DEVELOPMENT OF BRACKISH GROUNDWATER FOR HYDRAULIC FRACTURING OPERATIONS: REGULATORY AND POLICY ISSUES

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By Leonard H. Dougal and Mallory Beck[1]

I. Introduction.

A. The Brackish Groundwater Resource Opportunity.

According to the Texas Water Development Board ("TWDB"), more than 2.7 billion acre-feet of brackish groundwater exists within the State of Texas.[2] Texas has numerous aquifers capable of producing both fresh and brackish groundwater, including 9 major and 21 minor aquifers recognized by the TWDB. Among the major aquifers, the Gulf Coast aquifer has the largest volume of brackish water with approximately 522 million acre-feet and the Mesilla Bolson aquifer in west Texas has the smallest with approximately 0.5 million acre-feet.[3] Of the minor aquifers, the Queen City and Sparta aquifers contain the largest volume of brackish water with approximately 246 million acre-feet and the Lipan aquifer contains the smallest with approximately 1.3 million acre-feet.[4]

The growing interest in development and use of brackish groundwater is reflected in the 2012 State Water Plan, where five regional water planning groups included a total of 39 brackish groundwater desalination projects, which would produce over 181,000 acre-feet per year of new water supplies in year 2060. Of course, the State Water Plan only includes projects (deemed "water management strategies") which seek state funding or require state permits, and hence private sector development of brackish groundwater projects are not reflected in the plan.

In terms of water quality (or salinity), the major aquifers and the minor aquifers are estimated to contain nearly equal volumes of brackish water, but the volume of brackish water in the range of 1,000 to 3,000 milligrams per liter ("mg/l") of total dissolved solids ("TDS") in the major aquifers is almost twice as much as that in the 3,000 to 10,000 mg/l range and a little less than twice as much as in the minor aquifers.[5] However, the TWDB figures on salinity by aquifer are merely "very generalized estimates and may not represent site-specific conditions."[6] There remains a lack of water-quality data and irregular distribution of that data, particularly for some aquifers in the State.[7]

Because water quality data is dependent upon wells, data gaps exist, particularly in the minor aquifers, due to the lack of wells or lack of water-quality analyses of existing wells.[8] In the past, because water with concentrations of more than 3,000 mg/l of TDS was considered unusable, very few wells were drilled in these areas and exploratory wells which encountered such water were often plugged and abandoned without water samples being collected and analyzed.[9] In other words, as LBG-Guyton Associates concluded in 2003, "the water-quality database is probably biased toward lower TDS measurements."[10] Plus, water-quality data, including TDS measurements, were collected over nearly a century

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1 The views and opinions stated in this paper are solely those of the authors and do not necessarily represent the views or opinions of Jackson Walker LLP, or any of its clients.

2 *See* LBG-Guyton Associates, Brackish Groundwater Manual for Texas Regional Water Planning Groups (Feb. 2003), *available at* https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/2001483395.pdf (last accessed Dec. 29, 2014); *see also* Texas Water Development Board, Desalination: Brackish Groundwater (Feb. 2013), *available at* http://www.twdb.state.tx.us/publications/shells/desal_brackish.pdf (last accessed Dec. 29, 2014).

3 *Id.*; *see also* maps identifying the 9 major (http://www.twdb.texas.gov/groundwater/aquifer/major.asp) and 21 minor aquifers (http://www.twdb.texas.gov/groundwater/aquifer/minor.asp) and the Geologic Atlas of Texas illustrating the surface extent of the aquifers (http://www.twdb.texas.gov/groundwater/aquifer/GAT/index.asp).

4 *Id*.

5 Sanjeev Kalaswad, Brent Christian, and Rima Petrossian, *Brackish Groundwater in Texas*, The Future of Desalination in Texas, vol. 2, Texas Water Development Board (2004), *available at* http://www.twdb.state.tx.us/publications/reports/numbered_reports/doc/R363/B2.pdf (last accessed Dec. 30, 2014).

6 *Id.*

7 LBG-Guyton Associates, Brackish Groundwater Manual for Texas Regional Water Planning Groups, *supra* note 2.

8 *Id*.

9 *Id.*

10 *Id.*

by many different people using different methods, thereby undermining the reliability of the data.[11] Furthermore, there are natural variations in water quality even within the same aquifer due to mineral composition, geochemical processes, groundwater flow velocity, residence time, long-term historical changes in recharge rates, and location of recharge and discharge areas.[12]

B. Defining Brackish Water.

Although there is no statutory definition of "brackish" water, in various reports and studies, the TWDB defines brackish water as containing TDS in a concentration of 1,000-9,999 mg/l.[13] For comparison purposes, the TWDB defines "fresh" water as containing 0-999 mg/l of TDS; "saline" water as containing 10,000-35,000 mg/l of TDS; and "seawater" as containing more than 35,000 mg/l of TDS.[14]

11 *Id.*

12 *Id.*

13 *See* Texas Water Development Board, Desalination: Brackish Groundwater, *supra* note 2; *but see* Mary K. Sahs, Frac Water – Regulation of Quantity and Quality and Reporting by Texas Groundwater Conservation Districts, The Changing Face of Water Rights (Feb. 2012), available at http://www.sahslaw.com/wp-content/uploads/2014/11/Fracking-Paper-for-SBOT.pdf (last accessed Jan. 16, 2015). The Texas Commission on Environmental Quality has established a standard for public water supply systems which is also no more than 1,000 mg/l of TDS. *See* 30 Tex. Admin. Code § 290.105. Although this does not define "brackish" water it does support creating a definition based on the 1,000 mg/l level. Proposed legislation in the 83rd session in 2013 considered defining brackish water as water containing TDS of 1,000-10,000 mg/l. However, some disagree with this definition. In some parts of the State, particularly in west Texas, water with low total dissolved solids is unavailable. There, water up to 3,000 mg/l of TDS is considered "fresh" and therefore, it is argued, should not be classified as brackish. *See* Edmond R. McCarthy, Jr., *Developing Brackish Groundwater Supplies*, The University of Texas School of Law Texas Water Law Institute (Dec. 2013).

14 *See* Texas Water Development Board, Desalination: Brackish Groundwater, *supra* note 2; Texas Water Development Board, Brackish FAQs, *available at* http://www.twdb.state.tx.us/innovativewater/desal/faqbrackish.asp (last accessed Dec. 30, 2014).

C. The Components of a Typical Brackish Groundwater Project.

As stated by the American Petroleum Institute, "[a] significant part of a hydraulic fracturing operation involves securing access to reliable sources of water, the timing associated with this accessibility, and the requirements for obtaining permission to secure these supplies."[15] Supplying water for hydraulic fracturing, and other activities, is a growing industry. And groundwater, and increasingly brackish groundwater, is a potential source of that supply. Oil and gas producers, and energy service companies, continue to improve and reformulate their "recipes" for hydraulic fracturing fluids to take advantage of lower quality water supplies, including brackish groundwater.

In areas of Texas with intensive oil and gas development, regional projects to supply water to multiple leases or producers are viable. A typical groundwater supply project of this type will involve several steps, each of which may raise their own economic and regulatory obstacles. First, a water supplier must locate and purchase the land or lease the groundwater rights necessary to develop a water well field. Second, permits must be obtained from the local groundwater conservation district, if one exists, for purposes of drilling, operating, and producing groundwater. Further permitting may be required, in the form of transport permit, to export the water outside the boundaries of the groundwater conservation district. The water, once produced, must be stored. Storage may take place on-site near the well field or off-site after delivery to a location central to the supplier's oil field or potential customers. In either case, an open pit is the most likely method of storage and the pit will need to be lined as a protection against water losses and to prevent contamination of groundwater. The permits for such pits may be obtained from the Railroad Commission of Texas ("RRC").[16]

15 American Petroleum Institute Guidance Document HF2, Water Management Associated with Hydraulic Fracturing (June 2010), available at http://www.shalegas.energy.gov/resources/HF2_e1.pdf (last accessed Jan. 19, 2015).

16 Blythe Lyons and John James Tintera, Sustainable Water Management in the Texas Oil and Gas Industry, Atlantic Council Energy & Environment Program (July 2014), available at http://texasalliance.org/wp-content/uploads/2014/08/Texas-White-Paper-on-

Depending on the distance between the water well field and the water supplier's potential customers, the water may need to be transported large distances typically by either trucking or pipeline. Pipelines are costly and require acquisition of rights-of-way, crossing permits for public roadways, and sometimes leak. But, the alternative, trucking, can also be expensive and often faces opposition from the community due to increased traffic and damage to local roads. In Panola County, Texas, for example, the general practice is for oil and gas producers to purchase the water well field property, drill multiple water wells to feed a permanent pond, and then use the pond to serve their hydraulic fracturing operations within a ten-mile radius, typically transporting the water by truck.[17]

D. Hydraulic Fracturing and Flowback Water.

Hydraulic fracturing is a process used to optimize the production of oil and gas by injecting fluids and proppants at high pressure into the target formation to induce fractures then and allow oil and gas to flow back to the wellbore.[18] Fracturing fluids are formulated in different manners, but typically are a mixture of approximately 90 percent water, 9 percent sand or other granular propping agents, and less than 1 percent chemicals used primarily to viscosify the fluid so it can transport the sand.[19] Water used in hydraulic fracturing is often pre-treated with formation-specific chemical additives such as anti-corrosive agents, biocides, friction reducers, lubricants, and surfactant and clay stabilizers.[20] Although as a percentage of the overall volume of water these additives are negligible, they are enough to render the flowback water, the water returned after completion of the fracturing operations, non-potable. Flowback water can also contain "produced water" – water native to the formation itself before any hydraulic fracturing occurs – which can itself contain pre-existing contaminants, such as barium, calcium chloride, iron, magnesium, naturally occurring radioactive materials, salts, and sulfur.[21]

The majority of flowback water is recovered from several hours to a couple of weeks after hydraulic fracturing although flowback water in the form of produced water may continue for several months after production has begun.[22] The volume of produced water varies from area to area, and it may account for less than 30 percent to more than 70 percent of the original fracture fluid volume.[23] In the Eagle Ford Shale, less than 20 percent of injected water is returned as flowback or produced water.[24] On the other hand, the Permian Basin has relatively high flowback levels.[25] The volume of produced or flowback water may also vary within a single formation. For example, in the Marcellus Shale in Pennsylvania, flowback water ranges from 10 to 50 percent of the original volume used for hydraulic fracturing.[26]

E. Disposal and Recycling of Produced Waters.

Traditionally, flowback water has been viewed as a waste which needs to be disposed. The most common disposal method for flowback water is

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sustainable-Water-Management-by-the-Oil-and-Gas-Industry-July-29-2014.pdf (last accessed Jan. 16, 2015).

17 Mary K. Sahs, Frac Water – Regulation of Quantity and Quality and Reporting by Texas Groundwater Conservation Districts, *supra* note 13.

18 American Petroleum Institute Guidance Document HF2, Water Management Associated with Hydraulic Fracturing, *supra* note 15.

19 Kathy Wythe, Fractured, txH_20 (Winter 2013), *available at* http://twri.tamu.edu/publications/txh2o/winter-2013/fractured/ (last accessed Dec. 31, 2014) (quoting Dr. Stephen Holditch, professor emeritus in Texas A&M's Harold Vance Department of Petroleum Engineering).

20 U.S. Department of Energy, Modern Shale Gas Development in the United States: A Primer (April 2009), *available at* http://energy.gov/fe/downloads/modern-shale-gas-development-united-states-primer (last accessed Jan. 6, 2015).

21 *Id.*

22 *Id.*

23 *Id.*

24 Jean Philippe Nicot, Robert C. Reedy, Ruth A. Costley, and Yun Huang, Oil & Gas Water Use in Texas: Update to the 2011 Mining Water Use Report (Sept. 2012), *available at* https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/0904830939_2012Update_MiningWaterUse.pdf (last accessed Dec. 31, 2014).

25 Blythe Lyons and John James Tintera, Sustainable Water Management in the Texas Oil and Gas Industry, *supra* note 16.

26 Don Hopey, *Gas drillers recycling more water, using fewer chemicals*, Pittsburgh Post-Gazette (Mar. 2011), *available at* http://www.post-gazette.com/local/region/2011/03/01/Gas-drillers-recycling-more-water-using-fewer-chemicals/stories/201103010632 (last accessed Jan. 6, 2015).

by well injection into underground formations.[27] In Texas, there are many permeable formations that can accept wastewater thereby allowing disposal by injection well to be a palatable option in spite its high costs.[28] Such injection wells require permitting under the Safe Drinking Water Act Underground Injection Control program, which for oil and gas operations is administered by the Railroad Commission of Texas ("RRC"). Injection wells for flowback and produced water disposal are usually Class II injection wells.

Other disposal methods (less commonly used in Texas given widespread availability of disposal wells) include treatment in municipal or industrial treatment facilities, placement into surface impoundments such as evaporation ponds or reserve pits, and landfarming. Discharge to an existing municipal or industrial treatment facility may involve higher costs of treatment of the water for the facility, impact the facility's wastewater treatment process, and may be limited by the wastewater treatment facility's capacity, by local ordinances, or by the wastewater treatment facility's own permits.[29] Additionally, municipal treatment facilities may be required to obtain regulatory approval before accepting flowback water. Evaporation ponds require a large amount of land, are subject to evaporation potential and local precipitation factors, must be properly constructed to avoid groundwater contamination, require a permit from RRC (or TCEQ for non-oil field operations), and still involve proper disposal of solids remaining after evaporation.[30] In places like East Texas where evaporation rates do not exceed precipitation rates, reserve pits are sometimes used for purposes of dewatering the flowback water before disposal of the water through injection wells.[31] According to the RRC, landfarming is "a method of treatment and disposal of low toxicity wastes in which the wastes are spread and mixed into soils to promote reduction or organic constituents and dilution and attenuation of metals."[32] Landfarming may be performed on the same lease where the waste is generated with written consent of the surface tract owner without a permit if the wastes meet certain criteria.[33] Otherwise, permitting is required.

More recently, oil and gas companies have begun investigating and developing recycling methods for flowback and produced water. According to a 2012 study, only two percent of water in the Permian Basin, five percent of water in the Barnett Shale, twenty percent of water in the Anadarko Basin, and five percent of water in the East Texas Basin was recycled.[34] According to that study, zero percent of

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[27] U.S. Department of Energy, Modern Shale Gas Development in the United States: A Primer, *supra* note 20.

[28] By contrast, the Marcellus Shale in Pennsylvania does not have many available injections wells requiring trucking or other disposal methods. *See id.*

[29] LBG-Guyton Associates, Brackish Groundwater Manual for Texas Regional Water Planning Groups, *supra* note 2; Mark Graves, A Decision Framework for Desalination Options in South Central Texas, Waterscapes (Winter 2007), *available at* https://www.hdrinc.com/sites/all/files/content/articles/article-files/3623-a-decision-framework-for-desalination-options-in-south-central-texas.pdf (last accessed Dec. 30, 2014); Mike Mickley, *Review of Concentrate Management Options*, The Future of Desalination in Texas, vol. 2, Texas Water Development Board (2004), *available at* http://www.twdb.state.tx.us/publications/reports/numbered_reports/doc/R363/C9.pdf (last accessed Dec. 31, 2014); NRS Consulting Engineers, Guidance Manual for Brackish Groundwater Desalination in Texas, *Phase II Permitting* (2008), *available at* http://www.desal.org/desaldemo/Desal%20PDFs%20for%20Site/GM%20-%20Full.pdf (last accessed Dec. 31, 2014)

[30] LBG-Guyton Associates, Brackish Groundwater Manual for Texas Regional Water Planning Groups, *supra* note 2; R.W. Beck, Inc., Guidance Manual for Permitting Requirements in Texas for Desalination Facilities Using Reverse Osmosis Processes (Nov. 2004), *available at* https://www.twdb.texas.gov/publications/reports/contracted_reports/doc/2003483509.pdf (last accessed Dec. 30, 2014); Mark Graves, A Decision Framework for Desalination Options in South Central Texas, Waterscapes, *supra* note 29; Mike Mickley, *Review of Concentrate Management Options*, *supra* note 29; NRS Consulting Engineers, Guidance Manual for Brackish Groundwater Desalination in Texas, *supra* note 29.

[31] Mary K. Sahs, Frac Water – Regulation of Quantity and Quality and Reporting by Texas Groundwater Conservation Districts, *supra* note 13.

[32] Railroad Commission of Texas, Landfarms and Landtreatment Facilities (May 2014), available at http://www.rrc.state.tx.us/oil-gas/applications-and-permits/environmental-permit-types-information/landfarms-and-landtreatment-facilities/ (last accessed Jan. 16, 2015).

[33] *Id.*

[34] Jean Philippe Nicot, Robert C. Reedy, Ruth A. Costley, and Yun Huang, Oil & Gas Water Use in Texas: Update to the 2011 Mining Water Use Report, *supra* note 24. It should be noted, however, that individual companies have reported greater recycling efforts. For example, Devon Energy reported in 2008 that it was recycling 90-100% of its flowback water in the Barnett Shale. *See* Jay Ewing, Taking a Proactive Approach to Water Recycling in the Barnett Shale, Devon Energy, Fort Worth Bus. Press Barnett Shale Symposium (Feb. 2008). Fountain Quail

water in the Eagle Ford Shale was recycled.[35] Flowback water may be treated through self-contained systems at the well site or by municipal or commercial treatment facilities where transportation to the treatment facility is practical.[36] Mobile treatment units involving ultrafiltration, distillation or reverse osmosis to remove high levels of solids, organics, and other impurities and render the flowback and produced water sufficient for reuse in hydraulic fracturing are beneficial to avoid transportation costs associated with offsite treatment or disposal. Methods of treatment will vary depending on the contaminants in the water which, as explained above, can vary greatly from one well site to another.[37]

To encourage this type of recycling, the RRC in March 2013 adopted amendments to its rules. Rule 3.8(a)(41) defines "Non-commercial fluid recycling" as "[t]he recycling of fluid produced from an oil or gas well, including ... fluids produced from the hydraulic fracturing process" and states that this recycling may take place on an existing lease or drilling unit, on land leased or owned for the operation of a disposal well, or on land leased or owned for the operation of an injection well either by the operator or someone who contracts with the operator.[38] The amendment also allowed for pits to be used for storing the non-commercial fluid recycling fluid or treated fluid.[39] Rule 3.8(d)(7)(B) authorizes non-permitted recycling of treated fluids for use as water for hydraulic fracturing or another type of oilfield fluid to be used in the wellbore of an oil, gas, geothermal or service well.[40] It further authorizes reuse of treated fluid in any other manner, other than discharge to water of the State, without a permit as long as the reuse occurs pursuant to a permit issued by another state or federal agency.[41] Essentially, the RCC adopted these amendments to remove regulatory hurdles and hence to encourage recycling.

The Texas Legislature followed suit to encourage recycling and reuse by passing House Bill 2767 in 2013. That bill added Chapter 122 to the Texas Natural Resources Code and addressed ownership issues regarding the treatment and recycling for beneficial use of certain wastes arising out of or incidental to the drilling for or production of oil and gas. Unless specifically modified by contract, Chapter 122 provides that ownership of oil and gas waste is transferred to those who are engaged to recycle and reuse it and additionally eliminates certain types of tort liability for the recycler.

F. The Energy Water Initiative.

Industry leaders are also taking other steps to address water use. The Energy Water Initiative includes 18 U.S.-based energy companies seeking new solutions for managing water on a sustainable basis.[42] The initiative responds to concerns about water resources, including focusing on reducing consumption and increasing reuse and recycling, especially in light of recent droughts and growing water scarcity. The initiative aims "to address the issue as an industry and work together to think about new ways to deal with water, sooner rather than later."[43] The group plans four phases of research: (1) research and publications review (complete); (2) developing and piloting a water life cycle mapping model; (3) review of industry strategies, practices, and technologies for better water use and management; and (4) developing and implementing potential conservation measures.[44]

II. Groundwater Regulatory Issues.

A. Ownership of Groundwater.

Under Texas law, groundwater – statutorily defined as "water percolating below the surface of the

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Water management, an oilfield services company, stated in 2011 that it had recycled more than 14 million barrels of wastewater in the Barnett Shale. *See* Fountain Quail Water Management, Fountain Quail Expands Operations to Eagle Ford Shale, (June 25, 2011), available at http://www.pr.com/press-release/334144 (last accessed Jan. 15, 2015).

35 *Id.*

36 U.S. Department of Energy, Modern Shale Gas Development in the United States: A Primer, *supra* note 20.

37 Mark Henricks, Energy industry works to recycle hydro-fracking waste water, American Recycler.com (May 2012), available at http://www.americanrecycler.com/0512/1517energy.shtml (last accessed January 15, 2015).

38 16 Tex. Admin. Code § 3.8(a)(41)

39 *Id.* § 3.8(a)(42).

40 *Id.* § 3.8(d)(7)(B).

41 *Id.*

42 BG Group, A sustainable water strategy – BG Group takes the lead on water – a vital issue for gas in the US and beyond, available at http://www.bg-group.com/~/tiles/?tiletype=news&id=62 (last accessed Jan. 15, 2015).

43 *Id.*

44 *Id.*

earth"[45] – is the property of the owner of the land beneath which it is found.[46] Although groundwater is the property of the owner of the land, its development and use may be regulated by the State.[47]

B. Role of Groundwater Conservation Districts.

By statute, the Legislature has placed the responsibility of managing groundwater through regulating the spacing of and/or production from water wells in the hands of groundwater conservation districts, if one is created governing a specific area.[48] The statute is silent as to whether "groundwater" includes brackish groundwater as opposed to merely fresh groundwater. Yet, many groundwater conservation districts ("GCDs") have taken the position that they are authorized to regulate brackish water wells, including spacing and production.

Groundwater conservation districts, created by the special legislation or action by the Texas Commission on Environmental Quality, are the "state's preferred method of groundwater management through rules developed, adopted, and promulgated by a district."[49] There are currently 98 groundwater conservation districts in Texas – 96 are confirmed and two are awaiting confirmation elections.[50] GCDs are authorized to make and enforce rules for "conserving, preserving, protecting, and recharging of the groundwater or of a groundwater reservoir or its subdivisions in order to . . . prevent degradation of water quality . . . ."[51] Groundwater conservation districts may set civil penalties for violations of their rules or enforce the Water Code or their rules through injunctions or other relief sought from a court.[52]

C. Authority of GCDs over Groundwater Production.

While recognizing the landowner's rights to groundwater under his land, the Legislature has granted the GCDs the power to regulate (1) the spacing of wells based on (i) distances of all wells from property lines or adjoining wells; (ii) distances of certain wells based on production capacity, pump size, or other characteristics from property lines or adjoining wells; and (iii) other spacing requirements adopted by the GCD;[53] and to regulate (2) the production of groundwater by (i) setting production limits on wells; (ii) setting production limits on acreage or tract size; (iii) setting production limits from a defined number of acres assigned to an authorized well site; (iv) setting maximum production limits based on acre-feet per acre or gallons per minute per well site per acre; (v) managed depletion; or (vi) any combination of these.[54]

Groundwater conservation districts are also responsible for issuing permits for the "drilling, equipping, operating, or completing of wells or for substantially altering the size of wells or well pumps" and for issuing amendments to such permits.[55] Except as to the application of a fee or surcharge, groundwater conservation districts must treat permit applications seeking to transfer water out of the district the same as applications for in-district users, but the district must consider certain factors in granting or denying an application for a permit to transfer water out of the district.[56] Permits and permit amendments are issued subject to the rules of the GCD, and it is up to the individual GCDs, with certain statutory requirements and limitations, to determine each regulated activity which requires a

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45 Tex. Water Code 35.002(5)

46 *See Edwards Aquifer Authority v. Day*, 369 S.W.3d 814, 823-24 (Tex. 2012); Tex. Water Code § 36.002(a) ("The legislature recognizes that a landowner owns the groundwater below the surface of the landowner's land as real property.").

47 Tex. Water Code § 36.002(d)(2).

48 *Id.* § 36.0015.

49 *Id.*

50 Texas Water Development Board, Groundwater Conservation District Facts, *available at* http://www.twdb.texas.gov/groundwater/conservation_districts/facts.asp (last accessed Dec. 29, 2014). Relatedly, The Texas Water Code also authorizes the creation of Groundwater Management Areas ("GMAs") and delegates the delineation of GMAs to the TWDB. Tex. Water Code § 35.004; 31 Tex. Admin. Code, Chapter 356. TCEQ

51 Tex. Water Code § 36.101.

52 *Id.* § 36.102.

53 *Id.* § 36.116(a)(1).

54 *Id.* § 36.116(a)(2).

55 *Id.* § 36.113(a).

56 *Id.* § 36.122. The factors include the availability of water in the district and in the proposed receiving area for the time period for which the water is requested, the projected effect of the proposed transfer on aquifer conditions, depletion, subsidence, or effects on existing permit holders or other groundwater users within the district; and the approved regional management plan and the district's management plan. Tex. Water Code § 36.122(f).

permit or permit amendment. There are no specific requirements for production allowances, with some GCDs placing no limits on production, while others set relatively small limits.[57] There is also no mandatory or established length of time for a permit term, and therefore, terms vary from one GCD to another. Many GCDs have a one-year term for production permits, and rarely do permits have a term of more than five years, except in the case of export permits which have statutory minimum terms of between three and 30 years.[58]

D. GCD Management Plans.

Among their duties, GCDs are required to develop and implement management plans which are reviewed and approved by the Texas Water Development Board ("TWDB").[59] A GCD's management plan must address the following goals: (1) providing the most efficient use of groundwater; (2) controlling and preventing waste of groundwater; (3) controlling and preventing subsidence; (4) addressing conjunctive surface water management issues; (5) addressing natural resource issues; (6) addressing drought conditions; (7) addressing conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, or brush control, where appropriate and cost-effective; and (8) addressing the desired future conditions ("DFC") adopted by the district under Section 36.108.[60]

E. Groundwater Management Areas and Establishment of Aquifer Desired Future Conditions.

In an effort to promote uniformity of regulation of groundwater by region, the Legislature amended the Texas Water Code to authorize the creation of Groundwater Management Areas ("GMAs"), and delegated the delineation of GMAs boundaries to the TWDB.[61] For each aquifer within the GMA, the GMA members (composed of representatives from local GCDs) must establish the "desired future condition" ("DFC") of the aquifer, which is a quantified condition of groundwater resources (such as water levels, spring flows, or volumes) that the GMA desires to maintain at a specified time or times in the future.[62] Before voting on proposed DFCs, a groundwater conservation district shall consider various factors, including "the impact on the interest and rights in private property, including ownership and rights of management area landowners and their lessees and assigns in groundwater as recognized under §36.002 . . .".[63] Districts may establish different DFCs for each aquifer, subdivision of an aquifer or geologic strata located in whole or in part within the boundaries of the GMA or each geographic area overlying an aquifer or subdivision of an aquifer within the boundaries of the GMA.[64] DFCs will also be established for geographic areas of aquifers for which no GCD exists. Once the DFCs are established, the Texas Water Development Board will run models to determine the amount of water that may be permitted from the aquifer in keeping with the DFCs, referred to as the "modeled available groundwater" (MAG). The MAG for an individual aquifer essentially serves as a cap on the amount of groundwater that can be

[57] Claudia Russell, Texas Water Issues: Groundwater Conservation Districts' Rules and Regulations and Other Legal Obstacles Awaiting Unsuspecting Landowners, State Bar of Texas 15th Annual Changing Face of Water Rights Course (Feb. 2014); *see also* Texas Alliance of Groundwater Districts, Groundwater Conservation District Index, *available at* http://www.texasgroundwater.org/gcdi-map.html (last accessed Dec. 30, 2014).

[58] Tex. Water Code § 36.122(i); *see also* Claudia Russell, Texas Water Issues: Groundwater Conservation Districts' Rules and Regulations and Other Legal Obstacles Awaiting Unsuspecting Landowners, *supra* note 57.

[59] Tex. Water Code §§ 36.1071, 36.1072, 36.108.

[60] *Id.* § 36.1071.

[61] *Id.* § 35.004; 31 Tex. Admin. Code, Chapter 356. The Texas Commission on Environmental Quality may designate a "priority groundwater management area." Within a "priority groundwater management area," a local commissioners court may adopt water availability requirements "to prevent current or projected water use in the county from exceeding the safe sustainable yield of the county's water supply." Meanwhile, the Texas Water Development Board ("TWDB") is the agency responsible for conducting studies, investigations, and surveys of quantity, quality, and availability of groundwater and prepares the State Water Plan and State Drought Plan. *See* Tex. Water Code §§ 16.012, 16.015, 16.051, 16.055. The TWDB is also tasked with conducting desalination studies and research. Tex. Water Code § 16.060. The TWDB has divided Texas into 16 GMAs. Tex. Water Code § 35.004. Districts located within each GMA are required to conduct joint planning to define the desired future conditions for groundwater resources within their GMAs. *See id.* § 36.108.

[62] 31 Tex. Admin. Code § 356.10(6).

[63] Tex. Water Code § 36.108(d)(7).

[64] *Id.* § 36.108(d-3).

permitted from that aquifer (if a GCD exists in the area of the proposed well).

F. Regulation of Brackish Groundwater by GCDs.

Despite oversight in varying degrees by the TCEQ and the TWDB, and requirements of state law such as Chapter 36 of the Texas Water Code and each GCD's enabling legislation, each GCD has authority to adopt its own set of regulations and management plans to control the production, use, and export of groundwater originating within the GCD's boundaries.[65] Hence, there is no uniform statewide set of rules or management plans for groundwater. Since the Legislature has not prohibited GCDs from regulating brackish groundwater and many take the position that they are authorized to do so, some regulate it in the same manner as they do fresh groundwater, some choose not to regulate it, and still others have special rules for brackish groundwater.[66]

However, Chapter 36 of the Texas Water Code "does not apply to production or injection wells drilled for oil, gas, sulphur, uranium, or brine, or for core tests, or for injection of gas, saltwater, or other fluids under permits issued by the Railroad Commission of Texas."[67] In that context, it is worth noting that under a rule governing "exploratory and specialty wells" the RRC regulates and permits "injection water source wells" which wells are likely those primarily used for water flooding of oil fields.[68] Further, Chapter 36 provides an exemption from permitting requirements for "drilling a water well 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 provided that the person holding the permit is responsible for drilling and operating the water well and the water well is located on the same lease or field associated with the drilling rig."[69] Therefore, depending on the intended use and the operator, oil and gas operators may not need to obtain drilling permits from GCDs. Yet, they will likely still be required to register their wells, comply with casing, pipe, and fittings rules, file drilling logs, and keep records of production and may be required to pay fees to the GCD, including export fees.[70]

A primary objective of many GCDs (but typically unstated) is to preserve the water within their boundaries for local use (and economic development) within the district and restrict or hinder the ability of developers to export water to distant cities with growing demand. Even with oversight by TCEQ and the TWDB, and the creation of GMAs to provide regional oversight, groundwater regulation in Texas remains fragmented, and in certain areas of the State permitting for large projects can be unpredictable.

G. Property Rights.

Beyond the regulations, parties must be attuned to the law governing real property in Texas. In Texas, a landowner owns water, oil, gas and like fluids beneath his property subject to the rule of

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65 Claudia Russell, Texas Water Issues: Groundwater Conservation Districts' Rules and Regulations and Other Legal Obstacles Awaiting Unsuspecting Landowners, *supra* note 57.

66 Texas Alliance of Groundwater Districts, Groundwater Conservation District Index, *supra* note 57. According to the Texas Alliance of Groundwater Districts as of December 30, 2014, the following GCDs have rules specifically addressing brackish water: Barton Springs/Edwards Aquifer Conservation District; Evergreen Underground Water Conservation District; Gonzales County Underground Water Conservation District; Pecan Valley Groundwater Conservation District; Pineywoods Groundwater Conservation District; Plateau Underground Water Conservation and Supply District; and Plum Creek Conservation District. Again, according to the Texas Alliance of Groundwater Districts as of December 30, 2014, the following GCDs do not regulate the production of brackish groundwater: Coke County Underground Water Conservation District; Colorado County Groundwater Conservation District; Crockett County Groundwater Conservation District; Hays Trinity Groundwater Conservation District; Headwaters Groundwater Conservation District; Hill Country Underground Water Conservation District; Jeff Davis County Underground Water Conservation District; Lower Trinity Groundwater Conservation District; Middle Pecos Groundwater Conservation District; Panola County Groundwater Conservation District; and Sandy Lane Underground Water Conservation District.

67 Tex. Water Code § 36.117(l).

68 16 Tex. Admin. Code § 3.5(e); Mary K. Sahs, Frac Water – Regulation of Quantity and Quality and Reporting by Texas Groundwater Conservation Districts, *supra* note 13.

69 Tex. Water Code § 36.117.

70 *Id.* For a more in-depth discussion of the variety of rules and regulations placed by GCDs on water wells used for hydraulic fracturing, *see* Mary K. Sahs, Frac Water – Regulation of Quantity and Quality and Reporting by Texas Groundwater Conservation Districts, *supra* note 13.

capture.[71] The rule of capture provides that, "absent malice or willful waste, 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 their neighbors even if in so doing they deprive their neighbors of the water's use."[72]

However, the ownership of minerals beneath the surface can be severed from the land resulting in the mineral interest owner having the superior, or "dominant" rights to the property. In other words, a party possessing the dominant mineral estate, including a lessee of the mineral estate, has the right to go onto the surface of the land[73] to extract the minerals, as well as those incidental rights reasonably necessary for the extraction.[74] The incidental rights include the right to use as much of the surface as is reasonably necessary to extract and produce the minerals. This includes the right to drill water wells and use groundwater belonging to the surface estate as may be reasonably necessary to carry out the mineral estate lessee's operations under the lease.[75]

Texas law also recognizes a requirement by the dominant, mineral estate to "accommodate" prior uses of the servient, surface estate. "If the mineral owner has reasonable alternative uses of the surface, one of which permits the surface owner to continue to use the surface in the manner intended . . . and one of which would preclude that use by the surface owner, the mineral owner *must* use the alternative that allows continued use of the surface by the surface owner."[76] On the other hand, if the mineral owner or lessee has only one method for developing and producing the minerals, that method may be used regardless of whether it precludes or substantially impairs an existing use of the servient surface estate.[77]

In spite of the interest in water recycling and treatment, legal impediments may limit incentives to use water treatment technologies. Of particular note are the impediments created by the split-estate structure of Texas real property law. Treated flowback water could be viewed as advantageous to oil and gas operators for more than mere reuse on the same lease. It could be useful to fracture wells or for other oilfield operations on other leases operated by the same company, sold to other operators for similar uses, or even sold for various commercial or industrial purposes. However, the ownership of the groundwater – as between a mineral lessee and the surface estate owner – can interfere with either party's ability to effectively reuse the water.[78] The field operator, who may be able to invest in the reuse of the water, may not be willing, or able, to do so if the reuse is not reasonably necessary to the operations under the lease. And, the property owner may not have the ability, or incentive, to reuse the water. As mentioned earlier, House Bill 2767, seeks to address certain of these ownership issues, in the context of oil field wastes.

III. Legislative Issues.

A. Last Session.

In the 83rd Legislative Session in 2013, nine bills relating to brackish water were introduced.[79] None were passed. The bills that addressed brackish groundwater most in depth, and which also received the greatest degree of the debate in the session, were companion bills HB 2578 (Rep. Larson) and SB 1760 (Sen. Uresti).[80] House Bill 2578 and Senate Bill 1760

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71 *Edwards Aquifer Auth. v. Day*, 369 S.W.3d 814, 831-32 (Tex. 2012).

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

73 Surface owners and lessees of the surface estate have identical rights with regard to the mineral estate, except as such rights are limited in the surface lease. *See, e.g.*, *Robinson Drilling Co. v. Moses*, 256 S.W.2d 650, 650 (Tex.Civ.App.—Eastland 1953, no writ).

74 *Tarrant Cnty. Water Control & Improvement Dist. No. One v. Haupt, Inc*., 854 S.W.2d 909, 911 (Tex. 1993); *Getty Oil Co. v. Jones*, 470 S.W.2d 618, 621 (Tex. 1971).

75 *Sun Oil Co. v. Whitaker*, 483 S.W.2d 808 (Tex. 1972); *Stradley v. Magnolia Petroleum Co.*, 155 S.W.2d 649 (Tex. Civ. App.—Amarillo 1941, writ ref'd).

76 *Haupt*, 854 S.W.2d at 911-12 (emphasis in original).

77 *Id.* at 911; *Getty Oil*, 470 S.W.2d at 622.

78 For a more detailed discussion of this issue, see Peter E. Hosey and Jesse S. Lotay, Quench My Thirst: Water Rights in the Context of Water Treatment Technologies (March 2013), available at http://images.jw.com/com/publications/1836.pdf (last accessed Jan. 15, 2015).

79 For an in-depth analysis of each of these bills, *see* Edmond R. McCarthy, Jr., *Developing Brackish Groundwater Supplies*, The University of Texas School of Law Texas Water Law Institute (Dec. 2013).

80 Other bills included proposals to: exclude wells used to withdraw brackish groundwater for "advanced brackish desalination" projects from GCD oversight (HB 2752 & SB 1284); modify other sections of the Texas Water Code to encourage the development, protection, and production of brackish aquifers (HB 3718); expand the Texas Economic Development Act's ad valorem tax benefits to desalination projects (HB 3512); exclude

addressed various aspects of regulatory requirements for the development of brackish groundwater as well as marine seawater.[81] For purposes of context, some of the key terms pertaining to brackish groundwater included in HB 2578 are summarized here:

- Defined "brackish" water as water containing TDS at a concentration of more than 1,000 mg/l but is not "marine seawater" and defined "marine seawater" as containing more than 10,000 mg/l of TDS;[82]
- Required the TWDB to work with GCDs to identify and designate local or regional brackish water production zones in areas of the state with moderate to high availability and productivity of brackish water that could be used to reduce the use of fresh groundwater and, amongst other factors, were also separated by hydrogeologic barriers to prevent impacts to existing water availability or quality;[83]
- Required GCDs located over a designated brackish groundwater production zone to issue permits which would allow, amongst other requirements: unlimited withdrawals and rates of withdrawal of brackish groundwater from a designated brackish groundwater production zone; provide for a permit term of at least 30 years; require monitoring of the aquifer in the area of the production zone; and require reporting from the permit holder;[84] and
- Allowed GCDs to require the TWDB to investigate harm caused by brackish groundwater withdrawals, and allowed the GCD, after notice and hearing, to amend a permit to mitigate any damage.[85]

The Texas House of Representatives passed Representative Larson's HB 2578 but it died pending in the Senate Natural Resources Committee. Although it died, it is certainly an indication of the issues involving brackish groundwater that will be raised in future legislative sessions.

B. Looking Forward.

Bills to address groundwater regulation are anticipated in the 84th Legislative Session, and some will certainly address brackish groundwater. A draft bill circulated in advance of the Session was designed to encourage the use of brackish groundwater resources. This specific draft, and likely other bills introduced on the subject, would require the TWDB to study brackish groundwater production zones and to consider adding such zones to groundwater availability modeling. Similarly, proposed legislation may require regional water planning groups to consider brackish groundwater production in

desalination facilities from TCEQ performance-based regulation (HB 2154); establish a Texas Center for Innovative Desalination Technology at the University of Houston, in partnership with the University of Texas El Paso (HB 841); and expand Texas Occupation Code requirements (including requiring filing of well logs) to cover brackish groundwater wells (HB 2624). More broadly applicable to the management of GCDs, bills were also introduced to expand the appeal process of a District's establishment of desired future conditions (HB 2769) and to permanently restrict the TCEQ from establishing GCDs in areas where annual surface water use is more than 50 times more than groundwater production, is located in a priority groundwater management area, and has a population greater than 2.3 million (HB 2169).

[81] HB 2578 is available online at http://www.capitol.state.tx.us/BillLookup/History.aspx?LegSess=83R&Bill=HB2578 (last accessed Dec. 30, 2014); SB 1760 is available at http://www.capitol.state.tx.us/BillLookup/History.aspx?LegSess=83R&Bill=SB1760 (last accessed Dec. 30, 2014).

[82] *See* HB 2578, § 3 (amending Texas Water Code § 11.1311 to add subsection (b-1)).

[83] *See id.* §§ 5, 6 (amending Texas Water Code §§ 16.053(e)(5)(J) and 16.060(c)(5)).

[84] *See id.* § 7 (amending subchapter D, Chapter 36, Texas Water Code to add new § 36.1015(b)).

[85] *See id.*

development of water management strategies for the next State Water Plan, and seek to encourage GMAs and GCDs to streamline permitting to promote the development and use of brackish groundwater. It has also been suggested that brackish groundwater projects should not be subject to the export regulations of the type otherwise typically placed on groundwater production within a groundwater conservation district.

One piece of draft legislation to promote development uses the concept of a rulemaking process for the designation of brackish groundwater production zones within groundwater reservoirs. In the rulemaking, such zone could be designated so long as it was demonstrated that production from the zone would not cause unreasonable negative impacts to quality or quantity of groundwater production or alternatively that such impacts would be mitigated. Designation of these zones would be subject to a petition by an interested party, notice, and hearing. Then, if adopted, the development of the brackish groundwater within the zone would utilize a streamlined permitting process and provide for permit terms consistent with typical project financing – e.g. a term of 20 – 30 years.

At the writing of this paper, no legislation had yet been filed in the 84th Session to address brackish groundwater, and hence it is too early to gauge what legislation may gain traction and ultimately pass this Session.

IV. Conclusion.

Brackish groundwater in Texas is a vast resource that has great promise for satisfying a portion of the growing demand for water in the State. Oil and gas producers, and service companies, are reformulating their hydraulic fracturing recipes to utilize higher salinity source water, so as to preserve freshwater resources, and lessen local opposition to oil and gas development. Use of brackish groundwater has been steadily growing among producers. Changes to existing laws and regulations are needed to continue to promote development of this vast resource, which development will lessen demand for fresh water resources which are needed to supply growing cities, industry and agriculture