester CO2, or even produce oil, and many more services for years to come.

GROUNDWATER HEROES

GARY SHAWVER

Gary has contributed greatly to IGWA and groundwater quality over his years of service in the water well industry. He has been an active member of IGWA since its founding in 1984 and served as one of its first directors from 1984 to 1986, its Vice President from 1986 to 1987, and its President from 1987 to 1988. He also served as an IGWA director from 1995 to 1997. Gary can always be counted on to move his profession forward. Most folks are probably not aware that he was one of the first people in Iowa to commit to using groundwater as a renewable energy source when, in 1979, he installed a groundwater heat pump in his own home. He is a consistent contributor of well cuttings and drillers logs to the Iowa Geological and Water Survey; in fact, a good portion of the cuttings stored at the Survey are from Shawver wells. Because of his consistent professionalism and dedication to groundwater quality, IGWA is proud to name Gary Shawver a groundwater hero.



PAUL VANDORPE

Paul has been a geologist with the Iowa Geological and Water Survey for nearly 36 years and has been a member of IGWA since its inception in1984. Interestingly, Paul started out his career at the IGWS working on the Survey's coal exploration project, but in 1981, he became part of the groundwater world by joining the Water Division of the Survey. For 30 years, Paul has provided valuable information on Iowa's aquifers to geologists, water well drillers, groundwater professionals, consultants, engineers, and the general public. Anyone who thinks of IGWA thinks of Paul. He served IGWA as Treasurer for twenty years (1989-2009), and from 2009 to 2010, he served as IGWA's Business Manager. For 26 years, Paul worked tirelessly for IGWA, whether it was registering folks for the spring or fall meeting, arranging for the printing and mailing of the Quarterly, or speaking on IGWA's behalf. Paul is indeed a groundwater hero.

Permitting Geothermal Applications

Michael K. Anderson, P.E. – IDNR

Photo Credit: Deb Tinker – IDNR

Geothermal wells are being increasingly utilized for energy-efficient heating and cooling of homes, businesses and communities in the State of Iowa. Geothermal wells use the constant temperature available from the earth (resource temperatures of 4°C (40°F) to 38°C (100°F)) as a heat source in winter or a heat sink in summer. In summer, excess heat is transferred into the ground, and cool air is brought back to the surface (and vice versa). By using constant earth temperature, efficiency of a heating and cooling system increases. This reduces the amount of energy needed for heating and cooling of a structure and provides the owner with long term monetary savings and a smaller ecological footprint. There can be cost savings of 30-70% in heating mode, and 20-50% in cooling mode. It is estimated that there are ~ 1,600,000 systems in the U.S. that create an annual savings of more than 7 billion kWh.

There are three types of geothermal systems typically used. Two systems are considered closed (vertical well or horizontal loops), meaning that the systems circulate a fluid in closed pipes with no interaction with the environment (except exchange of heat). A third type of system is an open loop system. In these systems, groundwater is pumped from an aquifer directly into the building where the heat contained within the groundwater is transferred through a heat pump. Once the heat value of groundwater has been utilized, the water is either discharged to a stream or sewer, or it is pumped back into the same aquifer via a 2nd well, located a suitable distance from the first well. It is this third type of "open loop" system that has been raising issues within the Iowa Department of Natural Resources (Iowa DNR) over the past three to four years. The Iowa DNR is charged with permitting new geothermal systems in the state.

Concerns are sometimes raised during Iowa DNR permitting whether open loop systems are a beneficial use of our groundwater resources. For most cases they are, but they are NOT suitable for confined aquifers or for "limited extent" unconfined aquifers. Geology is an important factor affecting a potential geothermal project and whether a permit can be issued. Local geology will control the selection of the geothermal method, the number and depth of boreholes, and the drilling technique used. Other permitting issues to contend with include:

- *Is there sufficient water quantity available to nearby groundwater users?*
- *How will discharge water be disposed?*
- *How will drilling and grouting be conducted to prevent loss of fluids to the aquifer?*
- *Will groundwater flow to deeper aquifers be prevented?*
- *Will groundwater pumping affect nearby environmental contamination, including underground storage tanks (USTs), septic tanks, and other potential known or unknown sources (e.g., dry cleaners, hazardous waste sites).*

Several types of permits are typically needed for open loop geothermal wells. To begin with, a permit to construct the well (s) is needed to ensure compliance with well construction regulations. Permits are issued by county health departments under an agreement with the Iowa DNR. If an "open loop" system will withdraw more than 25,000 gallons of water a day, a water withdrawal permit is required. If an open loop system is used and water is discharged to a water of the state, a discharge permit will be required so that discharged water does not result in a violation of water quality standards. It should be noted that these regulations are not specific to geothermal wells - all wells require a construction permit, and many other wells require a withdrawal permit, and a discharge permit if applicable. Should an open loop system be designed with a reinjection well, an EPA injection well Class "V" permit or a letter of authorization/ registration is required.

Two recent examples highlight some permitting issues involved with new geothermal systems. In both cases, open loop cooling with discharge to sewers was not feasible, so the applicants asked Iowa DNR to consider re-injection. Permitting re-injection was considered feasible if a pumping test was conducted and no thermally altered or chemically treated water were injected into the aquifer.

Cedar Rapids area

The Silurian aquifer in the area has been used extensively for municipal and industrial purposes and published reports indicated very large yields potentially available in the fractured dolomite wells. Recharge to the aquifer occurs with precipitation and leakage from surface water bodies including the Cedar River and Cedar Lake. Because of the recharge potential and aquifer permeability, the aquifer was not deemed susceptible to significant depletion and significant cones of depression from pumping wells were not anticipated given the pumping rates and volumes requested. A pumping test for a proposed reinjection well did not indicate any problems, so an open loop permit was issued in the fall of 2008. Prior to this test, three middle school wells were permitted for the City of Cedar Rapids Community School District in 2004 and no problems have been experienced.

Waterloo – Cedar Falls area

Devonian carbonate rocks are fractured and solutionally enlarged in the Waterloo and Cedar Falls area, making the aquifer a highly productive water supply. Due to its connection with the Cedar River and shallow bedrock vulnerability, the aquifer is subject to nitrate-nitrogen contamination. Background nitrate concentrations are typically around 7.0 mg/l in the aquifer. In March 2008, a 187 foot deep open-loop geothermal well was installed, with perforated casing from 140 to 185 feet below ground surface. Subsequently, the applicant had a discharge permit denied because nitrate loads discharged to the Cedar River from the open-loop system exceeded the Total Maximum Daily Load (TMDL) for nitrate stablished for the river. An injection well was subsequently proposed to dispose of approximately 100 gallons per minute (gpm) of water from the open loop well. The close proximity of the open loop system to a Cedar Falls Utilities Well (~700 feet) required Iowa DNR to evaluate the potential impact of the injection well discharge on the water supply well.

The pumping test revealed that the radius of influence of the pumping of the geothermal well was about 600 feet. And that most of the injection water was captured by the pumping well. Minor drawdown caused by Cedar Falls Utilities Well on the injection test well was offset by the much larger drawdown caused by the pumping of the geothermal well. Based on the hydrogeologic data, any additional risk posed by the proposed injection well on the Cedar Falls Utilities Well was deemed to be extremely low. The allocation permit was issued in mid-January of 2009, although the case can be re-opened if contrary data emerges. To date, no problems have been observed.

Legislative Review:

Iowa's Proposed Chapter 48, Ground Heat Exchanger Loop Borehole Systems

Russell Tell – Iowa DNR

During the last decade Ground Heat Exchange (GHEX) has been a steadily growing source of heating and cooling for Iowa's homes, businesses and public buildings. Prospective users are lured by energy efficiency, anticipated low life cycle cost, and incentives like tax credits, rebates, and reduced electric rates.

Iowa is considered one of the national leaders in the use of GHEX technology. We have seen the number of GHEX related borehole and well construction permits increase each of the last seven years. Construction permits issued for GHEX systems currently make-up over thirty three percent of all well permits issued in our state. This amounts to approximately 6,200 individual boreholes proposed and an estimated 1.4 million feet of borehole installed in 2010.

During this time of industry growth, individuals from within the GHEX industry and other stakeholders came forward with questions and concerns regarding loop borehole fields and the environmental protections used in the construction of these systems. The stakeholders were looking for the department's help to develop a more appropriate standard for GHEX loop borehole fields. The DNR agreed to assemble and work with a stakeholder group to look at potential changes in Iowa's well construction standards as they applied to GHEX loop borehole systems.

FEBRUARY 17, 2005

A working committee was formed which included representatives from a number of professional disciplines that understand GHEX installations and well construction in general. The committee's initial discussions focused on how GHEX loop borehole fields are regulated in other states and how these systems are commonly installed in Iowa's varying geology. This led to exploring how borehole installation practices can affect system efficiency and environmental protections; what normally constitutes adequate environmental protections; what changes in current rules could serve all stakeholders; and how to approach the development of a new statewide standards that would be comparable to industry standards that are being developed at the national level. The goals of the committee were to provide adequate environmental protections, allow for good system efficiency, achieve the results with the normal equipment, practices and products available to the drilling industry, and have a rule that is adaptable so that new and unforeseen technologies have a reasonable way to be evaluated.

The committee work resulted in the creation of a proposed set of rules known as Chapter 48, Ground Heat Exchanger (GHEX) Loop Borehole Systems. Chapter 48 is a stand-alone chapter of Iowa Administrative Code (rules) dedicated to GHEX loop borehole system installation.

A brief summary of the rules as proposed includes the following items:

- *Establish a new level of Well Contractor Certification – GHEX Loop Borehole Driller;*
- *Establish a new dedicated exam that utilizes Iowa and industry standards and practices for testing of an applicant;*

- *Provide a "grandfathering" period for existing Iowa DNR Certified Well Drillers so they can become an Iowa DNR Certified GHEX Loop Borehole Driller by submitting application and meeting minimum work experience requirements;*
- *Establish an extra step in the initial well permitting process to determine the location of nearby water supply wells;*
- *Define setbacks specific to GHEX boreholes;*
- *Establish the requirement that all boreholes include full depth grout placement;*
- *Define borehole construction for specific geologic situations;*
- *Establish criteria for filling voids found during construction;*
- *Establish pressure testing requirements for both vertical and horizontal piping;*
- *Establish a trench bedding specification;*
- *Provide for additional types of heat transfer fluids and additives;*
- *Establish a defined borehole and piping plugging standard when the heat exchanger cannot be used;*
- *Establish the ability to define additional construction requirements when encountering difficult bedrock geology;*
- *Provide for sharing all information known or developed to potential bidders when borehole fields are competitively bid;*
- *Provide for recording and locating of boreholes, borehole field, and horizontal header piping.*
- *Establish grounds for additional requirements when working in geologic settings that make borehole completion difficult and unpredictable.*

As of the date of this publication, proposed Chapter 48 has gone through a public comment period that has resulted in a number of concerns that the department would like to explore and address. This will result in additional work with stakeholders to discuss the concerns, work on changes in the rule language where needed and possible, and the scheduling of at least one additional public hearing to allow for public comment on the latest proposed changes. Unless delayed by additional action or rule making requirements, I anticipate that you will see some form of Chapter 48 implemented by 10/2011.

If you would like additional information regarding Chapter 48 or you have questions regarding the Iowa DNR Private Well Program, please contact Russell Tell by phone at 515-725-0462, or by email at Russell.tell@dnr.iowa.gov.

student bio

Alison Schell is a sophomore majoring in Geology and Earth Science at the University of Northern Iowa. In her spare time, Alison has interests in golfing, swimming and traveling.

investigating the source of nitrate: NITROGEN IN CEDAR FALLS UTILITIES WELL #3

Alison Schell - University of Northern Iowa

The Iowa Department of Natural Resources' Source Water Assessment program is concerned about high concentrations of nitrate in one of Cedar Falls' municipal wells. The objective of my research project is to find out more information about the source the high nitrate concentrations affecting Cedar Falls Utilities (CFU) Well #3. Testing began in February 2011 and continued twice a week for eight consecutive weeks at four separate locations. Sampling sites included CFU's Well #3 and Well #9, the Cedar River at Pfeiffer Park, and the Cedar River boat ramp in George Wyth State Park. Water quality was tested on-site for dissolved oxygen, total dissolved solids, conductivity, and pH. In the hydrogeology lab at the University of Northern Iowa, additional testing was conducted for nitrate, sulfate, and chloride. The results showed high levels of nitrate (as NO-3 – N) in Well # 3 ranging from 8.65 mg/L to 9.35 mg/L with a mean of 9.02 mg/L. This value is very similar to concentrations observed in previous years. Agricultural fields in the area appear to be the source of nitrate in the well. The exact mechanism of nitrate transport from the fields to the Well# 3, which is 218 ft deep, is now being investigated using geophysics.

do you know

a student or intern in the groundwater field with an interesting project?

We want to promote our up and coming young professionals by publishing their project abstracts in our magazine.

Email an abstract to:
IGWA Underground Newsletter Editor,
Lisa Walters at lwalters@iowaruralwater.org.
Thanks!

investigating surface water and GROUNDWATER QUALITY

NEAR DRY RUN CREEK, CEDAR FALLS, IOWA

Jacob Donaghy - University of Northern Iowa

At the University of Northern Iowa, we are investigating differences in water chemistry between shallow and deep groundwater quality that may contribute baseflow to Dry Run Creek, an impaired stream that flows through the Cedar Falls area. A well nest of 10 wells located on campus are being used for evaluating groundwater flow and contaminant transport. Eight shallow ranging in depth from 10 to 20 feet were drilled into glacial sediments above the bedrock surface and two wells 70 and 90 feet deep were drilled into the Devonian carbonate bedrock. Differences in water chemistry between Dry Run Creek surface water and deep groundwater demonstrate the differences between open and closed systems. Total dissolved solids (TDS) ranged from 186 to 273 mg/l in deep groundwater while surface water ranged from 345 to 375 mg/l. On the other hand, dissolved oxygen (DO) was lower in the deep groundwater compared to surface water, ranging from 1.72 to 3.43 mg/l in groundwater and 7.60 to 11.66 mg/l in surface water. Since the deep groundwater is not in contact with the atmosphere or surrounding land use (closed system), surface runoff and land use do not substantially affect groundwater quality and TDS concentrations are low. Similarly, DO concentrations are low in the closed bedrock system where biogeochemical reactions have consumed available oxygen and DO levels are not replenished by atmospheric contact. We are currently implementing real-time water quality meters in the creek and one of the deep wells to further evaluate water quality differences between the two systems.

Well nests adjacent to Dry Run Creek, Cedar Falls, Iowa.

student bio

Jacob Donaghy is in his second year of the Environmental Science Masters Program at the University of Northern Iowa. He completed his B.S. at Iowa State University in Environmental Science (2009) and is interested in watershed hydrology, nutrient flow and surface/groundwater interactions. In his spare time, Jacob likes to hunt, fish, ride motorcycle/snowmobile/four wheeler and spend time with family and friends.

got a job?

Do you have a job opportunity that you would like to promote? Promote to IGWA members! We will post your job posting to www.igwa.org and even send it out to our members in the email listserv!

Email your posting to:
IGWA Underground Newsletter Editor, Lisa Walters at lwalters@iowaruralwater.org.

UP FOR DISCUSSION

Bob Drustrup – Environmental engineer with 25 years experience in the environmental cleanup field.

With Justice for All: Why we should move away from polluter pays towards a universal cleanup fund

We need to ask ourselves "Are we interested in cleaning up truly contaminated sites or are we mainly interested in seeking retribution for past pollution sins?"

Today's regulatory programs that deal with groundwater contamination generally trace their roots back to the federal Superfund program that was signed into law on December 11, 1980 by President Jimmy Carter. It was enacted to clean up the worst hazardous waste sites in the country, like Love Canal in Buffalo New York and the LaBounty site in Charles City, Iowa. Initially groundwater contamination was the clear focus of the Superfund program. All 23 Superfund National Priority List (NPL) sites in Iowa became NPL sites because of groundwater contamination concerns.

A cornerstone of Superfund and most state groundwater cleanup programs is the "polluter pays" principle (P^3). In simple terms, "polluter pays" means if you caused contamination you are responsible for cleaning it up. It makes sense, like when your mom told you it was your responsibility to clean up the mess you made. P^3 is a nearly universally accepted. It appeals to peoples' basic sense of fairness. It gives the regulatory cops authority to bring justice to the environmental bad guys: classic good versus evil. While all of the above is true, I'm going to break ranks and argue that P^3 can be (and often is) grossly unfair and counterproductive when dealing with contamination that resulted from a past activity that was not illegal or inappropriate at the time. (This does not include recent spills, which should continue to be addressed immediately by the party responsible for the spill.)

With P^3 there is an implication that polluters intentionally caused contamination. Often polluters are viewed as evil industry causing contamination by avoiding more expensive, environmentally friendly practices. On the contrary, in my nearly 25 years of working in the Superfund program, I have not found this to be the case. In fact, more often it's just the opposite.

Many of the Superfund NPL sites in Iowa are the result of businesses attempting to comply with other environmental regulations. For example, the Midwest Manufacturing Company in Kellogg constructed a wastewater treatment facility to comply with the Clean Water Act. This facility generated a waste sludge. They came to the state and asked how to properly dispose of the sludge. The state gave no recommendations so they ended up burying the sludge on-site and at a remote off-site location. This was done before current disposal regulations existed and in a manner that was considered appropriate at that time. Midwest Manufacturing was designated as a Superfund NPL site because the buried sludge was later classified as a hazardous waste and deemed a potential threat to the city wells. (No threat to the city was subsequently found.) So was Midwest Manufacturing an evil industry? Hardly.

The goal of the 1987 Groundwater Protection Act is to prevent contamination of groundwater "and, if necessary, to restore groundwater to

Superfund was NOT intended to clean up this site.

Superfund was NOT intended to clean up this site.

a potable state, regardless of present condition, use, or characteristics." This "if necessary" clause is the basis for risk-based corrective action (RBCA) regulation of groundwater contamination. With RBCA, groundwater cleanup is only required when a site poses an unacceptable risk to human health or the environment. Since all groundwater contaminated with pollutants cannot be cleaned up to a pristine condition, RBCA is inevitable. There are simply not enough resources to clean up everything. Therefore, it makes sense that we focus on the most problematic groundwater contamination, especially at sites where people have potential exposure.

The problem is P^3 + RBCA = injustice. The importance of groundwater contamination is often a function of the site's location rather than the magnitude of the contamination or the action that caused it. Most groundwater contamination addressed today occurred long before applicable regulation existed.

Iowa's underground storage tank (UST) program avoids the injustice of RBCA + P^3 by providing a cleanup fund. Funds are generated by a penny tax on gasoline and diesel and the tax produces about $20 million per year. Since everyone directly or indirectly uses gasoline or diesel, we all share in the cost of cleanup of high-risk UST contamination. Funds are focused on problem sites. Cleanup is not required for UST contamination that does not pose a high risk.

While RBCA approaches are also used in Iowa to regulate groundwater contamination not associated with USTs, there is no universal cleanup fund available. Hence, the polluter is still required to pay for site cleanups. This has created a variety of problems including:

- *Environmental liability concerns involving previously developed properties (i.e., brownfields), causing decrease in property values and increase in costs of property transactions, which contribute to urban decay and suburban sprawl.*
- *Disincentives for parties to identify contamination for which they may be responsible.*
- *Adversarial relationships between regulators and "polluters" creating a need for more expensive legally defensible data and legal fees and increasing the time to resolve real contamination concerns.*
- *Obvious situations of unfairness, e.g., identical contaminating actions resulting in required expensive cleanup at a sensitive location and no action at a remote location.*

Dry cleaning and agricultural chemical industries in other states have recognized this RBCA + P^3 problem and pushed for industry-specific cleanup funds. Interestingly, such a fund was established for the agricultural-chemical industry in Iowa, but no money was ever allocated to it.

While we could let individual industries push for industry-specific cleanup funds similar to the UST Fund, wouldn't it make more sense to comprehensively address this issue by establishing a universal cleanup fund? An additional penny tax on gasoline, for example, which most people would view as insignificant, would go a long way to accomplish this. We need to ask ourselves "Are we interested in cleaning up truly contaminated sites or are we mainly interested in seeking retribution for past pollution sins?"

Superfund was intended to clean up this site.

Superfund was intended to clean up this site.

IGWA Member News

Calvert Honored

H.B. Calvert, a technical assistance provider with Midwest Assistance Program, Inc. serving Iowa and Northern Missouri, was named to the Rural Community Assistance Partnership Hall of Fame. Inductees to the Hall of Fame have made significant positive contributions to RCAP over the course of their service. Calvert has been with MAP for nearly 20 years.

His dedication to MAP and to the communities of Iowa and Missouri was celebrated November 30, 2010 at the RCAP National Conference in Washington, DC. Calvert is based in Fort Madison, Iowa.

In addition to his award, H.B. is retiring in August. An IGWA member since 1993, he writes, "I know I will enjoy retirement, but I will also miss working with the many wonderful people working to make Iowa a better place to live." Congratulations, H.B.!

Goodbye and Good Luck

Tom Marshall, Treasurer for the Iowa Groundwater Association from 2009-2011, has accepted a geologist position with the South Dakota Geological Survey and will be leaving the state. He was previously employed as a Research Geologist with the Iowa Geological and Water Survey where his interests were focused on Pennsylvanian stratigraphy and public outreach. Tom's contributions to IGWA will be missed and we wish him luck in his future endeavors.

Membership Recognition

Five new individual and three new corporate members have joined the Iowa Groundwater Association since January 2011. They are:

- Brian Gedlinske, Cedar Falls, IA
- EarthView Environmental, Coralville, IA
- David Miller, Mason City, IA
- Thein Well Company Inc., Spicer, MN
- James Goodrich, Iowa City, IA
- Jeri Massengill, Hopkins, MN
- Stanley Consultants Inc., Coralville, IA
- Ginger Thune, Des Moines, IA

5-Year Members
• Bob Campbell • Dennis Sensenbrenner • Jeff Sherman • David Wonder

10-Year Members
• Karen Oppelt • Becky Svatos

15-Year Members
• Jim King • Robert Rohlfs

20-Year Members
• Michael Anderson • Robert Blok • Steve Hardy

25-Year Members
• Dan Kolpin

DID YOU KNOW

that IGWA is now accepting government groups, such as Iowa DNR sections or county public health departments, as corporate members?

Contact an IGWA Board member for details.

Upcoming Events

"Proper Grouting Techniques"

Education Program for Well Drillers & County Sanitarians
August 10, 2011
Central Iowa Expo, Boone, Iowa
www.iwwa.org/IWWA%20Summer%20Education%20Program%20for%20Well%20Drillers.pdf

IRWA Fall Conferences:

Okoboji – September 13-14, 2011 & Dubuque – September 27-28, 2011
www.iowaruralwater.org/conference_fall.html

2011 Iowa Science Teachers Fall Conference

October 17-18, 2011
Scheman Building, ISU Campus, Ames IA

Iowa Environmental Council Annual Conference

November 3, 2011 8 a.m. - 4 p.m.
Parents Hall, Olmsted Center, Drake University – 2875 University Avenue, Des Moines, IA
www.iaenvironment.org/conference/Annual_Conference.php

Basics of Onsite 101

November 8, 2011
Ankeny, IA DMACC - Bldg 18, Rm 35
Instructor is Brent Parker. Registration is at 8:00am. Class: 8:30am - 3:30pm
Register on-line at www.wastewatertraining.com/Register.aspx?id=9

IAMU 17th Annual Water/Wastewater Operator's Training Workshop

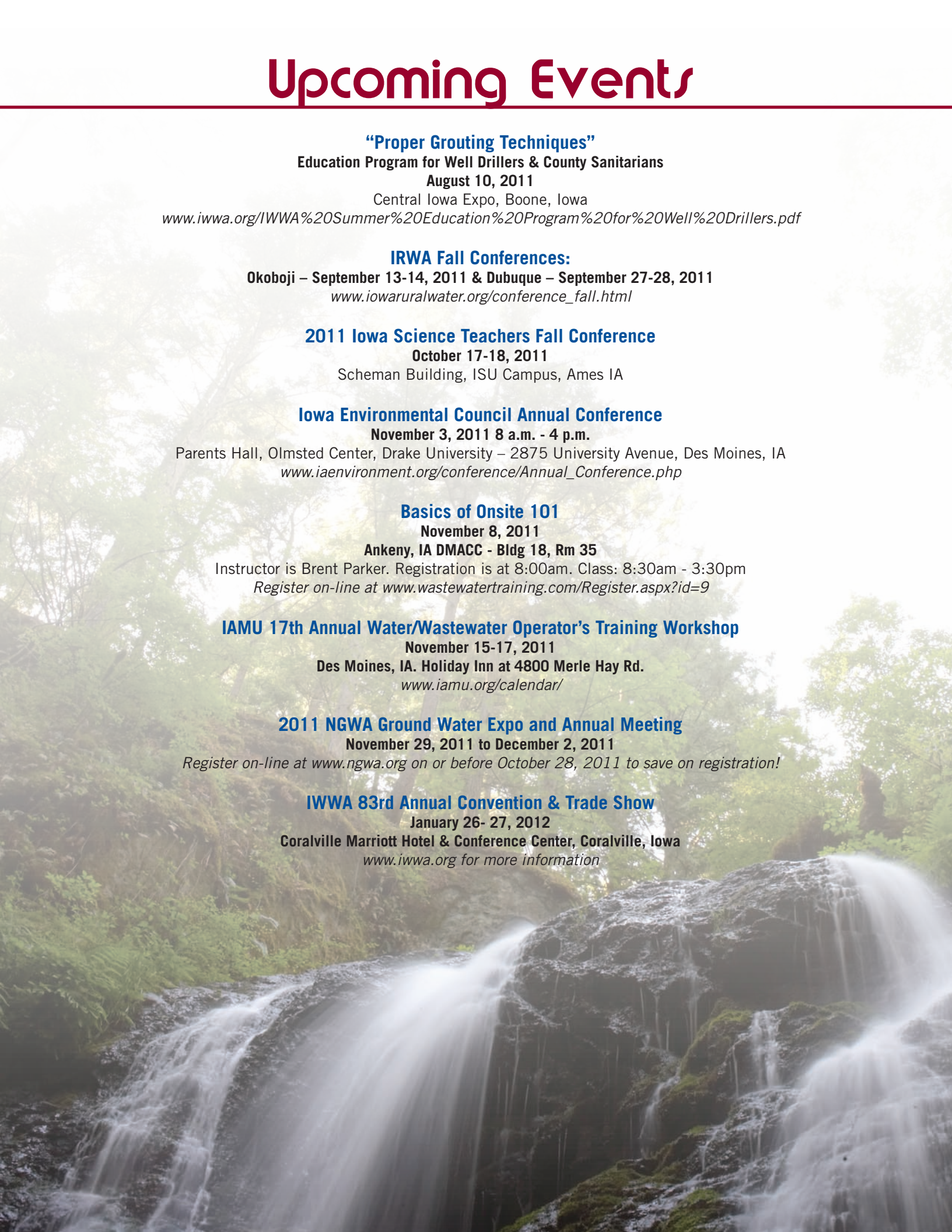
November 15-17, 2011
Des Moines, IA. Holiday Inn at 4800 Merle Hay Rd.
www.iamu.org/calendar/

2011 NGWA Ground Water Expo and Annual Meeting

November 29, 2011 to December 2, 2011
Register on-line at www.ngwa.org on or before October 28, 2011 to save on registration!

IWWA 83rd Annual Convention & Trade Show

January 26- 27, 2012
Coralville Marriott Hotel & Conference Center, Coralville, Iowa
www.iwwa.org for more information



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