

COMMENT

**THE SOUTH TEXAS DROUGHT AND THE
FUTURE OF GROUNDWATER USE FOR
HYDRAULIC FRACTURING IN THE EAGLE
FORD SHALE**

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I. INTRODUCTION

“Whiskey is for drinking, water is for fighting over.”¹

As a state that has experienced its fair share of historical droughts,² Texas is no stranger to water crises.³ Each drought the state endures creates its own unique problems and controversies as citizens struggle over allocation of one of the state’s most precious commodities: water.⁴ In 2011, Texas experienced one of its worst droughts on record since the

1. Barbara Schmidt, *Mark Twain Quotations-Whiskey*, TWAINQUOTES.COM, <http://www.twainquotes.com/WaterWhiskey.html> (last visited Nov. 23, 2012) (noting the confusion over the origin of this quote, which is commonly attributed to Mark Twain). Though its origin cannot be confirmed, the quote routinely appears in literature and discourse addressing water rights, likely because it captures the timelessness and the intensity of these battles. *See generally* Mark Lubell, *Whiskey Is for Drinking, Water Is for Cooperation*, CENTER FOR ENVIRONMENTAL POLICY AND BEHAVIOR (Jan. 9, 2012), <http://environmentalpolicy.ucdavis.edu/blog/2012/01/222> (commenting on the connotations of the phrase).

2. *See* ROBERT L. LOWRY, JR., TEX. BD. OF WATER ENG’RS, A STUDY OF DROUGHTS IN TEXAS 11–18 (1959), *available at* <http://www.twdb.state.tx.us/publications/reports/bulletins/doc/B5914/B5914.pdf> (listing data from eleven droughts in Texas from 1891 to 1959). Texas continually experiences droughts that make an impact but are not considered “historic” like the current drought of 2011 or the drought of the 1950s. *See Drought Information*, TEXAS ALLIANCE OF GROUNDWATER DISTRICTS (Mar. 4, 2012, 9:56 AM), http://www.texasgroundwater.org/index.php?option=com_content&view=article&id=39&Itemid=72 (stating the drought of the 1950s is commonly referred to as “the drought of record”); *cf.* Farzad Mashhood, *Current Drought Pales in Comparison with 1950s ‘Drought of Record’*, AUSTIN AM. STATESMAN (Aug. 4, 2011, 12:01 PM), <http://www.statesman.com/news/local/current-drought-pales-in-comparison-with-1950s-drought-1692176.html?printArticle=y> (referring to a previous drought that spanned from 2007 to 2009).

3. *See, e.g.*, ELMER KELTON, *THE TIME IT NEVER RAINED* (1973) (portraying the harsh struggles of farmers and ranchers in West Texas during the record drought of the 1950s in the form of an historical novel).

4. *See* Farzad Mashhood, *Current Drought Pales in Comparison with 1950s ‘Drought of Record’*, AUSTIN AM. STATESMAN (Aug. 4, 2011, 12:01 PM), <http://www.statesman.com/news/local/current-drought-pales-in-comparison-with-1950s-drought-1692176.html?printArticle=y> (recognizing the drought of the 1950s had a significantly greater economic loss (\$22 billion compared to the current drought’s \$4.2 billion) and noting the resulting increase in urbanization because much of the agricultural population was forced to move to urban areas after the loss of their crops or livestock).

1950s.⁵ Coincidentally, Texas is the largest U.S. producer of oil and gas⁶ and is in the midst of one of its greatest oil booms as production from major shale plays, such as the Eagle Ford, is on the rise.⁷ Oil and gas production in shale fields necessitates a technique called hydraulic fracturing, which requires large volumes of water to be injected at high pressure to “frac” and release gas from an underground formation.⁸ The large amounts of water required for hydraulic fracturing potentially places a greater strain on the regional water supply, and this is a concern for local residents, farmers, and ranchers as they “face growing competition for scarce water” due to worsening drought conditions.⁹

5. See JOHN W. NIELSEN-GAMMON, OFFICE OF THE ST. CLIMATOLOGIST, THE 2011 TEXAS DROUGHT: A BRIEFING PACKET FOR THE TEXAS LEGISLATURE 3 (Oct. 31, 2011), *available at* http://atmo.tamu.edu/osc/library/osc_pubs/2011_drought.pdf (announcing that since the state began collecting such data in 1895, 2011 was the driest year on record, surpassing each of the individual years occurring during the drought of the 1950s).

6. See TEX. COMPTROLLER OF PUB. ACCOUNTS, THE ENERGY REPORT 35 (2008), *available at* <http://www.window.state.tx.us/specialrpt/energy/pdf/04-CrudeOil.pdf> (noting that Texas has been the nation’s leading producer of petroleum since the early 20th Century). Even before the Eagle Ford Shale was discovered in 2008, Texas ranked among the largest oil and gas producers in the world. See BUREAU OF ECON. GEOLOGY, UNIV. OF TEX., OIL AND GAS PRODUCTION IN TEXAS 2 (2005), *available at* <http://www.beg.utexas.edu/UTopia/images/pagesizemaps/oilgas.pdf> (proclaiming that in 2005 Texas would rank within the top ten producing nations in the world based on its petroleum production volumes).

7. See NAT’L ENERGY TECH. LAB., U.S. DEP’T OF ENERGY, SHALE GAS: APPLYING TECHNOLOGY TO SOLVE AMERICA’S ENERGY CHALLENGES 4 (Mar. 2011), *available at* http://www.netl.doe.gov/technologies/oil-gas/publications/brochures/Shale_Gas_March_2011.pdf (providing a chart showing increasing volumes of gas production from Texas’s Eagle Ford and Haynesville Shales, as well as the Barnett Shale maintaining steady production levels).

8. See HOWARD R. WILLIAMS & CHARLES J. MEYERS, MANUAL OF OIL AND GAS TERMS 448–49 (Patrick H. Martin & Bruce M. Kramer eds., 14th ed. 2009) (defining “hydraulic fracturing” as a method used extensively on limestone formations).

9. See Joe Carroll, *Worst Drought in More Than a Century Strikes Texas Oil Boom*, BLOOMBERG (June 13, 2011, 3:49 PM), <http://www.bloomberg.com/news/2011-06-13/worst-drought-in-more-than-a-century-threatens-texas-oil-natural-gas-boom.html> (reporting on the current drought’s effects on the Eagle Ford Shale’s fracing activities); see also J. Daniel Arthur, Water Management Planning in the Eagle Ford Shale Play, Presentation at the Society of Petroleum Engineers Eagle Ford Shale Technical Workshop 2 (Aug. 24–26, 2011), *available at* <http://www.all-llc.com/publicdownloads/ALLEagleFordWMP082411.pdf> (noting the growing concern over water sourcing in the region); Michael Barajas, *Texas Fracking Critics Tour the Eagle Ford As Complaints of Contamination Surface*, SAN ANTONIO CURRENT (June 22, 2011), <http://sacurrent.com/texas-fracking-critics-tour-the-eagle-ford-as-complaints-of-contamination-surface-1.1165133> (detailing concerns over water scarcity as fracing operations increase amidst prolonged drought conditions); Tracy Idell Hamilton, *Drought Spurring Fracking Concerns*, SAN ANTONIO EXPRESS-NEWS (July 3, 2011, 12:54 AM), www.mysanantonio.com/news/energy/article/Droughtspurringfrackingconcerns-1450808.php#page-2 (asserting “a perennial question for the region” is whether there is enough water); Sanford Nowlin, *Drought May Hamper Eagle Ford Shale Production*, HOUS. BUS. J. (July 1, 2011, 5:00 AM), <http://www.bizjournals.com/houston/print-edition/2011/07/01/drought-may-hamper-eagle-ford-shale.html> (predicting that if drought conditions continue, future conflicts over the water supply are

As concern increases over diminishing groundwater resources, the question inevitably becomes whether increased restrictions on the quantity of water used for hydraulic fracturing are necessary to supplement existing legal remedies for residents worried about their groundwater supply.¹⁰ This Comment will highlight legal issues raised by the high volumes of groundwater used for hydraulic fracturing in the Eagle Ford Shale, with an emphasis on such usage during a drought.¹¹ It will subsequently address the issue of whether hydraulic fracturing in the Eagle Ford Shale substantially affects the quantity of groundwater supplies and will consider possible legal remedies available to those who believe their water source is at risk of depletion. Lastly, this Comment will explore proposed solutions that attempt to mitigate the effects of diminishing groundwater supplies in a state so severely affected by prolonged and recurring droughts.¹²

likely); Rick Spruill, *Water Availability, Not Contamination, Worries Residents Above Eagle Ford Shale*, CORPUS CHRISTI CALLER (Oct. 15, 2011, 10:00 PM), <http://www.caller.com/news/2011/oct/15/water-availability-not-contamination-worries/> (noting some residents in Karnes County are more concerned with water availability than water contamination problems caused by hydraulic fracturing); Vicki Vaughan, *How Much Is Needed in Fracking?*, SAN ANTONIO EXPRESS-NEWS (Oct. 10, 2011, 9:20 PM), www.mysanantonio.com/business/article/How-much-is-needed-in-fracking-2212002.php (reasoning that it is only a natural reaction for people to be concerned about water use related to hydraulic fracturing during an ongoing drought).

10. Cf. Mike Lee, *Parched Texans Impose Water-Use Limits for Fracking Gas Wells*, BLOOMBERG BUSINESSWEEK (Oct. 6, 2011, 2:08 PM), <http://www.businessweek.com/news/2011-10-06/parched-texans-impose-water-use-limits-for-fracking-gas-wells.html> (describing water restrictions that have already been imposed by local groundwater conservation districts against hydraulic fracturing operations in order to mitigate their effects on reservoir levels); Kathy Wythe, *If Drought Continues, Water Policy Changes to Come, Says Texas A&M Expert*, TEXAS WATER RESEARCH INSTITUTE (Oct. 2011), <http://twri.tamu.edu/publications/drought/2011/october/if-drought-continues-water-policy-changes-to-come/> (noting Dr. John Nielson-Gammon's predictions that water policy changes will occur if the drought persists).

11. See, e.g., 16 TEX. ADMIN. CODE § 3.29 (2012) (Tex. R.R. Comm'n, Hydraulic Fracturing Chemical Disclosure Requirement) (requiring disclosure of water volumes used per well for hydraulic fracturing operations); see also Stephen Rassenfoss, *From Flowback to Fracturing: Water Recycling Grows in the Marcellus Shale*, J. OF PETROLEUM TECH., July 2011, at 48, 49, available at <http://www.spe.org/jpt/print/archives/2011/07/12Marcellus.pdf> (noting the pressure on Texas oil and gas operators "from municipalities and the public to conserve water").

12. See, e.g., Brian J. Smith, Comment, *Fracing the Environment?: An Examination of the Effects and Regulation of Hydraulic Fracturing*, 18 TEX. WESLEYAN L. REV. 129, 146 (2011) (encouraging the state to subsidize programs aimed at "develop[ing] more efficient and cost-effective water-recycling technology" to reduce the amount of freshwater needed for each frac job).

II. BACKGROUND OF WATER USE IN ASSOCIATION WITH HYDRAULIC FRACTURING

A. *Hydraulic Fracturing in the Eagle Ford Shale*

Hydraulic fracturing, or “fracing,”¹³ is the process by which oil or gas is extracted from certain underground formations that are lacking in permeability, such as shale or limestone.¹⁴ Permeability is a required characteristic for production in a formation in which oil and gas is discovered because it allows for the transmission of hydrocarbons through the formation and up to the earth’s surface.¹⁵ “Traditional oil and gas reservoirs are naturally porous and permeable . . . [and] allow for the relatively free movement of hydrocarbon molecules.”¹⁶ Without

13. Hydraulic fracturing was commonly abbreviated as “frac’ing” or “fracing” at first, but in recent years the usage of the term “fracking” has become increasingly popular with media outlets and the public. See Apache Corp., *What’s all the Fracking Fuss About?*, ARROWS NEWSLETTER, Spring 2011, available at http://www.apachecorp.com/News/Articles/View_Article.aspx?Article.ItemID=1591 (noting that “[i]n the end, it’s only a word”); Scott Detrow, *Fracking, Fracing, or Frac’ing?*, STATE IMPACT (Sept. 6, 2011, 9:56 AM), <http://stateimpact.npr.org/Pennsylvania/2011/09/06/fracking-fracing-or-fracing/> (attempting humor by describing the dispute over spelling of the word as a “really important question”).

14. See HOWARD R. WILLIAMS & CHARLES J. MEYERS, *MANUAL OF OIL AND GAS TERMS* 448–49 (Patrick H. Martin & Bruce M. Kramer eds., 14th ed. 2009) (citing the United States Supreme Court’s description of fracing, borrowed from the Texas Supreme Court, as “pumping fluid down a well at high pressure so that it is forced out into the formation”).

The pressure creates cracks in the rock that propagate along the azimuth of natural fault lines in an elongated elliptical pattern in opposite directions from the well. Behind the fluid comes a slurry containing small granules called proppants—sand, ceramic beads, or bauxite are used—that lodge themselves in the cracks, propping them open against the enormous subsurface pressure that would force them shut as soon as the fluid was gone. The fluid is then drained, leaving the cracks open for gas or oil to flow to the wellbore.

Coastal Oil & Gas Corp. v. Garza Energy Trust, 268 S.W.3d 1, 6–7 (Tex. 2008); see *Hydraulic Fracturing at a Glance*, API ENERGY, at 2 (2008), http://www.api.org/policy/exploration/upload/Hydraulic_Fracturing_at_a_Glance.pdf (noting hydraulic fracturing is used to allow hydrocarbons to move more freely through a formation, thus making drilling in such formations more economical due to the high rate of capture).

15. See HOWARD R. WILLIAMS & CHARLES J. MEYERS, *MANUAL OF OIL AND GAS TERMS* 700 (Patrick H. Martin & Bruce M. Kramer eds., 14th ed. 2009) (defining permeability as “[a] measure of the resistance offered by rock to the movement of fluids through it”); API ENERGY, *WATER MGMT. ASSOCIATED WITH HYDRAULIC FRACTURING* 5 (June 2010), available at http://www.shalegas.energy.gov/resources/HF2_e1.pdf (defining “permeability” as “the measure of a rock or formation’s ability to transmit fluids”).

16. Ezra A. Johnson, *Emerging Trends in the Eagle Ford Shale Play*, Presentation at the Dall. Bar Ass’n 25th Annual Rev. of Oil and Gas Law, at 1 (Aug. 27, 2010), available at http://www.coxsmith.com/portalresource/lookup/wosid/intelliun-105-5300/media.name=/Emerging%20Trends%20in%20the%20Eagle%20Ford%20Shale%20Play%20by%20Ezra%20A%20%20Johnson_3149576_1.pdf.

permeability, the oil or gas is unable to escape the formation and reach the surface.¹⁷ Formations with low permeability are known as “tight” formations, and the process of extracting oil and gas from tight formations is considered unconventional because it requires the use of enhanced recovery techniques, such as hydraulic fracturing, to effect production.¹⁸ The fracing process increases permeability by injecting large quantities of hydraulic fluid into a drilled well at high pressure to create fissures in the formation.¹⁹ This process allows the oil or gas to seep upward through the wellbore and makes it available for production.²⁰ Fracing fluid usually “consists of a viscous gelled fluid” made from high volumes of water and a mixture of chemicals.²¹

Hydraulic fracturing is a relatively new technique.²² The first use of the technology occurred in the late 1940s,²³ and recent technological advances have facilitated its use in oil and gas bearing formations once considered inaccessible to operators.²⁴ The increasing importance of hydraulic fracturing is largely due to its application in freeing up “[c]lean burning natural gas” that is essentially locked within these dense and relatively

17. *See id.* (describing how shale plays in Texas are different from traditional oil and gas formations because of their low levels of permeability).

18. *See* HOWARD R. WILLIAMS & CHARLES J. MEYERS, *MANUAL OF OIL AND GAS TERMS* 998, 1020 (Patrick H. Martin & Bruce M. Kramer eds., 14th ed. 2009) (defining a “tight formation” as a sedimentary rock “that greatly hinders the flow of any gas through the rock” and is “characterized by low permeability” resulting in the use of hydraulic fracturing, and also defining unconventional gas as “[a] generic term applying to . . . gas shale . . . and [gas hydrates]” (citing Sam Fletcher, *Unconventional Gas Vital to U.S. Supply*, OIL & GAS J., Feb. 28, 2005, at 20)); API ENERGY, WATER MANAGEMENT ASSOCIATED WITH HYDRAULIC FRACTURING 3 (June 2010), *available at* http://www.shalegas.energy.gov/resources/HF2_e1.pdf (defining shale gas as natural gas produced from shale formations with low levels of permeability).

19. *Freeing Up Energy, Hydraulic Fracturing: Unlocking America's Natural Gas Resources*, API ENERGY, at 2 (June 19, 2010), http://www.api.org/policy/exploration/hydraulicfracturing/upload/HYDRAULIC_FRACTURING_PRIMER.pdf.

20. *Id.*

21. *Eagle Ford: Water Use in Association with Oil and Gas Activities Regulated by the Railroad Commission of Texas*, RAILROAD COMMISSION OF TEXAS, <http://www.rrc.state.tx.us/eagleford/wateruse.php> (last visited Nov. 23, 2012).

22. *See* NAT'L ENERGY TECH. LAB., U.S. DEP'T OF ENERGY, *SHAPE GAS: APPLYING TECHNOLOGY TO SOLVE AMERICA'S ENERGY CHALLENGES* 3 (Mar. 2011), *available at* http://www.netl.doe.gov/technologies/oil-gas/publications/brochures/Shale_Gas_March_2011.pdf (pointing out hydraulic fracturing was first used as a recovery method in the late 1940s, nearly one hundred twenty years after the first commercial gas wells were drilled in New York).

23. API ENERGY, WATER MANAGEMENT ASSOCIATED WITH HYDRAULIC FRACTURING vi (June 2010), *available at* http://www.shalegas.energy.gov/resources/HF2_e1.pdf.

24. *See Freeing Up Energy, Hydraulic Fracturing: Unlocking America's Natural Gas Resources*, API ENERGY, at 3 (June 19, 2010), http://www.api.org/policy/exploration/hydraulicfracturing/upload/HYDRAULIC_FRACTURING_PRIMER.pdf (explaining the nation's natural gas reserves increased by 30% in five years due to the ability to tap into tight formations).

impermeable formations.²⁵ The United States is home to a vast array of these dense formations, known as shale plays.²⁶ In a society that increasingly emphasizes clean energy technology and reducing reliance on foreign fuel sources, the local nature of such a vast amount of clean-burning fuel makes drilling domestically an attractive and lucrative endeavor.²⁷

Spanning twenty-three counties and six million acres in South Texas, Petrohawk discovered the Eagle Ford Shale in 2008 when it drilled the first well in LaSalle County.²⁸ Drilling activities increased rapidly, and in 2011 the Railroad Commission issued 2,826 drilling permits, almost tripling the number of permits issued in 2010.²⁹ In 2012, the Railroad Commission estimated 4,293 permits will be issued in the Eagle Ford.³⁰ In 2009, the Eagle Ford had 67 producing gas wells and 40 producing oil wells.³¹ By 2010 “[t]here were . . . 72 producing oil leases” and 158 producing gas wells, and these numbers will no doubt continue to rise in

25. *Id.* at 2–3.

26. See U.S. ENERGY INFO. ADMIN., DEP’T OF ENERGY, REVIEW OF EMERGING RESOURCES: U.S. SHALE GAS AND SHALE OIL PLAYS 4–5 (July 2011), available at <ftp://ftp.eia.doe.gov/natgas/usshaleplays.pdf> (stating, as of July 2011, as many as twenty-two different shale plays have been discovered in the United States).

27. See NAT’L ENERGY TECH. LAB., U.S. DEP’T OF ENERGY, SHALE GAS: APPLYING TECHNOLOGY TO SOLVE AMERICA’S ENERGY CHALLENGES 2 (Mar. 2011), available at http://www.netl.doe.gov/technologies/oil-gas/publications/brochures/Shale_Gas_March_2011.pdf (noting shale gas helps answer the nation’s call for cleaner burning fuels and reduced reliance on foreign fuels); *Hydraulic Fracturing at a Glance*, API ENERGY, at 2 (2008), http://www.api.org/policy/exploration/upload/Hydraulic_Fracturing_at_a_Glance.pdf (observing that many American manufacturing jobs rely on clean burning energy). See generally *About the Clean Energy Ministerial*, CLEAN ENERGY MINISTERIAL, <http://www.cleanenergyministerial.org/about/index.html> (last visited Dec. 5, 2012) (identifying the United States as a participating government in the initiatives of the Clean Energy Ministerial, which include advancing clean energy technologies and “transition[ing] to a global clean energy economy”).

28. See Darrell T. Brownlow, *Eagle Ford Shale Play and the Carrizo Aquifer*, FOUNTAINHEAD, 4th Quarter 2010, at 1, 4, available at <http://www.tgwa.org/downloads/newsletter/Fountainhead-Q4-2010.pdf> (declaring the Eagle Ford spans approximately six million acres across South Texas); *Eagle Ford Information*, RAILROAD COMMISSION OF TEXAS, <http://www.rrc.state.tx.us/eagleford/index.php> (last updated Sept. 12, 2012) (reporting the existence of twenty active and seventeen inactive fields in the Eagle Ford Shale, lying within twenty-three counties in South Texas).

29. See *Texas Eagle Ford Shale Drilling Permits Issued*, RAILROAD COMMISSION OF TEXAS, <http://www.rrc.state.tx.us/eagleford/EagleFordDrillingPermitsIssued.pdf> (last visited Nov. 23, 2012) (reporting a drastic rise in drilling permits issued within the first three years after the discovery of the Eagle Ford Shale, with 26 permits issued in 2008, 94 permits in 2009, and 1,010 permits in 2010).

30. See *id.* (estimating the number of permits to be issued by the end of 2012).

31. *Eagle Ford Information*, RAILROAD COMMISSION OF TEXAS, <http://www.rrc.state.tx.us/eagleford/index.php> (last updated Oct. 25, 2012).

the coming years as permitted wells are completed.³² The Eagle Ford Shale has been particularly popular “due to its capability of producing both gas and more oil than other traditional shale plays.”³³ Due to its relatively high carbonate content of approximately 70%, the shale play is more fragile and, therefore, more easily fraced than typical shale plays, making it a lucrative area for oil and gas operators to drill.³⁴ The Eagle Ford produces both dry and wet gas in addition to oil³⁵ and is divided generally into three “windows” delineating the production zones where each type of petroleum product is primarily found.³⁶

Drilling and production in the Eagle Ford utilizes a combination of “horizontal drilling and hydraulic fracturing techniques.”³⁷ The play ranges in depth from 4,000 to 12,000 feet, with some wells being as deep as 16,000 feet when both vertical and lateral depths are taken into consideration.³⁸ According to a review issued by the United States Energy Information Administration, the average depth of a well in the Eagle Ford

32. *Id.*

33. *Id.*; see also U.S. ENERGY INFO. ADMIN., DEP'T OF ENERGY, REVIEW OF EMERGING RESOURCES: U.S. SHALE GAS AND SHALE OIL PLAYS 5 (July 2011), available at <ftp://ftp.eia.doe.gov/natgas/usshaleplays.pdf> (providing data from 2009 that shows the Eagle Ford as one of the only shales with oil production capabilities).

34. *Eagle Ford Information*, RAILROAD COMMISSION OF TEXAS, <http://www.rrc.state.tx.us/eagleford/index.php> (last updated Oct. 25, 2012); see also Morgan P. O'Brien, *Eagle Ford Shale Overview*, presented at the Am. Ass'n of Drilling Eng'rs Symposium 2010, at 10 (Jan. 20, 2010), available at <http://www.aade.org/app/download/7021878004/AADE+Eagleford+Shale+%28Petrohawk%29.pdf> (estimating and comparing the Eagle Ford Shale's 70% carbonate content with the Haynesville Shale, whose carbonate content is estimated to be near 50%).

35. *Eagle Ford Information*, RAILROAD COMMISSION OF TEXAS, <http://www.rrc.state.tx.us/eagleford/index.php> (last updated Oct. 25, 2012).

36. See U.S. ENERGY INFO. ADMIN., DEP'T OF ENERGY, REVIEW OF EMERGING RESOURCES: U.S. SHALE GAS AND SHALE OIL PLAYS 5 (July 2011), available at <ftp://ftp.eia.doe.gov/natgas/usshaleplays.pdf> (indicating the Eagle Ford has three zones: a dry gas zone, a condensate zone, and an oil zone); *Eagle Ford Shale Play, Western Gulf Basin, South Texas*, U.S. ENERGY INFORMATION ADMINISTRATION, http://www.eia.gov/oil_gas/rpd/shaleusa9.pdf (last visited Nov. 23, 2012) (delineating the windows where dry and wet gas are produced in the Eagle Ford).

37. Selam Gebrekidan, *Analysis: 100 Years After Boom, Shale Makes Texas Oil Hot Again*, REUTERS (May 3, 2011, 3:13 PM), available at <http://www.reuters.com/article/2011/05/03/us-pipeline-eagle-ford-idUSTRE7426A220110503>.

38. See *Eagle Ford Information*, RAILROAD COMMISSION OF TEXAS, <http://www.rrc.state.tx.us/eagleford/index.php> (last updated Oct. 25, 2012) (describing the vertical and lateral depths of the first well drilled in the Eagle Ford); see also Darrell T. Brownlow, *Eagle Ford Shale Play and the Carrizo Aquifer*, FOUNTAINHEAD, 4th Quarter 2010, at 1, available at <http://www.tgwa.org/downloads/newsletter/Fountainhead-Q4-2010.pdf> (noting the Eagle Ford formation is found at depths “between 7,000 and 12,000 feet” below the surface).

Shale is 7,000 feet.³⁹ Statistics indicate around 4,875,000 gallons of water are required to complete each Eagle Ford well.⁴⁰ Most of the water used to complete a well is for fracing; where 162,500 gallons are needed to drill the well, 4,712,500 gallons are allocated for fracing purposes.⁴¹

The majority of the Eagle Ford Shale lies within the South Central Texas Regional Water Planning Area, whose current water supply consists of 70% groundwater resources.⁴² The remaining water supply for the region comes from various surface water resources.⁴³ The principal water source for hydraulic fracturing in the Eagle Ford is groundwater, primarily because less surface water is available in the region.⁴⁴ In particular “[t]he Carrizo Aquifer is the primary source of [groundwater] for hydraulic fracturing” in the Eagle Ford.⁴⁵ Additional sources include the Edwards Aquifer and “the lower-yielding Gulf Coast Aquifer” in the northern and eastern portions of the play, respectively, as well as a small amount of surface water.⁴⁶ In evaluating potential water sources for fracing operations, oil companies consider various factors, including local regulatory restrictions, estimated volume requirements determined by the depth and pressure of the well, geological characteristics of the formation,

39. U.S. ENERGY INFO. ADMIN., DEPT OF ENERGY, REVIEW OF EMERGING RESOURCES: U.S. SHALE GAS AND SHALE OIL PLAYS 30 (July 2011), available at <ftp://ftp.eia.doe.gov/natgas/usshaleplays.pdf>.

40. DARRELL T. BROWNLOW, CARRIZO CONSULTING, LP, EAGLE FORD SHALE & THE CARRIZO AQUIFER 16 (June 30, 2011), available at <http://www.eaglefordflyer.com/Assets/Files/Resources/Land%20Mineral%20Royalty%20Owner/Eagle-Ford-Shale-Carrizo-Aquifer.pdf>.

41. *Id.*; see also *Water Use in Eagle Ford Deep Shale Exploration: Fact Sheet*, CHESAPEAKE ENERGY, at 1 (May 2012), http://www.chk.com/media/educational-library/fact-sheets/eagleford/eagleford_water_use_fact_sheet.pdf (estimating a single Eagle Ford well requires an average of “4.8 million gallons of water”).

42. TEX. WATER DEV. BD., WATER FOR TEXAS: SUMMARY OF THE 2011 REGIONAL WATER PLANS L-1 (Jan. 20, 2011), available at <http://www.twdb.state.tx.us/waterplanning/rwp/regions/doc/2011RWPLegislativeSummary.pdf>.

43. See, e.g., *id.* (identifying the Canyon Reservoir and Guadalupe River as surface water sources).

44. See Darrell T. Brownlow, *Eagle Ford Shale Play and the Carrizo Aquifer*, FOUNTAINHEAD, 4th Quarter 2010, at 1, 4, available at <http://www.tgwa.org/downloads/newsletter/Fountainhead-Q4-2010.pdf> (noting the Carrizo Aquifer, one of the largest local groundwater sources, is the primary water source for fracing operations in the region); see also API ENERGY, WATER MANAGEMENT ASSOCIATED WITH HYDRAULIC FRACTURING 5 (June 2010), available at http://www.shalegas.energy.gov/resources/HF2_e1.pdf (highlighting how difficult it is for operators and service companies to find water sources for hydraulic fracturing in arid regions).

45. Darrell T. Brownlow, *Eagle Ford Shale Play and the Carrizo Aquifer*, FOUNTAINHEAD, 4th Quarter 2010, at 1, 4, available at <http://www.tgwa.org/downloads/newsletter/Fountainhead-Q4-2010.pdf>.

46. See *id.* at 1, 4–5 (providing a map showing primary aquifers utilized by oil and gas operators for hydraulic fracturing operations in the Eagle Ford).

and discussions with local water management entities.⁴⁷

The potential water sources for a fracing project include “surface water bodies, municipal water supplies, groundwater, wastewater sources, or . . . recycled [water] from other sources including previous hydraulic fracturing operations.”⁴⁸ Ultimately, the water source for a project is determined by the formation’s geological requirements and the potential hydrocarbon yield from using a particular type of water.⁴⁹ The majority of the groundwater that oil companies use for fracing in the Eagle Ford comes from water wells drilled on the surface owner’s property that pump fresh groundwater from reservoirs; however, when permitted, some oil companies store water in larger reservoirs created through capture of surface water runoff.⁵⁰ Fresh water obtained on-site is often more practical because the cost of trucking the water to the fracing location can be too expensive for some operators, and capturing surface water runoff for use in fracing Eagle Ford wells is unlikely given the drought conditions in South Texas.⁵¹ While some non-potable water is adequate for hydraulic fracturing purposes, there may be instances where it is not an economically viable source due to the increased costs related to treating such water.⁵² If

47. See API ENERGY, WATER MANAGEMENT ASSOCIATED WITH HYDRAULIC FRACTURING 1 (June 2010), available at http://www.shalegas.energy.gov/resources/HF2_e1.pdf (laying out the factors considered in determining water sourcing for fracing and suggesting the development of a hierarchy of preferred water sources placing industrial wastewater as a priority); J. Daniel Arthur, Water Management Planning in the Eagle Ford Shale Play, Presentation at the Society of Petroleum Engineers Eagle Ford Shale Technical Workshop, at 6, 10 (Aug. 24–26, 2011), available at <http://www.all-llc.com/publicdownloads/ALLEagleFordWMP082411.pdf> (suggesting the use of industrial waste water as a primary water source for fracing fluids rather than using valuable drinking water sources).

48. API ENERGY, WATER MANAGEMENT ASSOCIATED WITH HYDRAULIC FRACTURING 5 (June 2010), available at http://www.shalegas.energy.gov/resources/HF2_e1.pdf.

49. *Id.* at 13.

50. See *Water Use in Eagle Ford Deep Shale Exploration: Fact Sheet*, CHESAPEAKE ENERGY, at 1 (May 2012), http://www.chk.com/media/educational-library/fact-sheets/eagleford/eagleford_water_use_fact_sheet.pdf (identifying sources other than groundwater that are utilized by the company for fracing, including municipal water and surface water sources like ponds, lakes, and rivers).

51. See, e.g., Mike Lee, *Parched Texans Impose Water-Use Limits for Fracking Gas Wells*, BLOOMBERG BUSINESSWEEK (Oct. 6, 2011, 2:08 PM), <http://www.businessweek.com/news/2011-10-06/parched-texans-impose-water-use-limits-for-fracking-gas-wells.html> (citing a company that paid \$68,000 to truck water from an off-site location 50 miles away); Stephen Rassenfoss, *From Flomback to Fracturing: Water Recycling Grows in the Marcellus Shale*, J. OF PETROLEUM TECH., July 2011, at 48, 49, available at <http://www.spe.org/jpt/print/archives/2011/07/12Marcellus.pdf> (acknowledging it is often cheaper to drill onsite and use fresh water on the premises rather than incurring the costs of trucking in large amounts of water).

52. See *id.* at 13 (“Additional treatment may be required prior to use for fracturing which may not be possible or feasible.”).

its saline content is too high, non-potable water is inappropriate for fracing because it can lead to corrosion of the well or the chemical makeup may not be adequate for successful production.⁵³

B. *Water Law in Texas*

Water rights in Texas are highly dependent upon the characterization of a particular water source.⁵⁴ Water in Texas is classified as groundwater, diffused water, or surface water.⁵⁵ Surface water is comprised of streams, rivers, and lakes,⁵⁶ while groundwater is further subdivided and defined as a subterranean stream or percolating water.⁵⁷ Both distinctions are determinative of whether the state controls the waters or if it is instead subject to private ownership. Surface water and subterranean streams are owned by the state, while landowners own percolating groundwater “in place” as real property in the same manner as oil and gas.⁵⁸ “[Texas] law presumes that all underground water sources are percolating waters, as opposed to subterranean streams.”⁵⁹ The Texas Supreme Court recently

53. Cf. API ENERGY, WATER MANAGEMENT ASSOCIATED WITH HYDRAULIC FRACTURING 16 (June 2010), available at http://www.shalegas.energy.gov/resources/HF2_e1.pdf (discussing levels of saline content in non-potable water used for fracing and stating that the chemical makeup may not be adequate for successful production).

54. See generally WELLS A. HUTCHINS, THE TEXAS LAW OF WATER RIGHTS 558–59 (1961) (discussing varying water rights based on the legal characterization of different water sources and how the classification affects legal ownership).

55. See Stephanie E. Hayes Lusk, Comment, *Texas Groundwater: Reconciling the Rule of Capture with Environmental and Community Demands*, 30 ST. MARY’S L.J. 305, 314 (1998) (noting the classification of water in Texas is made according to the hydrological cycle (citing FRANK F. SKILLERN, TEXAS WATER LAW 5 (rev. ed. 1992))).

56. See WELLS A. HUTCHINS, THE TEXAS LAW OF WATER RIGHTS 77 (1961) (listing examples of surface waters that are subject to state ownership).

57. See TEX. WATER CODE ANN. § 36.001(5) (West 2011) (defining groundwater as “water percolating below the surface of the earth”); WELLS A. HUTCHINS, THE TEXAS LAW OF WATER RIGHTS 558 (1961) (noting Texas still draws a distinction between percolating waters and underground streams).

58. See WATER § 11.021(a) (West 2008) (establishing state ownership of surface waters); *Edwards Aquifer Auth. v. Day*, 369 S.W.3d 814, 832 (Tex. 2012); *City of Corpus Christi v. City of Pleasanton*, 154 Tex. 289, 276 S.W.2d 798, 802 (1955) (noting that a landowner is permitted to use all percolating water captured from his or her well); *Tex. Co. v. Burkett*, 117 Tex. 16, 296 S.W. 273, 278 (1927) (noting the presumption of underground waters as percolating waters which are subject to private ownership by the landowner); *Hous. & Tex. Cent. Ry. Co. v. East*, 98 Tex. 146, 81 S.W. 279, 280–81 (1904) (affirming that a landowner is not liable to his or her neighbor for capturing percolating waters from his or her own well); *Pecos Cnty. Water Control & Improvement Dist. v. Williams*, 271 S.W.2d 503, 505 (Tex. Civ. App.—El Paso 1954, writ ref’d n.r.e.) (reaffirming “percolating waters belong to the landowner”).

59. See Stephanie E. Hayes Lusk, Comment, *Texas Groundwater: Reconciling the Rule of Capture with Environmental and Community Demands*, 30 ST. MARY’S L.J. 305, 314 (1998) (citing FRANK F. SKILLERN, TEXAS WATER LAW 5 (rev. ed. 1992)).

defined this “ownership in place” of percolating groundwater as no different than ownership of oil and gas below the surface.⁶⁰ Aquifers, such as the Carrizo and Gulf Coast, are examples of such percolating waters. The characterization of ownership is important because water owned and controlled by the state is subject to regulation and limitations on usage,⁶¹ while groundwater owned individually by landowners is subject to limited restrictions put forth by local groundwater conservation districts and is governed by the ancient common law doctrine known as the rule of capture.⁶²

In the context of oil and gas exploration and the conveyance of mineral rights, it is important to note that groundwater in Texas is legally a part of the surface estate, rather than the mineral estate.⁶³ Therefore, the execution of an oil and gas lease will not convey an interest in groundwater apart from an implied easement on the surface estate, which provides the dominant mineral estate with the right to use the surface estate—including its groundwater—as much as is reasonably necessary for the exploration and production of oil and gas.⁶⁴

Groundwater in Texas is managed by statutory regulations⁶⁵ and the common law rule of capture, two seemingly “opposing management regimes.”⁶⁶ Under the common law in Texas, a landowner’s use of the groundwater beneath his land is governed by the rule of capture—an ancient common law doctrine establishing ownership over migratory

60. See *Day*, 369 S.W.3d at 832 (holding that “[e]ach owner of land owns separately, distinctly and exclusively all the oil and gas under his land” and that “this correctly states the common law regarding ownership of groundwater in place” (citing *Elliff v. Texon Drilling Co.*, 146 Tex 575, 210 S.W.2d 558, 561 (1948))).

61. See WELLS A. HUTCHINS, *THE TEXAS LAW OF WATER RIGHTS* 77 (1961) (describing state ownership of various types of surface water and noting the limitation this type of ownership imposes upon proprietors).

62. See *Hous. & Tex. Cent. Ry. Co.*, 81 S.W. at 280–81 (establishing the rule of capture as the rule of law for Texas groundwater ownership).

63. See *Fleming Found. v. Texaco, Inc.*, 337 S.W.2d 846, 852 (Tex. Civ. App.—Amarillo 1960, writ *ref'd n.r.e.*) (asserting the rule in Texas that groundwater is owned by the surface estate).

64. See *Sun Oil v. Whitaker*, 483 S.W.2d 808, 810 (Tex. 1972) (affirming the mineral estate, acting as the dominant estate, includes the “implied grant” to use the surface, acting as the servient estate, no more than reasonably necessary for the purposes of exploration and development of the minerals).

65. See TEX. WATER CODE ANN. § 36.0015 (West 2011) (charging groundwater districts to “provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater and of groundwater reservoirs or their subdivisions”).

66. See Chris Connelley, Comment, *The Inconvenience in Texas Groundwater Law*, 46 HOUS. L. REV. 1301, 1301–03 (2009) (arguing the common law rule of capture allowing exploitation of groundwater by landowners with minimal restrictions is in opposition to the regulatory authority of groundwater districts to conserve groundwater).

resources at the moment “one exerts control over it and reduces it to possession.”⁶⁷ Courts first developed the rule of capture in response to disputes over the ownership of wild animals, otherwise known as *ferae naturae*.⁶⁸ In *Pierson v. Post*,⁶⁹ the New York Supreme Court ultimately determined one did not own such property, in this case an animal, until exerting actual control over it.⁷⁰ In 1904, Texas first applied the rule of capture to groundwater in its landmark decision, *Houston & Texas Central Railway Co. v. East*.⁷¹ Absent willful and wanton waste or negligence, the rule limits landowner liability for any damages incurred by neighbors that result from extraction of groundwater on one’s own land.⁷²

The State of Texas took its first step to limit the rule of capture by passing the Conservation Amendment to the Texas Constitution in 1917.⁷³ The amendment grants the legislature authority to manage the state’s natural resources.⁷⁴ The legislature then passed the Act of May 19,

67. See *City of San Marcos v. Tex. Comm’n. on Envtl. Quality*, 128 S.W.3d 264, 270 (Tex. App.—Austin 2004, pet. denied) (reaffirming Texas’s application of the rule of capture to groundwater disputes (citing *Pierson v. Post*, 3 Cai. 175, 178 (N.Y. Sup. Ct. 1805))).

68. See generally *Pierson*, 3 Cai. R. at 178–79 (holding ownership of a hunted fox was not established by merely chasing or pursuing the wounded animal, but rather by exercising control so as to deprive the animal of its natural liberty).

69. *Pierson*, 3 Cai. 175.

70. *Id.* at 179.

71. See *Hous. & Tex. Cent. Ry. Co. v. East*, 98 Tex. 148, 81 S.W. 279, 280–81 (1904) (adopting the common law rule of capture to resolve groundwater disputes in Texas). The rule of capture’s application to groundwater was first established in the English common law case *Acton v. Blundell*, stating:

[T]he person who owns the surface may dig therein, and apply all that is there found to his own purposes at his free will and pleasure; and that if, in the exercise of such right, he intercepts or drains off the water collected from underground springs in his neighbor’s well, this inconvenience to his neighbor falls within the description of *damnum absque injuria* [an injury without a remedy], which cannot become the ground of an action.

Acton v. Blundell 152 Eng. Rep. 1223, 1235 (Ex. Ch. 1843).

72. See *Sipriano v. Great Spring Waters of Am.*, 1 S.W.3d 75, 76–77 (1999) (reaffirming the rule of capture’s application to groundwater and noting that “landowners have the right to take all the water they can capture under their land and do with it what they please, and they will not be liable to neighbors even if in so doing they deprive their neighbors of the water’s use”); *Elliff v. Texon Drilling Co.*, 146 Tex. 575, 210 S.W.2d 558, 563 (1948) (ruling a neighboring landowner may seek recompense if a landowner wastes oil, gas, or distillate by negligence).

73. See TEX. CONST. art. XVI, § 59 (amended 1964, 1973, 1978) (establishing the legislature as the responsible entity for conserving the state’s natural resources); see also *Sipriano*, 1 S.W.3d at 77 (suggesting the constitutional amendment was a reaction to the droughts of 1910 and 1917 and an effort to preserve the state’s natural resources); Stephanie E. Hayes Lusk, Comment, *Texas Groundwater: Reconciling the Rule of Capture with Environmental and Community Demands*, 30 ST. MARY’S L.J. 305, 322 (1998) (indicating the purpose of the constitutional amendment was to provide the state with the ability to combat water depletion).

74. TEX. CONST. art. XVI, § 59 (amended 1964, 1973, 1978).

1949, which created groundwater conservation districts.⁷⁵ The Edwards Aquifer Act of 1995 created the Edwards Aquifer Authority, which furthered the goals of the 1917 amendment by “regulat[ing] the withdrawal of well water from the Edwards Aquifer in order to comply with federal environmental regulations protecting the endangered species living in the aquifer.”⁷⁶ In 1997, the Texas Senate enacted Senate Bill 1,⁷⁷ providing more authority to groundwater districts by clarifying that the locally-controlled districts “are the state’s preferred method of groundwater management.”⁷⁸ In doing so, Senate Bill 1 allowed for more aggressive management of the state’s groundwater at the local level and provided for more resources and accountability to effectively promulgate such management.⁷⁹ The desire to manage groundwater locally through the regional groundwater districts is based on the premise “that those closest to the resource are those most capable of managing it.”⁸⁰

While litigants have attempted to expand landowner liability and increase regulation through adoption of the reasonable use rule, the Texas Supreme Court has continually reaffirmed the rule of capture’s application to groundwater.⁸¹ According to the court, one reason for maintaining the

75. See Act of May 19, 1949, 51st Leg., R.S., ch. 306, 1949 Tex. Gen. Laws 559, *repealed by* Act of May 29, 1995, 74th Leg., R.S., ch. 933, § 6, 1995 Tex. Gen. Laws 4673, 4701 (creating locally-controlled groundwater districts).

76. Stephanie E. Hayes Lusk, Comment, *Texas Groundwater: Reconciling the Rule of Capture with Environmental and Community Demands*, 30 ST. MARY’S L.J. 305, 325 (1998); see also Act of May 30, 1993, 73rd Leg., R.S., ch. 626, 1993 Tex. Gen. Laws 2351 (amended 1995, 1999, 2001, 2003, 2007, 2009) (establishing the Edwards Aquifer Authority).

77. Act of June 19, 1997, 75th Leg., R.S., ch. 1010, 1997 Tex. Gen. Laws 3610.

78. *Sipriano*, 1 S.W.3d at 79 (quoting TEX. WATER CODE ANN. § 36.0015 (West 2011)); see Act of June 19th, 1997, 75th Leg., R.S., ch. 1010, § 4.26, 1997 Tex. Gen. Laws 3610, 3643 (amended 2001) (current version at WATER § 36.0015 (West Supp. 2012)) (identifying groundwater conservation districts as the state’s preferred groundwater management method); see also Martin Hubert, *Senate Bill 1, The First Big and Bold Step Toward Meeting Texas’s Future Water Needs* 30 TEX. TECH L. REV. 53, 65 (1999) (pointing out that “[Senate Bill] 1 expressly recognizes that groundwater conservation districts are the state’s preferred method of groundwater management”).

79. Martin Hubert, *Senate Bill 1, The First Big and Bold Step Toward Meeting Texas’s Future Water Needs*, 30 TEX. TECH L. REV. 53, 65 (1999).

80. See *id.* at 65–66 (describing the development of Senate Bill 1 for the purpose of improving the state’s response to future droughts).

81. *Acord City of San Marcos v. Tex. Comm’n. on Envtl. Quality*, 128 S.W.3d 264, 270–71 (Tex. App.—Austin 2004, pet. denied) (acknowledging Texas as the last remaining state to maintain the rule of capture for groundwater “because it allows a landowner to pump as much groundwater as the landowner chooses, despite the drain on an increasingly scarce resource”); see *Sipriano*, 1 S.W.3d at 80 (declining to adopt the reasonable use standard and maintaining the common law rule of capture for groundwater); *Friendswood Dev. Co. v. Smith-Sw. Indus.*, 576 S.W.2d 21, 29 (Tex. 1978) (refusing to adopt a reasonable use rule in place of the rule of capture); *City of Pleasanton v. City of Pleasanton*, 154 Tex. 289, 276 S.W.2d 798, 802 (1955) (reaffirming the rule of capture’s application to groundwater). Many other states have opted for the reasonable use rule as a solution to disputes

rule of capture is the authority given to the legislature through the Conservation Amendment to the Texas Constitution in 1917, “charg[ing] the legislature with a constitutional duty to preserve groundwater through regulation.”⁸² Most recently, when establishing ownership in place for groundwater, the Texas Supreme Court’s decision in *Edwards Aquifer Authority v. Day*⁸³ relied upon case law that dealt with ownership of oil and gas, which also follows the rule of capture, and found no reason why groundwater should be treated any differently.⁸⁴ Although the rule of capture allows great leniency to landowners’ use of groundwater, the doctrine is not without certain exceptions—including willful and wanton waste, negligence, and subsidence to neighbor’s land—all of which increase the likelihood that liability will be imposed upon the offending party.⁸⁵

C. Drought Management in Texas

In order to evaluate how the practice of hydraulic fracturing could be impacted by future water restrictions enacted in response to periods of prolonged drought, it is important to first understand the structure of the state’s drought management system. The chief of the Texas Division of Emergency Management acts as the state’s drought manager pursuant to the Texas Water Code.⁸⁶ Effectuating this role, the chief also acts as chairman of the Texas Drought Preparedness Council (TDPC).⁸⁷ Drought monitoring in Texas is accomplished through a cooperative effort of the TDPC and other entities, including the Texas Water Development Board (TWDB).⁸⁸ The Drought Monitoring and Response Committee

arising out of municipal use of high capacity rural wells to supply the city. Ronald Kaiser & Frank F. Skillern, *Deep Trouble: Options for Managing the Hidden Threat of Aquifer Depletion in Texas*, 32 TEX. TECH L. REV. 249, 276, 283, 285, 287 (2001). Compare *Sipriano*, 1 S.W.3d at 79–80 (declining to adopt the reasonable use standard and maintaining the common law rule of capture for groundwater), with *Bristol v. Cheatham*, 255 P.2d 173, 180 (Ariz. 1953) (affirming the reasonable use rule because it “prevent[s] the withdrawal of underground waters for . . . uses not connected with any beneficial ownership or enjoyment of the land [from which] they are taken”).

82. See *Sipriano*, 1 S.W.3d at 79 (acknowledging the legislature’s duty to preserve natural resources).

83. *Edwards Aquifer Auth. v. Day*, 369 S.W.3d 814 (Tex. 2012).

84. See *id.* at 831 (stating that “we see no basis in these differences to conclude that the common law allows ownership of oil and gas in place but not groundwater”).

85. See, e.g., *Elliff v. Texon Drilling Co.*, 146 Tex. 575, 210 S.W.2d 558, 563 (1948) (ruling a neighboring landowner may seek recompense if a landowner wastes oil, gas, or distillate by negligence).

86. TEX. WATER CODE ANN. § 16.055(a) (West Supp. 2012).

87. *Id.* § 16.055(d).

88. *Id.* § 16.055(b). See generally TEX. WATER DEV. BD., WATER FOR TEXAS: SUMMARY OF

was established in 1997, and in 1999 the legislature created the TDPC in an effort to better manage and mitigate a drought's effects on the state.⁸⁹

Composed of representatives from various entities, the council's responsibilities include advising both the governor and local water planning groups on drought-related issues, "ensuring effective coordination among state, local, and federal agencies in drought-response planning[.]" making specific recommendations for emergency responses to drought-related disasters, and providing a biannual report to the legislature outlining the state's drought conditions.⁹⁰ The council is also charged with the development and implementation of a state drought preparedness plan for the purpose of mitigating the effects of a drought.⁹¹ In addition, the council provides monthly situation reports containing information on statewide drought conditions.⁹²

Acting in a representative capacity on the TDPC, the TWDB aides in the management and mitigation of the state's drought conditions by gathering data from various local and national sources.⁹³ The TWDB participates in groundwater management through the coordinated efforts of the state's regional groundwater conservation districts⁹⁴ that are deemed the state's "preferred method of groundwater management."⁹⁵ Groundwater districts are charged with "provid[ing] for the conservation, preservation, protection, recharging, and prevention of waste of

THE 2011 REGIONAL WATER PLANS (Jan. 20, 2011), *available at* <http://www.twdb.state.tx.us/waterplanning/rwp/regions/doc/2011RWPLegislativeSummary.pdf> (compiling a summary of the various local groundwater conservation districts' water plans).

89. Act of June 18, 1999, 76th Leg., R.S., ch. 979, § 7, Tex. Gen. Laws 3756–58 (amended 2009) (current version at WATER § 16.055); Act of June 19, 1997, 75th Leg., R.S., ch. 1010, § 1.02, 1997 Tex. Gen. Laws 3610, 3615 (amended 1999, 2009) (current version at WATER § 16.055); *see also* WATER § 16.055 (laying out the authority for the Drought Response Plan and the State Drought Preparedness Plan).

90. WATER § 16.055(e).

91. *Id.* § 16.0551(a); *see also* DROUGHT PREPAREDNESS COUNCIL, TEX. DEP'T OF PUB. SAFETY, STATE DROUGHT PREPAREDNESS PLAN (Feb. 15, 2006), *available at* <http://www.txdps.state.tx.us/dem/CouncilsCommittees/droughtCouncil/droughtPrepPlan.pdf> (providing an example of a drought preparedness plan).

92. *See generally* DROUGHT PREPAREDNESS COUNCIL, TEX. DEP'T OF PUB. SAFETY, STATEWIDE DROUGHT SITUATION REPORT 2 (Oct. 12, 2011), *available at* <http://www.txdps.state.tx.us/dem/CouncilsCommittees/droughtCouncil/sitrep0911.pdf> (providing a grim situation report for the state in October 2011).

93. *See Drought*, TEX. WATER DEVELOPMENT BOARD, <http://www.twdb.state.tx.us/data/drought/> (last visited Nov. 23, 2012) (listing various sources for current drought monitoring in Texas).

94. WATER § 36.1072 (West Supp. 2012).

95. *Id.* § 36.0015 (West 2008).

groundwater, and of groundwater reservoirs or their subdivisions”⁹⁶ and do so partly through the preparation of a mandatory management plan, which is then approved by the TWDB.⁹⁷ As part of the management plan, groundwater districts are authorized to issue permits for the drilling of water wells and may offer exemptions for those permits when appropriate.⁹⁸ Since 1997, the TWDB has compiled annual summaries of regional water plans put forth by local groundwater districts throughout the state.

These plans present the information regarding the recommended conservation and other types of water management strategies that would be necessary to meet the state’s needs in drought conditions, their cost, and estimates of the state’s financial assistance that would be required to implement these strategies. The plans also present the sobering news of the economic losses likely to occur if these water supply needs cannot be met. As the state continues to experience rapid growth and declining water supplies, implementations of these plans is crucial to ensure public health, safety, and welfare and economic development in the state.⁹⁹

The plans were promulgated by Senate Bill 1 in an effort to increase accountability of groundwater districts and they must be certified by the Texas Water Development Board upon completion.¹⁰⁰ In addition, the districts’ plans are subject to an audit by the state auditor to ensure that “the ‘district is actively engaged in achieving the objectives’ of its [water] management plan.”¹⁰¹

D. *Drought Conditions in Texas*

The state’s most devastating drought in recorded history occurred over the course of about a decade beginning in 1947,¹⁰² and it is often used as

96. *Id.*

97. See 31 TEX. ADMIN. CODE § 356.3 (2012) (Tex. Water Dev. Bd., Required Management Plan) (establishing a mandatory water management plan for Groundwater Conservation Districts); *id.* § 356.7(a) (Tex. Water Dev. Bd., Approval) (requiring approval of the mandatory water management plan by the executive administrator); WATER § 36.001(4) (naming the Texas Water Development Board as the executive administrator with regard to this particular section of the Water Code); WATER § 36.1072 (West Supp. 2012) (mandating the Texas Water Development Board review and approve plans submitted by Groundwater Conservation Districts).

98. WATER § 36.117.

99. TEX. WATER DEV. BD., WATER FOR TEXAS: SUMMARY OF THE 2011 REGIONAL WATER PLANS iii (Jan. 20, 2011), available at <http://www.twdb.state.tx.us/waterplanning/rwp/regions/doc/2011RWPLegislativeSummary.pdf>.

100. Martin Hubert, *Senate Bill 1, The First Big and Bold Step Toward Meeting Texas’s Future Water Needs*, 30 TEX. TECH L. REV. 53, 66 (1999).

101. *Id.* at 66 (quoting WATER § 36.302(c) (West 2008)).

102. See *About Texas Water Development Board*, TEXAS WATER DEVELOPMENT BOARD,

a benchmark for current drought measurements.¹⁰³ The severity of that drought was largely due to the sheer length of time over which it occurred.¹⁰⁴ The drought that began in 2011 has been one of the worst droughts recorded in Texas since the record drought of the 1950s.¹⁰⁵ In fact, as of September 2011, “[t]he drought is worsening daily in most . . . Texas climate regions” with relief nowhere in sight, according to the TDPC.¹⁰⁶ In June of 2012, record temperatures were reported in several areas across Texas, and studies indicated “the drought in much of the state is expected to either persist or intensify” into the fall.¹⁰⁷

Drought is measured by a variety of factors and is defined in different ways for different purposes; however, for planning purposes, a drought is typically defined as “a protracted period of deficient precipitation” that results in less than adequate water supplies for a particular activity.¹⁰⁸ When agricultural and grassland activities are affected, these are commonly considered short-term physical effects of a drought; on the other hand, impact upon hydrological and ecological activities are considered long-term effects.¹⁰⁹ Generally, drought results from a lack of precipitation

<http://www.twdb.state.tx.us/about/> (last visited Nov. 23, 2012) (citing Texas’s worst drought in history).

103. See Farzad Mashhood, *Current Drought Pales in Comparison with 1950s ‘Drought of Record’*, AUSTIN AM. STATESMAN (Aug. 4, 2011, 12:01 PM), <http://www.statesman.com/news/local/current-drought-pales-in-comparison-with-1950s-drought-1692176.html?printArticle=y> (noting that the 1950s drought is often used as a benchmark to determine the severity of other droughts and proclaiming that “the 1950s drought blows this one out of the water”).

104. See *id.* (stating the drought lasted from 1947 to 1957).

105. *Id.*

106. See DROUGHT PREPAREDNESS COUNCIL, TEX. DEP’T OF PUB. SAFETY, STATEWIDE DROUGHT SITUATION REPORT 3 (Oct. 12, 2011), available at <http://www.txdps.state.tx.us/dem/CouncilsCommittees/droughtCouncil/sitrep0911.pdf> (providing a dismal outlook for statewide drought conditions in the monthly situation report for September 2011 and warning that “[t]he situation is desperate”).

107. See DROUGHT PREPAREDNESS COUNCIL, TEX. DEP’T OF PUB. SAFETY, STATEWIDE DROUGHT SITUATION REPORT 2 (July 16, 2012), available at <http://www.txdps.state.tx.us/dem/CouncilsCommittees/droughtCouncil/sitrep0612.pdf>; *id.* (outlining temperature and precipitation summaries for regions across Texas, and forecasting persisting drought in the coming months).

108. See *Drought Basics: What Is Drought?*, NATIONAL DROUGHT MITIGATION CENTER, <http://drought.unl.edu/DroughtBasics/WhatIsDrought.aspx> (last visited Nov. 23, 2012) (defining drought both conceptually and operationally). How a drought is defined varies depending on various factors such as the particular water source that is deficient and the effects of such water shortages. DROUGHT PREPAREDNESS COUNCIL, TEX. DEP’T OF PUB. SAFETY, STATE DROUGHT PREPAREDNESS PLAN 3 (Feb. 15, 2006), available at <http://www.txdps.state.tx.us/dem/CouncilsCommittees/droughtCouncil/droughtPrepPlan.pdf> (noting definitions for “drought are based on meteorological, agricultural, hydrological, and socioeconomic effects”).

109. See *Drought Monitor, State-of-the-Art Blend of Science and Subjectivity*, U.S. DROUGHT MONITOR, <http://droughtmonitor.unl.edu/classify.htm> (last updated Jan. 2, 2008) (indicating short-term effects occurring under drought conditions of less than six months, and long-term drought effects occurring

and from human activities that increase demand upon water supplies.¹¹⁰

The National Drought Monitor provides designations for each geographic area, indicating the severity of drought conditions for a particular region.¹¹¹ During August 2011, a devastating 96% of the state experienced at least extreme drought conditions.¹¹² By September 2011, nearly 60% of the state was still classified under the two most severe drought categories, with 40% falling within the most severe drought classification.¹¹³ The entire Eagle Ford Shale region was classified as lying within the two most severe drought categories as of September 2011.¹¹⁴ While the drought abated in the easternmost portions of Texas during 2012, a large portion of South Texas is still experiencing either extreme or exceptional drought conditions as of September 2012.¹¹⁵ According to the TWDB, as of October 2011, the total conservation storage capacity of all of Texas's 109 reservoirs was at 59%, or 18.4 million acre-feet, signaling a 400,000 acre-foot drop in less than a month.¹¹⁶ By August 2012, reservoirs in the South Texas region remained below 50% of capacity and, in the case of the San Antonio region, were categorized as extremely low.¹¹⁷ In addition, nearly all Texas counties enforced burn bans due to

after more than six months).

110. *See Drought Basics: What Is Drought?*, NATIONAL DROUGHT MITIGATION CENTER, <http://drought.unl.edu/DroughtBasics/WhatisDrought.aspx> (last visited Nov. 23, 2012) (clarifying that drought is due to a confluence of natural and human forces).

111. *See Drought Monitor: State-of-the-Art Blend of Science and Subjectivity*, U.S. DROUGHT MONITOR, <http://droughtmonitor.unl.edu/classify.htm> (last updated Jan. 2, 2008) (describing the "drought severity classification" method that includes categories ranging from D0 (indicating abnormally dry conditions) to D4 (indicating exceptional drought conditions)). Most drought monitoring systems utilize various key indices to measure the severity of a particular drought situation. *See, e.g.*, JOHN W. NIELSEN-GAMMON, OFFICE OF THE ST. CLIMATOLOGIST, THE 2011 TEXAS DROUGHT: A BRIEFING PACKET FOR THE TEXAS LEGISLATURE 35 (Oct. 31, 2011), *available at* http://atmo.tamu.edu/osc/library/osc_pubs/2011_drought.pdf (using the Palmer Drought Severity Index, described as "[t]he most common measure of drought intensity in the United States").

112. *See* DROUGHT PREPAREDNESS COUNCIL, TEX. DEPT OF PUB. SAFETY, STATEWIDE DROUGHT SITUATION REPORT 2-3 (Oct. 12, 2011), *available at* <http://www.txdps.state.tx.us/dem/CouncilsCommittees/droughtCouncil/sitrep0911.pdf> (noting extreme drought conditions across the vast majority of the state in September of 2011).

113. *Drought Monitor Archives*, U.S. DROUGHT MONITOR, *available at* <http://droughtmonitor.unl.edu/archive.html> (select "South" from the drop down menu on the left, then select "November 8, 2011" from the drop down menu below the image of the map).

114. *Id.*

115. *Id.* (select "South" from the drop down menu on the left, then select "September 11, 2012" from the drop down menu below the image of the map).

116. *See* WATER CONDITIONS, RESERVOIR STORAGE, TEX. WATER DEV. BD. 1 (Oct. 2011), *available at* http://www.twdb.texas.gov/publications/reports/waterconditions/twc_pdf_archives/2011/twcOct2011.pdf (indicating at least nine reservoirs were at or below 10% of total capacity during October of 2011).

117. *See* WATER CONDITIONS, RESERVOIR STORAGE, TEX. WATER DEV. BD. 1 (Sept. 2012),

the dry conditions during November 2011.¹¹⁸ By September 2012, burn bans remained in effect for 148 of Texas's 254 counties, including the vast majority of those lying in the Eagle Ford region.¹¹⁹

The importance of drought management is heightened by the likelihood that the current drought will continue into the future as a result of prolonged La Niña conditions and climate-produced "drought susceptibility . . . since at least the year 2000."¹²⁰ According to the National Oceanic and Atmospheric Association, Texas experienced both its driest and hottest summer on record in 2011 and the hottest summer of any state in the nation.¹²¹ The forecasted reemergence of El Niño conditions during late 2012 indicates that "some improvement [is] forecast[ed] in southern Texas;"¹²² however, this slight improvement may not be sufficient to mitigate the long-term drying trend in the region. In light of these statistics, Texas must ensure that a plan is in place to mitigate the drought's potential negative impact on the state's groundwater supplies.¹²³

available at <http://midgewater.twdb.state.tx.us/Reservoirs/TWC/PDF/latest.pdf> (demonstrating the persisting drought's effect upon reservoir levels in South Texas in 2012).

118. See e.g., *Texas Outdoor Burn Ban Hits Record 248 Counties*, NBC 5, DALLAS-FORT WORTH (Aug. 4, 2011 10:46AM), <http://www.nbcdfw.com/weather/stories/Texas-Outdoor-Burn-Bans-in-Record-248-Counties-126512298.html> (describing a record number of burn bans instituted by counties across Texas during the pervasive drought).

119. See *Outdoor Burn Bans*, TEXAS FOREST SERVICE, <http://tfsfrp.tamu.edu/wildfires/DecBan.png> (last visited Nov. 23, 2012) (providing a regularly updated map of effective burn bans, and illustrating that while some burn bans have been lifted between 2011 and 2012, the majority of such bans remained in effect as of September 2012).

120. See JOHN W. NIELSEN-GAMMON, OFFICE OF THE ST. CLIMATOLOGIST, THE 2011 TEXAS DROUGHT: A BRIEFING PACKET FOR THE TEXAS LEGISLATURE 3 (Oct. 31, 2011), available at http://atmo.tamu.edu/osc/library/osc_pubs/2011_drought.pdf (indicating that Texas has suffered from dry conditions since at least 2000 due to global ocean temperature patterns).

121. U.S. *Seasonal Drought Outlook Archive: Discussion for the Seasonal Drought Outlook: October-December 2011*, NATIONAL WEATHER SERVICE, http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_archive/2011/sdo_ond11_text.shtml (last updated Sept. 15, 2011).

122. U.S. *Seasonal Drought Outlook Archive: Discussion for the Seasonal Drought Outlook: September-November 2012*, NATIONAL WEATHER SERVICE, http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_archive/2012/sdo_son12_text.shtml (last updated Aug. 16, 2012).

123. See DROUGHT PREPAREDNESS COUNCIL, STATEWIDE DROUGHT SITUATION REPORT 2-3 (Oct. 2011), available at <http://www.txdps.state.tx.us/dem/CouncilsCommittees/droughtCouncil/sitrep0911.pdf> (describing the extreme drought conditions of September 2011 and the effects thereof).

III. EXISTING SOLUTIONS TO PROTECT GROUNDWATER FROM DEPLETION

A. *Is There a Fracing Problem?*

Several studies indicate that water volumes used for hydraulic fracturing in the Eagle Ford are relatively insignificant when compared to the amount of water used for other purposes, such as agricultural and municipal water use.¹²⁴ Given the relatively small amount of water used for fracing and its beneficial economic impact in the region, any regulatory measures specifically targeting hydraulic fracturing for water conservation purposes should be considered with great caution.¹²⁵ The greatest amount of water use in the Eagle Ford is allocated for agricultural purposes;¹²⁶ therefore, given the minimal economic rate of return on agricultural usage relative to that of the oil industry, regulatory measures should not be taken against hydraulic fracturing without first considering the reduction of agricultural

124. See, e.g., Darrell T. Brownlow, *Eagle Ford Shale Play and the Carrizo Aquifer*, FOUNTAINHEAD, 4th Quarter 2010, at 1, 4–5, available at <http://www.tgwa.org/downloads/newsletter/Fountainhead-Q4-2010.pdf> (indicating the projected usage of water for oil and gas operations in the Eagle Ford area is 300,000 acre-feet over the life of the play, which is just slightly more than the 275,000 acre-feet of current annual withdrawals); TEX. WATER DEV. BD., WATER FOR TEXAS: SUMMARY OF THE 2011 REGIONAL WATER PLANS L-2 (Jan. 20, 2011), available at <http://www.twdb.state.tx.us/waterplanning/rwp/regions/doc/2011RWPLegislativeSummary.pdf> (reflecting the water demands in the South Central region for mining constituted 1.4% of overall water demands in the region in 2010).

125. See Darrell T. Brownlow, *Eagle Ford Shale Play and the Carrizo Aquifer*, FOUNTAINHEAD, 4th Quarter 2010, at 1, 4–5, 12, available at <http://www.tgwa.org/downloads/newsletter/Fountainhead-Q4-2010.pdf> (revealing the relatively minimal water use for fracing as well as the great potential for a large economic impact in the region due to such oil and gas activities); Kathy Wythe, *If Drought Continues, Water Policy Changes to Come, Says Texas A&M Expert*, TEXAS WATER RESEARCH INSTITUTE (Oct. 2011), <http://twri.tamu.edu/publications/drought/2011/october/if-drought-continues-water-policy-changes-to-come/> (expecting policy changes with an increasing emphasis on conservation for municipal and agricultural water usage); cf. DARRELL T. BROWNLOW, CARRIZO CONSULTING, LP, EAGLE FORD SHALE & THE CARRIZO AQUIFER 24–25 (June 30, 2011) (comparing the large economic impact of Eagle Ford Shale drilling and its relatively minimal use of water to the large volumes of water used for corn production that has relatively less economic impact for the region). See generally CTR. FOR CMTY. & BUS. RESEARCH, THE UNIV. OF TEX. AT SAN ANTONIO INST. FOR ECON. DEV., ECONOMIC IMPACT OF THE EAGLE FORD SHALE (Feb. 2011), available at <http://cbr.iedtexas.org/index.php/Download-document/47-Economic-Impact-of-the-Eagle-Ford-Shale.html> (projecting that the economic impact from drilling in the Eagle Ford Shale region will continue to rise).

126. TEX. WATER DEV. BD., WATER FOR TEXAS: SUMMARY OF THE 2011 REGIONAL WATER PLANS L-2 (Jan. 20, 2011), available at <http://www.twdb.state.tx.us/waterplanning/rwp/regions/doc/2011RWPLegislativeSummary.pdf>; see DARRELL T. BROWNLOW, CARRIZO CONSULTING, LP, EAGLE FORD SHALE & THE CARRIZO AQUIFER 22 (June 30, 2011) (illustrating that agricultural uses in the Eagle Ford region have accounted for the greatest percentage of water consumption).

water use.¹²⁷

The region in South Texas encompassing the Eagle Ford Shale used approximately 68.4 billion gallons of water in 2008.¹²⁸ The TWDB reported water demands of 404,980 acre-feet in 2010 for irrigation and livestock, compared to mining demands of 14,524 acre-feet.¹²⁹ The total water use for hydraulic fracturing in the Eagle Ford will ultimately depend on the total number of wells drilled over the life of the play, which, in turn, will be greatly influenced by the price of natural gas.¹³⁰ Experts have projected the total number of wells drilled in the region will reach 20,000, which equates to one well for every 300 acres of land.¹³¹ If each well uses 15,000 acre-feet of water, then the total water withdrawal from the Carrizo Aquifer would amount to about “300,000 acre-feet over the life of the play.”¹³² According to the TWDB and studies from local groundwater

127. Compare DARRELL T. BROWNLOW, CARRIZO CONSULTING, LP, EAGLE FORD SHALE & THE CARRIZO AQUIFER 24 (June 30, 2011) (estimating the economic impact resulting from 1,250 acre-feet of water used for cultivating 625 acres of corn at \$187,500), with CTR. FOR CMTY. & BUS. RESEARCH, THE UNIV. OF TEX. AT SAN ANTONIO INST. FOR ECON. DEV., ECONOMIC IMPACT OF THE EAGLE FORD SHALE 10, 22 (Feb. 2011), available at <http://cbr.iedtexas.org/index.php/Download-document/47-Economic-Impact-of-the-Eagle-Ford-Shale.html> (projecting the current impact of Eagle Ford Shale drilling to be \$2.9 billion in total economic output for 2010 and the future impact of the Eagle Ford Shale through 2020, resulting in \$21.5 billion in total economic output).

128. BUREAU OF ECON. GEOLOGY, UNIV. OF TEX., CURRENT AND PROJECTED WATER USE IN THE TEXAS MINING AND OIL AND GAS INDUSTRY 173 (June 2011), available at http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0904830939_MiningWaterUse.pdf (prepared for Texas Water Development Board); see also *Water Use in Eagle Ford Deep Shale Exploration: Fact Sheet*, CHESAPEAKE ENERGY, at 1 (May 2012), http://www.chk.com/media/educational-library/fact-sheets/eagleford/eagle-library_water_use_fact_sheet.pdf (reporting water statistics and citing the Texas Water Development Board).

129. TEX. WATER DEV. BD., WATER FOR TEXAS: SUMMARY OF THE 2011 REGIONAL WATER PLANS L-2 (Jan. 20, 2011), available at <http://www.twdb.state.tx.us/waterplanning/rwp/regions/doc/2011RWPLegislativeSummary.pdf>.

130. See Darrell T. Brownlow, *Eagle Ford Shale Play and the Carrizo Aquifer*, FOUNTAINHEAD, 4th Quarter 2010, at 1, 4, available at <http://www.tgwa.org/downloads/newsletter/Fountainhead-Q4-2010.pdf> (finding a broad analysis of wells in the Eagle Ford suggests that an estimate of as many as twenty thousand wells is “highly speculative given infrastructure limitations”); BUREAU OF ECON. GEOLOGY, UNIV. OF TEX., CURRENT AND PROJECTED WATER USE IN THE TEXAS MINING AND OIL AND GAS INDUSTRY 182 (June 2011), available at http://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0904830939_MiningWaterUse.pdf (prepared for Texas Water Development Board) (forecasting the number of shale wells fraced and the resulting projected water use to decrease dramatically if the price of gas remain “below \$5/Mcf for an extended period of time”).

131. Darrell T. Brownlow, *Eagle Ford Shale Play and the Carrizo Aquifer*, FOUNTAINHEAD, 4th Quarter 2010, at 1, 4, available at <http://www.tgwa.org/downloads/newsletter/Fountainhead-Q4-2010.pdf>.

132. *Id.*; see also Kiah Collier, *Fracking Gives Texas Another Oil Boom, but at a Huge Water Cost*, INDEPENDENTMAIL.COM (June 30, 2011), <http://www.independentmail.com/news/2011/jun/>

districts, the estimated decline in the Carrizo Aquifer would be anywhere from thirty to thirty-five feet by the year 2060 due to such withdrawals.¹³³ Dr. Darrell T. Brownlow, writing for the Texas Ground Water Association, estimated that such water use over the life of the play is unlikely to have an adverse impact on the Carrizo Aquifer given factors such as the region's expansive geological footprint, the number of years over which the withdrawal would take place, and the amount of the withdrawal relative to the current annual demand on the Carrizo Aquifer.¹³⁴ However, Dr. Brownlow pointed out that the eastern portions of the Eagle Ford may experience "short-term localized impacts" due to the Gulf Coast Aquifer's lower yield relative to the Carrizo Aquifer.¹³⁵

B. *Current Regulations and Remedies*

One argument against increased regulation of water use for hydraulic fracturing is that remedies already exist for curtailing water overuse by way of common law doctrines and contract provisions included within oil and gas leases, which limit groundwater use for oil and gas related purposes.¹³⁶ Local groundwater districts have the authority to manage groundwater usage within their jurisdictions by requiring permits and limiting the way in which groundwater is used for particular purposes.¹³⁷ The following section discusses the existing limits placed on water usage under the rule of capture within the scope of oil and gas exploration and development in Texas.

1. Common Law Protections and Remedies

Oil and gas operators using a surface owner's water supply are limited

30/fracking-gives-texas-another-oil-boom-huge-water-c/?print=1 (citing the Texas Water Development Board's estimate that 13.5 billion gallons of water was used statewide for fracing in 2010).

133. Darrell T. Brownlow, *Eagle Ford Shale Play and the Carrizo Aquifer*, FOUNTAINHEAD, 4th Quarter 2010, at 1, 4–5, available at <http://www.tgwa.org/downloads/newsletter/Fountainhead-Q4-2010.pdf>.

134. *See id.* at 1, 5, 12 (noting that the Carrizo has an annual demand of 275,000 acre-feet, an amount less than the total estimated withdrawal due to Eagle Ford fracing that would take place over the course of ten to fifteen years and would occur over a "broad expanse of the region").

135. *Id.* at 1, 5.

136. *E.g.*, HOWARD R. WILLIAMS & CHARLES J. MEYERS, *MANUAL OF OIL AND GAS TERMS* 949 (Patrick H. Martin & Bruce M. Kramer eds., 14th ed. 2009) (identifying express lease provisions that stipulate surface and subsurface owners' rights under an oil and gas lease).

137. *See generally* 30 TEX. ADMIN. CODE §§ 293, 294 (2012) (Tex. Water Dev. Bd.) (covering aspects of groundwater districts).

by several common law protections, namely the implied easement of reasonable use and the accommodation doctrine.¹³⁸ Ownership of the mineral estate can be severed or separated from the surface by conveyance through a mineral or royalty deed, via judicial determination, or by the execution of an oil and gas lease. The surface estate then becomes the servient estate and is subject to an easement belonging to the dominant mineral estate.¹³⁹ In the absence of express language to the contrary, execution of an oil and gas lease affords the mineral estate an easement to use the surface estate for drilling activities, but such use is limited to the extent it is deemed reasonably necessary for the purposes of exploration and production of minerals.¹⁴⁰ This is known as the implied easement of reasonable use.¹⁴¹

Groundwater belongs to the surface estate and is subject to the implied easement in the same manner as the rest of the surface.¹⁴² Aquifers, such as the Eagle Ford's Carrizo-Wilcox, constitute groundwater that is considered part of the surface estate.¹⁴³ As part of the surface estate, groundwater pumped from the aquifer can be used by the operator for hydraulic fracturing during oil and gas exploration, subject to the implied easement of reasonable use.¹⁴⁴ The surface owner will have an action for damages against the lessee if such surface use is excessive and unreasonable under the standard.¹⁴⁵ While the courts have affirmed water

138. See *Sun Oil v. Whitaker*, 483 S.W.2d 808, 810 (Tex. 1972) (affirming the mineral estate's easement is limited to what is reasonably necessary); *Getty Oil Co. v. Jones*, 470 S.W.2d 618, 622–23 (Tex. 1971) (noting the surface owner's right to surface accommodation by the lessee under certain circumstances).

139. See *Sun Oil*, 483 S.W.2d at 810 (holding the surface estate is the servient estate and the mineral estate is the dominant estate); HOWARD R. WILLIAMS & CHARLES J. MEYERS, *MANUAL OF OIL AND GAS TERMS* 893 (Patrick H. Martin & Bruce M. Kramer eds., 14th ed. 2009) (defining severance as a "separation of a mineral or royalty interest from other interests in the land").

140. See *Sun Oil*, 483 S.W.2d at 810 (affirming the mineral estate's "implied grant" to reasonable use of the surface estate for the purposes of exploration and development of the minerals); *Stanolind Oil & Gas Co. v. Wimberly*, 181 S.W.2d 942, 944 (Tex. Civ. App.—El Paso 1944, no writ) (emphasizing the right to use the surface as much as reasonably necessary to enjoy the mineral estate).

141. Cf. *Stanolind Oil & Gas Co.*, 181 S.W.2d at 944 (addressing the reasonable use doctrine).

142. *Sun Oil*, 483 S.W.2d at 811 (citing *Fleming Found. v. Texaco, Inc.*, 337 S.W.2d 846, 849 (Tex. Civ. App.—Amarillo 1960, writ ref'd n.r.e.)).

143. TEX. WATER CODE ANN. § 36.001(5) (West 2008); see *Fleming Found.*, 337 S.W.2d at 849, 851 (stating although water is technically a mineral, it is part of the surface estate).

144. See *Sun Oil*, 483 S.W.2d at 811 (confirming that the implied right to use the surface estate extends to water).

145. See *Humble Oil & Refining Co. v. Williams*, 420 S.W.2d 133, 134 (Tex. 1967) (ruling the surface owner has the burden of proving that the lessee engaged in either negligence or used the land more than reasonably necessary).

usage for waterflood projects¹⁴⁶ to be reasonably necessary for oil and gas operations,¹⁴⁷ the question remains as to whether the high volumes of water required for fracing are reasonable when used during extreme drought conditions such as those likely to persist in South Texas.¹⁴⁸

Another possible remedy available to the surface owner is the accommodation doctrine, which limits the lessee's easement allowing reasonable use of the surface estate for the purpose of mineral development and exploration.¹⁴⁹ Under the accommodation doctrine, the lessee under an oil and gas lease must reasonably accommodate the surface owner's pre-existing surface uses when oil and gas activities interfere with pre-existing surface use and reasonable alternatives are available to the lessee.¹⁵⁰ The doctrine extends to "that which lies beneath . . . the surface" water, as well as the air space above the surface in determining whether the lessee's use requires that they reasonably accommodate the surface estate.¹⁵¹ Mere inconvenience to the servient surface owner, however, is insufficient to trigger remedies under the doctrine.¹⁵² There must also be a reasonable alternative available to the mineral interest owner before the surface owner is entitled to recompense.¹⁵³ The doctrine acts to "balanc[e] the interests of both the mineral and surface owners."¹⁵⁴

While the potential conflict between the accommodation doctrine and water usage for hydraulic fracturing has not been widely litigated, it is possible a scenario could arise under enduring drought conditions wherein a surface owner who uses water for livestock or agricultural purposes could require an operator to alter fracing techniques by increasing recycled water use or fracing with gas or sand, which requires less water than

146. See *Oil Field Glossary: Waterflood*, Schlumberger, <http://www.glossary.oilfield.slb.com/Display.cfm?Term=waterflood> (last visited Nov. 23, 2012) (defining "waterflood" as "[a] method of secondary recovery in which water is injected into the reservoir formation to displace residual oil").

147. *Sun Oil*, 483 S.W.2d at 811 (citing *Carroll v. Roger Lacy, Inc.*, 402 S.W.2d 307 (Tex. Civ. App.—Tyler 1966, writ ref'd n.r.e.)).

148. *But cf. Valence Operating Co. v. Tex. Genco, LP*, 255 S.W.3d 210, 216–17 (Tex. App.—Waco 2008, no pet.) (declaring a mineral owner may be required to accommodate the surface owner's existing use of the surface).

149. See HOWARD R. WILLIAMS & CHARLES J. MEYERS, *MANUAL OF OIL AND GAS TERMS* 8 (Patrick H. Martin & Bruce M. Kramer eds., 14th ed. 2009) (defining the accommodation doctrine as a potential limitation on the mineral estate).

150. *Getty Oil Co. v. Jones*, 470 S.W.2d 618, 622 (Tex. 1971).

151. *Id.* at 621.

152. HOWARD R. WILLIAMS & CHARLES J. MEYERS, *MANUAL OF OIL AND GAS TERMS* 8 (Patrick H. Martin & Bruce M. Kramer eds., 14th ed. 2009).

153. *Id.*

154. *Id.*

traditional fracing techniques.¹⁵⁵ An additional requirement of the accommodation doctrine mandates that if a reasonable alternative exists for the lessee, then the use of that alternative must be “usual, customary, and reasonable” within the industry for the accommodation doctrine to apply.¹⁵⁶ As certain alternative methods of hydraulic fracturing become more economically viable, the possibility of legal recourse by surface owners will increase with the expanded use of alternative fracing methods within the industry.¹⁵⁷

2. Surface Damage Clauses and Surface Use Agreements

As previously mentioned, the implied easement of reasonable use applies where there is an absence of express language to the contrary in an oil and gas lease.¹⁵⁸ In an oil and gas lease, the surface damage clause provides express language limiting the scope of the mineral estate’s implied easement to use the surface as much as reasonably necessary.¹⁵⁹ The clause typically requires a lessee to pay the surface owner for any damages resulting from operations under a lease, regardless of whether a court finds the use of the land reasonable.¹⁶⁰ Such provisions can also limit the lessee’s rights to use the surface by expressly stipulating the extent of the easement.¹⁶¹ Landowners concerned with high water volume usage for hydraulic fracturing can stipulate that the lessee purchase water from the surface owner and/or negotiate an agreement that only a certain amount of water come from the leased premises. Such an agreement would require the lessee to obtain the remaining water elsewhere through

155. *Cf.* Sun Oil v. Whitaker, 483 S.W.2d 808, 811 (Tex. 1972) (determining waterflood projects are deemed a reasonable use of the land for the purposes of the implied easement of reasonable use); Haupt, Inc., v. Tarrant Cnty. Water Control & Improvement Dist., 870 S.W.2d 350, 353–54 (Tex. App.—Waco 1994, no writ) (ruling in an inverse condemnation case, the accommodation doctrine still applied where the city flooded the land for the purposes of creating a reservoir).

156. *See* HOWARD R. WILLIAMS & CHARLES J. MEYERS, MANUAL OF OIL AND GAS TERMS 8 (Patrick H. Martin & Bruce M. Kramer eds., 14th ed. 2009) (stating the alternative methods required by the doctrine must be “usual, customary, and reasonable” in order to be accepted as alternatives methods available to the lessee for the purposes of the doctrine).

157. *See* DARRELL T. BROWNLOW, CARRIZO CONSULTING, LP, EAGLE FORD SHALE AND THE CARRIZO AQUIFER 27 (June 30, 2011) (stating recycling flowback water may become economically viable as development continues in the Eagle Ford).

158. *See* HOWARD R. WILLIAMS & CHARLES J. MEYERS, MANUAL OF OIL AND GAS TERMS 949 (Patrick H. Martin & Bruce M. Kramer eds., 14th ed. 2009) (providing express clauses to define rights of parties under an oil and gas lease).

159. *See id.* (describing surface and subsurface user provisions in an oil and gas lease).

160. Humble Oil & Refining Co. v. Williams, 420 S.W.2d 133, 134–35 (Tex. 1967) (citing Meyer v. Cox, 252 S.W.2d 207 (Tex. Civ. App.—San Antonio 1952, writ ref’d)).

161. HOWARD R. WILLIAMS & CHARLES J. MEYERS, MANUAL OF OIL AND GAS TERMS 949 (Patrick H. Martin & Bruce M. Kramer eds., 14th ed. 2009).

recycling methods, tapping of non-potable water sources, or trucking in water from an outside supply source.¹⁶² Stipulating such limitations within the lease terms could potentially ease the demand on the landowner's fresh groundwater reserves.

This remedy is only available if the surface owner also possesses the mineral estate; otherwise, the mineral estate owner has no incentive to seek surface use protections. However, if the surface owner lacks ownership of the minerals under the property, the surface owner can negotiate a surface use agreement with the lessee that will stipulate agreed-upon terms regarding proper usage of the surface.¹⁶³ Landowners and lessees often negotiate as to location of well sites, roads, pipelines, production facilities, and compressors, and they may agree to terms regulating impact and usage of the surface estate.¹⁶⁴

It is becoming a common practice in the Eagle Ford for many landowners to capitalize on the ability to sell water for hydraulic fracturing in a lucrative business known as "water wildcatting."¹⁶⁵ Some landowners are receiving anywhere from ten to eighty cents per barrel of water.¹⁶⁶ Local water conservation districts are known to sell water to operators in the Eagle Ford as well.¹⁶⁷ Oil and gas operators in the Eagle Ford, such as Anadarko and Swift Energy, are known to purchase their water supplies from groundwater districts.¹⁶⁸ Although surface damage clause provisions and surface use agreements allow landowners to protect the pumping of water from beneath their land, the clause does little to protect their groundwater if either they or neighboring landowners tap into the

162. *See id.* (explaining how a surface owner can limit the rights of a lessee to surface usage by inserting express lease clauses into an oil and gas lease).

163. *See generally* EARTHWORKS, TEXAS: SAMPLE OIL AND GAS LEASE AND SURFACE USE AGREEMENT, http://www.earthworksaction.org/files/publications/Texas-Sample-Model-Gas-Lease_2011106.pdf (last visited Nov. 23, 2012) (providing a list of sample stipulations to be made in surface use agreements negotiated in Texas).

164. *See Guide to Surface Use Agreements*, LAND WITH MINERALS, http://www.landwithminerals.com/resource_center/article/guide-to-surface-use-agreements/ (last visited Nov. 23, 2012) (listing common demands of surface owners when negotiating surface use agreements with lessees).

165. *See* Robert Crowe, *Warming Trend: Regulators Far from Ready for Challenges Fracking Brings to South Texas*, SAN ANTONIO CURRENT (Jan. 26, 2011), <http://www2.sacurrent.com/news/story.asp?id=71968> (discussing how South Texan landowners in the Eagle Ford Shale are taking advantage of the local water demands by selling water to operators for hydraulic fracturing).

166. *Id.*

167. *See* Joe Carroll, *Worst Drought in More Than a Century Strikes Texas Oil Boom*, BLOOMBERG (June 13, 2011, 3:49 PM), <http://www.bloomberg.com/news/2011-06-13/worst-drought-in-more-than-a-century-threatens-texas-oil-natural-gas-boom.html> (noting that Anadarko and Swift Energy purchase their fracturing water from the Hidalgo Irrigation District No. 2, and Anadarko also buys water from the Wintergarden Groundwater Conservation District).

168. *Id.*

water wildcatting business, because legitimate concerns exist over the depletion of reservoirs due to large amounts of water being pumped from a single source.¹⁶⁹

3. Regulatory Limitations to the Rule of Capture

While the rule of capture generally allows a landowner to pump as much groundwater from his land as he chooses without liability to neighboring landowners, certain limitations apply.¹⁷⁰ The rule is limited by the authority of both the Texas Railroad Commission, for oil and gas purposes, and by the local groundwater district, if one exists in the area where the land is situated.¹⁷¹ Additionally, the rule does not preclude liability for negligent, malicious, or wasteful acts.¹⁷² This section focuses primarily upon regulatory limitations on the rule of capture imposed by groundwater districts.

Courts apply the ancient English rule of capture only in its purest form where there is not a local groundwater conservation district with authority over the area.¹⁷³ Groundwater conservation districts limit the rule of capture by regulating the manner in which users utilize the state's groundwater reserves within the districts' jurisdictional boundaries.¹⁷⁴ The conservation districts accomplish such regulation by requiring permits for various purposes and/or limiting the way in which lessees use water for particular purposes.¹⁷⁵ The current drought and resulting concern over diminishing groundwater supplies are guiding a policy shift in the way

169. See Robert Crowe, *Warming Trend: Regulators Far from Ready for Challenges Fracking Brings to South Texas*, SAN ANTONIO CURRENT (Jan. 26, 2011), <http://www2.sacurrent.com/news/story.asp?id=71968> (pointing out the possibility of wells going dry within ninety days due to pumping for hydraulic fracturing operations).

170. See *Friendswood Dev. Co. v. Smith-Sw. Indus.*, 576 S.W.2d 21, 30 (Tex. 1978) (explaining a landowner will be liable for subsidence on neighbors' land if the subsidence results from a negligent withdrawal of water).

171. See Chris Connelley, Comment, *The Inconvenience in Texas Groundwater Law*, 46 HOUS. L. REV. 1301, 1302 (2009) (stating the rule of capture applies in areas where there is not an established groundwater conservation district).

172. See *Friendswood Dev. Co.*, 576 S.W.2d at 30 (explaining a landowner will be liable for negligent withdrawal of water).

173. See Colleen Schreiber, *Texas Groundwater Law In Flux: Primer is Constantly Changing*, LIVESTOCK WEEKLY (Oct. 12, 2006), available at http://texaswatermatters.org/pdfs/news_355.pdf (asserting the rule of capture applies where no groundwater district exists).

174. See Chris Connelley, Comment, *The Inconvenience in Texas Groundwater Law*, 46 HOUS. L. REV. 1301, 1340–41 (2009) (arguing for a fundamental change in Texas groundwater management by expanding the reach of the regulatory system).

175. E.g. Evergreen Underground Water Conservation Dist. Rule 5.7 (Jan. 23, 2009), available at <http://www.evergreenuwcd.org/files/Evergreen%20rules%20Adopted%201-23-09.pdf> (requiring well monitoring for “[a]rge [s]cale [g]roundwater [p]umping [p]rojects”).

groundwater districts manage groundwater reserves.¹⁷⁶ While water permits for oil and gas drilling are exempted from certain rules put forth by the groundwater conservation districts, those districts can choose whether to consider fracing as a separate activity that does not fall within those exemptions.¹⁷⁷

Until recently, most groundwater conservation districts have considered fracing operations to be within the permit exemption;¹⁷⁸ however, the current drought is leading some to consider enacting specific water use restrictions against the water-intensive process.¹⁷⁹ When fracing operations began in the Eagle Ford in 2008, the Evergreen Underground Water Conservation District, which has authority over several counties in the area, extended its existing annual drilling restriction of two acre-feet per year to hydraulic fracturing.¹⁸⁰ Other conservation districts have said they will consider applying restrictions to fracing “if the water table drops too low.”¹⁸¹ In addition to restricting permitted usage of water, some conservation districts require monitors to be installed on wells that are used for large-scale pumping projects and provide for the suspension of such a well if the monitored levels fall below a predetermined depth.¹⁸²

Moreover, some municipalities in the Barnett Shale in North Texas have

176. See Kathy Wythe, *If Drought Continues, Water Policy Changes to Come, Says Texas A&M Expert*, TEX. WATER RESEARCH INSTITUTE (Oct. 2011), <http://twri.tamu.edu/publications/drought/2011/october/if-drought-continues-water-policy-changes-to-come/> (discussing the likelihood of a policy change in Texas water law if the drought continues for another two to four years).

177. See, e.g., Mike Lee, *Parched Texans Impose Water-Use Limits for Fracking Gas Wells*, BLOOMBERG BUSINESSWEEK (Oct. 6, 2011) (discussing Ogallala Aquifer and High Plains Underground Water Conservation District No. 1 recently imposing restrictions on water use for fracing).

178. See TEX. WATER CODE ANN. § 36.117(b)(2) (West 2011) (requiring a permit exemption for temporary rig supply wells “used solely to supply water for a rig that is actively engaged in drilling or exploration operations for an oil or gas well permitted by the Railroad Commission of Texas”). The Texas Railroad Commission has interpreted “a rig that is actively engaged in drilling or exploration” to include such activities as hydraulic fracturing. *Eagle Ford: Water Use in Association with Oil and Gas Activities Regulated by the Railroad Commission of Texas*, RAILROAD COMMISSION OF TEXAS <http://www.rrc.state.tx.us/eagleford/wateruse.php> (last visited Dec. 5, 2012).

179. See Mike Lee, *Parched Texans Impose Water-Use Limits for Fracking Gas Wells*, BLOOMBERG BUSINESSWEEK (Oct. 6, 2011, 2:08 PM), <http://www.businessweek.com/news/2011-10-06/parched-texans-impose-water-use-limits-for-fracking-gas-wells.html> (citing several water conservation district general managers, including those in the High Plains District No. 1, Evergreen District, and Hemphill District, who are either considering enacting rules restricting water use for fracing or have already done so).

180. *Id.*

181. See *id.* (reporting on the various groundwater conservation districts’ restrictions on fracing).

182. Evergreen Underground Water Conservation Dist. Rule 5.7 (2009), available at <http://www.evergreenwcd.org/files/Evergreen%20rules%20Adopted%201-23-09.pdf>.

addressed municipal water supply concerns due to fracing by imposing specific water regulations on operators drilling gas wells.¹⁸³ Becoming the first city to do so, Grand Prairie has completely “ban[ned] the use of city water for [fracing]”¹⁸⁴ and, while Arlington permits the use of city water for fracing, it prohibits companies from taking city water from one drill site to be used for fracing operations at another location.¹⁸⁵ For those pushing for increased regulation by groundwater districts, the recent *Day* decision establishing ownership in place for groundwater will presumptively have a negative effect on such efforts.¹⁸⁶ Groundwater districts will likely hold back on efforts to enact further regulation out of concern that these regulations will constitute a taking of property that requires compensation.¹⁸⁷

IV. REVIEW OF PROPOSED SOLUTIONS TO MITIGATE THE PURPORTED EFFECTS OF FRACING ON GROUNDWATER SUPPLIES

This section reviews several existing proposals offered by those seeking to mitigate a potential future water supply crisis resulting from both environmental conditions, such as prolonged droughts, and possible overuse by municipalities and industries.¹⁸⁸ These proposals include encouraging a shift in current water management policies,¹⁸⁹ abrogation

183. See, e.g., Mike Lee, *Parched Texans Impose Water-Use Limits for Fracking Gas Wells*, BLOOMBERG BUSINESSWEEK (Oct. 6, 2011, 2:08 PM), <http://www.businessweek.com/news/2011-10-06/parched-texans-impose-water-use-limits-for-fracking-gas-wells.html> (reporting on Arlington and Grand Prairie’s municipal rules on restricting water use for fracing).

184. See *id.* (illustrating how municipalities and groundwater conservation districts are dealing with water supply concerns during a drought amidst increasing fracing operations).

185. See, e.g., *id.* (noting that Chesapeake Energy was cited with a permit violation from Arlington for trucking city water from Arlington for a fracing operation in Grand Prairie).

186. See Mose Buchele, *What the State Supreme Court Ruling on Water Rights Means for Texas*, STATE IMPACT (Feb. 24, 2012, 3:01 PM), <http://stateimpact.npr.org/texas/2012/02/24/what-does-the-supreme-court-ruling-on-water-rights-mean/> (noting the recent decision “left some gray area in terms of how much regulation may be acceptable”).

187. See *Edwards Aquifer Auth. v. Day*, 369 S.W.3d 814, 833, 843 (Tex. 2012) (ruling “[g]roundwater rights are property rights subject to constitutional protection, whatever difficulties may lie in determining adequate compensation for a taking” and adding that “the Takings Clause ensures that the problems of a limited public resource—the water supply—are shared by the public, not foisted onto a few”).

188. See generally Corwin W. Johnson, *What Should Texas Do About the Rule of Capture?*, TEX. WATER DEV. BD. REP. 361, at 11 (2004), available at http://www.texscience.org/water/rule_capture/Johnson_what_should_texas_do_about_rule_of_capture.pdf (offering alternative suggestions to be used in place of the rule of capture).

189. See Mike Lee, *Parched Texans Impose Water-Use Limits for Fracking Gas Wells*, BLOOMBERG BUSINESSWEEK (Oct. 6, 2011, 2:08 PM), <http://www.businessweek.com/news/2011-10-06/parched-texans-impose-water-use-limits-for-fracking-gas-wells.html> (discussing a trend among municipalities and groundwater conservation districts to enact more water restrictions for hydraulic

of common law rules,¹⁹⁰ and gaining a better understanding of the water supply landscape through better water volume reporting practices and studies on the effects of hydraulic fracturing on water supplies.¹⁹¹

A. *Abrogation of the Rule of Capture*

Because Texas is one of the few remaining states which follows the rule of capture,¹⁹² critics of the rule have pushed both the legislature and the courts to replace the ancient doctrine with rules used in other states such as reasonable use, correlative rights, or the Restatement (Second) of Torts section 858.¹⁹³ Proponents of abrogating the rule of capture argue the ancient doctrine is an inadequate method for managing our current water demands.¹⁹⁴ At a minimum, critics concede the rule of capture encourages development through free-market allocation of water for what the market regards as its most valuable uses.¹⁹⁵ However, they argue that free-market access to water afforded by the rule will inevitably lead to the diminishment, or ultimate depletion, of water supplies and that the risk of such an outcome should drive reform in Texas's groundwater policies.¹⁹⁶

1. Adoption of Reasonable Use

Long before water consumption allocated to hydraulic fracturing

fracturing amidst the drought); Kathy Wythe, *If Drought Continues, Water Policy Changes to Come, Says Texas A&M Expert*, TEXAS WATER RESOURCE INSTITUTE (Oct. 2011), <http://twri.tamu.edu/publications/drought/2011/october/if-drought-continues-water-policy-changes-to-come/> (suggesting water policy changes are to come).

190. See Corwin W. Johnson, *What Should Texas Do About the Rule of Capture?*, TEX. WATER DEV. BD. REP. 361, at 11 (2004), available at http://www.texscience.org/water/rule_capture/Johnson_what_should_texas_do_about_rule_of_capture.pdf (explaining alternatives to the rule of capture).

191. Some proposals for increased reporting practices are currently imposed by statute. See, e.g., 16 TEX. ADMIN. CODE § 3.29 (2012) (Tex. R.R. Comm'n, Hydraulic Fracturing Chemical Disclosure Requirement) (requiring disclosure of chemicals used for hydraulic fracturing operations).

192. Corwin W. Johnson, *What Should Texas Do About the Rule of Capture?*, TEX. WATER DEV. BD. REP. 361, at 11 (2004), available at http://www.texscience.org/water/rule_capture/Johnson_what_should_texas_do_about_rule_of_capture.pdf.

193. *Id.*

194. See Chris Connelley, Comment, *The Inconvenience in Texas Groundwater Law*, 46 HOUS. L. REV. 1301, 1343 (2009) (arguing the rule of capture is an inadequate rule for dealing with the current water demand as populations grow).

195. See Corwin W. Johnson, *What Should Texas Do About the Rule of Capture?*, TEX. WATER DEV. BD. REP. 361, at 11 (2004), available at http://www.texscience.org/water/rule_capture/Johnson_what_should_texas_do_about_rule_of_capture.pdf (suggesting more widely used rules such as correlative rights, reasonable use, or the Restatement (Second) of Torts section 858 as alternatives to the rule of capture).

196. *Id.*

became an issue, critics of the rule of capture pushed the courts to adopt the reasonable use doctrine in its place.¹⁹⁷ Proponents of the reasonable use doctrine argue that unfettered access to groundwater sources provided through the rule of capture would ultimately deplete the state's groundwater resources without providing any protective recourse against unreasonable usage, even during a drought.¹⁹⁸ The reasonable use doctrine provides landowners with a legal remedy against a neighboring landowner who makes use of the water underlying their own tract in an unreasonable manner.¹⁹⁹ In order to be reasonable, the water usage must be for the beneficial use of the land from which it was extracted.²⁰⁰ The doctrine's on-tract limitation asserts "[a]ny use on any land other than the tract where the well is situated is categorically classified as unreasonable, no matter how beneficial it may be."²⁰¹ The limitation draws on the fact that water rights originate with landownership.²⁰² Additionally, reasonable use proponents argue that the on-tract limitation tends to prevent excessive water use and that this effect qualifies as a strong policy reason for its adoption.²⁰³ Through its on-tract limitation, the doctrine would prevent the "water wildcatting" occurring in the Eagle Ford, inhibiting landowners from selling water from their land to operators for fracing purposes either on their tract or on others.²⁰⁴ However, adoption of the reasonable use rule by Texas courts is unlikely because the Texas Supreme Court has continually deferred to the legislature and has refused

197. See *Hous. & Tex. Cent. Ry. Co. v. East*, 81 S.W. 279, 281 (Tex. 1904) (overturning the lower court's decision to apply the reasonable use doctrine, and instead adopting the rule of capture).

198. See Stephanie E. Hayes Lusk, Comment, *Texas Groundwater: Reconciling the Rule of Capture with Environmental and Community Demands*, 30 ST. MARY'S L.J. 305, 317 (1998) (arguing the rule of capture endangers the water supply and does not provide for limitation of use in emergency situations).

199. See, e.g., *Bristol v. Cheatham*, 255 P.2d 173, 180 (Ariz. 1953) (stating the reasonable use rule requires a beneficial use for the land from which the water was pumped).

200. See *Brady v. Abbott Labs.*, 433 F.3d 679, 683 (9th Cir. 2005) (ruling the defendant's use of water was for the beneficial use of the land and, therefore, would not incur liability for such use under the reasonable use doctrine (citing *Farmer's Inv. Co. v. Bettwy*, 558 P.2d 14, 20 (Ariz. 1976))); see also *Bristol*, 255 P.2d at 180 (clarifying that if the water is used for a beneficial purpose of the land from which it was pumped, then there will be no liability, even if the water is diverted); *Evans v. City of Seattle*, 47 P.2d 984, 987 (Wash. 1935) (en banc) (confirming the application of the reasonable use rule for Washington over the rule of capture and correlative rights).

201. Corwin W. Johnson, *What Should Texas Do About the Rule of Capture?*, TEX. WATER DEV. BD. REP. 361, at 12 (2004), available at http://www.texscience.org/water/rule_capture/Johnson_what_should_texas_do_about_rule_of_capture.pdf.

202. *Id.*

203. *Id.*

204. *Cf. Evans*, 47 P.2d at 987 (prohibiting water to be used as merchandise under the reasonable use rule).

to abrogate the rule of capture in favor of reasonable use.²⁰⁵ Furthermore, the court's holding in *Day*, establishing that "[g]roundwater rights are property rights subject to constitutional protection," reinforces the point that any movement towards adoption of the reasonable use rule by courts in Texas could constitute a taking.²⁰⁶

2. Adoption of Correlative Rights for Groundwater

The correlative rights doctrine applies to landowners whose tracts overlay a common reservoir and provides every landowner with "a right . . . to be protected against damage to a common source of supply and a right to a fair and equitable share of the source of supply."²⁰⁷ Oil and gas law in Texas applies correlative rights to limit the extent of the rule of capture and to provide legal recourse to landowners injured by excessive production of oil or gas on a nearby tract.²⁰⁸ Currently, groundwater in

205. *Accord* City of San Marcos v. Tex. Comm'n on Envtl. Quality, 128 S.W.3d 264, 271 (Tex. App.—Austin 2004, pet. denied) (recognizing Texas still follows the rule of capture, although most other states have changed course in this regard); *see* Sipriano v. Great Spring Waters of Am., Inc., 1 S.W.3d 75, 79–80 (Tex. 1999) (declining to adopt the reasonable use standard and maintaining the common law rule of capture for groundwater); Friendswood Dev. Co. v. Smith-Sw. Indus., 576 S.W.2d 21, 29 (Tex. 1978) (refusing to adopt a reasonable use rule in place of the rule of capture); City of Corpus Christi v. City of Pleasanton, 154 Tex. 289, 276 S.W.2d 798, 802 (Tex. 1955) (reaffirming the rule of capture's application to groundwater). Many other states have opted for the reasonable use rule as a solution to disputes arising out of municipal use of high capacity rural wells to supply the city. Ronald Kaiser & Frank F. Skillern, *Deep Trouble: Options for Managing the Hidden Threat of Aquifer Depletion in Texas*, 32 TEX. TECH L. REV. 249, 276, 283, 285, 287 (2001). *Compare* Sipriano, 1 S.W.3d at 79–80 (declining to adopt the reasonable use standard and maintaining the common law rule of capture for groundwater in Texas), *with* *Bristor*, 255 P.2d at 180 (affirming the reasonable use rule in Arizona by "prevent[ing] the withdrawal of underground waters for . . . uses not connected with [the] beneficial ownership or enjoyment of the land [from which] they are taken"). The Texas Supreme Court has reached its conclusion to maintain the rule of capture mostly out of deference to the legislature. *See* Sipriano, 1 S.W.3d at 76–77 (citing both common law precedent and statutory action as the reasoning for maintaining the rule of capture rather than adopting either reasonable use or correlative rights in its place); *see also* TEX. CONST. art. XVI, § 59 (amended 1964, 1973, 1978) (placing the responsibility of regulating the state's natural resources, including groundwater, with the legislature).

206. *Cf.* Edwards Aquifer Auth. v. Day, 369 S.W.3d 814, 833, 843 (Tex. 2012) (reinforcing the constitutional right to ownership in place of groundwater by the landowner and noting that "[t]he [l]egislature can discharge its responsibility under the Conservation Amendment without triggering the Takings Clause").

207. HOWARD R. WILLIAMS & CHARLES J. MEYERS, MANUAL OF OIL AND GAS TERMS 229 (Patrick H. Martin & Bruce M. Kramer eds., 14th ed. 2009); *see also* Allen v. Alaska Oil & Gas Conservation Comm'n, 147 P.3d 664, 671–72 (Alaska 2006) (defining correlative rights as it relates to both oil and gas and groundwater as "the rights of owners of property overlying a [common] pool").

208. *See* Hous. & Tex. Cent. Ry. Co. v. East, 98 Tex. 146, 81 S.W. 279, 281 (1904) (establishing the rule of capture in Texas).

Texas is not governed by correlative rights,²⁰⁹ but other states such as California have applied the rule to such resources.²¹⁰ The rule alleviates excessive water use by prohibiting landowners who own land over a common reservoir from extracting more than their fair share of water in proportion to the land owned on the surface.²¹¹ Any excess water beyond the “fair and just” amount appropriated to the correlative rights owners may be appropriated by others, in which case it may be used off-tract.²¹² The appropriation users’ rights, however, are subordinate to those with “correlative rights for on-tract uses.”²¹³

Critics of adopting correlative rights in Texas point out that the resultant limitations have an undesirable effect on “free market transfers of groundwater.”²¹⁴ Additionally, the difficulty in determining exactly what constitutes “fair and just” shares of water stands as another unfavorable aspect of the doctrine.²¹⁵ Because litigation is necessary and correlative rights owners may assert their rights at any time, a judicial determination of what is “fair and just” may be modified or shares could be diluted by subsequent judicial actions instituted by other owners.²¹⁶ Often, the appropriated shares are determined by the surface area of the land, but this method fails to account for varying uses of the land such as industrial,

209. See Jean A. Bowman, *Reallocating Texas' Water: Slicing up the Leftover Pie*, 19 TEX. WATER RES., no. 4, Winter 1993, at 1, 5 (discussing difficulties in establishing groundwater banks because of the lack of correlative rights for groundwater in Texas); see also Corwin W. Johnson, *What Should Texas Do About the Rule of Capture?*, TEX. WATER DEV. BD. REP. 361, at 11, 12–13 (2004), available at http://www.texscience.org/water/rule_capture/Johnson_what_should_texas_do_about_rule_of_capture.pdf (suggesting correlative rights and the reasonable use doctrine as possible “[a]lternatives to the [r]ule of [c]apture”).

210. See generally *Katz v. Walkinshaw*, 74 P. 766, 776 (Cal. 1903) (adopting correlative rights for groundwater in California).

211. Cf. *Spear T Ranch, Inc. v. Knaub*, 691 N.W.2d 116, 128 (Neb. 2005) (stating under correlative rights, water rights are “apportioned among the landowners based on their reasonable needs” in the common reservoir).

212. Corwin W. Johnson, *What Should Texas Do About the Rule of Capture?*, TEX. WATER DEV. BD. REP. 361, at 11, 12 (2004), available at http://www.texscience.org/water/rule_capture/Johnson_what_should_texas_do_about_rule_of_capture.pdf.

213. *Id.*

214. *Id.*

215. See *Spear T Ranch, Inc.*, 691 N.W.2d at 128–29 (noting the difficulty in determining what is “fair and just”); Corwin W. Johnson, *What Should Texas Do About the Rule of Capture?*, TEX. WATER DEV. BD. REP. 361, at 11–12 (2004), available at http://www.texscience.org/water/rule_capture/Johnson_what_should_texas_do_about_rule_of_capture.pdf (pointing out that litigation is necessary for determining what is “fair and just”).

216. See Corwin W. Johnson, *What Should Texas Do About the Rule of Capture?*, TEX. WATER DEV. BD. REP. 361, at 11, 13 (2004), available at http://www.texscience.org/water/rule_capture/Johnson_what_should_texas_do_about_rule_of_capture.pdf (pointing out the failure to address varying uses in land).

agricultural, or residential uses, each of which could have dramatically different water needs.²¹⁷

B. *Decrease Fresh Water Needs for Fracing*

As hydraulic fracturing increases throughout the Eagle Ford and other shale plays across the country, so do the technological advances emanating from the maturing industry.²¹⁸ The industry is developing new fracing methods that do not require the large volumes of water that are used for traditional hydraulic fracturing operations.²¹⁹ One company uses a liquefied petroleum gas, which is a gelled substance made of a blend of ethane, propylene, propane, butane, and sulfur, among other substances.²²⁰ In order to guide the industry toward using less water for the fracing process, states and local governments should strive to remove any regulatory barriers to the development of these new fracing methods and encourage the industry to utilize new forms of fracing fluids rather than using water as the primary fluid.²²¹ Drilling companies, as with any business, will use the most cost-effective method to accomplish their goals.²²² As long as stifling regulations do not hinder new technological development and Texas water regulations increase as groundwater sources continue to diminish, the free market will likely find a way to utilize new and improved methods of fracing that require less water usage.²²³

In addition to reducing the need for water in general, new technology that allows for the use of recycled water for hydraulic fracturing can also minimize the strain on the state's groundwater resources. The industry is already seeing an increase in the number of companies that recycle the water that "flows back to the surface after the fracing process."²²⁴ Using

217. *Id.*

218. *E.g.* GASFRAC ENERGY SERVICES, INC, <http://www.gasfrac.com/> (last visited Dec. 5, 2012) (exemplifying an emerging company providing an alternative form of fracing).

219. *See* Sean Milmo, *Fracking with Propane Gel*, ROYAL SOCIETY OF CHEMISTRY (Nov. 15, 2011), <http://www.rsc.org/chemistryworld/News/2011/November/15111102.asp> (reporting on companies using alternative ingredients, such as propane, sand, or other proprietary blends for fracing).

220. GASFRAC ENERGY SERVICES, INC, <http://www.gasfrac.com> (last visited Dec. 5, 2012).

221. *See* Brian J. Smith, Comment, *Fracing the Environment?: An Examination of the Effects and Regulation of Hydraulic Fracturing*, 18 TEX. WESLEYAN L. REV. 129, 146 (2011) (encouraging subsidies for water recycling methods).

222. *Cf.* Sean Milmo, *Fracking with Propane Gel*, ROYAL SOCIETY OF CHEMISTRY (Nov. 15, 2011), <http://www.rsc.org/chemistryworld/News/2011/November/15111102.asp> (citing cost as a potential drawback of using propane gel).

223. *E.g.* GASFRAC ENERGY SERVICES, INC, <http://www.gasfrac.com/> (last visited Dec. 5, 2012) (describing an emerging company in the fracing industry).

224. Brian J. Smith, Comment, *Fracing the Environment?: An Examination of the Effects and*

portable distilling trucks, companies like Devon Energy are able to recycle water on-site.²²⁵ Oil companies in the Eagle Ford are already showing an interest in the technology.²²⁶ Recycling water used in fracing operations is still a costly process, and this prevents many companies from employing the process in their fracing operations.²²⁷ As a solution, some suggest local governments should consider subsidizing recycling programs to aid in the development of “more efficient and cost-effective water-recycling technology.”²²⁸ In addition to incentivizing the industry with subsidies, some also suggest that as the recycling process becomes more affordable for oil and gas operators, those who do not employ the technology in their operations should be penalized by either fines or other disciplinary measures to encourage its use.²²⁹

Another available method to obtain water for fracing is for operators to truck in water from outside sources that are more capable of withstanding the large volumes of withdrawal.²³⁰ Though the process is somewhat costly, for some operators the practice is not necessarily cost-prohibitive

Regulation of Hydraulic Fracturing, 18 TEX. WESLEYAN L. REV. 129, 146 (2011); see also *The Future of Water Recycling*, BASIN OIL & GAS, no. 2, July 2008, available at <http://fwbog.com/index.php?page=article&article=18> (discussing developing recycling technology).

225. See *The Future of Water Recycling*, BASIN OIL & GAS, no. 2, July 2008, available at <http://fwbog.com/index.php?page=article&article=18> (distinguishing Devon Energy as the industry leader in fracing flow-back recycling); Mike Lee, *Parched Texans Impose Water-Use Limits for Fracking Gas Wells*, BLOOMBERG BUSINESSWEEK (Oct. 6, 2011, 2:08 PM), <http://www.businessweek.com/news/2011-10-06/parched-texans-impose-water-use-limits-for-fracking-gas-wells.html> (noting the various methods, including recycling, that operators have adopted to combat increased water restrictions).

226. See *The Future of Water Recycling*, BASIN OIL & GAS, no. 2, July 2008, available at <http://fwbog.com/index.php?page=article&article=18> (discussing Devon Energy's efforts to increase their use of recycling technology); Tracy Idell Hamilton, *Drought Spurring Fracking Concerns*, SAN ANTONIO EXPRESS-NEWS (July 3, 2011, 12:54 AM), www.mysanantonio.com/news/energy/article/Droughtspurringfrackingconcerns-1450808.php#page-2 (explaining that companies like El Paso Corp. and others are showing an interest in recycling flowback water).

227. See *The Future of Water Recycling*, BASIN OIL & GAS, no. 2, July 2008, available at <http://fwbog.com/index.php?page=article&article=18> (noting that, over the long run, using recycled water could be a more economical than using fresh water).

228. See Brian J. Smith, Comment, *Fracing the Environment?: An Examination of the Effects and Regulation of Hydraulic Fracturing*, 18 TEX. WESLEYAN L. REV. 129, 146 (2011) (offering long-term solutions for controlling the amount of water used in hydraulic fracturing).

229. *Id.*

230. See Kiah Collier, *Fracking Gives Texas Another Oil Boom, but at Huge Water Cost*, INDEPENDENTMAIL.COM (June 30, 2011), <http://www.independentmail.com/news/2011/jun/30/fracking-gives-texas-another-oil-boom-huge-water-c/?print=1> (explaining how some operators purchase water from landowners and cities and truck it to the fracing location); Robert Crowe, *Warming Trend: Regulators Far from Ready for Challenges Fracking Brings to South Texas*, SAN ANTONIO CURRENT (Jan. 26, 2011), <http://www2.sacurrent.com/news/story.asp?id=71968> (explaining how locals are selling water to oil and gas operators who use the water for off-site operations).

because it is fractional compared to the overall cost of drilling and fracing a well in a shale formation.²³¹ If groundwater districts and municipalities in the Eagle Ford employ more restrictions on operators using their groundwater for fracing, then the industry may be forced to truck in their water from sources that either have a more ample supply or are less regulated.²³²

Non-potable water sources are another way fracing operators can obtain their supply without fear of endangering the general groundwater supplies used for human consumption.²³³ The benefit of non-potable water is that it is plentiful and lies beneath drinking water levels; therefore, by using it for fracing operations, oil and gas operators do not have to utilize valuable water sources needed for consumption by the general population.²³⁴ Non-potable water is unsuitable for human consumption because of its high saline content, or in other words, its brackish qualities.²³⁵ One of the drawbacks of using such water is that because non-potable water sources are found deeper underground than potable water sources, they require deeper wells that are more expensive to drill.²³⁶ In addition, the higher saline content requires treatment to ensure proper fracing and effective production, and, like recycled water, non-potable water use can be very costly because of the need for purification.²³⁷ Similar to drilling mud, water used for fracing must have the proper chemical makeup to be effective.²³⁸ If the water is too brackish, its corrosive properties can cause

231. See Mike Lee, *Parched Texans Impose Water-Use Limits for Fracking Gas Wells*, BLOOMBERG BUSINESSWEEK (Oct. 6, 2011, 2:08 PM), <http://www.businessweek.com/news/2011-10-06/parched-texans-impose-water-use-limits-for-fracking-gas-wells.html> (noting that one operator paid a meager \$68,000 to truck water to a drilling site, a relatively miniscule amount when compared to the \$3.5 million that it cost to frac the well).

232. See *id.* (discussing a trend amongst municipalities and groundwater conservation districts to enact more water restrictions for hydraulic fracturing amidst the drought).

233. See API ENERGY, WATER MANAGEMENT ASSOCIATED WITH HYDRAULIC FRACTURING 13, 16 (June 2010), available at http://www.shalegas.energy.gov/resources/HF2_e1.pdf (outlining industry best practices encouraging the use of non-potable water for fracing).

234. See Kathy Wythe, *If Drought Continues, Water Policy Changes to Come, Says Texas A&M Expert*, TEX. WATER RESEARCH INSTITUTE (Oct. 2011), <http://twri.tamu.edu/publications/drought/2011/october/if-drought-continues-water-policy-changes-to-come/> (noting Texas's large supply of brackish water).

235. See *id.* (citing Ronald Kaiser describing brackish water).

236. API ENERGY, WATER MANAGEMENT ASSOCIATED WITH HYDRAULIC FRACTURING 13, 16 (June 2010), available at http://www.shalegas.energy.gov/resources/HF2_e1.pdf.

237. *Id.*

238. Cf. Kiah Collier, *Fracking Gives Texas Another Oil Boom, but at Huge Water Cost*, INDEPENDENTMAIL.COM (June 30, 2011), <http://www.independentmail.com/news/2011/jun/30/fracking-gives-texas-another-oil-boom-huge-water-c/?print=1> (explaining industry officials say the decision to use fresh water for fracing is more a matter of effectiveness rather than cost).

costly damages to the drilling equipment and drill pipe.²³⁹ Using non-potable water becomes impracticable when the costs of converting it to a useful fracing fluid outweigh its benefits.²⁴⁰ Purifying non-potable water is another technological area where less regulation will encourage the development of more cost-effective ways to treat non-potable water for fracing operations, thereby lessening the demand on groundwater supplies used for drinking.²⁴¹

C. *Improve Water Monitoring*

1. Hydraulic Fracturing Disclosure Requirements Rule

Finally, many experts agree that one of the biggest needs for solving the water supply dilemma lies simply in gaining a better understanding of the effects of hydraulic fracturing on the availability of valuable groundwater sources, which can be acquired through the increased use of monitoring systems and studies.²⁴² One of the best ways to gather information is to increase communication between the industry and regulators.²⁴³ On December 13, 2011, Texas took its first major step in gathering data on water volumes used in hydraulic fracturing when the Texas Railroad Commission adopted the Hydraulic Fracturing Chemical Disclosure Requirements rule.²⁴⁴ The new rule requires that operators disclose both chemicals and water volumes used in hydraulic fracturing.²⁴⁵ Section

239. API ENERGY, WATER MANAGEMENT ASSOCIATED WITH HYDRAULIC FRACTURING 13 (June 2010), available at http://www.shalegas.energy.gov/resources/HF2_e1.pdf; see also Brian J. Smith, Comment, *Fracing the Environment?: An Examination of the Effects and Regulation of Hydraulic Fracturing*, 18 TEX. WESLEYAN L. REV. 129, 138 (2011) (speculating the extreme corrosiveness of the wastewater could affect productivity by corroding the machinery).

240. API ENERGY, WATER MANAGEMENT ASSOCIATED WITH HYDRAULIC FRACTURING 13 (June 2010), available at http://www.shalegas.energy.gov/resources/HF2_e1.pdf.

241. See Brian J. Smith, Comment, *Fracing the Environment?: An Examination of the Effects and Regulation of Hydraulic Fracturing*, 18 TEX. WESLEYAN L. REV. 129, 146 (2011) (describing techniques for government to encourage the use of recycled water and lessen demand for ground and surface water).

242. See Robert Crowe, *Warming Trend: Regulators Far from Ready for Challenges Fracking Brings to South Texas*, SAN ANTONIO CURRENT (Jan. 26, 2011), <http://www2.sacurrent.com/news/story.asp?id=71968> (citing Dr. Brownlow, who recommends providing better water level data to groundwater conservation districts by requiring that well logs be disclosed).

243. See API ENERGY, WATER MANAGEMENT ASSOCIATED WITH HYDRAULIC FRACTURING vi (June 2010), available at http://www.shalegas.energy.gov/resources/HF2_e1.pdf (suggesting best practices for allocating water sources for hydraulic fracturing including strongly encouraging communication between oil and gas operators and groundwater management organizations).

244. See generally 16 TEX. ADMIN. CODE § 3.29 (2012) (Tex. R.R. Comm'n, Hydraulic Fracturing Chemical Disclosure Requirement) (requiring disclosure of chemicals and water volumes used in hydraulic fracturing).

245. *Id.* § 3.29(c)(2)(A)(viii).

3.29(c)(2)(A)(viii) stipulates that operators must disclose the “total volume of water used in the hydraulic fracturing treatment(s) of the well or the type and total volume of the base fluid used in the hydraulic fracturing treatment(s), if [it is] something other than water.”²⁴⁶ The penalty for not complying with the rule could include significant fines for each day that the operator violates the rule.²⁴⁷ The rule appears to be a first step in assuaging public concerns over the process’s environmental effects.²⁴⁸

2. Industry Best Practices

The American Petroleum Institute (API) is also doing its part to increase communication between the industry and regulators by providing “best practices” for minimizing the negative environmental impacts of hydraulic fracturing, thereby proactively increasing communication beyond the level required by existing, mandatory regulations.²⁴⁹ Under API’s best practices, oil companies are encouraged to communicate and cooperate with local groundwater conservation districts charged with resource planning in the local communities where the drilling occurs.²⁵⁰ Such improved communication will also give oil companies a greater understanding of the “preferred sources of water to be used for hydraulic fracturing by the [groundwater districts].”²⁵¹

Some examples of API’s suggested solutions include encouraging companies to use non-potable water, where possible, to prevent a strain on the community’s “publicly utilized water resources,” as well as taking advantage of possible water recycling capabilities by reusing water previously used in hydraulic fracturing operations.²⁵² Some operators in the Eagle Ford have installed water-metering devices on their wells that

246. *Id.*

247. NAT. RES. CODE ANN. § 81.0531 (West 2011).

248. See Robert Crowe, *Warming Trend: Regulators Far from Ready for Challenges Fracking Brings to South Texas*, SAN ANTONIO CURRENT (Jan. 26, 2011), <http://www2.sacurrent.com/news/story.asp?id=71968> (citing Dr. Darrell T. Brownlow’s legislative recommendation as “something that would require the Railroad Commission to log wells and provide better information to groundwater districts”); Kate Galbraith, *Unlocking the Secrets Behind Hydraulic Fracturing*, N.Y. TIMES (Jan. 14, 2012) http://www.nytimes.com/2012/01/15/us/new-texas-rule-to-unlock-secrets-of-hydraulic-fracturing.html?_r=0 (quoting Environmental Defense Fund attorney Amy Hardberger, who describes the rule as “a huge step forward from where we were”).

249. See generally API ENERGY, WATER MANAGEMENT ASSOCIATED WITH HYDRAULIC FRACTURING (June 2010), available at http://www.shalegas.energy.gov/resources/HF2_e1.pdf (encouraging communication among oil and gas operators and groundwater management entities).

250. *Id.* at vi.

251. *Id.*

252. *Id.* at vii.

draw water from the Carrizo-Wilcox Aquifer.²⁵³ One such company claims that they “have not seen any significant declines in the overall water level of the aquifer and the drought conditions have not affected [their] operations.”²⁵⁴ Some companies are also known to share pumping data with local groundwater conservation districts in an effort to better monitor usage and its impact on water levels in the area.²⁵⁵

V. CONCLUSION

While hydraulic fracturing in the Eagle Ford Shale is relatively new to the South Texas region, the oil boom is anticipated to continue well into the future, and fracing operations are projected to increase as an estimated 20,000 wells are expected to be drilled over the life of the play.²⁵⁶ The strain on the state's groundwater reserves is expected to worsen as droughts will undoubtedly continue to plague the area and population rises.²⁵⁷ As a result, South Texas will likely see a continuing policy shift in the state's current water management scheme in an effort to protect the state's groundwater reserves.²⁵⁸ In fact, the recently-adopted rule by the Texas Railroad Commission requiring disclosure of chemicals used in fracing operations is a sign that the industry may soon face further regulations.²⁵⁹

As the drought persists, local groundwater districts with control over water resources in counties lying within the Eagle Ford will likely follow

253. Michael Barajas, *Texas Fracking Critics Tour the Eagle Ford As Complaints of Contamination Surface*, SAN ANTONIO CURRENT (June 22, 2011), <http://sacurrent.com/texas-fracking-critics-tour-the-eagle-ford-as-complaints-of-contamination-surface-1.1165133>.

254. *See id.* (describing the concern among Eagle Ford Shale locals over the water supply and what some operators are doing to monitor their usage).

255. *Id.*

256. Darrell T. Brownlow, *Eagle Ford Shale Play and the Carrizo Aquifer*, FOUNTAINHEAD, 4th Quarter 2010, at 1, 4, *available at* <http://www.tgwa.org/downloads/newsletter/Fountainhead-Q4-2010.pdf>.

257. *See* JOHN W. NIELSEN-GAMMON, OFFICE OF THE ST. CLIMATOLOGIST, THE 2011 TEXAS DROUGHT: A BRIEFING PACKET FOR THE TEXAS LEGISLATURE 3 (Oct. 31, 2011), *available at* http://atmo.tamu.edu/osc/library/osc_pubs/2011_drought.pdf (anticipating future drought conditions); TEX. WATER DEV. BD., WATER FOR TEXAS: SUMMARY OF THE 2011 REGIONAL WATER PLANS L-2 (Jan. 20, 2011), *available at* <http://www.twdb.state.tx.us/waterplanning/rwp/regions/doc/2011RWPLegislativeSummary.pdf> (expecting local populations to increase in size).

258. *See, e.g.*, 16 TEX. ADMIN. CODE § 3.29 (2012) (Tex. R.R. Comm'n, Hydraulic Fracturing Chemical Disclosure Requirement) (requiring water volume disclosure for fracing operations); *see also* Kathy Wythe, *If Drought Continues, Water Policy Changes to Come, Says Texas A&M Expert*, TEXAS WATER RESEARCH INSTITUTE (Oct. 2011), <http://twri.tamu.edu/publications/drought/2011/october/if-drought-continues-water-policy-changes-to-come/> (suggesting water policy changes may occur as the drought persists).

259. 16 ADMIN. § 3.29.

the direction of other Texas counties by placing increased restrictions on the amount of water used for fracking.²⁶⁰ With such a new technology, there will undoubtedly be continued concern over whether the water-intensive process has an adverse effect on groundwater resources, especially under the strain of drought conditions.²⁶¹ Local residents and the environmentally conscious have understandable concerns that hydraulic fracturing is straining much-needed water sources.²⁶² On the other hand, operators who are drilling in the area argue they have not yet seen a change in groundwater levels resulting from fracking operations.²⁶³ Others point out that the water used for fracking is relatively minimal in volume when compared to the overall water demand in the region.²⁶⁴ At the very least, there should be a concerted effort to monitor groundwater levels as they relate to hydraulic fracturing to determine accurately whether fracking operations are actually having a significant impact on groundwater depletion.²⁶⁵ For an industry that has such an enormously positive economic impact on the region, its effects on the groundwater supply must be completely evaluated and understood before enacting water restrictions that may not be entirely effective.²⁶⁶

In the meantime, concerned residents should take advantage of currently existing resources to protect their groundwater reserves through common law remedies, contractual provisions in oil and gas leases, and current rules and restrictions on water usage instituted by local groundwater conservation districts and the Texas Railroad Commission.

260. Mike Lee, *Parched Texans Impose Water-Use Limits for Fracking Gas Wells*, BLOOMBERG BUSINESSWEEK (Oct. 6, 2011, 2:08 PM), <http://www.businessweek.com/news/2011-10-06/parched-texans-impose-water-use-limits-for-fracking-gas-wells.html>.

261. *See, e.g.*, Michael Barajas, *Texas Fracking Critics Tour the Eagle Ford As Complaints of Contamination Surface*, SAN ANTONIO CURRENT (June 22, 2011), <http://sacurrent.com/texas-fracking-critics-tour-the-eagle-ford-as-complaints-of-contamination-surface-1.1165133> (“Concerns over water contamination and damaging health effects have followed the drilling process, known as hydraulic fracturing, nearly everywhere.”).

262. *See id.* (describing the concern among residents over water depletion).

263. *Id.*

264. *See* Darrell T. Brownlow, *Eagle Ford Shale Play and the Carrizo Aquifer*, FOUNTAINHEAD, 4th Quarter 2010, at 1, 4, *available at* <http://www.tgwa.org/downloads/newsletter/Fountainhead-Q4-2010.pdf> (concluding that “[i]t is unlikely that pumping 300,000 acre-feet of Carrizo water for hydraulic fracturing would have a significant adverse impact on water availability”).

265. *E.g.* 16 TEX. ADMIN. CODE § 3.29 (2012) (Tex. R.R. Comm’n, Hydraulic Fracturing Chemical Disclosure Requirement) (establishing mandatory water volume reporting requirements).

266. *See generally* CTR. FOR CMTY. & BUS. RESEARCH, THE UNIV. OF TEX. AT SAN ANTONIO INST. FOR ECON. DEV., ECONOMIC IMPACT OF THE EAGLE FORD SHALE (Feb. 2011), *available at* <http://cbr.iedtexas.org/index.php/Download-document/47-Economic-Impact-of-the-Eagle-Ford-Shale.html> (noting the massive economic impact the industry has on the Eagle Ford region).

