Texas Ground Water Association
Affiliate of the National Ground Water Association

FOUNTAINHEAD

4th Quarter 2010

A few simple diagnostic tools can help you build a loyal customer base

By KAVEH KHORZAD
President, Wet Rock Groundwater Services, LLC

Courtesy of Kaveh Khorzad

Well testing helps properly size a pump for maximum efficiency and capacity. The test will also help determine the best depth to set the pump, eliminating the chance of a "dry well."

During the economic downturn and housing slowdown, the drilling of new wells, especially public supply wells, has taken a hit. However, over the past two years, I've noticed an increased number of well rehabilitation requests from water utilities, especially during the summer months. This trend reinforces some basic truths about the water supply industry:

- People always need more water;
- They look for the most economical way to get it;
- They inevitably construct a well during the hottest time of the year when water is scarcest.

Improving well performance

Three simple, economical things can be done to increase water supply capacity. A contractor with these diagnostic tools in his

Please see Loyalty, page 6

Eagle Ford Shale Play and the Carrizo Aquifer

By DARRELL T. BROWNLOW, Ph.D
Vice President, CEMEX USA

The exploitation of oil and natural-gas rich shale in South Texas known as the Eagle Ford Shale has prompted discussion of its possible impacts on the region's groundwater resources. Initial research suggests that (1) there is enough water to support both agricultural and mining uses and (2) the attractive economic opportunities available to local landowners easily defends the use of groundwater from the Carrizo aquifer for hydraulic fracturing.

The Eagle Ford Shale is a geologic formation found at depths that range between 7,000 and 12,000 feet under more than a dozen counties in South Texas, extending some 6,000,000 acres from Webb County in the southwest to Gonzales in the northeast. It is an emerging shale play, with promising results reported by a growing list of oil and gas producers. Indications are that a single Eagle Ford

Please see Eagle Ford, page 4

From the top of the rig

Perspectives of Division Presidents

Dale Felder
Contractors & Drillers

A good year

Boy, where does the time go when you are busy? Seems just like yesterday that Leroy was hounding me for a copy of the president's letter for the third quarter edition of the Fountainhead, and here he wants another one for the fourth quarter. Writing is somewhat tough on us water well contractors, and it does take a bit of thinking to figure out how we might say it.

As I write my last president's letter, please allow me to express my sincere thanks to all of you who have been a part of our Association as members. The Boards of Directors of each of the three divisions have worked very hard this year. It's been a joy to be with all of them. They all play an important role in our lives and to them, I say thanks a million.

My term as president has been a pleasurable time, and I look forward to my year as immediate past president. I also want to give a special thanks to Shirley Casarez who served another term as president of the Ladies' Auxiliary and did a marvelous job. Thanks Shirley! Last, but not least, thanks to the staff of TGWA. They do everything to make our work easier when possible.

As we start a new year in January at our Annual Convention & Trade Show in Lubbock, the Texas Legislature will be underway in its 82nd Session in Austin. It's

Please see Felder, page 9

Dan Collins
Manufacturers & Suppliers

Get Involved

If you're a reader of this portion of the Fountainhead you'll remember my June letter with its call for TGWA members to get involved. Same plea again here with a slight twist. I singled out our involvement and participation, as an industry, in groundwater conservation districts as critically important to their and our future success.

This time I'm asking for your involvement in our annual conference and trade show in Lubbock. Education is one of, if not the, primary functions of your association and there will be plenty of opportunities to continue your professional education in Lubbock. Not only will you have an opportunity to "git some education", you'll have a great opportunity to educate vendors and distributors.

We're looking forward to seeing you in Lubbock.

John Waugh
Ground Water Science

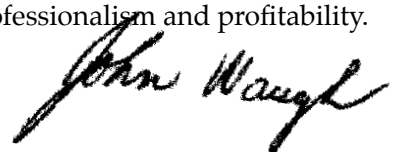
Annual meeting focuses on continuing education

Drillers, pump installers, and apprentices: The upcoming annual convention & trade show is the perfect opportunity to complete your continuing education requirements required to maintain your state licenses. Courses offered include the one-hour statutes and rules class, as well as other classes to improve our techniques, safety, and profitability.

Drillers and pump installers: You'll be able to get your required C.E. hours during the meeting. As usual, one hour of C.E. credit will be earned by registering for and attending the trade show, where you will also get to see the latest technology and equipment to make your work easier and more profitable.

Scientists and engineers: Complete several CEU's toward maintaining your PG and PE licenses. Class topics will include an ethics course geared for Engineers, Geoscientists, and Contractors.

These classes are developed and scheduled through the efforts of the Ground Water Science Board of Directors, and several are taught each year by current and former GWS Directors and members. I hope that you will all take advantage of this opportunity to not only maintain your professional licenses, but also to network with members from other areas, sharing experiences and ideas. In this way, we can continue to improve our industry's professionalism and profitability.



From Shirley Ann Casarez

Hi, I'm here thinking about our weather which although unusually warm for this time of year does not affect or slow down upcoming events. The holidays are upon us, and that means the state convention is just around the corner. January 26-28 will be here before we know it.

We had a nice turnout for our quarterly meeting in San Marcos, and the weather was the best. Our ladies decided that we will visit Buddy Holly Blvd and The Micro Brewery for the "Ladies Day Out," then stroll to visit various shops, art galleries and top the afternoon off with a nice lunch. We need to be back at the convention center at 3:00 for our "Meet and Greet".

Please sign up for the "Ladies Day Out." There will be goody bags (first come) and cash door prizes. I promise you will not leave empty handed. Come be apart of our special family. I'm looking forward to seeing everyone in Lubbock.

Peace be with you,

Shirley Ann

See you in Lubbock!
at the 64th annual
TGWA Annual Convention and Trade Show
January 26-28, 2011

Lubbock Memorial Civic Center

Members of the M&S Division will show the latest equipment, technology and supplies.

Plan to come see and hear a great line-up of presentations, entertaining events and vendors!

To register, go to www.tgwa.com

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Eagle Ford, continued from front page

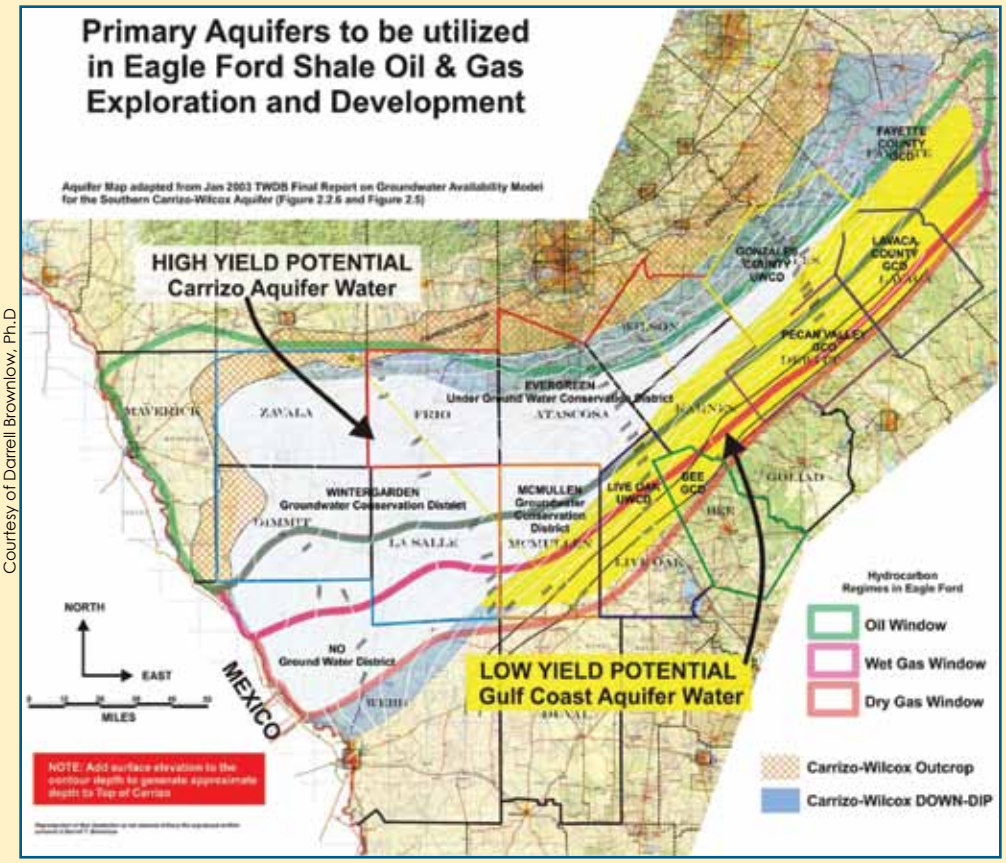
well could net 300,000 - 400,000 barrels of oil. If oil stays above $80 per barrel, the gross revenue potential of a single well could be $24 million to $32 million.

The Carrizo Aquifer is the primary source of water for

Every acre-foot of water from the Carrizo used in hydraulic fracturing has a gross revenue potential of about $2,080,000.

hydraulic fracturing of the shale formation to extract oil and natural gas. The aquifer is located approximately one mile above the Eagle Ford shale. The thick siliceous sands of the Carrizo yield high quality groundwater for thirsty agricultural interests and a growing municipal community resting on the edge of the fast-growing and water-hungry city of San Antonio.

Courtesy of Darrell Brownlow, Ph.D



The Eagle Ford Shale Play stretches across 14 counties in an area of nearly 6,000,000 acres. Both the high yield Carrizo Aquifer and the low yield Gulf Coast Aquifer are critical in supplying water for the hydraulic fracturing of the Eagle Ford wells.

Courtesy of Darrell Brownlow, Ph.D

An Eagle Ford well being drilled

Groundwater, and specifically the Carrizo Aquifer in this region of Texas, is by law managed through local groundwater conservation districts. There is one exception, and that is groundwater used by the oil industry, the use of which is overseen by the Texas Railroad Commission. Historically, the issue of competing management interests has never risen to serious levels of concern.

In discussing this subject, perspective is important. A broad analysis of the number of potential Eagle Ford wells in the region suggests that as many as 20,000 oil and gas wells could be drilled across the 6,000,000 acre Eagle Ford play. It must be pointed out that this number of wells is highly speculative given infrastructure limitations and fluctuations in the price of natural gas and oil. However, assuming 20,000 wells are drilled using 15 acre-feet of water per well, the corresponding water usage would be about 300,000 acre-feet over the life of the play

Current (non oil- and gas-related) withdrawals from the Carrizo Aquifer amount to roughly 275,000 acre-feet per year. Groundwater

Please see Eagle Ford, page 5

Eagle Ford, continued from page 4

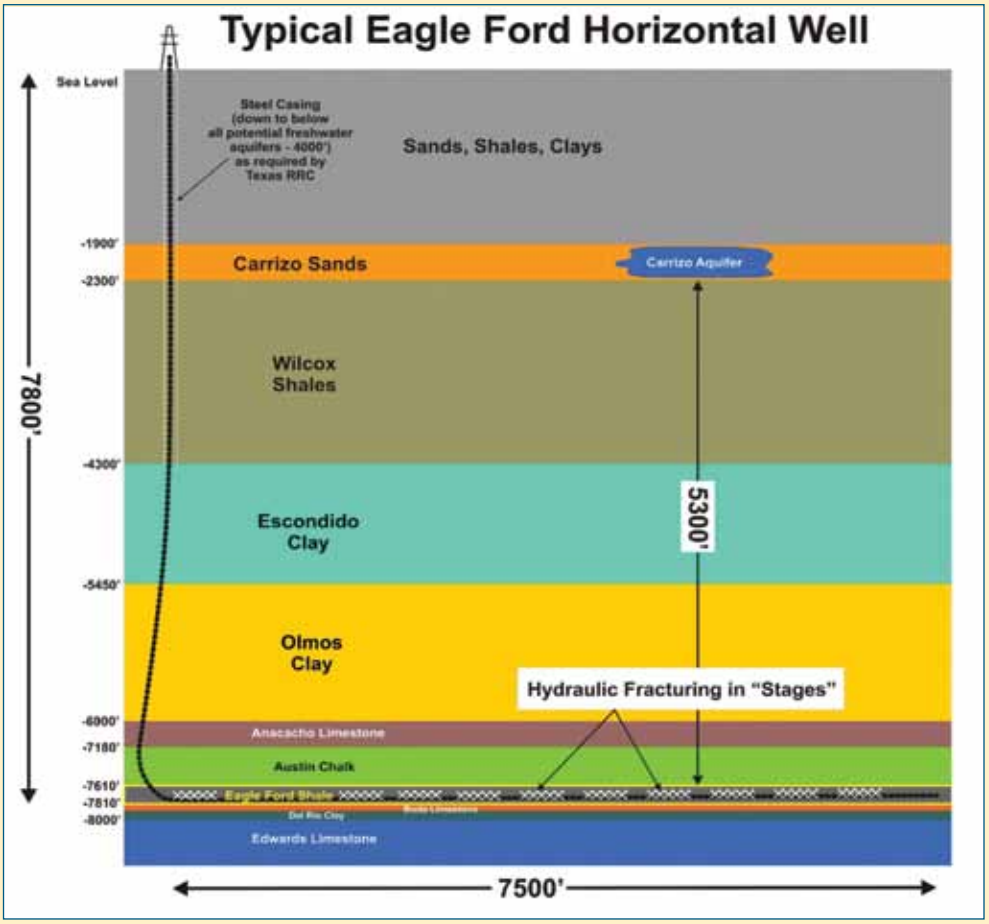
management studies by local groundwater districts and the Texas Water Development Board estimate that given this rate of withdrawal, the Carrizo water table will decline an average of 30 feet to 35 feet by 2060.

It is unlikely that pumping 300,000 acre-feet of Carrizo water for hydraulic fracturing would have a significant adverse impact on water availability for planned uses.

An additional withdrawal of 300,000 acre-feet for hydraulic fracturing would represent slightly more than a single year of the current 275,000 acre-feet pumping demand. The oil- and gas-related withdrawal would occur across a broad expanse of the region and over 10-15 year period. Considering these factors, it is unlikely that pumping 300,000 acre-feet of Carrizo water for hydraulic fracturing would have a significant adverse impact on water availability for planned uses. However, some short-term localized impacts are possible, particularly in the eastern portions of the play where the primary source of water would be the lower-yielding Gulf Coast aquifer.

An economic opportunity for the region

The economic perspective is also important. A single Eagle Ford hydraulic fracturing job requires approximately 15 acre-feet of water. Oil company estimates



Courtesy of Darrell Brownlow, Ph.D

The Eagle Ford Shale is a geological formation which lies directly beneath the Austin Chalk and above the Buda Limestone, at depths between 7,000 and 12,000 feet. The Carrizo Aquifer is located approximately 5000 feet above the Eagle Ford Shale.

suggest a successful Eagle Ford well could net 300,000-400,000 barrels of oil with a gross revenue potential of $24 million to $32 million – if oil stays above $80/barrel. Two thousand acre-feet of irrigation water would satisfy the requirements

Please see Eagle Ford, page 12

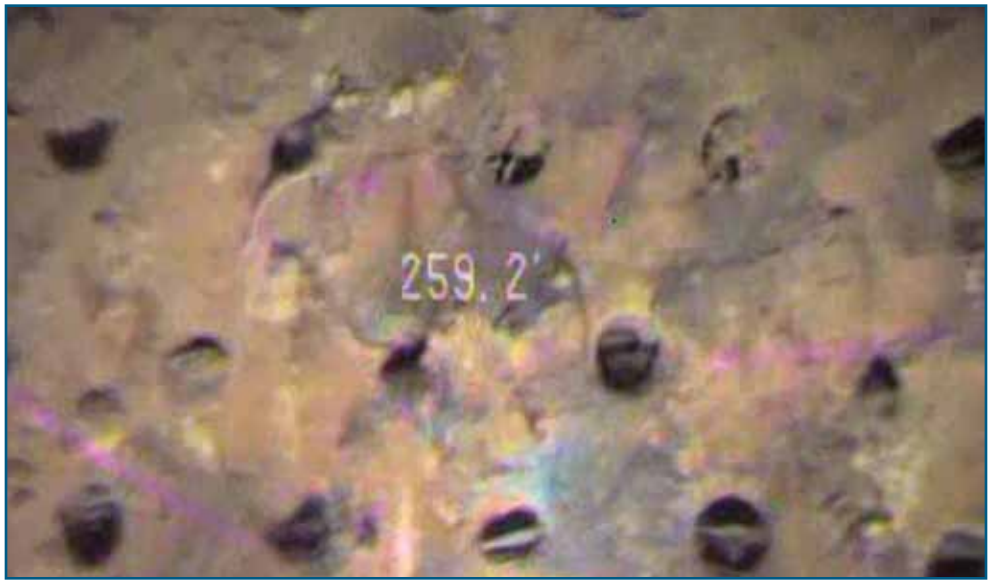
Courtesy of Darrell Brownlow, Ph.D

An Eagle Ford well undergoing hydraulic fracturing

Loyalty, continued from front page

toolkit will develop a new source of income by offering clients simple, low-cost ways to improve the performance of their wells:

- **Perform a downhole video survey** of the well when a pump needs to be pulled. This will enable you to check on the well's condition.
- **Install a permanent 1-inch PVC e-line** when the pump is reinstalled to make a record of water levels. Monitor the well's status by maintaining a log of at least weekly static and pumping water level measurements.
- **Perform a pump test** to determine the most efficient and highest-capacity pump and pump setting. This will help the well withstand drought.



A downhole video survey will show a plugged screen, like the one above, which causes water to be pumped at a reduced rate.

Conduct a downhole video survey

Wells frequently pump water at a reduced rate. In many cases, this is due to a clogged screen, although it can also be caused by drought or a neighbor's drilling a new well.

A downhole video survey helps determine the condition of the well by showing a hole forming in the casing or enlarged torch slots in the screen (in which case sediment may begin to be pumped). The video gives the well owner options and time to plan his course of action, whether it's a new well or remediation. It prevents emergencies that force well owners into bad decisions.

In my experience, well owners who have a downhole video survey done are amazed by the results. A picture or video shows them everything they need to know to make an informed decision. Once the work is done, the well's capacity increases. Believe me, there's nothing that builds a good reputation faster than saving your clients the cost of having to drill a new well.

Record the water levels

Well owners who want to be proactive and save money should consider installing a one-inch (or at a minimum 3/4-inch) PVC pipe strapped to the column pipe to monitor the water level. There is no better canary in the coal mine.

Maintaining (at least) a weekly log of static and pumping water levels provides valuable information on the condition of the well or pump. A pumping level that drops steadily with normal static water levels may indicate screen blockage. A normal static water level with low pump rates may indicate problems with the pump or a hole in the column pipe. Checking the water levels is a simple and relatively cheap method of troubleshooting what's going on underneath your feet.

Perform a pump test of the well

A pump test determines the best setting for drought protection. It sizes the pump to ensure it produces enough water during a drought.

Many wells are drilled with a production pump that has never been properly sized to the well's performance. Drillers tend to estimate production capability and install a pump at the depth they think will work best. In some cases, the pump is not the most efficient choice, or it may not be placed at the proper depth.

When a water utility needs to drill a new well to meet Texas Commission on Environmental Quality's capacity requirements, we perform a pump test on the existing wells to calculate maximum production capacity for normal and drought conditions. In many cases, the pump is not set deep enough and is not producing near the well's maximum capacity. A new pump and/or more column

Please see Loyalty, continued on page 7

Loyalty, continued from page 6

pipe are all that's needed to meet capacity requirements -- not a new well. Better yet, the new pump is more efficient and saves the utility electric costs.

A pump test can also be a cost saver for the homeowner. Many Hill Country drillers will tell you that during severe droughts they receive complaints day and night that a domestic well is dry. In most cases, the water level has decreased to the point that the pump cavitates. The fix is to lower the pump setting.

Build your reputation by saving clients' money

During tough economic times, a few simple things can be done to save well owners money and provide them with better-performing, longer-lasting wells. Using diagnostic tools like downhole video surveys, e-line tubes and pump tests to monitor and improve a well's capacity and performance will help you build a strong, loyal client base. In the long run, this level of customer service will separate your from your competition.

TAKE AWAY

Build a loyal customer base by using simple diagnostic tools that help your clients more effectively monitor and maintain their wells. These tools include:

- Downhole video survey to determine the condition of the well
- An e-line tube to monitor the water level
- Pump test to determine the best setting and pump size

About the author

Kaveh Khorzad is president of Wet Rock Groundwater Services, LLC a multi-disciplinary groundwater consulting firm specializing in well construction and groundwater studies. Contact him at k.khorzad@wetrockgs.com or 512-773-3226.

Welcome New Members

JAMES "JIM" A. BLAIR
Bee Cave Drilling, Inc.
Dripping Springs, TX

RUSSELL CLARK
LAKOS Separators & Filtration Solutions
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Apply online at www.tgwa.org/membership.html

Membership Categories

- ❏ * Company driller, contractor or pump installer - $175
- ❏ Individual driller, contractor or pump installer - $125
- ❏ * Manufacturer or supplier company - $150
- ❏ Individual manufacturer, supplier or manufacturer's rep - $ 60
- ❏ ** Ground water science division company, entity or association - $ 80
- ❏ Individual ground water science division membe - $ 30
- ❏ Individual student membership (must be enrolled in school, college or university - $ 10
- ❏ Individual registered driller or technician (Must be an employee of a company member) - $ 30
- ❏ Individual associate (any person not qualified under any of the above categories) - $ 30

* Company - Includes drilling and/or pump contracting firm or manufacturer or supplier company or corporation and two additional individuals of that company.

** Includes two additional science division members of that company.

Public hearing to consider TCEQ's Hill Country Priority Ground Water Management Area recommendations

By STEVEN P. MUSICK, P.G.
Musick Groundwater Consulting

The initial public hearing to take evidence on the Texas Commission on Environmental Quality's recommendations for managing withdrawals from the Trinity Aquifer in Comal and Travis counties took place on October 28. Designated a priority groundwater management area in 1990 after groundwater levels fell during the 1980's, most of the area (Figure 1) is covered by single county districts, but areas in western Comal and southwestern Travis counties remain unmanaged by a groundwater conservation district.

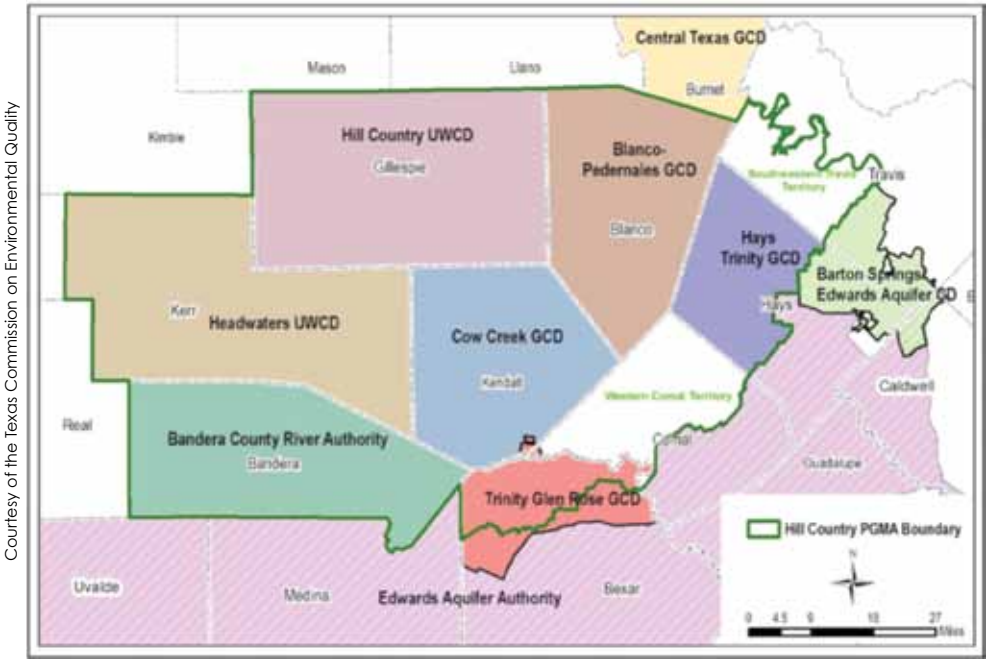
TCEQ evaluated four configurations and examined whether a particular district configuration or existing district would have adequate boundaries and sufficient authority and funding to implement a management plan. TCEQ considered adding territories to adjacent GCDs and creating a new district.

Ultimately, the agency recommended that a new GCD be created to include the area where the Trinity aquifer crops out in Comal, Hays, and Travis counties, overlapping the current Hays Trinity GCD in Hays County (Figure 2). The overlap and TCEQ's evaluation and recommendations will be considered in the public hearing process.

Adding the western Comal territory to the Trinity Glen Rose GCD in Bexar County and the southwestern Travis territory to the Barton Springs-Edwards Aquifer Conservation District was determined to be both feasible and practicable. However, the two GCDs do not support

Please see PGMA, continued on page 9

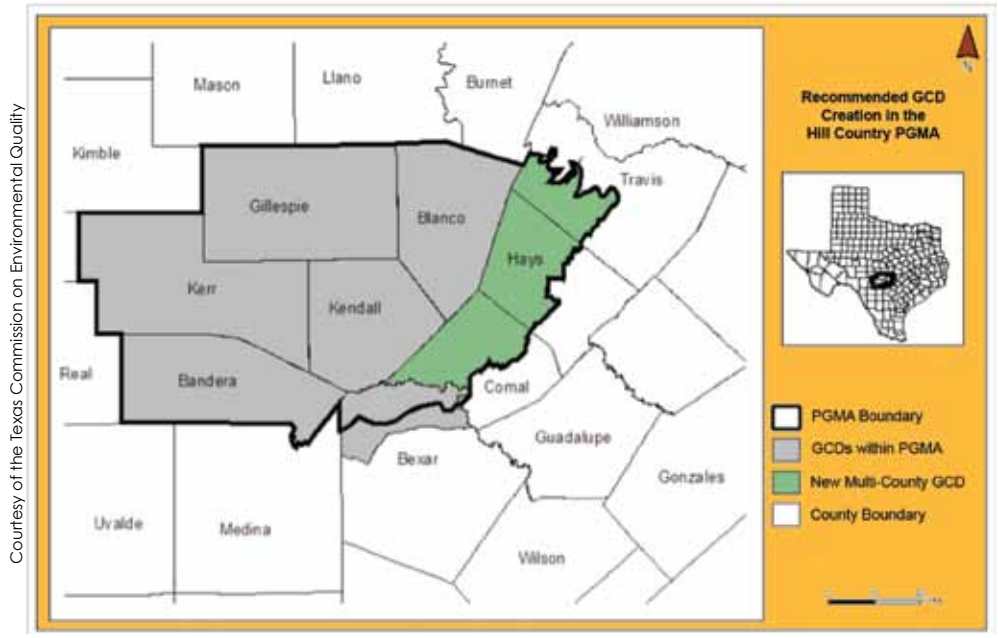
Groundwater Conservation Districts in the Hill Country PGMA



Courtesy of the Texas Commission on Environmental Quality

Figure 1: The location of groundwater conservation districts within the Hill Country PGMA and the remaining Trinity aquifer areas in western Comal and southwestern Travis counties.

Recommended New Groundwater Conservation District



Courtesy of the Texas Commission on Environmental Quality

Figure 2: Recommended groundwater conservation district for the Hill Country PGMA in western Comal, Hays and southwestern Travis counties.

PGMA, continued from page 8

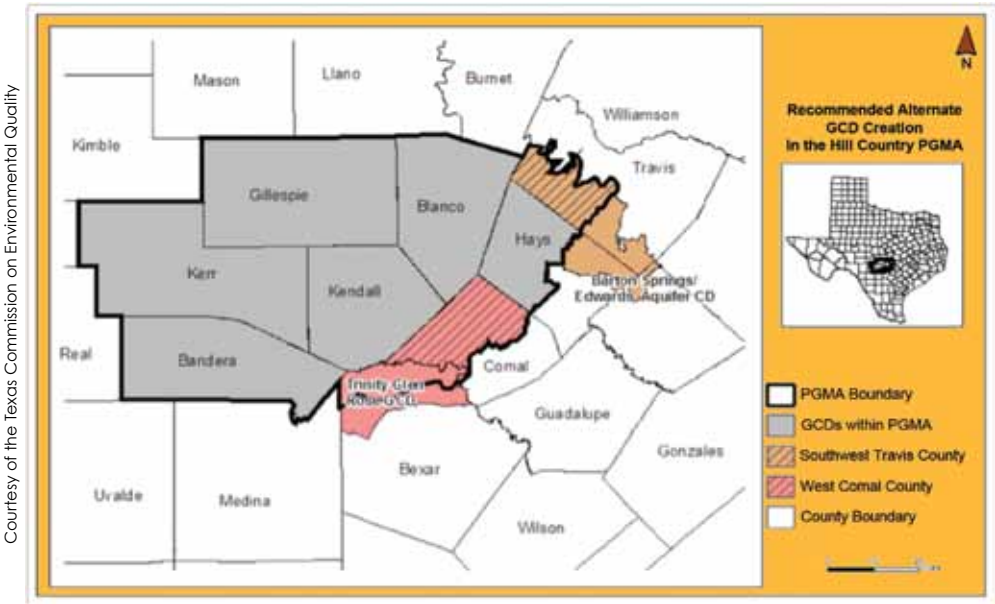
the additions to their districts. This option is TCEQ's alternate recommendation (Figure 3).

The agency ruled out creating a district in each of the two territories (for which only a portion of each county would be affected) due to lack of a sufficient funding base. It also ruled out including the two areas in one district because of the difficulty of managing widely separated areas, as well as the lack of a sufficient funding base.

TCEQ's report, "Groundwater Conservation District Recommendation for Hill Country Priority Groundwater Management Area -- Western Comal and Southwestern Travis Counties," provides the agency's analysis of the groundwater management options for the areas not covered by a groundwater conservation district.

The public hearing, conducted by an administrative law judge from the State Office of Administrative Hearings, provides a forum for TCEQ staff and affected parties to present testimony and evidence. The judge will consider all evidence and prepare a report of findings, conclusions, and recommendations before presenting his findings to TCEQ commissioners for their consideration and action.

Alternative Recommendation



Courtesy of the Texas Commission on Environmental Quality

Figure 3: Recommended alternative for addition of territory in western Comal and southwestern Travis counties to existing GCDs.

About the author

Steve Musick holds a bachelors degree in Geological Sciences from the University of Texas. He worked with the Texas Commission on Environmental Quality and its predecessor agencies for 26 years in the areas of groundwater management, groundwater districts, groundwater protection, and program development. He currently consults for the Ground Water Protection Council on technical and policy issues.

Felder, continued from page 2

important that we continue to monitor activities of the Legislature as well as those of local political subdivisions (districts, cities, etc.) in our own areas. We must be ever so attentive to what's going on in our local areas as well as the state. As we close out this year, please allow me to express to each and everyone of you, Happy Holidays and a Prosperous New Year. May you have the best year of your life.

Hope to see all of you in Lubbock, January 25-28, 2011. Make plans to be there! It's important to you and your profession.

PENALTIES & SANCTIONS

A listing of the enforcement actions handed down this quarter to date by the Texas Department of Licensing and Regulation for violations of water well industry regulations.

9/9/10

A ROSHARON man was fined $1,000 for drilling a water well and failing to submit the required State of Texas Well Report within 60 days.

8/9/10

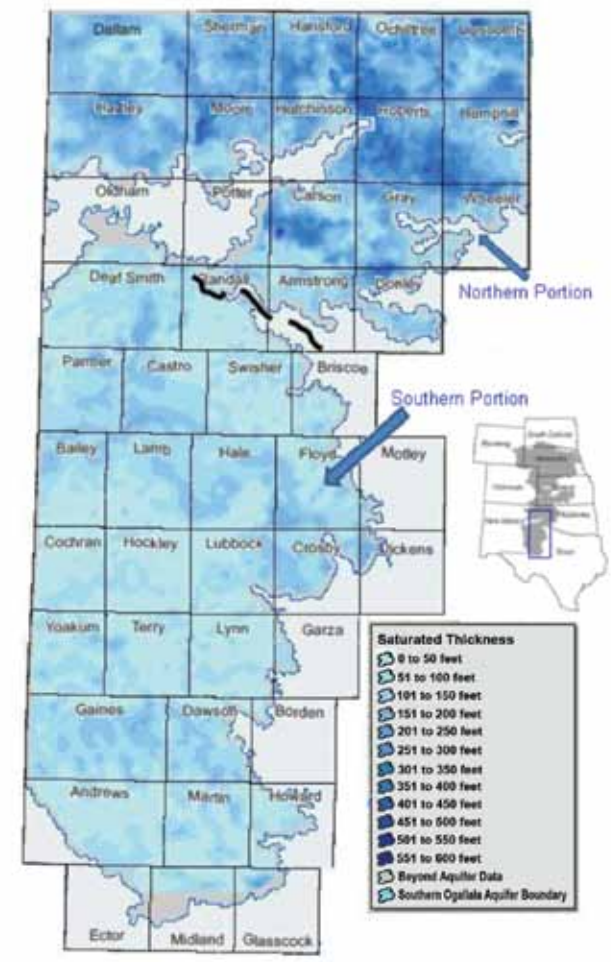
A COMAL County man was fined $6,000 for offering to act as a water well driller without the proper licensing.

Water resources of the Ogallala Aquifer in Texas

By STEVEN WALTHOUR
General Manager,
North Plains Groundwater
Conservation District

The Ogallala aquifer is the largest water resource in the Great Plains. It is an unconfined, or water table aquifer that extends approximately 174,000 square miles from South Dakota, through Wyoming, Nebraska, Colorado, Kansas, New Mexico, Oklahoma, to the Texas Panhandle. In the Texas Panhandle, the Ogallala covers about 36,000 square miles through all or parts of 46 counties contains approximately 366.7 million acre-feet of groundwater in storage (Oliver 2010a). The map shows the Ogallala aquifer, its varying saturated thickness, and two aquifer portions that are segregated by a groundwater divide in Texas.

As the Southern Rocky Mountains began to uplift and the Cretaceous seas retreated, streams flowing east and southeastward from the mountains cut channels into the pre-Ogallala surface of Permian, Triassic, Jurassic and Cretaceous strata. These streams along with eolian process transported large sediment quantities east and southeast from the Rocky Mountains filling in the channels and creating a thick blanket of coalescing clay, silt and sand deposits of the Ogallala and associated formations. Eventually, a combination of the climate's becoming more arid and the Pecos River's incising northward through the formation in New Mexico, isolated the Ogallala in Texas from its Southern Rocky Mountains water and sediment source. Uplift continued and the Texas High Plains surface tilted southeastward (Knowles et al., 1984). Today, the Ogallala formation's thickness ranges from zero to more than 900 feet in the Panhandle and is controlled, in part, by the depth of these paleochannels as well as by dissolution of salt in older rock strata. The Ogallala's greatest sediment thicknesses and saturated thicknesses occur in the northeastern part of the Texas Panhandle.



The Ogallala aquifer showing its varying 2004 saturated thickness, and two aquifer portions that are segregated by a groundwater divide in Texas (modified from Center for Geospatial Technology, 2007).

Interbedded sequences of unconsolidated to poorly consolidated clay, silt, and sands with minor sequences of gravel constitute most of the sediment deposited in the Ogallala formation. The sands are generally tan, cream, yellow, or reddish brown, very fine to coarse-grained, sub-angular to sub-rounded, and poorly to well-sorted. The gravel is usually associated with sand, silt, and clay. On the Texas High Plains, the Ogallala formation is generally capped by caliche near the surface. In addition to these layers, caliche also occurs at depth and may represent older soil horizons.

Drillers' logs describe Permian and Triassic sediment beneath the Ogallala Formation as a combination of red clay, red sand and silt or red beds. Where Cretaceous sediment underlies the Ogallala, widespread yellow, blue, or black clay marks the unconformity. In local areas, the base of the Ogallala can be obscured by pre-Ogallala sediment with similar characteristics to basal Ogallala sand and gravel. The Ogallala is partially hydraulically connected

to underlying sandstones of the Cretaceous and Jurassic-age Rita Blanca Aquifer in Dallam and Hartley counties, to the Santa Rosa sandstone at the base of the Triassic age Dockum Group and to Cretaceous-age limestone of the Edwards Trinity aquifer near Lubbock.

The Ogallala is segregated into northern and southern portions by the Palo Duro Canyon and a groundwater divide, both located along the Prairie Dog Town Fork of the Red River. Groundwater in the aquifer's northern portion generally flows eastward and discharges through wells, into the Canadian and tributaries of the Red River in the eastern Panhandle, or it flows into Oklahoma. The aquifer is laterally hydraulically connected except where the Canadian River has eroded through the formation.

The northern portion's saturated thickness ranges from less than 50 feet to over 550 feet and depth-to-water ranges from zero to over 400 feet. Well capacities range from a few gallons per minute to over 1,000 gallons per minute. However, irrigation, municipal and industrial wells typically produce between 250-600 gallons per minute. This portion contains approximately 243.7 million acre-feet of groundwater in storage which currently supports over 90 percent of estimated 1.85 million acre-feet annual water demand for the area (Freese and Nichols 2006).

In the Ogallala's southern portion, groundwater generally flows southeastward and is discharged through wells or into tributaries of the Red, Colorado and Brazos Rivers. The southern portion's saturated thickness ranges from less than 50-450 feet with less than 100 feet over most of the area. Depth-to-water below the land surface can range from 100-200 feet. The Ogallala's southern portion has an estimated volume in storage of 123.0 million acre-feet (Oliver 2010b) which supports over 94 percent of the projected 4.38 million acre-feet annual water demand for the area (HDR Engineering, Inc., 2006).

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About the author

Steven Walthour is the General Manager of the North Plains Groundwater Conservation District. He has 28 years experience in subsurface geology and groundwater management . Steve holds a Masters Degree from the University of Arkansas and is a licensed professional geoscientist in the State of Texas (License No. 1582). Steve and the district are members of the Texas Ground Water Association. He has made several presentations at C.E. classes for the water well industry.

Dan Parris receives NGWA honorary life membership award

Dan Parris, a past president of the Texas Ground Water Association Manufacturers and Suppliers' Division, received the Life Member Award of the National Ground Water Assoc. at the association's annual convention and trade show in Las Vegas on Dec. 9.

Dan joined the Texas Water Well Association, now the TGWA in 1975 and is still an active member. He soon became a board member of the M&S Division and was elected president in 1981, where he served multiple times as chair. Dan was also a member of the National Water Well Association, now the NGWA , serving on the board of directors of the Manufacturer's Division and also as its chairman during some 30-plus years of membership. Dan was instrumental in forming the Product Groups in the Manufacturer's Division of NGWA.

Dan began his career in the water well business in 1958, repairing & installing pumps for his father's hardware store in a small town in western Illinois. The business was sold in 1973, and he started working for a major pump manufacturer and moved to Texas.

Dan has been involved in the sales & service of jet pumps, submersibles and turbines. In 1989 he entered the water well screen business and spent 20 years in that field, retiring from Johnson Screens in 2009. He has since started a manufacturer's rep business related to water well products and continues to be active in the industry.

Dan has been married to his wife Faye for 50 years; they have three grown children and one granddaughter. They have recently moved to rural Iola, Texas.

The TGWA congratulates Dan for receiving this award – it is well deserved! We express our appreciation to Dan's family for sharing him with us these many years.

Eagle Ford, continued from page 5

of 130 Eagle Ford wells (at 15 acre-feet per well). If each of these 130 wells generated $32 million, the landowner could receive royalties up to 25 percent of the $4.16 billion gross.

In other words, every acre-foot of water used in hydraulic fracturing has a gross revenue potential of about $2,080,000. If a landowner receives a royalty of 25 percent, a single acre-foot of Carrizo water could yield $520,000 ($1.60 per gallon). In contrast, a farmer might use 2,000 acre feet of groundwater to irrigate 1,000 acres of corn, peanut or coastal hay for a gross yield of $500-$1,000 per acre, or $250 per acre-foot of irrigation water.

The point here is that using groundwater from the Carrizo for hydraulic fracturing in the Eagle Ford Shale has enormous economic potential for landowners, oil production companies and the entire region. Moreover, from a geologic and water planning perspective, additional impact on the aquifer appears minimal.

TAKE AWAY

Hydraulic fracturing using groundwater from the Carrizo Aquifer in the Eagle Ford Shale has enormous economic potential for landowners, oil production companies and the entire region. Moreover, from a geologic and water planning perspective, additional impact on the aquifer (beyond existing planned groundwater uses) appears minimal.

About the author

Darrell T. Brownlow is a native of South Texas, resident of Wilson County and cattle rancher in LaSalle County. Dr. Brownlow serves on the South Central Texas Regional Water Planning Group (Region L) and was the governor's appointee to the Evergreen Underground Water Conservation District from 2000-2010. He graduated from Texas Tech University with degrees in the geosciences. Currently, he is vice president of Mining and Resource Management for CEMEX USA. Darrell can be reached at dtbrownlow@hughes.net.

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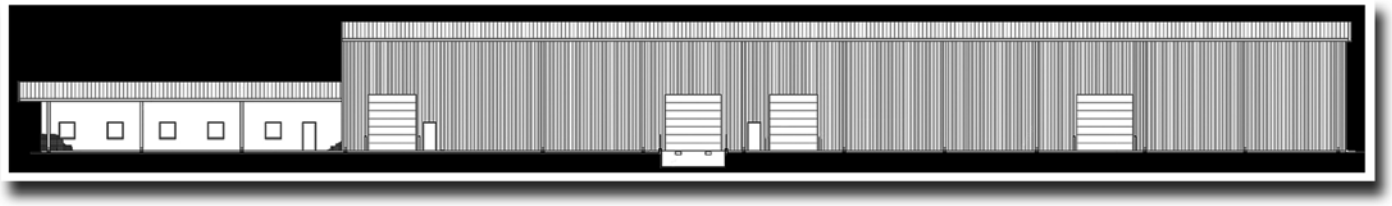

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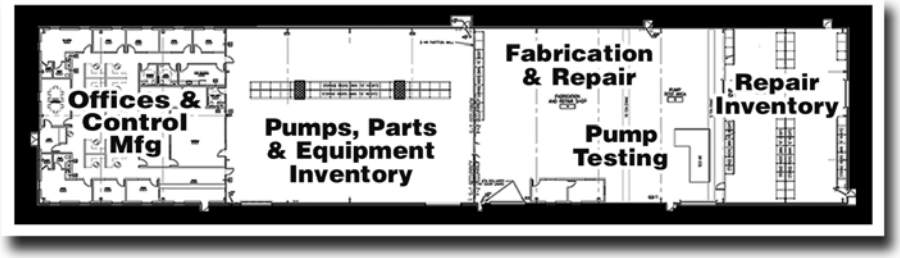

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