



SCHOOL OF LAW
TEXAS A&M UNIVERSITY

Texas Wesleyan Law Review

Volume 16 | Issue 1

Article 12

10-1-2009

Drilling Into the Issues: A Critical Analysis of Urban Drilling's Legal, Environmental, and Regulatory Implications

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Available at: <https://doi.org/10.37419/TWLR.V16.I1.10>

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COMMENT

DRILLING INTO THE ISSUES: A CRITICAL ANALYSIS OF URBAN DRILLING'S LEGAL, ENVIRONMENTAL, AND REGULATORY IMPLICATIONS

*R. Marcus Cady, II**

THE SITUATION	128
INTRODUCTION	129
SECTION I. NATURAL GAS BENEFITS	130
A. <i>A Cleaner Alternative Fuel</i>	130
B. <i>Economic Benefits</i>	131
C. <i>Large Domestic Natural Gas Reserves</i>	131
SECTION II. THE PROLIFIC BARNETT SHALE	132
A. <i>The Barnett Shale's History</i>	132
B. <i>Barnett Shale Drilling Technology</i>	133
C. <i>Current Barnett Shale Statistics</i>	134
SECTION III. RELEVANT OIL AND GAS LEGAL DOCTRINES	134
A. <i>The Mineral Estate—The Dominant Estate</i>	134
B. <i>Accommodation Doctrine (Due Regard) Limitation</i>	135
C. <i>Texas Groundwater—The Rule of Capture</i>	136
D. <i>Surface Water Rights in Texas</i>	137
E. <i>Legal Rights to Water Use in Oil and Gas Operations</i>	138
SECTION IV. POTENTIAL ENVIRONMENTAL IMPACTS OF URBAN DRILLING	138
A. <i>Fresh Water Usage</i>	138
B. <i>Disposal of Waste Water in Barnett Shale Operations</i>	140
C. <i>Saltwater Disposal Wells</i>	141
D. <i>Regulation of Groundwater Pollution by Oil and Gas Operations</i>	144
E. <i>Recycling Waste Water in the Barnett Shale</i>	146
F. <i>Increased Air Pollution Resulting from the Barnett Shale</i>	146
SECTION V. MUNICIPAL DRILLING ORDINANCES	147
A. <i>Authority to Enact Municipal Drilling Ordinances</i> ..	147
B. <i>The Fort Worth Drilling Ordinance</i>	147

* With special acknowledgments to Keith Hirokawa, Rob Schmid, and Kelly Boyington for ideas, inspiration, and editing.

i.	Gas Well Permit Applications and Setbacks	148
ii.	Noise Level Restrictions	150
iii.	Compressor Stations	151
iv.	Salt Water Disposal	153
v.	Gas Drilling Review Committee	154
vi.	Summarized Opinion of Fort Worth's Drilling Ordinance	154
SECTION VI.	MUNICIPAL DRILLING ORDINANCES AS TAKINGS	155
A.	<i>Can Municipal Drilling Ordinances Rise to the Level of a Regulatory Taking?</i>	155
B.	<i>Federal Takings Jurisprudence</i>	155
C.	<i>Texas Takings Jurisprudence</i>	156
SECTION VII.	CONCLUSIONS	158

THE SITUATION

Unbeknownst to many Tarrant County residents, their homes have been sitting atop one of the largest natural gas fields in the United States, the Barnett Shale. New gas drilling and production technologies have allowed for enhanced recovery of natural gas from the Barnett Shale. Accordingly, oil and gas companies have been spending a significant amount of money to lease mineral rights, leaving the residents feeling as though they had hit the lottery. Competing groups of landmen¹ would court entire neighborhoods, each trying to offer the best lease signing bonus and royalty amount to the residents. Many residents signed early, only to learn the neighboring subdivision received a larger offer shortly thereafter. But, as is the case with many windfalls, there are also disadvantages to the Barnett Shale.

In order to execute a lease and receive a commission, many of the landmen would make promises and assurances to the residents; however, many such pledges went well beyond their authority as independent contractors. The typical mineral lease allows the oil and gas operator a primary term of at least three years to commence operations prior to expiration of the lease. Once the lessee begins operations within the primary term, the lessee has the right to hold the lease so long as oil or gas is produced in commercial quantities. This right is an enormous incentive for a lessee to commence operations within the primary term. As the lessee prepares to drill, many residents realize the lure of the bonus money, likely spent long ago, and a potential stream of small royalty checks, may not have been worth some of the problems created by having a gas well drilled in their "backyard," which might create many environmental concerns for the residents. As an issue for the oil and gas companies, many municipalities have

1. A landman is charged with the task of securing leases as an agent of an oil and gas company.

enacted drilling ordinances as an exercise of police power to protect the health, safety, and welfare of residents. However, have these ordinances gone far enough or too far in the name of “protecting” residents?

INTRODUCTION

New discoveries of natural gas reserves under metropolitan areas have forced oil and gas companies to alter their approach to exploration and production. Historically, companies engaged in the exploration for oil and natural gas focused on rural areas where leasing, drilling, and production activities had relatively minimal impact on surface owners. However, in an urban environment, thousands of residents can potentially be affected by the many activities associated with drilling and producing from a single well site. In capitalizing on significant urban reserves, oil and gas companies will have to overcome many impediments in order to successfully operate in and around major metropolitan areas; however, many of the legal and environmental ramifications have not been fully addressed.

There are as many as forty-one identified shale basins in the United States,² some of which are located under metropolitan areas. The Newark East, Barnett Shale Field is located under approximately nineteen North Texas counties, and Fort Worth's Tarrant County, home to over 1.6 million people,³ is considered one of the core areas for exploration.⁴ As one of the first modern shale plays in an urban area, the Barnett Shale is a prime candidate for an analysis of the environmental impacts of urban drilling, the associated legal implications, and a municipality's approach to dealing with urban drilling, and, as such, will likely set precedents for urban drilling nationwide.

This paper will aggregate and discuss some of those issues, including Fort Worth's attempt to balance the benefits and burdens of urban drilling. Section I will explain the significant advantages associated with increased production of natural gas. Section II will present a general overview of the Barnett Shale. Section III will detail some of the legal doctrines relative to oil and gas, land use, and water rights. Section IV will cover some of the potential environmental impacts of urban drilling on the community. Section V will review and analyze pertinent sections of Fort Worth's municipal drilling ordinance, along with some commentary regarding the effectiveness of the ordinance.

2. Brian J. Cardott, *Understanding Gains on 'New' Reservoir: Shales Closing 'Conventional' Gap*, AAPG EXPLORER, Nov. 2008, at 78, 75, available at <http://www.aapg.org/explorer/2008/11nov/11novExplorer08.pdf>.

3. U.S. CENSUS BUREAU, STATE AND COUNTY QUICK FACTS (2009), <http://quickfacts.census.gov/qfd/states/48/48439.html>.

4. JEFF HAYDEN & DAVE PURSELL, THE BARNETT SHALE: VISITORS GUIDE TO THE HOTTEST GAS PLAY IN THE US 11 (2005), available at <http://www.tudorpickering.com/pdfs/TheBarnettShaleReport.pdf>.

Section VI will explore whether a prohibitive drilling ordinance rises to the level of a regulatory taking. Finally, a brief conclusion will be offered in Section VII weighing the benefits of urban gas production against the potential for environmental harm.

Ultimately, this paper is driven by the need to define the proper balance between the advantages of increased natural gas production and the potential environmental and legal impacts of urban drilling. However, the balance depends on the proper regulation of urban drilling through prudent municipal ordinances. Municipalities must be vigilant in enforcing their police power by enacting effective drilling ordinances, but must also use discretion in order to avoid takings claims and conflicts with state laws, which have historically favored the dominance of the mineral estate.

SECTION I. NATURAL GAS BENEFITS

It can be said that increased natural gas production within the Barnett Shale region has beneficial effects for the environment, local and state economies, and national security. Increased urban production of natural gas also has significant and positive impacts on both macro and micro levels.

A. *A Cleaner Alternative Fuel*⁵

Natural gas⁶ has long been viewed as a relatively clean burning alternative to traditional energy generation methods, especially coal. Natural gas is used for electricity generation for commercial and residential power, manufacturing, transportation, and many other uses. Although the use of natural gas as fuel for electricity generated from power plants does emit nitrogen oxides and carbon dioxide, it does so to a much lesser degree than coal or oil used for the same purpose.⁷ The United States Environmental Protection Agency (EPA), in comparing the environmental effects of coal-fired power plants to natural gas-fired plants, states that natural gas produces half as much carbon dioxide, less than a third as many nitrogen oxides, and 1% as many sulfur oxides.⁸

5. This paper will only briefly discuss the environmental benefits of natural gas use, as a full scientific discussion is well beyond the scope.

6. Natural gas is a generic term and can possibly mean methane, ethane, butane, pentane, helium, nitrogen, and other naturally occurring gaseous materials. For the purposes of this paper, the natural gas referred to consists primarily of methane, or CH₄. However, Methane is a greenhouse gas and small amounts may escape into the atmosphere during oil and gas operations. Other sources, such as landfills, sewage facilities, and cattle feed yards account for the majority of methane released into the atmosphere.

7. U.S. ENVTL. PROT. AGENCY, NATURAL GAS (2007), <http://www.epa.gov/cleanenergy/energy-and-you/affect/natural-gas.html>.

8. *Id.* (quoting from U.S. EPA, eGRID 2000).

Natural gas, in a compressed state as CNG, or in a liquefied state as LNG, is also widely-used for transportation purposes as a cleaner alternative to gasoline and diesel. Compared to gasoline or diesel-fueled vehicles, natural gas vehicles (NGVs) produce 80% fewer ozone precursors and 95% fewer particulates.⁹ There are over 7 million NGVs in operation around the world.¹⁰ However, only 120,000 NGVs are currently in operation in the United States.¹¹

B. *Economic Benefits*

The Barnett Shale has provided many economic benefits, not only to the oil and gas companies, but also to residents, royalty owners, churches, school districts, municipalities, counties, and the state. The increased presence of companies in the natural gas industry has directly and indirectly created many employment opportunities throughout the region. Studies show that the Barnett Shale has created over 83,000 jobs within the region.¹² Accounting for drilling activity, pipeline development, and royalty and lease payments, it is estimated the Barnett Shale created an annual economic output of \$8.2 billion in 2007, a 50% increase over the prior year.¹³ State and local governments also received an estimated \$1.1 billion, exclusive of bonuses and royalty payments, in revenue through taxes and permit fees.¹⁴

C. *Large Domestic Natural Gas Reserves*

Additionally, the United States can reduce its dependence on foreign oil through the increased use of domestically produced natural gas, which has been a popular topic in politics and economics lately. It is estimated that domestic natural gas production increased by 6% in 2008.¹⁵ One of the fastest growing sources of natural gas in the United States is from the use of new drilling techniques in various shale basins. The drilling techniques employed in shale basins have increased the supply of domestic reserves of natural gas to the point

9. U.S. ENVTL. PROT. AGENCY, NATURAL GAS TAXI PROGRAM (2006), <http://www.epa.gov/air/recipes/natgas.html>.

10. John Lyon, President, IANGV, Opening Ceremony Speech at NGV2008 (June 4, 2008), available at <http://www.ngvglobal.com/en/association-news/65-million-ngvs-by-2020-iangv-projection-01923.html>.

11. NGVAmerica, http://www.ngvc.org/about_ngv/index.html (last visited June 8, 2009).

12. THE PERRYMAN GROUP, DRILLING FOR DOLLARS: AN ASSESSMENT OF THE ONGOING AND EXPANDING ECONOMIC IMPACT OF ACTIVITY IN THE BARNETT SHALE ON FORT WORTH AND THE SURROUNDING AREA 4 (2008), <http://www.bseec.org/images/summaryreport.pdf>.

13. *Id.*

14. *Id.* at 6.

15. ENERGY INFO. ADMIN., SHORT-TERM ENERGY OUTLOOK (2009), http://www.eia.doe.gov/steo#Natural_Gas_Markets [hereinafter *EIA-STE0*].

where they should last for at least the next 118 years.¹⁶ Due to the increased supply, U.S. imports of LNG are expected to fall from 770 billion cubic feet (BCF) in 2007 to 350 BCF in 2008, a reduction of 55%.¹⁷ The decline is due to strong global demand, supply constraints, and lower relative U.S. natural gas prices.¹⁸

It is clear natural gas is a viable energy source. Natural gas can provide a safer, cleaner burning alternative to other fossil fuels. Natural gas exploration in urban areas can also provide a much needed economic boost. Additionally, the substantial amounts of domestic natural gas reserves can decrease dependence on foreign sources of oil.

SECTION II. THE PROLIFIC BARNETT SHALE

The Barnett Shale Field is the second largest natural gas field in the continental United States, second only to the old and very large Hugoton Basin, which stretches from the Texas Panhandle to Kansas.¹⁹ According to a U.S. Geological Survey, it is estimated the Barnett Shale contains up to 39 trillion cubic feet (TCF) of natural gas, but future reserve estimates may soon surpass the size of the Hugoton.²⁰ Although still early in development, the Barnett Shale already accounts for over 6% of total gas production within the United States, which is more than the entire state of Louisiana.²¹

A. *The Barnett Shale's History*

Although most residents may think the Barnett Shale Field is a “new discovery,” the Barnett Shale is far from “new.” The Barnett Shale began its formation between 300 and 350 million years ago by the decomposition of marine biomass and subsequent geologic deposition.²² However, George Mitchell, founder of Mitchell Energy, is

16. Mark Clayton, *Controversial Path to Possible Glut of Natural Gas*, CHRISTIAN SCI. MONITOR, Sept. 17, 2008, available at <http://features.csmonitor.com/environment/2008/09/17/controversial-path-to-possible-glut-of-natural-gas/>.

17. *EIA-STEEO*, *supra* note 15. LNG is the typical gas imported from overseas due to stability and transportability.

18. *Id.*

19. MARTIN K. DUBOIS, KAN. LEGISLATIVE SPECIAL COMM. ON ENERGY AND ENV'T, UPDATE ON HUGOTON GAS FIELD 2 (2008), http://skyways.lib.ks.us/ksleg/KLRD/Testimony/EEP/8-20-08/03_DuBois_HugotonFieldNatGasRsrcs.pdf.

20. Jennifer Warren, *The Barnett Shale A Winning Play*, D CEO, Aug. 13, 2008, available at http://www.dmagazine.com/Home/2008/08/13/The_Barnett_Shale_A_Winning_Play.aspx. In 1996, total potential reserves in the Barnett Shale were estimated at just 3 trillion cubic feet (TCF) by the U.S. Geological Survey. In 2006, another estimate estimated 39 TCF. *Id.*

21. ENERGY INFO. ADMIN., IS U.S. NATURAL GAS PRODUCTION INCREASING? (2008), http://tonto.eia.doe.gov/energy_in_brief/natural_gas_production.cfm.

22. Timothy Riley, Note, *Wrangling with Urban Wildcatters: Defending Texas Municipal Oil and Gas Development Ordinances Against Regulatory Takings Challenges*, 32 VT. L. REV. 349, 351–52 (2007); NATALIE GIVENS & HANK ZHAO, REPUBLIC EN-

credited for expending the resources necessary to make the Barnett Shale economically viable.²³ Mitchell first started persistently testing the Barnett Shale in 1981.²⁴ His initial efforts concentrated on gas exploration in relatively rural areas to the north and west of Fort Worth. Current estimates believe the Barnett Shale is present under at least nineteen counties in North Texas.²⁵ In 2002, Mitchell sold his company to Devon Energy.²⁶ Consequently, Devon is now the largest producer in the Barnett Shale, having produced over 334,000,000 thousand cubic feet (MCF) of gas through October 2008, nearly double the production of the next competitor.²⁷

B. Barnett Shale Drilling Technology

The most significant technological advance made by Mitchell in Barnett Shale production is the combination of horizontal drilling with hydraulic fracturing. The Barnett Shale is a tight formation with very low permeability, which makes recovery of the gas extremely difficult. Horizontal drilling, coupled with hydraulic fracturing (also called "fracing"), allows drillers to break up the rock formation containing the natural gas, thereby increasing permeability, which maximizes the production potential of each well.²⁸

Traditionally, oil and gas wells are drilled vertically. However, a horizontal well begins as a vertical well, then, at a certain desired depth, turns laterally and extends a mile or more horizontally. Additionally, horizontal drilling allows many lateral wells to be drilled from a single vertical well site (or "pad site"). Hydraulic fracturing consists of the high-pressure injection of water, friction reducer, biocides, scale inhibitor, surfactants, and sand, all of which fracture the shale in order to allow the trapped gas to flow freely up the wellbore.²⁹ However, each well may require in excess of three million gallons of fresh water for drilling and completion.³⁰ Additionally, wells can subsequently be re-fractured to stimulate production, which requires even more

ERGY, THE BARNETT SHALE: NOT SO SIMPLE AFTER ALL, http://www.republicenergy.com/Articles/Barnett_Shale/Barnett.aspx.

23. Pablo Lastra, *The Barnett Shale Millionaires*, D MAGAZINE, June 2006.

24. *Id.*

25. R.R. COMM'N OF TEX., NEWARK, EAST (BARNETT SHALE) FIELD (2009), <http://www.rrc.state.tx.us/data/fielddata/barnettshale.pdf> [hereinafter *RRC Update*]. However, other sources put the number at as few as 15 counties and others as many as 21 counties.

26. Lastra, *supra* note 23.

27. *RRC Update*, *supra* note 25.

28. KATE VAN DYKE, FUNDAMENTALS OF PETROLEUM, 162-63 (4th ed. 1997).

29. R.R. COMM'N OF TEX., WATER USE IN THE BARNETT SHALE (2008), www.rrc.state.tx.us/barnettshale/wateruse_barnettshale.php [hereinafter *RRC-Water*].

30. L. PETER GALUSKY, JR., TEXERRA, FORT WORTH BASIN/BARNETT SHALE NATURAL GAS PLAY: AN ASSESSMENT OF PRESENT AND PROJECTED FRESH WATER USE 4 (2007), <http://www.texerra.com/Barnetthydro.pdf>.

water.³¹ The impact of water use in the Barnett Shale is discussed in further detail below.

C. *Current Barnett Shale Statistics*

As of January 8, 2009, there were 10,146 gas wells in the Barnett Shale on file with the Texas Railroad Commission (RRC) and 5,177 permitted locations.³² Additionally, at the conclusion of 2008, there were 947 producing gas wells, 413 permitted wells yet to be drilled, and 38 well permit applications on file with the City of Fort Worth.³³ The average gas well in the Barnett Shale is expected to be commercially viable for twenty to thirty years, with the potential to produce even longer.³⁴ That being said, studies indicate drilling activity in the Barnett Shale will reach its peak in 2010.³⁵

SECTION III. RELEVANT OIL AND GAS LEGAL DOCTRINES

Beginning with Spindletop's gushers in 1901, oil and gas exploration and production has been a major contributor to the Texas economy. Accordingly, Texas laws have generally favored oil and gas operators in their pursuit of hydrocarbons. The following is a brief discussion of the evolution of relevant oil and gas legal doctrines.

A. *The Mineral Estate—The Dominant Estate*

In Texas, as with other ownership-in-place jurisdictions,³⁶ a fee simple absolute interest has the power to sever the mineral and surface estates, creating two distinct estates, each with their own separate bundles of rights.³⁷ When severed, either through the sale, reservation, or the execution of a lease, the mineral estate is dominant over the surface estate.³⁸ Consequently, as dominant estate, the holder of the mineral rights has an implied easement to use the surface in exploration and production of the minerals.³⁹ However, the implied ease-

31. *RRC-Water*, *supra* note 29.

32. *RRC Update*, *supra* note 25.

33. City of Fort Worth, Applications and Permits, <http://www.fortworthgov.org/gaswells/default.aspx?id=50608> (last visited Dec. 31, 2008).

34. BARNETT SHALE ENERGY EDUC. COUNCIL, THE FACTS: DRILLING, <http://www.bseec.org/index.php/content/facts/drilling/> (last visited Dec. 31, 2008).

35. GALUSKY, *supra* note 30, at 8. However, the peak drilling year estimate is subject to, among other things, the volatility of natural gas pricing.

36. JOSEPH SHADE, PRIMER ON THE TEXAS LAW OF OIL AND GAS 9 (4th ed. 2008) (explaining the ownership-in-place theory as one where "the landowner owns all substances . . . which underlie his land.").

37. HOWARD R. WILLIAMS & CHARLES J. MEYERS, OIL AND GAS LAW § 210.6 (LexisNexis 2007).

38. SHADE, *supra* note 36, at 28.

39. *Chartiers Block Coal Co. v. Mellon*, 25 A. 597, 599 (Pa. 1893).

ment was eventually limited to only those uses that may be reasonably necessary to produce oil and gas.⁴⁰

B. *Accommodation Doctrine (Due Regard) Limitation*

Initially, the dominance of the mineral estate was broadly construed and the mineral owner was successful in most litigation, except for instances of negligence causing permanent surface damage.⁴¹ In an attempt to find a more favorable balance between the surface and mineral estates, the Texas Supreme Court adopted the Accommodation Doctrine (also known as Due Regard) in the 1971 case of *Getty Oil Company v. Jones*.⁴² The Accommodation Doctrine has since been further refined to place the burden on the surface owner to establish that “the proposed use of the surface by the mineral owner will substantially impair existing surface uses, . . . the mineral owner has reasonable alternatives, [and] the mineral owner must accommodate the surface owner.”⁴³

Absent the above limitations, express lease clauses, or other regulatory prohibitions, a mineral owner may use as much of the surface as may be reasonably necessary to explore for, and produce, oil and gas.⁴⁴ This includes, but is not limited to, the right of ingress and egress, seismic exploration, drilling, creating roads, installing machinery, re-stimulation of wells, and storage tank placement.⁴⁵ Additionally, and as addressed in more detail hereafter, the mineral owner may also use as much water as may be reasonably necessary to extract the minerals, despite the diminution of water available to the surface.⁴⁶

As can be imagined, many issues may arise between mineral lessees and surface owners, especially when the surface owner has no legal right to receive bonuses and royalties, which is the case in many neighborhoods where the real estate developers retained the mineral rights before selling the lots to builders or directly to the homeowners. Further, there is no implied right to receive compensation for surface damages,⁴⁷ leaving many surface owners who do not want oil and gas operations on their property with no recourse other than the foregoing limitations or municipal regulations.

40. *Mid-Texas Petroleum Co. v. Colcord*, 235 S.W. 710, 715 (Tex. Civ. App.—Fort Worth 1921, no writ).

41. William Jeffrey, *Recent Surface Damage Statutes: Rethinking the Balance of Interests Between Surface and Mineral Owners*, Address to Dallas Bar Association—Energy Law Section CLE 3 (Sept. 11, 2008).

42. *Getty Oil Co. v. Jones*, 470 S.W.2d 618, 621 (Tex. 1971).

43. SHADE, *supra* note 36, at 28.

44. *Id.*

45. *Id.*

46. *Sun Oil Co. v. Whitaker*, 483 S.W.2d 808, 812 (Tex. 1972).

47. SHADE, *supra* note 36, at 28.

C. *Texas Groundwater—The Rule of Capture*

As may now be obvious at this point, water plays a critical role in successful production in the Barnett Shale. In deciding ownership and rights to use groundwater, Texas adopted the common-law rule of capture in the 1904 case of *Houston & Texas Central Railway Company v. East*.⁴⁸ As a case of first impression, the Supreme Court of Texas in *East* chose to apply the rule of capture over the rule of reasonable use when determining ownership of groundwater.⁴⁹ Despite some limitations, the rule of capture essentially allows landowners to take and use as much water as can be “captured” from below their land and, absent malice or willful waste, will not be liable for depleting the source.⁵⁰ It is believed the essence of this rule was first established in the 1843 English case of *Acton v. Blundell*.⁵¹ The court in *Acton* summarized that a surface owner may dig and use all water as he pleases and any drainage to his neighbors falls under *damnum absque injuria*, or an injury without a remedy.⁵²

The rule of capture was first limited as a result of successive droughts which plagued the state in 1910 and 1917. Texas citizens voted to empower the legislature to make laws and codify the common law rule concerning rights to natural resources, including groundwater, through a constitutional amendment.⁵³ The statutory and common law limits placed upon the rule of capture related to groundwater include: (1) using the water for a beneficial purpose;⁵⁴ and (2) there may not be waste,⁵⁵ subsidence,⁵⁶ or malicious injury.⁵⁷ Beyond

48. *Houston & T.C. Ry. Co. v. East*, 98 Tex. 146, 148, 81 S.W. 279, 280 (1904).

49. *See id.*

50. *Sipriano v. Great Spring Waters of Am., Inc.*, 1 S.W.3d 75, 76 (Tex. 1999).

51. *Id.*

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

53. TEX. CONST. art XVI, § 59 (“[T]he preservation and conservation of all such natural resources of the State are each and all hereby declared public rights and duties; and the Legislature shall pass all such laws as may be appropriate thereto.”).

54. TEX. WATER CODE ANN. § 36.001(9) (Vernon 2008) (defining beneficial purpose as “(A) agricultural, gardening, domestic, stock raising, municipal, mining, manufacturing, industrial, commercial, recreational, or pleasure purposes; (B) exploring for, producing, handling, or treating oil, gas, sulphur, or other minerals; or (C) any other purpose that is useful and beneficial to the user”); *Sipriano*, 1 S.W.3d. at 76.

55. TEX. WATER CODE ANN. § 36.001(8) (Vernon 2008) (defining waste as “(A) withdrawal of groundwater from an underground reservoir at a rate and in an amount that causes or threatens to cause intrusion into the reservoir of water unsuitable for agricultural, gardening, domestic, or stock raising purposes; (B) the flowing or producing of wells from a groundwater reservoir if the water produced is not used for a beneficial purpose; (C) escape of ground water from a groundwater reservoir to any other reservoir or geologic strata that does not contain groundwater; (D) pollution or harmful alteration of groundwater in a groundwater reservoir by saltwater or by other deleterious matter admitted from another stratum or from the surface of the ground”).

56. *Friendswood Dev. Co. v. Smith-Sw. Indus., Inc.*, 576 S.W.2d 21, 30 (Tex. 1978) (reasoning that liability may lie where a landowner negligently withdraws groundwater that proximately causes subsidence of the land of another).

these limits, the legislature has also promulgated in the Texas Water Code that rights under the rule of capture may be further limited, or completely diminished, by the establishment of a Groundwater Conservation District (GCD).⁵⁸ A GCD is charged with the preservation and management of groundwater within its jurisdiction.⁵⁹ There are certain exemptions pertaining to groundwater use in oil and gas operations and concerns of GCD oversight within the Barnett Shale region⁶⁰ which are beyond the scope of this paper.⁶¹

D. Surface Water Rights in Texas

Texas recognizes two types of surface water: (1) diffuse surface water; and (2) water in a water course.⁶² Diffuse surface water belongs to the owner of the land upon which it gathers until it passes into a natural water course.⁶³ Once it reaches a water course, Texas law has placed all surface water in a state-owned trust.⁶⁴ Anyone who diverts or takes such water course surface water must have authorization or other water right from the State of Texas through the Texas Commission on Environmental Quality (TCEQ).⁶⁵ Many Texas mu-

57. *City of Corpus Christi v. City of Pleasanton*, 154 Tex. 289, 293, 276 S.W.2d 798, 801 (1955) (holding that groundwater may not be extracted to maliciously injure a neighbor).

58. Brendan Lowrey, *Oil and Water: The Relationship of Groundwater and Oil and Gas Exploration and Production*, Dallas Bar Association—Energy Law Section CLE 6 (Sept. 11, 2008) (discussing the creation of GCD's under TEX. WATER CODE ANN. § 36.002).

59. *Id.* at 8 (describing the purpose of a GCD as defined in TEX. WATER CODE ANN. § 36.015).

60. Michael L. Williams, *Can Oil and Water Mix? The Impact of Water Law on Oil, Gas and Mineral Production*, 68 TEX. B.J. 816, 817–18, Oct. 2005, available at http://www.texasbar.com/Template.cfm?Section=Texas_Bar_Journal1&Template=/ContentManagement/ContentDisplay.cfm&ContentID=12994; see generally Texas Water Development Board, Groundwater Conservation Districts: Confirmed and Pending Confirmation, <http://www.twdb.state.tx.us/mapping/gisdata.asp> (scroll down to the “Administrative” section to find the map) (last visited July 12, 2009).

61. TEX. WATER CODE ANN. § 36.117(b)(2) (Vernon 2008); see also Lowrey, *supra* note 58, at 10. However, oil and gas operations are exempt from GCD permit requirements if a water well is used to supply water for a rig actively engaged in drilling for an oil and gas well permitted by the RRC.

62. *City of San Marcos v. Tex. Comm'n on Envtl. Quality*, 128 S.W.3d 264, 271 (Tex. App.—Austin 2004, pet. denied) (citing *Domel v. City of Georgetown*, 6 S.W.3d 349, 353 (Tex. App.—Austin 1999, pet. denied)).

63. *Id.* at 272.

64. TEX. CONST. art XVI, § 59 (“the preservation and conservation of all such natural resources of the State are each and all hereby declared public rights and duties; and the Legislature shall pass all such laws as may be appropriate thereto.”); TEX. WATER CODE ANN. § 11.021(a) (defining state water as “water of the ordinary flow, underflow, and tides of every flowing river, natural stream, and lake, and of every bay or arm of the Gulf of Mexico, and the storm water, floodwater, and rainwater of every river, natural stream, canyon, ravine, depression, and watershed in the state is property of the state.”).

65. TEX. WATER CODE ANN. §§ 11.022, 11.121 (Vernon 2008).

unicipalities are grantees of such surface water rights and often sell the water for use in oil and gas operations.

E. *Legal Rights to Water Use in Oil and Gas Operations*

As discussed above, the mineral estate is the dominant estate. As such, shortly after adoption of the Accommodation Doctrine, the Texas Supreme Court granted certiorari on a dispute between a surface owner and mineral owner regarding the use of groundwater for a water flood recovery project.⁶⁶ The court held that to make the mineral owner purchase water elsewhere would be a “derogation of the dominant estate,” despite the fact that the surface owner would sustain a substantial loss of water use.⁶⁷ Interpreting the holding, Justice Daniel, in his dissent, wrote “this Court becomes the first to say that the dominant estate is once again so sovereign that it has the implied right to take, consume and destroy the fresh water supply of a surface owner for a secondary water flooding project without compensation.”⁶⁸

In short, as the law currently stands in Texas, the mineral estate may use as much water as reasonably necessary to develop the minerals, subject to the Accommodation Doctrine limitation and express clauses found in the mineral lease.

SECTION IV. POTENTIAL ENVIRONMENTAL IMPACTS OF URBAN DRILLING

Barnett Shale drilling and production has many potential environmental impacts. For example, the drilling and completion process requires an incredibly large amount of fresh water. Tarrant County’s growing population should be very concerned about such significant water usage in a region that is prone to drought. Most of the water used, in addition to previously trapped salt water, will later return to the surface as extremely corrosive waste water that must be disposed of properly. Additionally, the accidental escape of natural gas, the continuous use of compressor stations, and increased truck traffic create the potential for higher levels of air pollution.

A. *Fresh Water Usage*

Barnett Shale gas wells consume a considerable amount of fresh water during drilling and completion phases. It is estimated the average amount of water to complete each horizontal well in the Barnett

66. Sun Oil Co. v. Whitaker, 483 S.W.2d 808, 813 (explaining that a water flood is the injection of water or fluid to repressurize a well and enhance recovery).

67. *Id.* at 812.

68. *Id.* at 819 (Daniel, J., dissenting).

Shale is approximately three million gallons.⁶⁹ Overall, it is estimated groundwater comprises 60% of the total field usage, but county-wide averages of groundwater usage range from about 45% to 90%.⁷⁰ However, surface water is projected to become the source for the majority of fresh water used in the future.⁷¹ The projected increase in surface water use is attributed to more urban drilling, as surface water is the primary source of water for metropolitan areas.⁷² It is also estimated that a total of 16,262 acre-feet of water,⁷³ nearly 5.3 billion gallons, were used in drilling activities within the Barnett Shale in 2007.⁷⁴ Water consumption in 2010, the projected peak year of drilling in the Barnett Shale, is estimated to be 29,167 acre-feet, or over 9.5 billion gallons.⁷⁵

Although the actual water usage data and estimates represent large amounts, Barnett Shale operators consume less fresh water than any other major users within the area.⁷⁶ Barnett Shale operations comprised 0.5% of all water use within the region in 2005, but are projected to grow to 1.7% of total users in 2010.⁷⁷ However, water use projections in oil and gas operations are highly speculative and are subject to the volatility of gas prices, the geologic extent of the Barnett Shale formation, changes in technology, operational changes, and regulatory restrictions.⁷⁸ Therefore, the actual impact on water supplies, especially for a region often plagued with drought, has the potential to be materially greater.

Fresh water management within the Barnett Shale is limited. As discussed above, despite the majority of counties in Texas being subject to regulation by a GCD, none of the counties within the Barnett Shale production area fall under the purview of a GCD.⁷⁹ Accordingly, the rule of capture and the Accommodation Doctrine, with their limitations, are the laws governing the use of groundwater in Barnett Shale operations. Additionally, surface water use is restricted by the TCEQ or permit holders. However, another potential source of water

69. GALUSKY, *supra* note 30, at 4. However, some reports indicate as much as 4.5 million gallons.

70. JAMES BENE ET AL., TEX. WATER DEV. BD., NORTHERN TRINITY/WOODBINE GAM: ASSESSMENT OF GROUNDWATER USE IN THE NORTHERN TRINITY AQUIFER DUE TO URBAN GROWTH AND BARNETT SHALE DEVELOPMENT 14 (2007), http://www.twdb.state.tx.us/RWPG/rpgm_rpts/0604830613_BarnetShale.pdf.

71. GALUSKY, *supra* note 30, at 5.

72. BENE ET AL., *supra* note 70, at 2.

73. GALUSKY, *supra* note 30, at 6.

74. *Id.*

75. *Id.* at 9.

76. *See id.* The largest user is classified as "Municipal," using 80% of all fresh water in the Fort Worth Basin. *Id.* at 9. The next five users are steam electric with 5.7%, irrigation at 5.4%, manufacturing at 3.9%, livestock at 2.3%, and mining at 1.8%. *Id.*

77. *Id.*

78. BENE ET AL., *supra* note 70, at 14–15.

79. Williams, *supra* note 60, at 68.

for oil and gas operators in the Barnett Shale is recycled flow-back and produced waters, which is discussed in further detail below.

B. *Disposal of Waste Water in Barnett Shale Operations*

Oil and gas drilling and production often results in large amounts of waste water, especially within the Barnett Shale. Typically, there are two types of water associated with an oil and gas well: (1) flow-back water and (2) produced water. Flow-back water is water mixed with chemicals that is used in drilling and completing the well, but returns to the surface shortly after fracing.⁸⁰ Produced water is subterranean saltwater sharing a reservoir with oil and gas, but is brought to the surface during the continuous extraction of hydrocarbons, along with the remainder of the frac water.⁸¹

In the case of the Barnett Shale, of the approximate three million gallons of water used in the fracing process, 20% to 30% will return to the surface as flow-back water within two to three weeks after the frac.⁸² This water is highly contaminated with at least 17 different chemicals, which may even include Benzene.⁸³ The exact chemical composition of the water is unknown to the general public, as oil and gas companies consider it a trade secret.⁸⁴ Tests have shown typical flow-back water has a concentration of 20,000 to 30,000 parts per million (PPM) of chlorides and 40,000 to 50,000 PPM of total dissolved solids (TDS).⁸⁵

Produced water is highly concentrated saltwater, also called brine, which comes to the surface from oil and gas producing reservoirs. The chloride concentration of produced water is typically 70,000 PPM, many times saltier than ocean water, and a TDS concentration of 150,000 PPM.⁸⁶ Obviously, flow-back water and produced water are both highly toxic and corrosive. Spills or leaks of either could contaminate groundwater and effectively render soil unsuitable for any type of vegetative growth by creating a barren wasteland on the surface.

80. See LEAGUE OF WOMEN VOTERS OF TARRANT COUNTY, NATURAL GAS DRILLING FACTS AND ISSUES 4 (2007), http://www.lwvtarrantcounty.org/files/drilling_facts_issues.pdf [hereinafter LWV-FACTS].

81. *Id.*

82. Jay Ewing, *Taking a Proactive Approach to Water Recycling in the Barnett Shale*, Address to Fort Worth Business Press Barnett Shale Breakfast Symposium 12 (Feb. 29, 2008), <http://www.barnettshalenews.com/documents/EwingPres.pdf>.

83. Peter Gorman, *Peeling the Barnett Shale Onion*, FORT WORTH WKLY., Sept. 10, 2008, at 12, available at <http://archive.fwweekly.com/content.asp?article=7161> (quoting Jim Popp, a successful litigant opposing an injection well).

84. Clayton, *supra*, note 16.

85. Robert C. Grable, *Saltwater Disposal and Other "Hot Issues" in Urban Drilling*, Address to Fort Worth Business Press Barnett Shale Breakfast Symposium 2 (Feb. 29, 2008), <http://www.barnettshalenews.com/documents/Grable%20Barnett%20Shale%20Symposium%20Powerpoint%20Presentation.pdf>.

86. *See id.*

Additionally, naturally occurring radioactive material (NORM) is often associated with drill cuttings and produced water. The RRC regulates the disposal of any NORM resulting from oil and gas activities.⁸⁷ However, the general population is exposed to some level of NORM through normal, everyday activity, and the concentration level of NORM from Barnett Shale operations is not considered harmful.⁸⁸

Within the Barnett Shale, operators truck the waste water to injection wells, also called saltwater disposal (SWD) wells. However, the waste may reside in lined "pits" at the well site until the disposal trucks are able to pick up the waste water.⁸⁹ Although the pit liner is supposed to be extremely durable, there have been instances of spills and seepage.⁹⁰ Some municipalities, including Fort Worth, have enacted ordinances requiring a closed-loop drilling system, whereby the need for the pits is obviated.⁹¹ Another concern is the danger associated with trucking waste water through busy highways and residential streets, increasing the possibilities for accidents and spills,⁹² as a single well may require over 100 water-haulers to bring fresh water and remove waste during the frac stimulation process.⁹³

C. Saltwater Disposal Wells

As discussed, operators may dispose of waste water in injection wells, also called salt water disposal wells. The RRC has exclusive jurisdiction over the issuance of permits and the regulation of injection wells used in conjunction with oil and gas operations.⁹⁴ The RRC regulates injection wells according to their intended purposes: waste disposal into non-productive zones; secondary recovery into productive zones; or storage of hydrocarbons underground.⁹⁵ There are currently 96,684 injection wells "on the books" in Texas, while only

87. 16 TEX. ADMIN. CODE § 4.614 (2009) (Tex. R.R. Comm'n, Authorized Disposal Methods), available at [http://info.sos.state.tx.us/pls/pub/readtac\\$ext.viewtac](http://info.sos.state.tx.us/pls/pub/readtac$ext.viewtac).

88. See R.R. COMM'N OF TEX., NORM—NATURALLY OCCURRING RADIOACTIVE MATERIAL, <http://www.rrc.state.tx.us/environmental/publications/norm/index.php> (last visited June 18, 2009).

89. Gorman, *supra* note 83, at 13.

90. *Id.*

91. FORT WORTH, TEX., CODE ch. 15, art. II § 15-42(3) (2009), available at http://www.municode.com/resources/gateway.asp?pid=10096&ekmense=21_submenu_0_btnlink.

92. LEAGUE OF WOMEN VOTERS OF TARRANT COUNTY, GAS DRILLING WASTE-WATER DISPOSAL 2, 4 (2008), <http://www.lwvtarrantcounty.org/publications.html> [hereinafter *LWV-Waste*].

93. LWV-FACTS, *supra* note 80.

94. TEX. WATER CODE ANN. §§ 27.031, 27.002(6) (Vernon 2008).

95. John Tintera, *The Regulatory Framework of Saltwater Disposal 2008*, Address to Fort Worth Business Press Barnett Shale Breakfast Symposium 19 (Feb. 29, 2008), <http://www.barnettshalenews.com/documents/Tinterra%20SW%20FtWorth4.pdf>.

50,650 have been properly permitted.⁹⁶ Of the total permitted injection wells, 38,000 are for secondary recovery and 11,700 are for waste disposal.⁹⁷ Within the Barnett Shale area, there are 152 commercial SWD wells.⁹⁸ A commercial SWD well is defined as one that operates to dispose of waste for third parties.⁹⁹ The scope of this section focuses solely on disposal wells, private or commercial, for waste injection into non-productive zones, which comprises the majority of the SWD wells in the Barnett Shale production area.

Per the mineral estate's right to use the surface, SWD wells are typically allowed on leaseholds as being reasonably necessary for the production of oil and gas, but only for the disposal of waste from that particular leasehold.¹⁰⁰ However, SWD wells can be further limited by express lease clauses and municipal ordinances. For example, Fort Worth prohibits commercial SWD wells and has a long standing moratorium on the issuance of new SWD well permits within the city limits.¹⁰¹ Due to these limitations, most commercial SWD wells used for disposal of urban drilling waste are operated beyond city limits.

The application process requires a SWD well permit applicant to give notice and allow each "affected person" the opportunity to protest.¹⁰² An affected person is defined as "a person who has suffered or will suffer actual injury or economic damage other than that as a member of the general public," for example the owner of the surface tract upon which the well will be located, operators of wells within one half mile, and the county clerk or other appropriate official.¹⁰³ Commercial disposal well applicants must also give notice to the owner of record of each adjoining surface tract.¹⁰⁴

In applying for a SWD well permit, the applicant must prove the following: "(1) the injection well is in the public interest; (2) the use will not endanger or injure any oil, gas, or other mineral formation; (3) proper safeguards will protect surface and groundwater; and (4)

96. *Id.* at 6. The RRC is aware many injection wells have not been properly permitted over the years.

97. *Id.* at 20. The remaining wells are for hydrocarbon storage (800) and brine mining and other miscellaneous (150).

98. *Id.* at 43.

99. 16 TEX. ADMIN. CODE § 3.9(4), 3.46(b)(2) (2009) (Tex. R.R. Comm'n, Disposal Wells, Fluid Injection into Productive Reservoirs), available at [http://info.sos.state.tx.us/pls/pub/readtac\\$ext.viewtac](http://info.sos.state.tx.us/pls/pub/readtac$ext.viewtac).

100. TDC Eng'g, Inc. v. Dunlap, 686 S.W.2d 346, 349 (Tex. App.—Eastland 1985, writ ref'd n.r.e.).

101. FORT WORTH, TEX., CODE ch. 15, art. II § 15-42(A)(29) (2009), available at http://www.municode.com/resources/gateway.asp?pid=10096&ekmense1=21_submenu_0_btnlink; Mike Lee, *Saltwater from 31 Drilling Sites Will Be Piped to East Fort Worth Well*, FORT WORTH STAR-TELEGRAM, Oct. 15, 2008 [hereinafter *Lee-Saltwater*].

102. 16 TEX. ADMIN. CODE §§ 3.9(5)(E)(ii), 3.46(a)(5)(B).

103. *Id.* §§ 3.9(5)(A), 3.46(c)(1).

104. *Id.* §§ 3.9(5)(B), 3.46(c)(2).

the applicant has satisfied the showing of financial responsibility.”¹⁰⁵ Historically, the public interest requirement has been liberally construed by the RRC. The RRC has often held increased oil and gas production can be considered as a factor, or even the only factor, in the public interest determination.¹⁰⁶ However, the Austin Court of Appeals, in reviewing a contested permit application for a Barnett Shale SWD well, recently held the RRC must consider other factors to determine public interest.¹⁰⁷ In *Texas Citizens for a Safe Future and Clean Water v. Railroad Commission of Texas*, the appellate court determined the RRC must also consider factors such as public safety.¹⁰⁸

The RRC has also implemented stringent requirements for the drilling and operation of SWD wells. For example, SWD wells must use steel casing and cement through all zones above the disposal zone to prevent possible contamination of groundwater.¹⁰⁹ Additionally, the SWD wells must be drilled in to the deep Ellenberger (also spelled Ellenburger), a porous limestone formation saturated with extremely salty water, which is well below any sources of fresh water. Also, the RRC may enter public or private property to inspect injection wells to ensure compliance with applicable rules.¹¹⁰

Recently, two instances of SWD well leaks were reported in Tarrant County's western neighbor, Parker County. In October 2008, a SWD well in Aledo was shut down due to underground leaks and above-ground spills of waste water.¹¹¹ Also, in nearby Brock, a leak in a waste water transmission pipe, which ran beneath two plant farms, is suspected of killing surface vegetation and possible groundwater contamination.¹¹² Some believe the transmission pipe used to transport the waste water directly from the gas well, instead of trucks, became corroded from the brine and subsequently ruptured.¹¹³ Residents are duly concerned about the difficulty of locating leaky pipes buried be-

105. TEX. WATER CODE ANN. § 27.051(b) (Vernon 2008).

106. *Grimes v. State*, No. 03-04-00154-CV, 2005 WL 2043842 (Tex. App.—Austin, Aug. 26, 2005, no pet.) (mem. op.). *But see* *Tex. Citizens for a Safe Future and Clean Water v. R.R. Comm'n of Tex.*, 254 S.W.3d 492 (Tex. App.—Austin 2007, pet. filed) (holding that the Commission must use factors other than just increased oil and gas production to determine public interest).

107. *Tex. Citizens for a Safe Future and Clean Water v. R.R. Comm'n of Tex.*, 254 S.W.3d 492 (Tex. App.—Austin 2007, pet. filed).

108. *Id.* at 503 (stating public safety concerns can include traffic, dangers to school children nearby, waste hauling, among other factors).

109. 16 TEX. ADMIN. CODE § 3.9(8) (2009) (Tex. R.R. Comm'n, Disposal Wells), available at [http://info.sos.state.tx.us/pls/pub/readtac\\$ext.viewtac](http://info.sos.state.tx.us/pls/pub/readtac$ext.viewtac).

110. TEX. WATER CODE ANN. § 27.071.

111. Mike Lee, *Saltwater Disposal Well Shut Down for Spills, Leaks*, FORT WORTH STAR-TELEGRAM, Oct. 31, 2008, at B5, available at http://startelegram.typepad.com/barnett_shale/files/saltwater_disposal_well_shut_down_for_spills_leaks.htm.

112. Chelsea L. McGowan, *Brock Residents Demand Testing on Well Water*, WEATHERFORD DEMOCRAT, Nov. 6, 2008, available at http://www.weatherforddemocrat.com/local/local_story_311105531.html?keyword=topstory.

113. *Id.*

neath the surface.¹¹⁴ In addition to the corrosiveness, another safety concern involves the flammability of some waste byproducts. For example, explosions are possible due to the ignition of natural gas condensate, also known as “wet gas,” a common byproduct in oil and gas drilling and disposal operations.¹¹⁵

D. Regulation of Groundwater Pollution by Oil and Gas Operations

The potential for water pollution is incredibly high in oil and gas operations. For example, crude oil, flow-back water, drilling fluids, and treatment chemicals are just a few of the possible pollutants regularly found at a well site.¹¹⁶ Also, a considerable amount of waste water can come to the surface through drilling operations, which could lead to groundwater contamination.

Federal regulation of water pollution is quite pervasive. Federal water pollution laws include the Clean Water Act,¹¹⁷ the Oil Pollution Act (OPA),¹¹⁸ the Safe Water Drinking Act (SWDA),¹¹⁹ the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA),¹²⁰ and the Resources Conservation and Recovery Act (RCRA).¹²¹ In general, the SWDA is the only federal law relevant to groundwater pollution in a municipal context.¹²² Under the SWDA, the TCEQ is charged with the regulation of water pollution in Texas,¹²³ but pollution abatement, prevention, and remediation related to oil- and gas-related activities fall within the jurisdiction of the RRC.¹²⁴

114. *See id.*

115. *Hazard Communication in the 21st Century Workplace: Hearing Before the Subcomm. on Employment, Safety, and Training of the S. Comm. on Health, Education, Labor, and Pensions*, 108th Cong. 92 (2004) (statement of Carolyn W. Merritt, Chairman and Chief Executive Officer, U.S. Chemical Safety and Hazard Investigation Board), available at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=108_senate_hearings&docid=f:92926.pdf. An explosion occurred at a Houston-area SWD well when two trucks collided, igniting the natural gas condensate. *Id.*

116. Lowrey, *supra* note 58, at 12.

117. 33 U.S.C. § 1251 (2006).

118. 33 U.S.C. § 2701 (2001).

119. 42 U.S.C. § 300(f) (2006).

120. 42 U.S.C. § 9601 (2005).

121. 42 U.S.C. § 6901 (2004).

122. Lowrey, *supra* note 58, at 13.

123. TEX. WATER CODE ANN. § 26.121 (Vernon 2008).

124. TEX. NAT. RES. CODE ANN. § 91.101 (Vernon 2008) (memorandum of understanding between the RRC and TCEQ to clarify RRC’s jurisdiction over oil and gas wastes); TEX. WATER CODE ANN. § 26.131(b) (“The Railroad Commission of Texas may issue permits for the discharge of waste resulting from these activities, and the discharge of waste into water in this state resulting from these activities shall meet the water quality standards established by the commission”); TEX. HEALTH & SAFETY CODE ANN. § 361.003(11)(B)(i)–(iii) (Vernon 2008) (excluding oil and gas wastes from the Solid Waste Disposal Act).

The RRC enforces various standards and procedures for reporting, clean-up, and penalties associated with groundwater pollution from oil and gas activities.¹²⁵ Groundwater pollution is broadly defined in the Texas Water Code as:

Pollution of surface or subsurface water—The alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any . . . water in the state that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property, or to public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purposes.¹²⁶

The statute regulating potential incidents of groundwater pollution from oil and gas waste requires immediate notification to the appropriate RRC field office.¹²⁷ The generator or transporter must then take the “appropriate immediate action to protect human health and the environment.”¹²⁸ The responsible party must then recover as much of the waste by physical means as soon as possible after the spill.¹²⁹ The responsible party is then required to return the spill site to prior background levels or, as may be required or approved by the RRC, to a level that “no longer presents a hazard to human health or the environment, taking into consideration the geology and hydrology of the discharge site, the nature and quantity of the oil and gas waste discharged, and the present and anticipated use of the discharge site.”¹³⁰

Although the regulation of potential groundwater pollution from oil and gas waste may appear effective on its face, practical application may tell a different story. The RRC, despite the large amount of drilling activity in the Barnett Shale, did not have an office in Fort Worth, or even Tarrant County, until September 1, 2008.¹³¹ Prior to the opening of the Fort Worth office, the Barnett Shale activity in Fort Worth was under the jurisdiction of the RRC's district office in Kilgore, Texas.¹³² Kilgore is approximately 156 miles from Fort Worth.¹³³ Hopefully, the proximity of RRC inspectors to a core area of Barnett

125. Lowrey, *supra* note 58, at 15–17.

126. 16 TEX. ADMIN. CODE § 3.8(28) (2009); 30 TEX. ADMIN. CODE § 327.2(14) (2009).

127. 16 TEX. ADMIN. CODE § 3.98(x)(1)(A).

128. *Id.* § 3.98(x)(2)(A).

129. *Id.* § 3.98(x)(3)(A).

130. *Id.* § 3.98(x)(3)(B).

131. *Texas Railroad Commission to Open Fort Worth Office*, FORT WORTH BASIN OIL & GAS MAGAZINE, Sept. 2008, available at <http://www.fwbog.com/index.php?page=article&article=37>.

132. *Id.*

133. Google Maps, http://maps.google.com/maps?sourceid=navclient&rlz=1T4ADBR_enUS228US228&q=fort+worth,+tx&um=1&ie=UTF-8&split=0&gl=us&ei=4wWTSeYFNYTUMau14PEL&sa=X&oi=geocode_result&resnum=1&ct=image (last visited July 14, 2009).

Shale production will provide increased regulatory oversight and improved response time to environmental concerns.

E. *Recycling Waste Water in the Barnett Shale*

With the significant amount of water necessary for completion, some operators have explored the possibility of recycling drilling waste water. The waste water cannot be reused prior to recycling due to the extreme corrosiveness of the contaminated water, which could affect the productivity of the gas formation.¹³⁴ Additionally, the corrosiveness could possibly affect the integrity of the steel pipe and other equipment which may in turn lead to increased risk of leaks.

To date, many of the recycling operations have been halted, or at least limited in scope. The economic viability, inefficiency, and limited amounts of recycling capacity have all been cited as reasons affecting the recycling movement.¹³⁵ For example, it is much less expensive to simply dispose of waste water in a SWD well than spend the capital necessary to establish a recycling program.

F. *Increased Air Pollution Resulting from the Barnett Shale Production*

As mentioned above, natural gas, made up of primarily methane, is a fossil fuel that is environmentally friendly when compared to coal and other hydrocarbons. However, the exploration and production of natural gas may have some harmful effects on air quality. The potential for increased air pollution arises through the escape of natural gas as part of the drilling process, emissions from compressor stations, and elevated truck traffic.

Oil and natural gas operations account for approximately 24% of the domestic, man-made methane emissions, or 2% of all greenhouse gases.¹³⁶ The methane emissions result from normal operations through intentional venting,¹³⁷ continuously running compressors, and unintentional leaks (also known as “fugitive emissions”) in almost any part of the infrastructure.¹³⁸ Additionally, large trucks and equipment are used in every stage of the drilling and completion process, leading to increased exhaust emissions.

134. GALUSKY, *supra* note 30, at 14.

135. LWV-Waste, *supra* note 92.

136. U.S. ENVTL. PROT. AGENCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2006, (2008), available at http://www.epa.gov/climatechange/emissions/downloads/08_CR.pdf.

137. Venting is the intentional release of gas to test quality or release impurities. See HOWARD R. WILLIAMS & CHARLES J. MEYERS, MANUAL OF OIL AND GAS TERMS 1123 (13th ed. 2006).

138. U.S. Environmental Protection Agency, Natural Gas STAR Program, <http://www.epa.gov/gasstar/basic-information/index.html#sources> (last visited on July 14, 2009).

SECTION V. MUNICIPAL DRILLING ORDINANCES

A. *Authority to Enact Municipal Drilling Ordinances*

Although the RRC regulates most of the oil and gas activity in Texas, the RRC defers to home rule municipalities which enact drilling ordinances as an exercise of police power.¹³⁹ A home rule city is defined as a municipality with more than 5,000 residents, which may adopt a charter, pass ordinances, and levy taxes.¹⁴⁰ Home rule authority actually grants a municipality the power of self-government, and its laws will be considered valid unless it conflicts with, is inconsistent with, or is expressly preempted by federal or state law.¹⁴¹ Additionally, a municipality may expand the reach of its police powers beyond its physical boundaries through the exercise of extraterritorial jurisdiction.¹⁴² Extraterritorial jurisdiction allows for the municipality to enact ordinances for contiguous, unincorporated areas up to five miles outside its boundaries.¹⁴³ Accordingly, many of the home rule cities within the active areas of Barnett Shale production have established drilling ordinances, ranging from the rather lax to the extremely stringent.

As Fort Worth, with over 650,000 residents,¹⁴⁴ is the largest city within the core area of the Barnett Shale, and possibly has the greatest potential impact from the Barnett Shale activity, only the Fort Worth Drilling Ordinance will be critically analyzed in this paper.

B. *The Fort Worth Drilling Ordinance*

In response to increased urban drilling, Fort Worth's 2001 drilling ordinance was first amended in 2006.¹⁴⁵ However, due to citizen complaints, the city council appointed an eighteen-member task force to update and amend the 2006 ordinance.¹⁴⁶ The current ordinance was adopted in December 2008, and took effect January 1, 2009. The 2008 amended ordinance is quite extensive, but only sections relevant to this paper will be addressed. As with many other Barnett Shale drilling ordinances, Fort Worth regulates, among other things, the distance a well may be drilled from existing structures, noise levels, drilling of

139. *Unger v. State*, 629 S.W.2d 811, 812–13 (Tex. App.—Fort Worth 1982, writ ref'd) (adopting *Tysco Oil Co. v. R.R. Comm'n of Tex.*, 12 F. Supp. 202, 203 (S.D. Tex. 1935) and *Klepak v. Humble Oil & Ref. Co.*, 177 S.W.2d 215, 218 (Tex. Civ. App.—Galveston 1944, writ ref'd w.o.m.)).

140. TEX. CONST. art. XI, § 5; TEX. LOC. GOV'T CODE ANN. § 5.004 (Vernon 2008).

141. TEX. LOC. GOV'T CODE ANN. § 51.004(b)(4).

142. TEX. LOC. GOV'T CODE ANN. § 42.001 (Vernon 2008).

143. TEX. LOC. GOV'T CODE ANN. § 42.021(a) (Vernon 2008).

144. U.S. Census Bureau, *supra* note 3.

145. FORT WORTH, TEX., CODE ch. 15, art. II (2009), available at <http://www.municode.com/resources/gateway.asp?pid=10096>.

146. Will Brackett, *New Task Force Set to Study Barnett Gas Well Ordinance*, FORT WORTH BUS. PRESS, Feb. 15, 2008, available at <http://www.fwbusinesspress.com/display.php?id=7049>.

fresh water wells, compressor stations, landscaping and screening, drilling within a floodplain, saltwater disposal, measures for controlling air and water quality, road repairs, and an appointed gas inspector to enforce the ordinance. Below is an analysis of the pertinent sections of the Fort Worth Drilling Ordinance:

i. Gas Well Permit Applications and Setbacks

The 2006 ordinance classified wells as either (i) high impact, (ii) urban, or (iii) rural.¹⁴⁷ The 2008 ordinance did away with the foregoing nomenclature and classified wells based upon their distance from existing structures. The revised ordinance states “a well permit shall not be issued for any well to be drilled within six hundred (600) feet of a Residence, Religious Institution, Hospital Building, School, or Public Park.”¹⁴⁸ However, a permit may be granted for such a well if either approved by the City Council after notice and a public hearing, or by obtaining written consent from all “Protected Use” property owners.¹⁴⁹ The measurement of 600 feet is made as a straight line from the proposed wellbore to the closest exterior point of a building, or the property line of a school or public park.¹⁵⁰ However, if approved or waived, a well may be drilled as close as 300 feet from a public building, or 200 feet from a habitable structure.¹⁵¹

Permits for gas wells beyond the 600-foot radius require several forms of notice, but no specific approval process or waivers.¹⁵² First, prior to filing a permit application, the operator must publish notice in the local newspaper for at least ten consecutive days.¹⁵³ Second, the operator must conspicuously post signs at the proposed well site at least ten days prior to submitting an application.¹⁵⁴ Finally, after filing an application, the city, at the expense of the operator, will notify, via U.S. mail, surface owners within 1,000 feet of the proposed well.¹⁵⁵

In addition, every application for a gas well permit requires the operator to adhere to major things such as: (1) a plat of all structures and improvements within 600 feet and a list of the owners of record; (2) a description of the water source to be used; (3) RRC permit information; a road maintenance plan; (4) an EPA Stormwater Pollution Pre-

147. A Rural Well Permit was required for any well on an open space of not less than 25 acres, and no operations will be conducted within residences, religious institutions, public buildings, hospital buildings, schools, and public parks. FORT WORTH, TEX., CODE ch. 15, art. II, § 15-36(III). Urban Well Permits are required for wells not High Impact or Urban. *Id.* §§ 15-36(II).

148. *Id.* § 15-36(A).

149. *Id.* § 15-36(A)(1)–(2) (“Protected Uses” are residences, religious institutions, public buildings, hospital buildings, schools, and public parks).

150. *Id.* § 15-36(A).

151. *Id.* § 15-42(C)(1)(d)–(e).

152. *Id.* § 15-36(E)(1)–(3).

153. *Id.* § 15-36(E)(2).

154. *Id.* § 15-36(E)(3).

155. *Id.* § 15-36(E)(1).

vention Plan; (5) a noise management plan; (6) a surface reclamation plan; (7) a TCEQ determination of groundwater depth; and (8) a showing of financial responsibility.¹⁵⁶ The ordinance also requires the use of a closed loop mud system, which internally contains the waste products generated during the drilling and completion process, rather than using open “mud pits.”¹⁵⁷ However, lined pits may be used for wells located in open areas larger than twenty-five acres, provided no operations are conducted within 1,000 feet of a protected use.¹⁵⁸ In addition, the ordinance dictates that large trucks must use truck routes or commercial delivery routes “wherever capable of being used.”¹⁵⁹ Work hours at the site are not restricted for drilling, but hydraulic fracturing, “making location,” workover operations, and deliveries all must be conducted during daylight hours, Monday through Saturday.¹⁶⁰

Until October 7, 2008, the Fort Worth City Council had approved all applications for gas well permits located within 600 feet of protected uses.¹⁶¹ However, Chesapeake Energy petitioned the Council for a permit to drill within 300 feet of homes, and the council unanimously rejected the application.¹⁶² Neighborhood groups, who showed up *en masse* at the council meeting, were opposed to the permit because of the well's proximity to homes, safety concerns, noise emissions, and air pollution.¹⁶³ Chesapeake attempted to alleviate concerns by offering numerous pledges to the neighborhood groups such as: (i) sound walls to reduce noise; (ii) trucks routed away from the residential streets; (iii) a gas pipeline easement running along rail lines to avoid neighborhood eminent domain disputes; and (iv) the construction of a wall and landscaping to shield graffiti-decorated railcars from the neighborhood's view.¹⁶⁴ Chesapeake also claimed the selected location was the only viable option for drilling and, without permit approval, the resident lessors would not be able to monetize their minerals.¹⁶⁵

Beyond the City Council, Chesapeake's only remaining option is to sue the city under a constitutional takings claim, which is discussed in more detail below. It can only be assumed the residents prefer to exclude the disturbances associated with drilling rather than receive po-

156. *Id.* § 15-35(C)(1)-(28).

157. *Id.* § 15-42(A)(3).

158. *Id.*

159. *Id.* § 15-42(A)(37).

160. *Id.* § 15-42(A)(16), (41).

161. John-Laurent Tronche, *City Council Rejects Chesapeake's Request for Eighth Avenue Drill Site*, FORT WORTH BUS. PRESS, Oct. 7, 2008, available at <http://www.fwbusinesspress.com/display.php?id=8601>.

162. *Id.*

163. *Id.*

164. *Id.*

165. *Id.*

tential royalties associated with Chesapeake's production of their minerals.

Although the well setback and proximity to protected use portions of the ordinance appear adequate on its face, it was not until the Chesapeake permit denial that they actually served a purpose. With the two options, (i) either council approval or (ii) resident consent, wells located near protected uses will not be drilled unless amenable to residents. However, the Council approved all permits, despite the inability of the oil and gas company to acquire resident consent. The Council should give more weight to the desires of residents, but also consider the concessions made by the oil and gas operator in reviewing high impact permits.

ii. Noise Level Restrictions

The drilling and completion process for a single well creates a large amount of noise. Prior to the drilling rig coming on site, the operator must "make location," or use bulldozers and other heavy equipment to clear and level an area that is approximately two to four acres.¹⁶⁶ The drilling rig is usually hauled in by large semi trucks. Typically, while a drilling rig is on site, the drilling process will continue twenty-four hours a day for approximately three weeks.¹⁶⁷ Once erected, the drilling rig's lighted mast may be 120 to 150 feet in height, emitting noise from the draw works and brakes.¹⁶⁸ The actual drilling power is supplied by large diesel, or diesel and electric, engines which are able to turn the drilling bit and lengths of pipe clockwise through thousands of feet of rock formations.¹⁶⁹ Additional noise is created by fracturing and flowback operations, plus the associated traffic. In all, almost every aspect of the drilling and completion process creates a tremendous amount of noise.

However, the oil and gas industry has made considerable achievements in reducing the noise levels of drilling equipment. Due to the noise limits imposed by the ordinance, operators have used many sound abatement techniques to achieve satisfactory levels, including acoustical blankets, sound barrier walls and low-noise emission engines and mufflers.¹⁷⁰ These measures allow drilling rigs to generate noise levels below the limits prescribed by the ordinance.

The ordinance restricts drilling and equipment noise levels based upon the time of day and the ambient noise levels at the drillsite.

166. FORT WORTH LEAGUE OF NEIGHBORHOODS, GAS DRILLING 101, <http://www.fwlna.org/Gas%20Wells/FWLNA%20Gas%20Well%20Driling101.pdf>.

167. AskChesapeake.com, <http://www.askchesapeake.com/EN-US/Drilling/Pages/default.aspx#drilling101> (last visited July 17, 2009).

168. VAN DYKE, *supra* note 28, at 105.

169. JOHN ORBAN, III, MONEY IN THE GROUND 68 (4th ed. 1997).

170. FORT WORTH, TEX., CODE ch. 15, art. II, § 15-42(B)(7) (2009), available at <http://www.municode.com/resources/gateway.asp?pid=10096>.

Prior to obtaining a gas well permit, an operator must submit a noise-management plan to the gas inspector detailing how equipment will be used in the drilling, completion, transportation, and production of the well.¹⁷¹ The noise-management plan must include: (1) an identification of the noise impacts; (2) documentation of the Ambient Noise Level prior to any construction or installation of equipment; and (3) details of noise impact mitigation (which shall consider the nature of the location, the prevailing weather and wind patterns, vegetative cover, and the topography of the site).¹⁷² The Ambient Noise Level analog is defined as “the all encompassing noise level associated with a given environment, being a composite of sounds from all sources at the location, constituting the normal or existing level of environmental noise at a given location.”¹⁷³ The noise created from drilling, drilling equipment, or flowback operations, as measured from a protected use property line or closest protected use structure, may not exceed the Ambient Noise Level by more than five (5) decibels during the day or three (3) decibels at night.¹⁷⁴ Additionally, an operator is allowed to reach a maximum noise level of ten (10) decibels during fracturing operations.¹⁷⁵ The ordinance also allows for short durations in which operations may exceed the Ambient Noise Level.¹⁷⁶ However, the well operator is responsible for establishing and reporting the Ambient Noise Level,¹⁷⁷ which grants a lot of discretion on the part of the operator.

Between the advancements made by the industry and a fairly restrictive noise ordinance, the law should be effective as is. However, the city should assume responsibility for determining Ambient Noise Levels, not the well operator. As stated above, municipalities generate considerable revenue from urban production and should be able to spend additional capital to enforce their ordinances. It would not take too much to ensure operators' compliance with the noise ordinance through random noise assessments at drilling sites.

iii. Compressor Stations

Lift compressors, which are located near the wellhead, are required to separate fluids and lift the gas from the well. Line compressors, which are often located where they can access several pipelines, are

171. *Id.* § 15-42(B)(1).

172. *Id.* § 15-42(B)(1)(a)–(c).

173. FORT WORTH, TEX., CODE ch. 15, art. II, § 15-31(B) (2009), available at <http://www.municode.com/resources/gateway.asp?pid=10096&sid=43>.

174. *Id.* § 15-42(B)(2)(a).

175. *Id.* § 15-42(B)(2)(b) (fracturing operations are only allowed during daylight hours).

176. *Id.* § 15-42(B)(4).

177. *Id.* § 15-42(B)(3) (the operator must monitor the Ambient Noise Level for a continuous 72 hours, which must include a 24 hour reading on either a Saturday or Sunday).

used to pressurize the gas and send it to a larger pipeline. Either type of compressor can often be a loud and unsightly structure.

There is currently one lawsuit related to excessive noise from a compressor station.¹⁷⁸ The lawsuit, filed in a Tarrant County district court on September 10, 2008, alleges the excessive noise emitted from the compressor station created a nuisance.¹⁷⁹ Additionally, a Free-stone County resident, who lives approximately one mile from eleven gas compressors, claims to be suffering from a vibroacoustic disease (VAD).¹⁸⁰ VAD is caused by excessive exposure to low-frequency noises, such as those emitted from compressor stations.¹⁸¹

Other than noise restrictions and the 100-foot equipment setback,¹⁸² the 2001 and 2006 drilling ordinances did not fully address, or almost completely ignored, the noise issues caused by compressors. However, the 2008 ordinance dedicated an entire section to the regulation of compressor station noise emissions.¹⁸³ The new provision stipulates different maximum noise levels according to the zoning classification of the location, allowing higher noise levels for industrial and commercial than residential.¹⁸⁴ Except in residential zoning areas, operators may attempt to demonstrate the actual ambient level is higher than the maximums proscribed in order to establish a new ambient level for the location.¹⁸⁵ The operator is then prohibited from exceeding the ambient levels by more than the allowances given to drilling operations described above.¹⁸⁶

Lift compressors are allowed in all zoning districts, but must be located on the drilling pad site.¹⁸⁷ Lift compressors must also have a minimum setback of 300 feet from the nearest protected use.¹⁸⁸ The area around lift compressors must also comply with a fencing requirement,¹⁸⁹ a tree planting requirement,¹⁹⁰ and a “screening” require-

178. Marice Richter, *Fort Worth Man Sues Chesapeake Over Gas Drilling Noise*, THE DALLAS MORNING NEWS, Sept. 11, 2008, available at http://www.dallasnews.com/sharedcontent/dws/news/localnews/stories/DN-noisesuit_11met.ART0.Central.Edition1.26eac3a.html.

179. *Id.*

180. Peter Gorman, *Un-Well: Concerns Are Mounting Over Health Effects of Gas Drilling*, FORT WORTH WEEKLY, Oct. 29, 2008, available at <http://archive.fweekly.com/content.asp?article=7262>.

181. *Id.*

182. § 15-36(I)(E) (“requiring at least a 100 foot setback for any tank batteries, well facilities and equipment”).

183. *Id.* § 15-42(D).

184. *Id.* § 15-42(D)(1)(a).

185. *Id.* § 15-42(D)(1)(b).

186. *Id.* § 15-42(D)(1)(d) (not to exceed 5 decibels during the day, 3 decibels at night).

187. *Id.* § 15-42(D)(2)(a).

188. *Id.* § 15-42(D)(2)(c).

189. *Id.* § 15-42(D)(2)(d).

190. *Id.* § 15-42(D)(2)(e).

ment for compressors within 600 feet of a protected use.¹⁹¹ The ordinance also requires the use of secondary containment devices on all compressors,¹⁹² and exhaust mufflers to suppress noxious gas discharges and noise.¹⁹³

The larger line compressor locations are limited to only agricultural and various industrial zoning areas.¹⁹⁴ Otherwise, line compressors are restricted similarly to lift compressors as described above, but more lenient in some ways due to the zoning class of the location.¹⁹⁵

Finally, the City Council addressed many of the citizens' concerns over compressor stations. The necessary compressors were almost neglected in the 2001 and 2006 ordinances, but were fairly well-accounted for in the 2008 amended ordinance. It likely took numerous citizen complaints to get the City Council's attention on the loud, unsightly equipment that remains long after the drilling rig is dismantled and moved to another location.

iv. Salt Water Disposal

The ordinance prohibits commercial salt water disposal wells from being located within the City of Fort Worth.¹⁹⁶ The City may issue permits for private salt water disposal wells that meet certain specifications.¹⁹⁷ However, in 2006, the City placed a moratorium on the issuance of permits for any salt water disposal well within Fort Worth.¹⁹⁸

Chesapeake Energy, who operates a salt water disposal well near downtown Fort Worth, has reached an agreement allowing the company to pipe waste water from thirty-one gas wells to the one disposal well within the City.¹⁹⁹ The City, in granting Chesapeake permission to pipe the waste water, will be allowed to explore various recycling methods for future utility revenue generation by attempting to recycle a portion of the waste water.²⁰⁰

Waste water disposal poses multiple problems in urban drilling. Waste water will be produced, and it must be disposed of accordingly. The options are trucking or piping waste to rural disposal wells, or allowing a very regulated waste water disposal program within the city

191. *Id.* § 15-42(D)(2)(f) (landscaping, berming, structures, walls constructed of metal, masonry, or other structurally sound material such that it significantly screens the equipment and painted in a soft earth tone).

192. *Id.* § 15-42(D)(2)(g).

193. *Id.* § 15-42(D)(2)(h).

194. *Id.* § 15-42(D)(3)(a) (industrial classifications include light, medium and heavy).

195. *Id.* § 15-42(D)(3)(b)-(c).

196. *Id.* § 15-42(A)(29).

197. *Id.* § 15-42(A)(29).

198. *Lee-Saltwater*, *supra* note 101.

199. *Id.*

200. *Id.*

limits. The City Council's plan to work with Chesapeake will be a good indicator of the efficacy of urban piping and disposal of waste water. Alternatively, Fort Worth will be faced with the continuous trucking of the waste water through residential streets to rural SWD wells.

v. Gas Drilling Review Committee

Another new addition for the 2008 amended ordinance is the establishment of a "Gas Drilling Review Committee (GDRC)."²⁰¹ The GDRC is tasked with the due diligence review of all gas well applications requiring a City Council waiver.²⁰² The GDRC, chaired by the Assistant Director of Planning and Development, is composed of various city representatives from Transportation and Public Works, Gas Inspectors, Water, Planning and Development, Law, Community Relations, and Parks and Community Services Departments.²⁰³ The GDRC will hold hearings where the operator, city staff, and residents present the case for or against the proposed well site.²⁰⁴ The GDRC shall then prepare a report and recommendation for the City Council, and post it on the Fort Worth webpage for review prior to any waiver meetings.²⁰⁵

The addition of the GDRC created another level of protection for residents. It provides an overview for all parties to consider the implications of a proposed urban drilling site. Preemptive citizen complaints can allow an operator to make concessions or modifications in order to obtain resident waivers, or have a better chance of City Council approval, while at the same time addressing citizen concerns. Previously, a forum was unavailable for all sides to attempt to balance all interests.

vi. Summary of Fort Worth's Drilling Ordinance

Although the Fort Worth ordinance does deal with many of the problems related to urban drilling, the City Council needs to address additional issues in order to better serve its citizens. Increases in the price of natural gas will stimulate further drilling and production in the Fort Worth metro area, compounding the problems the 2008 amended ordinance attempted to solve. Although the 2008 ordinance tackled many issues the 2001 and 2006 neglected, it is still a reactionary ordinance. Given that Barnett Shale wells may produce for as many as thirty to forty years, Fort Worth will likely become better at balancing all interests. However, the future ordinances should not be

201. § 15-34(O).

202. *Id.* § 15-34(O)(1).

203. *Id.* § 15-34(O)(2).

204. *Id.* § 15-34(O)(4).

205. *Id.* § 15-34(O)(7)–(8).

too restrictive, as Fort Worth may have to defend itself against constitutional takings claims.

SECTION VI. MUNICIPAL DRILLING ORDINANCES AS TAKINGS

A. *Can Municipal Drilling Ordinances Rise to the Level of a Regulatory Taking?*

Although it has yet to be decided by the Texas Supreme Court, an argument can be made that a prohibitive drilling ordinance could be viewed as a partial, or even a categorical, regulatory taking. Property ownership is a highly-valued right, and as such, the United States and Texas Constitutions preclude takings of property without just compensation.²⁰⁶ Accordingly, a restrictive ordinance may give rise to both a state and federal cause of action under current takings jurisprudence. However, federal courts require that all possible state remedies be exhausted prior to initiating federal litigation.²⁰⁷ But, as Texas has borrowed significantly from federal takings jurisprudence,²⁰⁸ development of federal law will be examined initially.

B. *Federal Takings Jurisprudence*

Federal takings claims were first viewed under the test established in the landmark U.S. Supreme Court case of *Pennsylvania Coal Company v. Mahon*.²⁰⁹ *Pennsylvania Coal* established that the police powers of the state constituted an implied limitation on the use and enjoyment of private property.²¹⁰ However, if the government “regulation goes too far it will be recognized as a taking.”²¹¹ Essentially, the Court, rather than establishing a bright line test, created a test in which the analysis is one measuring the degree of the restricted use by the regulation.²¹²

Pennsylvania Coal was refined and clarified the 1978 Supreme Court case of *Penn Central Transportation Company v. New York City*.²¹³ *Penn Central* established a three-factor balancing test weighing: (1) “[t]he economic impact of the regulation”; (2) “the extent to which the regulation has interfered with distinct investment-backed

206. U.S. CONST. amend. V (“[N]or shall private property be taken for public use, without just compensation.”); TEX. CONST. art I, § 17 (“No person’s property shall be taken, damaged or destroyed for or applied to public use without adequate compensation . . .”).

207. *Williamson County Reg’l Planning Comm’n v. Hamilton Bank of Johnson City*, 473 U.S. 172, 195 (1985); see also *Riley*, *supra* note 22, at 374.

208. *Mayhew v. Town of Sunnyvale*, 964 S.W.2d 922, 932 (Tex. 1998) (stating that federal and Texas Takings Clauses are “coextensive”).

209. *Pa. Coal Co. v. Mahon*, 260 U.S. 393 (1922).

210. *Id.* at 413.

211. *Id.* at 415.

212. *Id.* at 416; see also *Riley*, *supra* note 22, at 376.

213. *Penn Cent. Transp. Co. v. City of New York*, 438 U.S. 104 (1978).

expectations”; and (3) “the character of the governmental action.”²¹⁴ The Court also concluded that a takings analysis must consider the “parcel as a whole.”²¹⁵

The Court further explained the “parcel as a whole” analysis of a taking, especially within the context of extractive industries and severable estates, in *Keystone Bituminous Coal Association v. DeBenedictis*.²¹⁶ In *Keystone*, an association of coal producers alleged that a Pennsylvania statute, which required a certain amount of the support estate must remain to prevent subsidence, constituted a taking by restricting the use of a severed support estate.²¹⁷ The association also argued that Pennsylvania recognized three separate estates: the surface estate; the mineral estate; and the support estate.²¹⁸ The Court held that the statute did not interfere with the profitable mining of coal and there was no “undue interference” with the “investment-backed expectations” of the coal operators.²¹⁹ The Court also rejected the separate estate theory and focused on “reliance on such legalistic distinctions within a bundle of property rights” which affirmed the property must be viewed as a “parcel as a whole.”²²⁰ Essentially, rights may be restricted, or even extinguished, in one of the estates, and a taking will be found only if a remaining estate is so restricted as to fail the *Penn Central* test.

Takings analyses were made more stringent with the introduction of “categorical takings” in *Lucas v. South Carolina Coastal Council*.²²¹ The *Lucas* opinion established a categorical taking occurs when a regulation deprives a property owner of all economically viable use of the property.²²² However, *Lucas* also shifts the burden of proof to the government to prove the regulation does not restrict further than current principles of property law allow.²²³

C. Texas Takings Jurisprudence

As stated, federal and Texas Takings Clauses are “coexistent,” and Texas claims will be analyzed “under the more familiar federal standards.”²²⁴ The Texas Supreme Court first began aligning with federal

214. *Id.* at 124.

215. *Id.* at 130–31.

216. *Keystone Bituminous Coal Ass’n v. DeBenedictis*, 480 U.S. 470, 500–01 (1987).

217. *Id.* at 478–79.

218. *Id.* at 478.

219. *Id.* at 485; Riley, *supra* note 22, at 392–93.

220. *Keystone*, 480 U.S. at 500 (citing *Penn Cent. Trans. Co. v. City of New York*, 438 U.S. 104, 130 (1978) (explaining that air rights above a property did not constitute a separate segment of property)).

221. *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1029 (1992).

222. *Id.* at 1029.

223. *Id.*

224. *Mayhew v. Town of Sunnyvale*, 964 S.W.2d 922, 932 (Tex. 1998).

takings jurisprudence in *Mayhew v. Town of Sunnyvale*.²²⁵ In *Mayhew*, the Town of Sunnyvale denied a planned development proposal that would change the character of the town, significantly increase the population, and strain city services.²²⁶ Upon review, the Texas Supreme Court first determined that Sunnyvale had a legitimate state interest in preserving its character and controlling its population growth.²²⁷ Second, the court looked at a two-prong test to determine whether the government denied (a) “landowners of all economically viable use of their land,” or (b) “unreasonably interfered with a landowners’ right to use and enjoy his property.”²²⁸ Under the first prong, the court simply analyzed whether or not the property retained any value after the regulation.²²⁹ For the second prong, the court evaluated “the economic impact of the regulation” and “the extent the regulation . . . interfered with distinct investment-backed expectations” to determine a taking.²³⁰ The court looked to the historical nature of the land and also whether the restriction was in place at the time the property was acquired, or if the restriction could have been reasonably expected.²³¹

Under the *Mayhew* test, municipal drilling ordinances will likely be upheld under both prongs of the test. As Texas analyzes takings under the federal standard, a completely restrictive drilling ordinance will not rise to the level of a categorical taking. Although an owner of a mineral estate may never capitalize on his interest, under *Penn Central* and *Keystone*, the court will evaluate the “property as a whole.” Accordingly, the surface estate will still retain some value, despite the inability to exploit the mineral estate. Applying *Lucas*, even a nominal value remaining in a property will render a takings claim unsuccessful.

Under the second prong, mineral owners and oil and gas companies will have difficulty establishing a taking occurs when a drilling ordinance prohibits drilling within a municipality. It will be difficult to argue that drilling for gas fits within the nature and character of a residential neighborhood. Additionally, oil and gas companies operating in urban areas are either currently subject to drilling ordinances, or ordinances can be reasonably expected, within urban areas.

225. Riley, *supra* note 22, at 382 & n.250.

226. *Mayhew*, 964 S.W.2d at 926.

227. *Id.* at 935.

228. *Id.* (citing *Lucas*, 505 U.S. at 1015–19; *Taub v. City of Deer Park*, 882 S.W.2d 824, 826 (Tex. 1994); *City of Austin v. Teague*, 570 S.W.2d 389, 393 (Tex. 1978)).

229. *Id.* at 937.

230. *Id.* (citing *Penn Cent. Trans. Co. v. City of New York*, 438 U.S. 104, 124; *Taub*, 882 S.W.2d at 826).

231. *Id.* at 937–38 (explaining that the Mayhews initially used the land for ranching, which did not lend itself to residential development, and subsequent acquisitions were made when the Mayhews should have known about the restrictions).

SECTION VII. CONCLUSIONS

Although urban drilling can create many environmental, legal, and regulatory issues, a balance can be struck between the benefit of increased natural gas production and appropriate regulatory measures by taking into account the needs and desires of both residents and oil and gas companies. According to case law, a municipality will be granted a lot of deference in enforcing its police power through a drilling ordinance before a court will consider the ordinance a constitutional taking. Oil and gas operators are not the only groups to benefit from the Barnett Shale; residents and municipalities have made some significant economic gains. In order to strike a balance, the municipality must create a drilling ordinance to protect its local environment, its citizens' peace and enjoyment, and general tranquility for at least the next generation. However, the ordinance must not be overly vigilant and preclude its residents and the municipality from the benefits of urban drilling.