Dusty Read checks the clean water tank at Challenger Water Solutions' recycling system demonstration facility. The entire system can be transported on a pair of 18-wheelers.

GONZALES COUNTY — Shale wells are swallowing twice as much water as they did a few years ago — around 10 million gallons each, or about 15 Olympic-sized swimming pools.

The process of making a Texas oil well has grown increasingly intense since the start of the shale boom, with more water, more sand, and more stages in the hydraulic fracturing process.

Bigger wells, but more water - San Antonio Express-News
leading to wells that make more oil, but also require more resources, according to a San Antonio Express-News analysis of the data drillers have reported to the industry website FracFocus for the past seven years.

The amount of water used per well in 2016 averaged 9.7 million gallons in South Texas’ Eagle Ford Shale oil field, up from 4.5 million gallons in 2013.

In the Permian Basin in West Texas, it took an average of 10.5 million gallons in 2016 to make a well, up from 2.7 million gallons in 2014 and 5.4 million gallons in 2015.

Those bigger, more water-intense wells are helping push Texas and the U.S. toward what’s expected to be record oil production this year.

The Eagle Ford pumps 1.2 million barrels of crude oil per day, and the Permian Basin this month will reach 2.8 million barrels per day, according to the U.S. Energy Information Administration.

Both regions are helping propel the U.S. toward what’s expected to be historically high oil production — in 2018, U.S. crude oil output is expected to average 10 million barrels per day, which would surpass the 1970 record of 9.6 million barrels per day.

**Oil production and water use in Texas fracking**

<table>
<thead>
<tr>
<th>Production</th>
<th>Water Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permian Basin</td>
<td>Get Unlimited Digital Access for <strong>$0.99 a week</strong></td>
</tr>
</tbody>
</table>

**Express Newsletters**

Get the latest news, sports and food features sent directly to your inbox.

Sign up
Allen Gilmer, co-founder of the research firm Drillinginfo, said today’s wells are a different breed than ones from a few years ago.

“In the Permian Basin today, the wells relative to 2013 are twice as good,” Gilmer said. “In the Eagle Ford they’re 50 percent better.”

The drilling is happening in the driest parts of the state. And it coincided with one of the worst droughts in the state’s history.

There’s little surf fresh, some brack

2 ARTICLES REMAINING

The Texas oil ren drillers get all tha

Get Unlimited Digital Access for $0.99 a week TRY IT

“The overall queSubscriber Login

The Mitchell Foundation was founded by the late George Mitchell, known as the “father of fracking.” His company was the first to figure out how to wed horizontal drilling techniques with hydraulic fracturing — the process of using water, chemicals and sand at high pressure to break tight rock and prop open the cracks, releasing oil and gas. Mitchell unleashed a new era in the industry.

“Because of technological developments, we’re finding more and more oil, and finding it in places that aren’t the ideal places for oil and gas development if water is a key input to production,” Hastings said. “In the western part of the Permian we’re really in the thick of the Chihuahuan Desert. There is no surface water. Mercifully, we have a lot of brackish groundwater.”

Water use in the oil field is a complex issue. Fifteen swimming pools per well is a lot of water, but it’s also used to make a lot of oil.

Water use hasn’t been on a steady climb in the oil industry, ether. The multiyear oil price bust, which started in late 2014, shelved projects and laid off tens of thousands of workers, and water use dipped. In 2016, the industry in Texas used 39.7 billion gallons of water to drill wells, down from 55.7 billion gallons in 2014, an analysis of FracFocus data shows.

The source

Danny Reible, a chemical engineering professor at Texas Tech University, said the issue isn’t the intensity of the wells — wells that require a bunch of water may be so productive that fewer wells need to get drilled.

Reible is more concerned about water sourcing.

Where precisely does the industry get the 15 swimming pools of water for each well? It’s one of the great research mysteries of the oil field, and it remains unknown. Operators are required by the state to report their total water use — but not water sourcing.
Average Water Use Per Frac Job - Permian Basin

In 2016, the average Permian Basin frac job used **10,496,987.86** gallons of water.
That's enough to fill **15.90** Olympic swimming pools.

"You have to monitor not just total water use, but what sort of water," Reible said

Researchers at the University of Texas at Austin estimate about a fifth of oil-field water used comes from a nonfresh source, including brackish aquifers. Some operators reuse the water that returns after hydraulic fracturing, called flowback water, and the water that comes out of the rock formation itself alongside oil and gas — production water. Others purchase municipal wastewater from cities. Some do all of that.

Reible served on the shale task force of the Academy of Medicine, Engineering and Science of Texas, a conglomerate of Texas research scientists that spent two years reviewing the impacts of shale development on earthquakes, wildlife, air quality, water, transportation and residents.

The task force report was released last year and said that as much as 90 percent of total water use in some sparsely populated counties might be associated with fracking. Groundwater declines of as much as 100 to 200 feet have been recorded in parts of the Eagle Ford and Permian.

Statewide, overall water use by the oil and gas industry is small – 1 percent. It pales in comparison to use by agriculture, around 60 percent.

"At the overall level, it's nothing compared to what agriculture uses," Reible said. "At the same time there's no good reason to use good quality water for this is if you can avoid it. Encouraging brackish and produced water use is what should happen."
and to recycle its own wastewater to reuse in the next frac job.

“It also has the added benefit of reducing disposal and transportation needs as well,” spokeswoman Castlen Kennedy said.

In College Station and in Canada, Apache used treated municipal wastewater to complete wells. In West Texas, it tapped brackish water from the Santa Rosa sandstone.

In the Alpine High field near Balmorhea in West Texas, Apache’s newest oil and gas discovery, it built five water recycling facilities that can store 3 million barrels of wastewater, around 126 million gallons, and has recycled 80 percent of its wastewater so far.

“We are implementing this process throughout Alpine High wherever landowner agreements do not require Apache to utilize their water resources,” Kennedy said, highlighting something that’s a common stumbling block to recycling in Texas — oil and gas leases often require oil companies buy water from ranchers because it’s a source of revenue. (And most ranchers would rather have an oil company drill a new fresh water well on their land than a brackish well — when drilling is done, they have a useful well).

In the Eagle Ford, Houston-based ConocoPhillips taps deep aquifers that landowners aren’t using. The company used the Texas Water Information System and the U.S. Geological Survey to create a 3-D model of the aquifers around its operations. It gave the software to local groundwater districts for their use, and Pete Spicer, a senior environmental scientist with ConocoPhillips, said the company uses it to work with landowners to decide where to drill deep water wells that won’t rile them or their neighbors.
Examples of creative water sourcing or recycling are plentiful, but Reible noted that there’s also the bottom line. Oil is a business, water is a cost and no one makes companies do this.

“The reality is water is cheap,” said Reible. “It becomes really difficult to bother with an alternative source.”

**Better wells**

Texas laws give drillers the right to use the well water they need to to complete wells, but operators don’t use more water just because they can.

Pushing more sand and more water into wells definitely has led to better results across the Eagle Ford, Jennifer Jacobs, an evaluations engineer with BMO Capital Markets, said when she spoke at the DUG Eagle Ford Conference in November in San Antonio.

“There probably is a tipping point on that,” Jacobs said.

Some companies have started to cut back on the amount of sand and fluid, she said, in an attempt to see if they can save money without sacrificing well results, she said.

Patrick Oenbring, CEO of Hawkwood Energy, who also spoke at the conference, detailed the resources required in the latest generation of oil wells. It starts with 100 rail cars of sand for each well.

“So we run basically 50 trucks a day 24 hours a day for two weeks, with each truck hauling 20 to 25 tons of sand,” Oenbring said.

The amount of water pumped to carry that sand is about equal to what the company hopes the well will produce in oil over its life, “and maybe the life is 20 years. A lot of fluid goes in in the first couple of...
produced — its wells make 30 percent to 40 percent water, the rest oil.

In the Permian Basin, it’s another story. Companies produce far more water than oil there.

“All those guys … (in the Permian) are essentially water disposal experts,” Gilmer of Drillinginfo said, as it’s the one spot in Texas where water recycling often is cheaper than disposal.

Bob Watson, chief executive of San Antonio-based Abraxas Petroleum, said finding water and then figuring out what to do with it is a key challenge to working in West Texas.

“If you get a well that’s 35 percent oil, you’re doing good. That’s after you get your frac water back,” Watson said.

Abraxas wells are returning about 35 percent water and 65 percent oil in the Permian.

The future

Drillers traditionally have gotten rid of their contaminated water by taking it to a saltwater disposal well, where it gets pumped into a depleted oil and gas reservoir.

Colin Leyden, a senior manager at the Environmental Defense Fund, said it’s hard to change a longstanding industry practice.

“I think what they’re struggling with is it all comes down to disposal wells are the classic, cheapest way to deal with it,” Leyden said. “The water is only good to you while you’re drilling. After that it’s a waste product.”

Disposal wells are common across the state, but they’ve been linked to an upswing of earthquakes in some regions, especially in North Texas, by several academic studies.

Recycling oil field water can reduce earthquake risk because it takes some of the water volume away from disposal wells, Leyden said. But it isn’t risk-free either. Treating and moving around brackish water in large volumes creates a spill risk at the surface.

“As long as you’re careful about spills, recycling in the oil field is all fine and good,” Leyden said.
In rural Gonzales County, Challenger Water Solutions is recycling oil field water. Water goes in brownish-gray and comes out clear, and Clint Layman said the company can do it at a price that’s on par with traditional methods of sourcing and disposing of water.

It’s still a tough sell.

“The real trick to it is getting the operators to use it,” Layman said. “Those guys don’t like to deviate from the normal thing.”

Because there’s so much skepticism about oil field water recycling, Layman invited companies to try the service, as well as scientists from UT Arlington’s Collaborative Laboratories for Environmental Analysis and Remediation to study their process. The university group is characterizing thousands of organic, inorganic and biological constituents after each step of Challenger’s process and will publish results independently.

Layman said he thinks the company has a chance to succeed — many water recyclers have come and gone — because it’s cost competitive.

“That way you don’t have everyone pulling water out of aquifers, and you don’t have all the seismic issues,” he said.

**Average water use per frac job in Texas**

Search Texas counties

Andrews County
Hastings, of the Mitchell Foundation, said the industry is moving toward more recycling and brackish water use.

“The desert is only going to get drier and you have water constraints,” Hastings said.

Water demand could keep growing, and locking down a supply is key for oil companies.

Executives at Permian-focused Pioneer Natural Resources have called their water program “a linchpin to our success.” Their plan includes spending more than $100 million to improve Midland’s water treatment plant so it can buy effluent from the city.

Pioneer has 785,000 acres in the Permian and hopes to pump 1 million barrels of oil per day itself from the field within a decade.

To make its goal, Pioneer has 785,000 acres in the Permian and hopes to pump 1 million barrels of oil per day — itself — from the field within a decade.

To make its goal, Pioneer has 785,000 acres in the Permian and hopes to pump 1 million barrels of oil per day — itself — from the field within a decade.

Get Unlimited Digital Access for $0.99 a week