

## Well Installation Board News

The next quarterly meeting is scheduled for 10 a.m. February 15, 2016. The meeting is being held in conjunction with the Missouri Water Well Association's annual convention at the Tan-Tar-A Resort located at 494 Tan-Tar-A Drive, in Osage Beach, Mo.

The Board also set tentative meeting dates for 2016. All will be held at the Missouri Geological Survey's Mozarkite Conference Room located at 111 Fairgrounds Road, in Rolla, Mo.

Meeting dates are May 6, 2016, August 5, 2016, and November 4, 2016.

## Staff News

### MaLinda Bassett Joins the Wellhead Protection Section



MaLinda Bassett joined the Wellhead Protection Section December 9, 2015, as the section secretary and will most likely be the person you speak with when you call the office. Bassett worked for the Department of Social Services/Children's Division in Jefferson City for the past 2 ½ years. Prior to that, she worked for 15 years as real estate agent and office manager for a real estate company. Bassett has been the Secretary/Treasurer of the Dixon Rural Fire Protection Board for the last 18 years. "I am glad to be a part of the Wellhead Protection Section in the Missouri Geological Survey and am looking forward to working with the drilling industry," said Bassett.

### Sheri Fry Leaves Wellhead



Sheri Fry accepted a promotion to a position with the Department of Natural Resources' Water Protection Program, Public Drinking Water Branch. Fry's last day with the Wellhead Protection Section was November 19, 2015. She began working with the section in May 1995 as a part-time data entry clerk. She ended her career with the section as an Environmental Specialist doing compliance and enforcement. "I have enjoyed working in the Wellhead Protection Section and learned a great deal during my time here from both the contractors and staff. I've also enjoyed the opportunity to interact with members of the drilling industry and have a great respect for the work they do in protecting Missouri's groundwater. I will always have many fond memories of my experiences while working with the Wellhead Protection Section," said Fry.

## Online Permit Testing

The Wellhead Protection Section, in conjunction with the Information Technology Services Division, developed an online testing application for restricted permits for pump, water, monitoring and heat pump well installation contractors. The project began in May 2015 and went live in October 2015. As of November 18, 2015, ten tests have been taken, with several more scheduled. Online permit testing is available at [dnr.mo.gov/mowells](http://dnr.mo.gov/mowells). Applicants must complete the Contractor and Apprentice Testing Application, Form 780-1424, <http://dnr.mo.gov/forms/780-1424-f.pdf> and submit it to the section to obtain a test ID. Once the test ID is provided, the applicant may proceed to the test site ([dnr.mo.gov/mowells](http://dnr.mo.gov/mowells)). An applicant may pay for the test online or make payment to the section prior to taking the exam. Applicants have 24 hours to complete an exam. The online test will benefit the regulated community by eliminating the need to travel to Rolla to take the test, which is offered only once a month. The automated test will save staff time and increase efficiency in state government.

## Heat Pump Prenotification

The following guidance is to address recurring issues and provide clarity for the installation of heat pump wells and the forms that must be submitted. Prenotification is required for any heat pump well that is grouted using a series of 5-foot plugs rather than utilizing full-length grout. While there are multiple options for submitting the required prenotification form, the most expeditious and advantageous option is electronic (online) submission at [dnr.mo.gov/forms/780-2167.htm](http://dnr.mo.gov/forms/780-2167.htm). Electronic submission ensures that all required fields are completed and legible. Furthermore, this option ensures that the form is received and the contractor has proof that this requirement has been met within the required time frame. Non-electronic forms that don't contain the required information burden both the permitted contractor and the section staff by repeat contacts to acquire missing information. A hard copy form may be obtained online at [dnr.mo.gov/forms/index.html#WellheadProtection](http://dnr.mo.gov/forms/index.html#WellheadProtection). This form may be mailed, faxed or sent by email to the section. Section staff members are conducting site visits to witness the installation of grout plugs in wells used for heat pump systems. In October 2015 for example, six heat pump installations were witnessed. These inspections ensure that wells used for geothermal exchange are constructed to minimum standards as set by state regulations. Contractors who install heat pump systems should be prepared to have section staff on site periodically without prior notification.

# GPS Fundamentals for Location Reporting

Missouri Well Construction Rules require certification and registration report forms to include geographic locations for reported wells. Unfamiliarity of users with the correct operation of handheld Global Positioning System (GPS) receivers can result in unreliable location accuracy. Greater knowledge of how GPS works will ensure that reported well locations are correct and will help maintain a reliable database.

The Global Positioning System is a constellation of 27 Earth-orbiting satellites (24 in operation and three spares) that circle the earth twice a day and transmit signal information to earth containing three different bits of information: a pseudorandom code (satellite ID information), ephemeris data (date and time), and almanac data (precise location of satellite). The function of a GPS receiver is to locate four or more of the satellites, calculate the distance to each, and use the information to deduce its location.

This operation is based on a simple mathematical principle called trilateration. In order to make the calculation, the GPS receiver has to know two things: the precise location of at least four satellites, and the distance between it and each of those satellites. The GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is from the ground location. Using distance measurements from four or more satellites, the receiver can determine its position for display on the unit's screen. When used correctly, the location information calculated by consumer-grade GPS receivers can be accurate to within a few meters.

A number of factors, however, can degrade a GPS signal and affect the accuracy of a calculated location:

- Ionosphere and troposphere delays: The satellite signal slows as it passes through the atmosphere. GPS systems calculate an average amount of delay to partially correct for this type of error.
- Signal multipath: The GPS signal reflects off objects such as tall buildings or expansive rock surfaces before it reaches the receiver. This increases the travel time of the GPS signal resulting in error.
- Receiver clock error: The clock in your hand-held receiver unit is not as accurate as the atomic clocks onboard the GPS satellites. Therefore, slight timing errors can occur.
- Orbital errors: Also known as ephemeris errors, these are inaccuracies of the satellite's reported location.
- Number of satellites visible: Accuracy is improved with more satellites within line-of-sight of your GPS receiver. Buildings, terrain, electronic interference, and dense foliage can impede signal reception, resulting in a faulty reading or possibly no reading at all. GPS units don't normally work indoors, underwater or underground.
- Satellite geometry and shading: This refers to satellite location in relation to receiver location. When the satellites are located at wide angles relative to each other, accuracy is improved. Accuracy is diminished when the satellites are located in a tight grouping.
- Selective Availability (SA): An intentional degradation of the signal once imposed by the U.S. Department of Defense was turned off in May 2000 but was a source of error on some older records.

To avoid signal-degrading conditions, a user can do the following to ensure a more accurate reading:

- Allow sufficient time to receive updated radio signals from multiple satellites. Have the GPS receiver turned on and placed where there is a clear view of the sky for at least 20 to 30 minutes before the unit is used.
- Hold the GPS receiver over the well location for at least one minute to get an accurate reading.
- Double-check the numbers when writing down coordinates. If you record the well location in the GPS unit as a waypoint to transcribe later, make sure to match the correct GPS locations with the correct well locations when retrieving the data.
- Double-check your data after typing. Typos on certification and registration report forms are more common than they should be.

Once an accurate reading is obtained, it should be reported in the correct format. The wrong format will result in significant error. For example, a reported latitude of 37°04'51.7" and longitude of -91°15'22.5" plots miles away from latitude 37.04517° and longitude -91.15225° even though the digits are the same. Most receivers offer different latitude-longitude formats as well as other region-specific position formats. Different latitude-longitude formats are displayed by some major GPS receiver manufacturers in this manner:

Format	Garmin	Magellan	Lowrance
Degrees-minutes-seconds	hddd°mm'ss.s"	DEG/MIN/SEC	Deg/Min/Sec
Degrees-decimal minutes	hddd°mm.mmm'	DEG/MIN/MMM	Degrees/Min
Decimal Degrees	hddd.dddd°	DEG/DDDDD	Degrees

GPS locations should be reported in latitude and longitude in the format of degrees, minutes, and seconds, with the seconds quantified to one digit to the right of the decimal point (Example: latitude 43°04'51.7", longitude -89°15'22.5"). The position format setting for most GPS receivers can be found in the main menu under the setup page. Consult the instruction manual specific to your unit for further guidance.

The map datum should be set to the North American Datum 1983 (NAD1983). If the receiver has several different datum settings, use NAD1983. Always verify the datum setting for the receiver. It usually can be found in the main menu under the setup page. Once again, consult the instruction manual specific to your unit.

Many inaccuracies may be due to incorrect settings within GPS receivers, resulting in contractors being unaware they are reporting erroneous data. Basic knowledge of how GPS works, along with an awareness of signal-degrading conditions, will improve the likelihood that reported well locations are accurate. Submitting correct location information in the proper format will help maintain a reliable database and will ensure that the information provided by the Missouri Geological Survey is accurate.

## Welcome Contractors

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

7NT Engineering – Charles Anderson II, Charles Willis  
 AAA Pump Service – Kyle Klahs  
 Environmental Operations – Jonathan Payne  
 Environmental Works – Robert Fess  
 Gold Mechanical – Ron Bogart  
 Golder Associates – Samantha DiCenso, Emily White, John Suozzi  
 Groundwater & Environmental – Stacy Dwyer  
 MoDNR – Tracey Mason, Matthew Barry, Alica Alexander, Jennifer Surber, Valerie Wilder, Cedric Cunigan, Amanda Branson, David Nykodym, Keith Brown, Christine O'Keefe, Connie Archer, Wes March, Amanda Coffey, Radu Mariuta, Abigail Schultz, Kyle O'Rourke, Hillary Wakefield  
 William Bros Well Drilling – Scott Rowden

## Welcome Apprentice Contractors

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

Anderson Engineering – David Kaler  
 Belchers Well Service LLC – Richard Belcher  
 Brotcke Well & Pump – James King  
 Custom Pump & Well – Thomas Ridenhour  
 MoDNR – Brittany King  
 Terracon – Travus McCroskey  
 Williams Bros Well Drilling – Scott Rowden

## Contractor and Apprentice Well and Pump Installation Testing Schedule

The following 2016 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.

Feb. 17, 2016	Aug. 17, 2016
March 16, 2016	Sept. 14, 2016
April 13, 2016	Oct. 12, 2016
May 18, 2016	Nov. 16, 2016
June 15, 2016	Dec. 14, 2016
July 13, 2016	

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. Persons with disabilities who may require special services may contact Jeannie Hoyle at 573-368-2450. For your convenience, the apprentice/restricted exam may be completed online at [dnr.mo.gov/mowells](http://dnr.mo.gov/mowells). Please contact the Wellhead Protection section at 573-368-2165 to obtain a test ID.

## 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:

Advanced Environmental Drlg – Greg Courson  
 Arcadis – Laura Madsen  
 AST Environmental – William Brab  
 B & B Pump – Scott Purrington  
 Buffington Brothers – Mike Leader  
 Bureau Veritas North America – Agatha Linger  
 Burns & McDonnell – Martha Hildebrandt  
 C M Mose & Son – Roger Mose  
 Cardno ATC – William Kipp  
 Cardno MM&A – Yvonne Huff, Randy Christman  
 CM Engineering – Kirk Mescher  
 Engineering Surveys & Service – Larry Hendren  
 Environmental Operations – Nolan Walla  
 Environmental Works – Vance Marlow, Michael Johnson  
 Gold Mechanical – Dwain Gold  
 Golder Associates – J Ronald Sides, Amanda Gilbertson, Chris Redington, Anne Faeth  
 Grantham Drilling – Jason Grantham  
 HDR Engineering – Lisa O'Dell  
 Jefferson County Public Works – Chris Ehlen  
 Jerry Matthews Drilling – Jerry Matthews, Michael Johnson, Jason Larocca  
 Leftys Pump & Drilling – Adam Becknell, Vance Marlow  
 MoDNR – Daniel Norris, Cory Jorgensen, Larry Teson, Jarrod Robertson, Joel Nanny  
 Reddish Drilling – Thomas Reddish  
 Reed Well Drilling – Billy Reed  
 Smith Pump & Drilling – Kevin Smith  
 Terracon – Clay Dodson

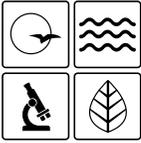
## Special Area 2

Each year, Wellhead Protection Section staff members review and update the casing depth map for Special Area 2. Data that may affect an area is collected by the well or pump contractor when a new well is drilled or an old well deepened. Data also is collected by the U.S. Environmental Protection Agency and environmental contractors during environmental investigations within Newton and Jasper counties. This data is collected on both new and existing wells. New impact areas are added and, if available, any published updates for area roads are added to the revised map.

The current map is valid for one year, from January of the year issued until the revised map is issued for the next calendar year. The map is reviewed and updated through the months of November and early December for the next calendar year. The effective dates are noted on each map. Contractors are responsible for using the correct map when drilling in Newton and Jasper counties; all known impact areas may not be

highlighted on older versions. The map for calendar year 2016 contains new impact areas, which are listed to the side.

Township North	Range West	Section	Quarter Section	Area Type	Minimum Casing	Contaminant To Sample For
25	30	31	NW	IMPACT	435	LEAD
25	31	36	NE	IMPACT	435	LEAD
27	34	24	SW	IMPACT	460	LEAD, CADMIUM
27	34	25	NW	IMPACT	450	LEAD, CADMIUM
28	31	12	SE	IMPACT	455	LEAD, CADMIUM
28	32	19	NE	IMPACT	455	LEAD
28	32	19	SE	IMPACT	475	LEAD



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**Well Online Services:** [dnr.mo.gov/mowells/](http://dnr.mo.gov/mowells/)

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- **Vacant – Office Support Assistant**  
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