The Connection

A Well Drilling Industry Newsletter

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Well Installation Board Update

The Well Installation Board (WIB) met in regular session on March 2, 2018, at the Missouri Geological Survey in Rolla. The agenda included legislative updates, the Governor's Red Tape Reduction Initiative, a summary about stakeholder meetings, section updates, and the status of the Groundwater Protection Fund. A presentation about the major highlights of rules changes and stakeholder comments was discussed with the WIB.

The May 2018 meeting was canceled due to a lack of agenda items. The next meeting is scheduled for August 17, 2018, in Rolla. If you have any interest or know of someone willing to serve on the Well Installation Board, there are four vacancies. Vacancies are for a private well user, public well user, water well contractor, and monitoring well contractor. You can apply by visiting Governor Parson's website online at governor.mo.gov. Go to the "Get Involved" tab at the top of the page and click on "Boards and Commissions" to apply.

Rule Update

On January 10, 2017, former Governor Greitens signed Executive Order 17-03 (sos.mo.gov/library/reference/orders/2017/eo3), which requires Missouri agencies to conduct a review of all existing and proposed regulations. The Well Installation Section completed this review and filed the proposed rule changes in late June 2018. These rules will be published in the Missouri Register and the public comment period will begin Aug. 1, 2018, and it will go through Sept. 14, 2018. During this time, anyone may file a statement in support of or in opposition to these proposed changes with Department of Natural Resources' Geological Survey Program, to the attention of Amber Steele at PO Box 250, 111 Fairgrounds Road, Rolla, MO 65402 or via email at amber.steele@dnr.mo.gov. Comments also may be submitted electronically using the Department of Natural Resources' website at dnr.mo.gov/proposed-rules/welcome.action#OPEN2.

Reporting Environmental Concerns and Requesting Investigations

Do you want to report a concern about how a well was drilled, an unplugged abandoned well, or any threat to a resource of Missouri such as a body of water or the air? Do you have questions about rules, regulations or the law? Do you want to ask a question or need assistance but don't know who to contact? Have you ever been transferred from person to person until someone can answer your question? Have you been transferred, but didn't get an answer to your question? If you answered yes to any of the questions, the best place for you to contact the department is by going online at dnr.mo.gov/concern.htm.

The "Environmental Concern Form" provides a short questionnaire that is monitored daily by department staff. All questions, concerns and reports are sent to the appropriate staff for resolution. The questionnaire eliminates guesswork as to what information is needed for staff to provide an accurate response. The form also provides you with an option to remain anonymous.

If you have a specific concern about a well, you can submit an investigation request using the form found at dnr.mo.gov/forms/780-1618-f.pdf. Investigation requests may be submitted for such issues as improper well construction, bacteriological or chemical contamination, or an unplugged abandon well. The Well Installation Section reviews every request and determines which requests are turned into investigations, also known as cases.

All information submitted to or gathered by the department is considered an open record unless specifically protected from disclosure according to the Missouri Sunshine Law. Many concerned citizens wish to remain anonymous for this reason. However, there are two drawbacks to this approach. First, staff will not be able to contact you if additional information is needed, which may slow or stop an investigation. Secondly, with no way to contact you, we will not be able to inform you of the results of an investigation.

Since staff can't be everywhere, we ask you, members of the public, to help us identify potential risks. So please, if you see an environmental concern of any kind, take a moment to submit a concern online using the Environmental Concern Form, call a Regional Office (dnr.mo.gov/regions/), or call the department's toll free number at 800-361-4827. Thank you for helping protect Missouri's natural resources.

Click image to go to Environmental Concern Form.

Thermal Grout

One of the options for grout used in the construction of geothermal wells is thermal grout slurry. As defined by the Missouri Well Construction Rules, thermal grout slurry is a grout containing at least seven and one-half percent by weight bentonite solids and at least 65 percent by weight silica solids. The grout slurry mixture must have a thermal conductivity greater than 0.85 Btu/hr.ft.degree F, and a permeability of not more than 1x10^-7 cm/s.

What makes thermal grout different than other grouts? The key to the advantages of thermal grout is in its thermal conductivity properties. In a geothermal system, heat is transferred between the loops in the wells and the earth. Because the heat is transferred through the grout, the thermal conductivity of the grout becomes an important factor in the efficiency of the geothermal system.

Grouts that have a higher thermal conductivity will transfer heat more rapidly than grouts with a lower thermal conductivity, resulting in the faster cooling or heating of the loops and a more efficient geothermal heating and cooling system. Thermal grouts as approved under the Missouri Well Construction Rules have higher thermal conductivities than regular bentonite grouts, while still maintaining adequate well seals. It should be noted that thermal grout is required to be installed the full-length of the well through a tremie lowered to an initial grouting point within 20 feet of the base of the borehole. Other thermal grouts may be reviewed and approved by Wellhead Protection on a case-by-case basis.

Sinkholes

Sinkholes in Missouri form by a slow process of erosion of limestone and dolomite (carbonate) bedrock. Rainfall percolating through the soil absorbs carbon dioxide and reacts with decaying vegetation, creating slightly acidic water. As it moves, that water slowly dissolves the carbonate rock and creates a network of cavities and voids. Over time, these processes continue and the voids grow larger. Sinkholes are a result of these processes and appear as a depression or hole in the land surface. Usually, sinkholes form gradually, but if there is not enough support for the land above an underground void, a sudden collapse of the land surface can occur. Though most sinkholes are a few feet in diameter, some expand to hundreds of feet across.

Sinkholes are a direct link from surface water to groundwater. In other types of topography, surface water is filtered through the soil. Groundwater can travel quite rapidly through these types of underground networks, known as karst, sometimes up to thousands of feet per day. This transport process can move surface water to wells and springs in the vicinity, creating the potential to transmit unnatural constituents such as contaminants.

Sinkholes often are tied to changes we create in the land surface. Some new sinkholes are linked to land-use practices, especially from pumping groundwater and from various construction and development practices. For example, a large lagoon or runoff storage pond creates weight and saturated conditions that can trigger an underground collapse of the supporting material. Sinkholes also can form by changes when the groundwater table is lowered by human usage or changed by weather. In urbanized areas, sinkholes can be hazardous as they can destroy highways and buildings.

Read more about sinkholes online at dnr.mo.gov/geology/geosrv/envgeo/sinkholes.htm

A large sinkhole that occurred in 2006, in the town of Nixa.

Welcome Contractors

The following individuals are now part of the Missouri Department of Natural Resources' permitted contractor community:

Associated Sheet Metal – Brian Sievers
B&B Well Drlg Inc. – Anthony Smith
Boessen Underground – Curtis Verdot, Charles Kiss
Brotcke Well & Pump – Shane Crites, Joshua Langston
Brown Well Drilling – Amy Nichols
Buechting Drilling – Jacob Buechting
Cascade Drilling – James Chambers, Shane Brown
Environmental Operations – Kelsey Tharp
Flynn Drilling – Chad Mudd, Devon Fuller, Colt Wesley, Brad Lavy, Nate Cody, Kenny Johnley and Nick Shocklee
Geotechnology – Elizabeth Rabbitt, Kenny Hemmen, Douglas Kettle
GHD Services – Sadie Punch
Gredell Engineering Resources – Grant Elliott
Groundwater & Environmental Services – Jamie Snider
Hagger Well Service – James (Brent) Meins
H D Sonic Drilling – Jon Keifer
Kissick Construction – Mark Rigdon
Layne Christensen – Michael Magnin, Daniel Harrison
MoDNR – Brian Newby, Elnaz Siami-Irdemoosa, Taylor Grabner, Todd Birky, Leslie Lueckenhoff, Travis Lyon, Taylor Thompson, Cailie Carlile, Katelyn Kane, Pitchaya Patana-Anake, Bryce Bobbitt, Hayley Neebe, Matthew Barton, Kyle Ganz, Kirsten Schaefer, Kyle Brown, Mark Hogan, David Drilling, Calvin Fales, Greg Snellen, Lisa Lori, Trevor Ellis
S S Papadopulos & Assoc – Benjamin Petersen
Seneca Companies – Douglas Wilson
The Doe Run Company – Genevieve M Sutton

Contractor and Apprentice Well and Pump Installation Testing Schedule

The following 2018 testing dates are scheduled at the Missouri Geological Survey, Annex Building, 1251 Gale Drive, Rolla. All tests begin at 9 a.m. Testing dates may be modified if necessary. Please bring a picture ID with you to the testing site.

August 15, 2018
September 12, 2018
October 17, 2018
November 14, 2018
December 12, 2018

If you are applying for a non-restricted permit, please be sure to bring your global positioning unit (GPS) and operating manual to the test site. Your GPS unit should be programmed to read in degrees, minutes and seconds in accordance with 10 CSR 23-3.060(5). If you have questions concerning this schedule or testing please call 573-368-2450.
For your convenience, the apprentice/restricted exam can now be completed online, at dnr.mo.gov/mowells. Please contact the Wellhead Protection section at 573-368-2165 to obtain a test ID.
Persons with disabilities who may require special services may contact Jeannie Hoyle at 573-368-2450.

Welcome Apprentice Contractors

The following individuals are now part of the Missouri Department of Natural Resources' permitted apprentice contractor community:

B&B Well Drilling – Bryan Bass
Brotcke Well & Pump – Kyle Boring v , Eric Herzog
Cole Camp Pump – Daniel Sparks
Dirty Dog Drilling – Cody Clines
Environmental Works – Benjamin Keifel, Zachary Adams, Aaron Stephens
Flynn Drilling – Andrew DeLong, Jason LaRocca, Nathan Potthoff,
Jeffrey Hatfield, Joshua Williams, Corey Webb, Samuel Shocklee, Anthony McElroy, Joshua Zweifel
Geotechnology – Kenneth Boone, Thomas Dwyer
Hampton Pump Service – Craig Bobbitt
Irrigation Central Inc. – Christopher Cannon, Michael Wagenblast, Zachary Bowers
Leigh Environmental – William Scott
Letts & Demery Pump – Gary Bailey
Maggards Pump – Tony Rains
Mr. Pump, LLC – Brandin Wills, Jeremy Freeman, Nicolas McCoy
Roberts Environmental – Matthew Kwiatowski, Doug Posey
Schroepfer Well Drlg – Leonard Jaycox
Terracon – William Platt

Farewell

The people addressed below are no longer permitted to operate as contractors according to the Water Well Drillers Act and Missouri Well Construction Regulations:

Mantle Well Service – Lyle Haslag
Pense Brothers Drilling – Ronald Rehkop (deceased)

Catch up with us on Twitter

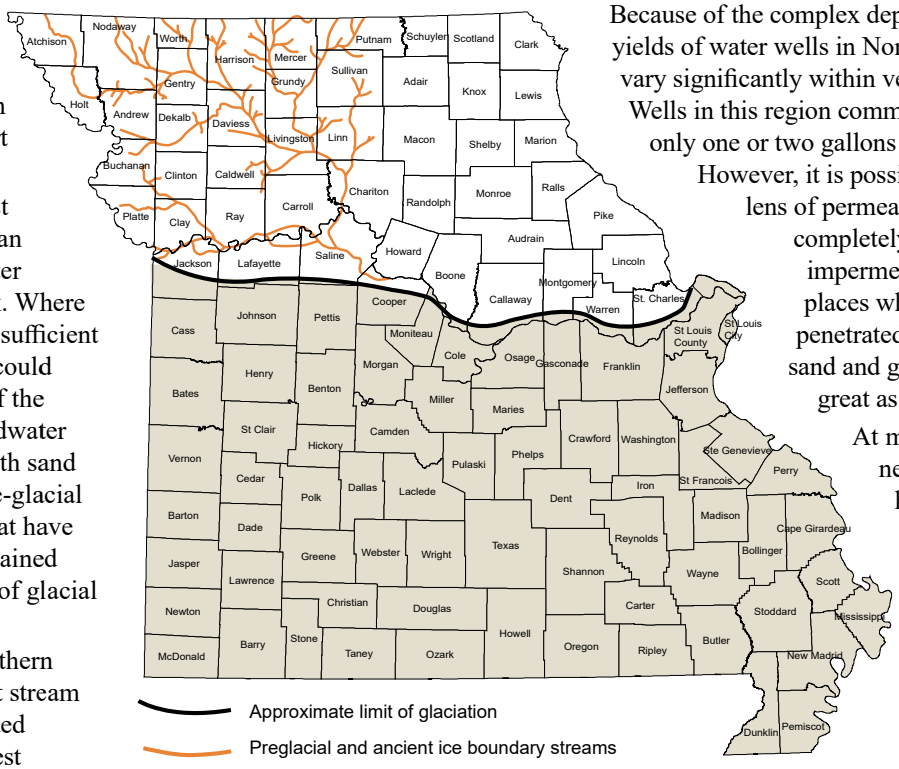
You don't need a Twitter account to read tweets the department sends. Just open a web browser and visit online at twitter.com/modnr. Better yet, if you have a Twitter account, you can receive our tweets as soon as we send them. Just follow us at @MoDNR. Check out a recent tweet about testing for non-restricted permits:
twitter.com/MoDNR/status/1015271769454850048.

Glacial Drift Aquifer in Northwestern Missouri Groundwater Province

In Northwest Missouri, water from wells drilled into bedrock typically is too highly mineralized to be used for irrigation or livestock. Mineral concentrations become greater with depth and treatment of water from this source is expensive. Consequently, the prospects for obtaining usable groundwater are modest and are limited to the surficial aquifer system. Within this environment, the geology is complex and can vary significantly over short distances.

Drilling a well in Northwest Missouri that will produce an ample supply of groundwater largely is a function of luck. Where one location can produce a sufficient yield, a nearby well likely could produce nothing. In most of the region, the available groundwater occurs in channels filled with sand and gravel deposited by pre-glacial and inter-glacial streams that have since been buried in fine-grained and poorly-sorted deposits of glacial drift.

Advancing ice covered Northern Missouri and buried ancient stream channels that had been eroded into the bedrock. The thickest deposits of glacial drift occur in the northwestern part of the state. Most of the region is covered by 100 to 200 feet, but thicknesses can be greater than 300 feet. The volume of water produced is dependent on the thickness and composition of the surficial material that was laid down directly by the ice as fine-grained and poorly-sorted till or was deposited by meltwater streams as gravel and sand alluvium. Over time, new drainage patterns developed over the unconsolidated glacial deposits. The meandering of meltwater streams across valley floors left deposits of sand and gravel surrounded by nearly impermeable clay and silt. The result is a thick and complex interbedding of coarse-grained and fine-grained material.



Because of the complex depositional environment, yields of water wells in Northwest Missouri can vary significantly within very short distances. Wells in this region commonly produce only one or two gallons per minute (gpm). However, it is possible to encounter a lens of permeable material that is completely surrounded by nearly impermeable silt and clay. In places where the wellbore has penetrated multiple thick beds of sand and gravel, yields can be as great as 1,000 gpm.

At many sites, it is necessary to drill test holes to locate the most productive zones. In the 1950s, Missouri Geological Survey and Water Resources staff conducted a test drilling program to assess the groundwater possibilities for the glacial drift aquifer in the Northwestern Missouri Groundwater Province. This project set out to identify areas that could yield sufficient amounts of water for domestic and agricultural use. These subsequent reports summarize and interpret the results on a county-by-county basis. The reports may be found at dnr.mo.gov/env/wrc/water_res_rpts.htm#Groundwater.

A Collaborative Approach to Compliance

Unplugged wells present potential hazards for Missouri residents. As part of our mission, the Well Installation Section (WIS) ensures abandoned wells are plugged in accordance with state regulations. This article highlights an example of how staff in the section work with a variety of partners to protect Missouri's groundwater resources.

Recently, section staff collaborated with a commercial property owner on a challenging abandoned well situation. During development of this property, it was discovered that wells constructed during the 1960s that were inadvertently buried. Because the wells were constructed before well installation regulations were in place, very little information was known about them, and they were difficult to locate. Staff worked collaboratively with the property owner, city utilities and well installation contractors to achieve compliance.

After obtaining general location information for one of the two abandoned wells, the property owner coordinated excavation work that resulted in finding the well, which was filled to a depth of approximately 15 feet with debris. A permitted well installation contractor hired by the property owner removed the material and plugged the abandoned well to meet state requirements.

Even less was known about the second well. The property owner and developer spent nearly two weeks attempting to locate the lost well. This involved multiple heavy equipment operators unearthing fill material away from the area where the well was thought to be. The well's casing was at last discovered after removing several feet of fill over a large portion of the property. After extraction of the well pump, the hole was plugged from bottom to top.

A beneficial outcome was achieved despite many challenges. Both wells were approximately 600 feet in depth and had the potential to contaminate a deep aquifer. Open lines of communication, clear direction and perseverance by all parties resulted in the elimination of a potential threat to state groundwater resources.

Iron in Water Wells

Groundwater is less susceptible to bacterial pollution than surface water. This is due to the filtration that takes place as the water moves through the soil and rock. While bacteria occasionally find their way into groundwater supplies, the natural process of the water moving through the layers of soil and rock generally is an effective filter. This same process leads to the presence of dissolved minerals. Water passing through voids and fractures dissolves minerals from surrounding rock and puts them into solution.

Iron is one of the most abundant elements in the earth's crust (by weight). It should be no surprise that iron is found in measurable quantities in nearly all ground water supplies.

Iron in its soluble form is ferrous iron. Often referred to as "clear water iron," it is easily oxidized in the presence of air to form ferric oxide, which is insoluble or visible iron. Ferrous iron above 0.1 milligrams per liter (mg/L) or ferric iron above 0.2 mg/L will exceed the taste threshold of most individuals resulting in a bitter taste to the water.

The U.S. Environmental Protection Agency does not include iron in the National Primary Drinking Water Regulations. However, iron is in the non-enforceable Secondary Regulations with a limit of 0.3 mg/L. The Secondary Regulations are based on aesthetic and taste considerations. Total iron levels at or above 0.3 mg/L are undesirable due to appearance and staining problems rather than health related issues. Levels at or above 0.3 mg/L tend to stain whatever it comes in contact with, such as plumbing fixtures, light colored laundry, etc. Low levels of iron often can be treated by the use of a standard water softener. The efficiency of this option depends on the total iron level and various other chemical properties of the water. The levels of manganese, sulfur, calcium carbonate and the pH of the water can have a large effect on how well a softener will remove iron. If the iron is in the soluble (ferrous) form, softeners will work fairly well. The removal of ferrous iron ranging up to approximately 10 mg/L or parts per million (ppm) can often be achieved. If the softener is designed for iron removal, the removal of ferric and ferrous iron can be achieved to levels as high as 15 to 20 mg/L. It should be stressed that the level of effectiveness is dependent on the softening system's size and design, as well as the chemical constituents of the water being treated. Higher levels of total iron or levels of ferric iron in water can be treated with such filtration techniques as glauconitic green sand/potassium permanganate filters. This often is a more cost effective method than the water softener for higher iron levels.

It is strongly recommended that a water chemistry analysis be performed before any treatment or filtration is applied. Many private water labs and the Missouri Department of Health Lab can perform a water chemistry analysis. This will determine accurate levels of the more common dissolved minerals found in ground water along with such characteristics as the ph of the water. This information is necessary for a treatment professional to determine the most cost effective method for water treatment.

Sources:

USGS, Appraising the Nation's Ground-Water Resources, 2007
Eldstrom Industries, Resources document MI-4146
North Dakota State University, publication AE-1030, 1992

Well Installation Section Staff

573-368-2165

Staff Website: dnr.mo.gov/geology/geosrv/wellhd/job.htm
Well Online Services: dnr.mo.gov/mowells/

- **Kyle Rollins – Section Chief**
  Management of section, regulations, policy and rulemaking.
  573-368-2171 • kyle.rollins@dnr.mo.gov
- **Justin Davis – Investigation and Remediation Unit Chief**
  Field investigation and remediation, variances, casing depths, well construction and abandonment information.
  573-368-2167 • justin.davis@dnr.mo.gov
- **Karen Smith– Processing Unit Chief**
  Information regarding pending enforcement letters, permitting and testing.
  573-368-2174 • karen.smith@dnr.mo.gov
- **MaLinda Bassett – Section Secretary**
  General information, fee letters, requests for forms and publications.
  573-368-2165 • malinda.bassett@dnr.mo.gov
- **Andrew Combs – Environmental Specialist**
  Field investigation, well plugging, heat pump records.
  573-368-2159 • andrew.combs@dnr.mo.gov
- **Airin Haselwander - Geologist**
  Public Water Systems, pilot holes, casing depths and variances.
  573-368-2196 • airin.haselwander@dnr.mo.gov
- **Eric Hohl – Technical Assistant**
  Water well construction and certification information and abandonment registration information.
  573-368-2168 • eric.hohl@dnr.mo.gov
- **Jeannie Hoyle – Permitting Clerk**
  Permitting, testing and apprentice information.
  573-368-2450 • jeannie.hoyle@dnr.mo.gov
- **Lori Miller – Correspondence Clerk**
  Matching of well and pump records, correspondence requesting information.
  573-368-2318 • lori.miller@dnr.mo.gov
- **Brad Mitchell – Geologist**
  Field investigation, well construction information, variances and casing depths.
  573-368-2116 • brad.mitchell@dnr.mo.gov
- **Dan Nordwald – Technical Assistant**
  Field investigation, well plugging, well construction, abandonment information.
  573-368-2451 • dan.nordwald@dnr.mo.gov
- **Matt Parker – Geologist**
  Field investigation, well construction, Special Area 2, variances and casing depths.
  573-368-2170 • matt.parker@dnr.mo.gov
- **Vacant– Environmental Specialist**
  Regulations, enforcement, policy, rulemaking and legislation.
- **Vacant – Office Support Assistant**
  General information, data entry and receptionist.

The Connection is published by the Missouri Department of Natural Resources' Missouri Geological Survey. Suggestions, ideas and comments concerning this newsletter are welcome. Send comments to: Missouri Department of Natural Resources' Missouri Geological Survey, Well Installation Section, PO Box 250, Rolla, MO 65402-0250, phone: 573-368-2165 or fax: 573-368-2317.