# Legal Considerations for Geothermal Applications in Texas

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Synopsis

## I. INTRODUCTION

In recent history, geothermal energy has achieved little celebrity relative to other renewable energy sources and carbon-mitigating technologies. Owing largely to grassroots efforts, this is beginning to change.[1] Geothermal proponents emphasize that geothermal projects produce few, if any, carbon emissions while generating baseload energy—something significantly more valuable than variable power from solar and wind projects. Importantly, geothermal development leverages a deep body of expertise found within the oil and gas industry, offering both a competitive advantage and a pathway for absorbing industry talent as governmental mandates and programs threaten livelihoods. Investors and the federal government are demonstrating an incipient willingness to acknowledge the unique potential of geothermal energy.

With this long-awaited tailwind, the geothermal community is growing. In Texas and elsewhere, its proponents aspire to reposition the industry's place within the energy landscape from that of an afterthought to a heavyweight. In doing so, developers are introducing geothermal principles into a variety of applications. Although these projects often involve novel approaches and strategies, Texas developers benefit from a deep body of law built alongside more than a century of oil and gas development. This article examines how Texas law shapes the rights and obligations of geothermal developers within the context of emerging geothermal applications.

## II. GEOTHERMAL APPLICATIONS

Generally, geothermal energy refers to the thermal energy distributed within the Earth's crust between constituent host rock and fluid located within its fractures and pores at temperatures above ambient levels.[2] It is considered renewable in the sense that it is practically inexhaustible: geothermal heat is continuously generated by the decay of radioactive elements deep within the Earth.[3] Mankind's use of geothermal energy at naturally occurring hot springs predates recorded history. For the modern geothermal industry, important early milestones include the installation of a district heating system in Boise, Idaho, in the 1890s and a dry-steam plant in Larderello, Italy, that began producing

[1] Nascent organizations include the Texas Geothermal Energy Alliance and Project Innerspace, each launched in 2022, joining other notable advocacy organizations such as ThinkGeoEnergy and Geothermal Rising.

[2] Mass. Inst. of Tech. (MIT), "The Future of Geothermal Energy: Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21st Century," at 1-9 (2006).

[3] Silviu Livescu et al., "Geothermal and Electricity Production: Scalable Geothermal Concepts," in *The Future of Geothermal in Texas* 25, 26 (Jamie C. Beard & Bryant A. Jones eds., 2023); *see also* Robert P. Wright & C. Christopher Wilson, "Development of Geothermal Resources: The Heat Is On," *Wind, Solar and Renewables Inst.* (Univ. of Tex. Feb. 2011), at 1.

electricity in 1904.[4] During the twentieth century, geothermal heat and power projects spread to other places with naturally favorable conditions, including northern California (where the Geysers field is operated by Calpine Corporation), Iceland, Indonesia, New Zealand, the Philippines, and Turkey.[5] In recent years, the industry has focused on applying concepts and techniques from the oil and gas industry—utilizing data obtained in the course of oil and gas exploration—in an effort to make geothermal energy relevant on a vastly broader geographic scale. Some of the many existing and emerging applications for geothermal energy are below.

### *A. Direct Use*

Direct-use geothermal applications utilize ground-sourced heat for residential, industrial, and other uses, including food processing, horticultural greenhouses, aquaculture, and ground-source heat-pump systems.

While many of these applications are narrow, many advocates believe ground-source heat pumps hold substantial decarbonization potential for heating and cooling within residential, commercial, and industrial real estate contexts. Unlike systems designed to extract heat at levels capable of power generation, ground-source heat pumps are predicated on the stability of temperatures in the shallow subsurface. Typically, these systems use fluid flowing through pipes or coiled tubing at shallow depths to absorb heat from the ground when the air is colder than the ground temperature and to deposit heat into the ground when the air is warmer than the ground temperature.[6] Where scarcity of surface area availability precludes trenching, heat-exchange systems may utilize a U-shaped vertical borehole system. On a larger scale, these designs may be integrated into a network to provide heating and cooling for large buildings and residential communities.[7] To achieve efficiencies in district and larger applications, developers may design deeper systems that optimally access heat based on the prevailing geothermal gradient[8] or may incorporate storage concepts discussed below.

### *B. Hydrothermal Electricity*

Hydrothermal energy is the conventional mode of geothermal energy production. With hydrothermal projects, heat is extracted from an in situ reservoir. Conventional hydrothermal energy production is available only in isolated areas that feature the requisite combination of subsurface conditions. Generally, heat must exist at a feasible depth, abundant water must exist under pressure

[4] MIT, *supra* note 2, at 1-9.

[5] ThinkGeoEnergy, "Global Geothermal Power Update" (Jan. 2020).

[6] Sergio Kapusta et al., "Direct Use Applications: Decarbonization of Industrial Processes, and Heating and Cooling Scenarios," in *Future of Geothermal in Texas*, *supra* note 3, at 47, 49–50.

[7] *Id.* at 50.

[8] *Id.* at 49.

in the target reservoir, and the reservoir geology must include appropriate permeability and porosity.[9]

Where conditions are appropriate, subsurface temperature and pressure conditions may produce steam without a significant amount of water at the wellhead. This dry steam drives a turbine to generate electricity.[10] More commonly, water is produced at high pressure and temperature at a wellhead connected to a flash tank, where the fluid's exposure to lower pressure generates steam. As with a dry-steam system, the flash steam drives a turbine to generate electricity.

At lower prevailing subsurface reservoir temperatures, or with residue water from a flash-steam operation, hydrothermal energy is collectible using a binary cycle or organic Rankine cycle (ORC) plant.[11] These systems utilize a heat-exchange fluid with a lower boiling point.[12] The produced water heats the second fluid to boiling, creating vapor that then drives a turbine. In Texas, given the depth of basement igneous rock and the lower downhole temperatures in sedimentary formations, geothermally generated electricity is likely to occur through binary cycle plants.[13] Research and development efforts are underway in an effort to improve efficiencies of power generation—for example, through use of carbon dioxide in supercritical phase as a heat-exchange fluid and by introducing thermo-electric generators that would convert heat to electricity downhole.[14]

### *C. Closed-Loop Geothermal*

Certain geothermal companies have focused recently on the possibility of generating electricity through closed-loop geothermal systems—so called because they are entirely circular and closed, neither injecting fluids into nor producing fluids from the rock surrounding the wellbore.[15] Unlike EGS (discussed below), these systems avoid any stigma of fracturing, and because they do not alter subsurface pressures, they avoid seismicity concerns. Without the availability of fractures, a closed-loop wellbore achieves significantly less two-dimensional surface contact with the rock on a linear-foot basis, limiting conduction and heat transfer into the wellbore.[16] To increase conduction, closed-loop designs frequently involve numerous long lateral wellbores, with each lateral connecting at its endpoint with a paired parallel lateral to create a loop, forming system resembling a radiator. Due to the quantity of drilling necessary and the challenge of drilling at the extremely high temperatures required to compensate for the system's limited conductivity, many commentators believe

[9] MIT, *supra* note 2, at 1-10.

[10] Rebecca Schulz & Silviu Livescu, "The Oil and Gas Industry Role: Technology Transfer, Development, Acceleration, and Scale," in *Future of Geothermal in Texas*, *supra* note 3, at 130, 139.

[11] *Id.*

[12] *Id.*; *see also* Livescu et al., *supra* note 3, at 39.

[13] Livescu et al., *supra* note 3, at 37.

[14] Schulz & Livescu, *supra* note 10, at 139.

[15] Livescu et al., *supra* note 3, at 32–33.

[16] *Id.* at 32.

closed-loop systems are not financially plausible absent significant cost reductions or technological breakthroughs.[17]

### *D. Enhanced Geothermal Systems*

An enhanced geothermal system (EGS) replicates the conditions found in a conventional hydrothermal system.[18] An EGS design transforms the ubiquity of heat at depth into an asset by overcoming the absence of water, permeability, or porosity at depths where that heat is found. Advocates believe EGS promises to radically expand the availability of geothermal energy—in effect, enabling "geothermal anywhere."[19]

EGS designs typically call for complementary injection and production wells connected at heat-bearing depths through bottomhole fractures that enhance the permeability of the rock.[20] Fluid is injected down through an injection well into the fractured rock, where it absorbs heat as it migrates through the fractures into the production well.[21] The heated fluid is then pumped to surface and run through a plant to produce electricity. While the system forms a loop, it is not closed to the rock.

Directional or horizontal drilling and multi-stage fracturing—methods pioneered by oil and gas developers—can augment the efficacy of EGS.[22] Additionally, some hybrid designs combine closed-loop and EGS elements—for example, by combining downward bottomhole fractures to bringing heat to the well through convection with a separate closed-loop downhole heat-exchange system, either within a single well or multiple wells.[23]

### *E. Geothermal Storage*

As costs of wind and solar energy have fallen, their average shares of our power supply have risen, increasing the public's reliance on them. Yet these energy sources are inherently variable, performing according to the whims and routines of the weather and the planet. A prolonged failure to produce power creates a vacuum, and even when they predictably generate supply at capacity, times of peak supply fail to align with peak demand. These factors create arbitrage opportunities for storage of energy.

Geothermal wells can be used for battery storage.[24] At times of peak renewable supply and lower prices, fluids are drawn from a cold well, and solar

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[17] Mark McClure, "Technical Barriers for Deep Closed-Loop Geothermal," *ResFrac Blog* (Mar. 21, 2023).

[18] MIT, *supra* note 2, at 1-10.

[19] Univ. of Tex. Bureau of Econ. Geology, "Geothermal Anywhere—Texas' Next Great Energy Opportunity," (July 15, 2021), https://www.beg.utexas.edu/articles/geothermal-anywhere-texas-next-great-energy-opportunity.

[20] Livescu et al., *supra* note 3, at 28–29; MIT, *supra* note 2, at 1-10.

[21] MIT, *supra* note 2, at 1-10.

[22] Livescu et al., *supra* note 3, at 31.

[23] *Id.* at 35.

[24] Sidney Green et al., "Geothermal Battery Energy Storage," 164 *Renewable Energy* 777 (Feb. 2021).

radiance or other renewable energy is used to heat those fluids, which are then injected into designated hot wells. At times of low renewable supply and higher prices, the system discharges: the heated fluids are produced, the resulting steam powers a turbine, and the fluids are injected into a cold well for later retrieval.[25] As the costs of lithium and other inputs for electrochemical batteries soar, the prospects for these geothermal aquifer or reservoir thermal energy storage systems appear more promising.

A similar approach provides for thermal storage for heating and cooling of facilities on a seasonal basis. This concept—a cousin of the ground-source heat-pump system—may feature subsurface storage systems in insulated layers using a large array of shallow closed boreholes or deeper open wells.[26] During the summer season, heated fluids can be stored subsurface, to be retrieved and used in winter. Conversely, fluids cooled during winter can be retrieved and used for cooling in summer.[27]

### *F. Oil and Gas Coproduction and Conversion*

The long history of oil and gas production in Texas has yielded a wealth of data on downhole geology and temperatures across the state. In many locations, those temperatures are suitable for geothermal energy production. In areas where waterflood operations achieve a sufficient flow rate at elevated temperatures, the heat capacity of large quantities of produced water can generate meaningful power.[28] Other areas of the state include wells completed in or above large, heated, high-pressure sedimentary zones or aquifers with high natural porosity.[29] Brines produced alongside oil and gas from those depths may be capable of geothermal power generation, and abandoned wells reaching those depths may be convertible into geothermal injection or production wells.[30] Conversely, operators may be able to deepen wells currently drilled above geothermal target zones to secure geothermal power.

In some cases, these efforts may yield sufficient capacity to justify delivering power to the grid or to neighbors. In other cases, they may offset the costs of building transmission and reduce or eliminate the amount of electricity purchased from providers for pumping and other oilfield operations.[31] Previously drilled wells and existing infrastructure can substantially decrease the costs of achieving geothermal power generation.[32] Likewise, incidental production of

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[25] *Id.*

[26] S. Gehlin, "Borehole Thermal Energy Storage," in *Advances in Ground-Source Heat Pump Systems* 295 (Simon J. Rees ed., 2016).

[27] *Id.*

[28] Birol Dindoruk et al., "Other Geothermal Concepts with Unique Applications in Texas," in *Future of Geothermal in Texas*, *supra* note 3, at 61, 63; *see also* MIT, *supra* note 2, at 2-34.

[29] Dindoruk et al., *supra* note 28, at 63–65; MIT, *supra* note 2, at 2-34.

[30] Daniel Raimi et al., "Decommissioning Orphaned and Abandoned Oil and Gas Wells: New Estimates and Cost Drivers," 55 *Environ. Sci. & Techn.* 15, 10224 (2021).

[31] Dindoruk et al., *supra* note 28, at 63.

[32] MIT, *supra* note 2, at 2-30.

dissolved gas and other minerals from a geothermal well can enhance the economics of a geothermal operation.[33]

A financial boost from geothermal power may in many instances extend the life of an oil or gas well. By continuing production—or by converting non-producing oil and gas wells to geothermal—operators can avoid or defer plugging and abandonment expense. Further, at a time when methane emissions from marginal and abandoned wells are the object of scrutiny and activism, geothermal power production furnishes a beneficial use to blunt criticism. Prudent operators in the oilfield will consider these benefits and the availability of tax credits, in exploring whether to undertake geothermal operations. Various studies estimate that the energy resource base accessible from existing wells is quite large,[34] making them "significant targets for short and intermediate-term development."[35]

## III. FOUNDATIONAL TEXAS LAW FOR GEOTHERMAL RIGHTS

### *A. Texas Geothermal Resources Act*

#### 1. 1975 Act

As a policy matter, Texas has declared that "the rapid and orderly development of geothermal energy and associated resources is in the interest of the people of the State of Texas."[36] To that end, nearly 50 years ago, Texas implemented the Geothermal Resources Act of 1975.[37] Generally, the Act establishes that "geothermal energy and associated resources" are to be developed in an efficient manner that avoids waste, with consideration afforded to the environment, protection of correlative rights, and conservation of natural resources.[38] Accordingly, this framework resembles that applicable to Texas regulation of oil and gas. Indeed, as with oil and gas,[39] the Act subjects the exploration, development, and production of geothermal energy and associated resources to the regulatory authority of the Texas Railroad Commission for the purpose of conservation and protection of correlative rights.[40] The Act also establishes procedures for the leasing and development of geothermal energy and associated resources on Permanent School Fund land.[41]

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[33] *Id.* at 2-31.

[34] S. Daniel Zafar & Bruce L. Cutright, "Texas' Geothermal Resources Base: A Raster-Integration Method for Estimating In-Place Geothermal Energy Resources Using ArcGIS," 50 *Geothermics* 148 (Apr. 2014); MIT, supra note 2, at 2-35.

[35] MIT, *supra* note 2, at 2-35.

[36] Tex. Nat. Res. Code § 141.002(1).

[37] *Id.* ch. 141.

[38] *Id.* § 141.002(2)–(3).

[39] *See generally id.* chs. 81–111.

[40] *Id.* § 141.011.

[41] *Id.* §§ 141.073–.079. Generally, this article addresses legal considerations applicable to geothermal development on private lands; it is not intended to examine legal issues relating to development or leasing of state lands, which are governed, in part, by Tex. Admin. Code tit. 31, pt. 1.

Under the Act, "geothermal energy and associated resources" has the following definition:

> (A) products of geothermal processes, embracing indigenous steam, hot water and hot brines, and geopressured water;
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> (B) steam and other gasses, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations;
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> (C) heat or other associated energy found in geothermal formations; and
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> (D) any by-product derived from them.[42]

Quite broadly, the above definition captures the ability to utilize heat and energy from all of the types of geothermal applications presented in Part II—those that capture heat and energy directly from indigenous fluids, directly from recycled fluids, directly from extraneous fluids sourced elsewhere and injected into the subsurface of the property, and indirectly through the medium of heat-exchange fluids and processes. Heat and energy harvested from an operation in which a formation has been fractured or stimulated appears to fall within the scope of the definition.

Notably, although the Act, when passed, defined "geothermal energy and associated resources," it did not squarely address to whom they belonged.[43] The Act specified that it was not intended to change the substantive law of the state[44] but elsewhere stated that geothermal energy and associated resources are to be "treated and produced as mineral resources."[45] This statement can be interpreted not as characterizing ownership[46] but rather as establishing the framework under which development occurs, consonant with the ensuing delegation of regulatory authority to the Railroad Commission. Regardless, confusion persisted, with some inferring that the Act characterized the resource as a constituent of the mineral estate.[47]

### 2. 2023 Amendments to the Act

The passage of Texas Senate Bill 785 introduced clarity to the Act's characterization of geothermal rights.[48] Effective June 18, 2023,[49] the Act was amended to supplement the definition of "geothermal energy and associated resources" and to clarify the state of the law as it pertains to ownership. First,

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[42] Tex. Nat. Res. Code § 141.003(4).

[43] A.W. Overbeck, "The Geopressured Geothermal Resources of Texas: A Report on Legal Ownership and Royalty Issues," at 6 (Univ. of Tex. at Austin Ctr. for Energy Studies Jan. 27, 1977) (noting that during hearings on the bill that became the Act, legislators declined a proposal to include a determination on ownership of the resource).

[44] Tex. Nat. Res. Code § 141.002(5).

[45] *Id.* § 141.002(4).

[46] Ben Sebree, "Who Owns Heat? Ownership of Geothermal Energy and Associated Resources Under Texas Law," in *Future of Geothermal in Texas*, *supra* note 3, at 333–34.

[47] *See* Wright & Wilson, *supra* note 3, at 18 (interpreting the Geothermal Resources Act as announcing that geothermal resources are mineral resources).

[48] S.B. 785, 88th Leg. (Tex. 2023).

[49] *See id.* § 4 (providing for effectiveness immediately at passage with a vote of two-thirds of all members elected to each house; having received such vote, the bill took effect on June 18, 2023).

the statute now specifies that oil, gas, products of oil or gas, and minerals produced from a geothermal formation are not "by-products" for purposes of the statute and are therefore not encompassed within the definition of "geothermal energy and associated resources."[50] Any element other than oil, gas, a product of oil or gas, or a mineral that is found in a geothermal formation and brought to the surface, "whether or not it is used in geothermal heat or pressure inducing generation," is a "by-product" and is therefore within the definition of "geothermal energy and associated resources."[51]

Second, the Act establishes that subsurface geothermal energy and associated resources are owned as real property by the landowner, or, where the surface estate and mineral estate have been severed, by the owner of the surface estate.[52] These property rights "entitle the owner . . . and the owner's lessee, heir, or assignee to drill for and produce the geothermal energy and associated resources."[53]

This ownership pronouncement does not apply if "otherwise expressly provided by a conveyance, contract, deed, reservation, exception, limitation, lease, or other binding obligation."[54] It also does not "apply to minerals dissolved in groundwater, including in hot brines" or "change existing law regarding: (A) oil, gas, or mineral extraction regardless of its heat or energy potential; (B) the rights of the dominant and servient estates; or (C) the ownership and use of groundwater."[55]

Notably, the Act continues to negate any intent to make any change in substantive law, professing a purpose of merely restating the law "in clearer terms to make it more accessible and understandable."[56] And, of course, constitutional protections limit the ability to of the government to deprive a citizen of his or her property.[57] Still, as discussed below, the amendment recognizing ownership of geothermal energy and associated resources in the owner of the surface estate appear to accurately reflect the body of Texas law.

### 3. Related Legislation

In addition to addressing ownership issues, Senate Bill 785 amends section 2703.056 of the Texas Insurance Code to allow a title insurance policy to include as an exception from coverage not only the mineral estate but also geothermal energy and resources.[58] In the same session, the legislature

[50] *Id.* § 2 (amending Tex. Nat. Res. Code § 141.003(5)).

[51] *Id.*

[52] *Id.* § 3 (adding Tex. Nat. Res. Code § 141.004(a)).

[53] *Id.* (adding Tex. Nat. Res. Code § 141.004(b)).

[54] *Id.* (adding Tex. Nat. Res. Code § 141.004(a)).

[55] *Id.* (adding Tex. Nat. Res. Code § 141.004(c)).

[56] Tex. Nat. Res. Code § 141.002(5).

[57] U.S. Const. art. V; Tex. Const. art. I, § 17; *see generally* Reagan Marble, "Produced Water: The Next 'Title' Wave of Litigation," *48th Annual Ernest E. Smith Oil, Gas and Mineral Institute* (Univ. of Tex. Sch. of Law 2022) (examining the constitutionality of 2019 amendments to Tex. Nat. Res. Code ch. 122 that purport to vest ownership of produced water in an oil and gas operator or its transferee).

[58] S.B. 785, *supra* note 48, § 1.

passed Senate Bill 786, which amends section 27.037 of the Texas Water Code to empower the Railroad Commission with regulatory authority over closed-loop geothermal wells.[59] In light of the classification of closed-loop geothermal wells as Class V injection wells, the amendment resolves the conflict between the general regulatory authority of the Texas Commission on Environmental Quality over Class V injection wells and the regulatory authority of the Railroad Commission over geothermal development.[60] Finally, the legislature passed Senate Bill 1210.[61] As discussed in Part IV.B.2 below, the bill amends section 89.047 of the Texas Natural Resources Code to facilitate the takeover of orphaned oil and gas wells for geothermal and energy-storage operations.[62]

#### 4. Conflict with Produced Water Statute

As noted above, under chapter 141 of the Texas Natural Resources Code, where the surface estate and mineral estate have been severed, the "geothermal energy and associated resources" belong to the owner of the surface estate.[63] This geothermal estate includes "indigenous . . . hot water and hot brines" as well as "hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations."[64]

By contrast, under section 122.002 of the Texas Natural Resources Code, "fluid oil and gas waste," when "produced and used by or transferred to a person who takes possession of that waste for the purpose of treating the waste for a subsequent beneficial use . . . is considered to be the property of the person who takes possession of it" for that purpose.[65] The same section provides that the "treated product" of fluid oil and gas waste belongs to the party who treats it or who takes possession of it for disposal or beneficial use.[66] "Fluid oil and gas waste" is defined as "waste containing salt or other mineralized substances, brine, hydraulic fracturing fluid, flowback water, produced water, or other fluid that arises out of or is incidental to the drilling for or production of oil or gas."[67]

In *Cactus Water Services, LLC v. COG Operating, LLC*, the El Paso Court of Appeals recently held that produced water from operations under an oil and gas lease belonged to the oil and gas operator.[68] Although treatment technologies had made it a valuable commodity in the oilfield, the court characterized produced water as waste, rather than groundwater. The court rested its conclusion upon

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[59] S.B. 786, 88th Leg. (Tex. 2023).

[60] *Id.*

[61] S.B. 1210, 88th Leg. (Tex. 2023).

[62] *Id.*

[63] Tex. Nat. Res. Code § 141.004(a).

[64] *Id.* § 141.003(4)(A)–(B).

[65] Tex. Nat. Res. Code § 122.002(1).

[66] *Id.* § 122.002(2).

[67] *Id.* § 122.001(2).

[68] No. 08-22-00037-CV, 2023 WL 4846861 (Tex. App.—El Paso July 28, 2023, pet. filed).

> a legal framework distinguishing oil and gas waste from groundwater, making clear that produced water is categorized within the former, and placing the burden of its safe disposal on operators, and according to years of the common industry practice in which operators have processed, transported, and disposed of oil and gas waste.[69]

Within the context of mineral and geothermal coproduction, a conflict exists between chapter 141, on one hand—which regards hot water and hot brines as part of the geothermal estate—and section 122.002 and *Cactus*, on the other—which generally regard produced water as property of the mineral operator. A policy of encouraging coproduction may warrant future legislative effort to address the conflict. Until then, disputes between parties citing these authorities may be determined by the relationship between the dominant and servient estates.[70]

### *B. Assessing the Act's Ownership Pronouncement*

Geothermal development involves groundwater (an incident of the surface estate), heat (a form of energy that does not qualify as a substance), and production of subsurface resources (an activity historically associated with oil, gas, and minerals). Because it combines these disparate attributes, commentators have noted that ownership of geothermal resources does not fall neatly into any well-settled property regime.[71]

Despite the validity of this observation, Texas jurisprudence resoundingly supports the legislative pronouncement that geothermal resources are not part of the mineral estate. First, the objective of geothermal production is to produce energy in the form of heat—which, while valuable, is not a substance. Under Texas law, minerals are substances.[72] Although geothermal heat, like a mineral, is a subsurface resource, it is not a substance, and categorizing a nonsubstance resource as a mineral is inappropriate.[73]

Second, geothermal energy is captured from convection of fluids and conduction between the underground rock and those fluids. These properties—fluids (other than oil and gas) and the subsurface rock—do not belong to the mineral estate. The estate remaining following a severance of minerals includes "not only the surface . . . but also the matrix of the underlying earth, i.e., the reservoir storage space."[74] In addition to groundwater,[75] this includes the geological structures[76] and "the mass of earth undergirding the surface,"[77]

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[69] *Id.* at *16.

[70] *See infra* Parts III.C, IV.C.

[71] *See generally* Overbeck, *supra* note 43.

[72] Moser v. U.S. Steel Corp., 676 S.W.2d 99, 102 (Tex. 1984) (defining the object of a severance of "minerals" to include "all substances within the ordinary and natural meaning of that word").

[73] Sebree, *supra* note 46, at 342.

[74] Humble Oil & Ref. Co. v. West, 508 S.W.2d 812, 815 (Tex. 1974).

[75] Edwards Aquifer Auth. v. Day, 369 S.W.3d 814, 831 (Tex. 2012); Sun Oil Co. v. Whitaker, 483 S.W.2d 808, 811 (Tex. 1972); Tex. Water Code § 36.002.

[76] *West*, 508 S.W.2d at 815; Myers-Woodward, LLC v. Underground Servs. Markham, LLC, No. 13-20-00172-CV, 2022 WL 2163857, at *11 (Tex. App.—Corpus Christi-Edinburg 2022, pet. filed).

which courts have determined include "all non-mineral 'molecules' of the land."[78] In fact, not even the mineral molecules themselves are absolutely vested in the owner of the mineral estate. Under the rule of capture, the mineral owner is entitled only to "a fair chance to recover the oil and gas" from its mineral estate.[79] These precedents leave little doubt that the right to develop geothermal energy cannot be part of the mineral estate.

Accordingly, the 2023 amendments to the Act appear to accurately capture the general rule that the right to explore for, produce, and enjoy geothermal energy belongs to the owner of the surface. The line separating the rights of a mineral owner and surface owner can, however, be blurred when one exercises its rights in a manner that affects or impairs the ability of the other to access or enjoy its rights. Those complications are discussed in more detail below. Consequently, for many geothermal applications, the recent Texas statutory pronouncement is not dispositive.

### *C. Severability Issues*

#### 1. Geothermal Resources as a Severable Subsurface Estate

The rule that geothermal resources belong to the surface estate is a general rule. In view of the severability of estates in minerals and groundwater,[80] there is little reason to doubt that an interest in geothermal resources—as a legal unit of ownership[81]—can be conveyed or reserved. The recent amendments to the Geothermal Resources Act reflect this principle, providing that subsurface geothermal resources are owned by the landowner "[e]xcept as otherwise expressly provided" in an instrument of title.[82]

#### 2. Eligibility of Dominance Doctrine for Non-Mineral Subsurface Interests

When an estate in land is severed, the owner of the severed interest has the implied right to reasonable use of the surface.[83] This rule "is born of simple logic" and exists because the severed interest "would be wholly worthless if the grantee or reserver could not enter upon the land" to explore for and develop the severed estate.[84] Under a long line of cases, a severed mineral estate is

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[77] Lightning Oil Co. v. Anadarko E&P Onshore, LLC, 520 S.W.3d 39, 47 (Tex. 2017); Dunn-McCampbell Royalty Interest, Inc. v. Nat'l Park Serv., 630 F.3d 431, 442 (5th Cir. 2011).

[78] *Myers-Woodward*, 2022 WL 2163857, at *11; *Dunn-McCampbell*, 630 F.3d at 442.

[79] Coastal Oil & Gas Corp. v. Garza Energy Tr., 268 S.W.3d 1, 15 (Tex. 2008). More recently, adjudicating a trespass claim by a mineral lessee following an invasion of sour gas into the pore space in the subsurface of the lease, the Texas Supreme Court regarded the claim as one "for trespass to non-possessory property rights." Regency Field Servs., LLC v Swift Energy Operating, LLC, 622 S.W.3d 807, 816 (Tex. 2021).

[80] *Edwards Aquifer Auth.*, 369 S.W.3d at 831 (recognizing ownership of groundwater in place); Coyote Lake Ranch, LLC v. City of Lubbock, 498 S.W.3d 53 (Tex. 2016) (recognizing that an estate in water, like a mineral estate, is severable).

[81] Averyt v. Grande, Inc., 717 S.W.2d 891, 894 (Tex. 1986).

[82] S.B. 785, *supra* note 48, § 3 (adding Tex. Nat. Res. Code § 141.004(a)).

[83] *Coyote Lake Ranch*, 498 S.W.3d at 64.

[84] *Id.* at 60.

considered "dominant" in the sense that it is benefitted, and the burdened estate is considered "servient."[85] The terms do not imply superiority or inferiority.[86] In *Coyote Lake Ranch, LLC v. City of Lubbock*, where the groundwater estate in a large ranch had been conveyed to the City of Lubbock, the ranch owner argued that the dominance doctrine should not be extended to severances of groundwater. The Texas Supreme Court rejected the argument, explaining: "Though we have not used the word to describe a severed groundwater estate, the estate is dominant for the same reason a mineral estate is: it is benefitted by an implied right to the reasonable use of the surface."[87]

3. Terminological Strictures for Non-Mineral Subsurface Interests

The holding in *Coyote Lake Ranch* highlights a problem of terminological imprecision. Historically, as severance of mineral interests became commonplace, our legal vocabulary developed from a binary structure: the severed estate was regarded as the mineral estate, and the balance of the property was referred to as the surface estate. This "surface estate" reference is an understandable shorthand: in Texas, the utility of the subsurface is overwhelmingly a story about minerals, and, historically, the only other value of property was derived from its use at and upon the surface.

Due to this "resource blindness,"[88] members of the legal community generally describe non-mineral subsurface estates—for example, groundwater rights, pore-space or subsurface storage and sequestration rights, and rights in geothermal resources[89]—as being part of the surface estate. But as a general rule, non-mineral estates, like their mineral brethren, are readily severable. With recent innovations and economic forces drawing greater attention to their value, a marketplace for non-mineral subsurface rights is rapidly emerging. As more and more of these interests are severed in that marketplace and held as standalone interests in property, referring to them as part of the surface estate will make no more sense than referring to minerals as belonging to the surface estate.

4. Implications of Non-Mineral Subsurface Estate Dominance

Further, under *Coyote Lake Ranch*, a severed estate in a non-mineral resource is dominant.[90] That is, a severed interest in groundwater or geothermal resources, for example, is dominant vis-a-vis the balance of the property from which the interest derives. Logically, where the burdened estate includes the right to occupy and enjoy not only the property at and upon the surface but also an unsevered mineral estate attached to that surface interest, this rule produces an unusual outcome: an interest in groundwater or geothermal re-

[85] *Id.* at 64.

[86] *Id.*

[87] *Id.*

[88] Monika U. Ehrman, "Hidden Resources," 13 *U.C. Irvine L. Rev.* 564, 567 (2023).

[89] *Id.* at 581–88.

[90] *Coyote Lake Ranch*, 498 S.W.3d at 64.

sources that is dominant with respect to the balance of the property, including the minerals. Likewise, if the minerals are severed *after* the severance of an interest in groundwater or geothermal resources,[91] the rights of the severed mineral owner are subject to the rights of the previously severed interests in groundwater or geothermal resources. In that situation, the severed mineral estate—though dominant with respect to the estate from which it was severed—remains servient with respect to the severed groundwater or geothermal resources estates. In either scenario, if the interest in groundwater or geothermal resources is referred to using the prevailing legal vocabulary as part of the surface estate, the result is that a surface interest will be dominant and the mineral estate will be servient—precisely the opposite of the rule as presented in Texas case law.

The resolution to this problem could take different forms. In light of the strong public policy favoring mineral development in Texas, some might argue that the mineral estate should always be dominant as against severed non-mineral subsurface interests. As a policy matter, universal dominance of the mineral estate arguably undervalues competing uses whose economic and societal importance has risen rapidly in recent years.[92] Moreover, such a rule, while straightforward, is arguably arbitrary and unfair—it fails to take into account the relative values of the property interests, the fact that an owner of a severed mineral interest may acquire his or her interest subject to the severance of the non-mineral subsurface interest, and the fact that the severed non-mineral subsurface interests are property rights entitled to constitutional protection.[93] And although Texas policy supports mineral development, it also favors protection and development of non-mineral subsurface interests such as groundwater[94] and geothermal resources.[95]

As an alternative to a rule of mineral dominance, courts could apply *Coyote Lake Ranch* in future disputes to definitively establish that a severed non-mineral subsurface interest can, under certain circumstances, be dominant as against a mineral interest.[96] This result may require the legal community to abandon the simplistic surface-mineral dichotomy in favor of a more nuanced vocabulary. To adjudicate the rights of a dominant non-mineral subsurface interest and a servient mineral estate, courts could simply apply existing law to establish that the non-mineral subsurface interest has an implied right of rea-

[91] This scenario assumes that the party acquiring the mineral interest has notice of the outstanding severed interest in groundwater or geothermal resources and does not qualify as a bona fide purchaser. *See, e.g.*, Madison v. Gordon, 39 S.W.3d 604, 607 (Tex. 2001).

[92] Meredith A. Wegener, "Balancing Rights in a New Energy Era: Will the Mineral Estate's Dominance Continue?," 57 *Hous. L. Rev.* 1037, 1069–72 (2020).

[93] One proposal addressing these issues is the "fair opportunity doctrine." *See* Joseph A. Schremmer, "A Unifying Doctrine of Subsurface Property Rights," 46 *Harv. Envtl. L. Rev.* 525 (2022).

[94] Tex. Water Code ch. 36; *Edwards Aquifer Auth.*, 369 S.W.3d at 832–33.

[95] Tex. Nat. Res. Code § 141.002.

[96] A.L. Blount et al., "The Accommodation Doctrine in Light of Renewable Energy," *Oil, Gas and Energy Law* 4 (2023) (arguing that *Coyote Lake Ranch* "created a path to allow groundwater to be given a slight edge in future conflicts" and suggesting that "other renewable energy sources including water, wind, and solar could dominate in a conflict").

sonable use of the mineral estate, with the accommodation doctrine resolving disputes over conflicting uses.[97]

## IV. Legal Concepts Applicable to Geothermal Applications

An undeniable asset of the emerging geothermal community is its creativity, which is borne out by the variety of applications that have been introduced or conceptualized, many of which are presented above. This diversity of operational designs implicates an assortment of legal issues and considerations under Texas law.

### *A. Trespass Issues Arising from Fracturing and Injection*

#### 1. Enhanced Geothermal Systems and Fracturing Operations

As discussed above, many EGS concepts borrow from oil and gas innovation by using fracturing to stimulate permeability, flow, and surface contact with the rock, improving the energy potential of a geothermal system. Yet engineers cannot tightly control the extent of the fractures, and in many cases fractures and the fluids and proppants injected to hold them open propagate across property lines, enabling drainage of resources from adjoining property.

In *Coastal Oil & Gas Corp. v. Garza Energy Trust*, the Texas Supreme Court held that hydraulic fracturing extending from an oil or gas well across a lease line does not result in an actionable trespass, reasoning that any injury suffered by the adjoining property owner is precluded by the rule of capture.[98] The court underscored the distinction between invasions at the surface and those far removed from the surface. Noting that a plane flying two miles above the surface is not a trespass, it explained: "The law of trespass need no more be the same two miles below the surface than two miles above."[99] In reaching the decision, the court cited numerous policy reasons why the rule of capture barred recovery for fracturing across property lines: the ability of the adjoining owner to protect itself by reciprocally drilling its own well; the usurpation of Railroad Commission regulatory authority that would result from allowing recourse for drainage from the practice; the poor ability of court systems to determine value of drained resources; the necessity of the practice for recovery of resources; and the absence of dissent regarding the practice within the industry.[100]

These policy reasons also support the case for denying a trespass claim when, for the purpose of geothermal energy production, fluid drains into a well from fractures extending beyond property lines. Accordingly, it is likely that courts will follow the reasoning of *Coastal* and allow production from EGS wells even when those producing wells include fractures that extend beyond property lines.[101]

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[97] *See infra* Part IV.D.

[98] 268 S.W.3d 1, 12–13 (Tex. 2008).

[99] *Id.* at 11.

[100] *Id.* at 14–17.

[101] Wright & Wilson, *supra* note 3, at 20.

However, unlike in the oil and gas context, an EGS operation may involve fracturing not only for drainage but also for injection. The standard EGS design contemplates fracturing to create pathways through which fluids pumped down into an injection well will migrate and pass into intersecting fractures connected to a producing well. Thus, in a doublet system with one injection well and one producing well, approximately half of the fracturing activity occurs for the direct purpose of injection, rather than purely for drainage. Does this distinction warrant a different rule than the one pronounced in *Coastal*? Arguably, no. Although fractures emanate from an injection well, to the extent they connect to a producing well (as designed), they are inextricably intertwined with the act of producing geothermal energy, and the rule of capture should apply.

Of course, some fluids pushed into fractures emanating from an injection well may not migrate to a point of intersection with the complementary fracture network. They may instead travel through a fracture to a point beyond the property line within adjoining property and then out into the subsurface mass in the adjoining property. Whether that event results in a trespass is fundamentally the same question as whether a trespass occurs when injected fluids migrate from an injection well into neighboring property—a question relevant not only to EGS in tight-rock formations, but also to any open geothermal system requiring injection for pressure and flow maintenance.

### 2. Migration of Injected Fluids into Neighboring Estate

Because circular geothermal systems can involve injection of fluids that migrate into adjoining subsurface property, prudent developers of these geothermal projects will evaluate the risk of trespass liability. In *FPL Farming Ltd. v. Environmental Processing Systems, L.C.*, the Texas Supreme Court left open the question of whether a neighbor alleging migration of a wastewater plume into its subsurface may have a claim for trespass.[102] In that case, the operator of an injection well argued that its regulatory permit precluded trespass liability for operations performed under the authority of that permit. Rejecting the operator's argument, the court held that a permit does not immunize an operator from trespass liability.[103] The court noted that a property owner faced with an invasion of subsurface fluids, unlike a property owner who may drill its own well to offset subsurface drainage from an adjoining well, does not have an obvious means by which to protect his or her interests.[104]

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[102] 351 S.W.3d 306, 314 (Tex. 2011).

[103] *Id.* The court distinguished *Railroad Commission of Texas v. Manziel*, 361 S.W.2d 560 (Tex. 1962), in which the court previously rejected a property owner's claim that trespass resulting from subsurface fluid migration warranted cancellation of an operator's permit for an enhanced oil recovery program. As explained by the court, *Manziel* did not address tort aspects of the operator's activity; it merely held that the alleged trespass was not grounds for cancellation of the permit. *FPL Farming*, 351 S.W.3d at 313.

[104] *Id.*; *see also* Schremmer, *supra* note 93, at 570 (observing that courts tend to regard intrusions as actionable "when self-help cannot rebalance the correlative relationship of the subsurface owners").

The court's silence on the issue in *FPL Farming* may concern geothermal operators intending to inject fluids as part of a geothermal project. Fortunately, *Lightning Oil Co. v. Anadarko E&P Onshore, LLC* offers guidance.[105] Broadly, *Lightning* indicates that the risk of trespass liability is primarily a function of the likelihood and magnitude of legal injury to adjoining property owners.[106] In *Lightning*, an oil and gas operator, Anadarko, obtained a surface and subsurface easement from a ranch owner whose interest was subject to an oil and gas lease held by a second operator, Lightning. At issue was whether Anadarko's plan of drilling through Lightning's lease to access its own leasehold estate would result in a trespass. As a preliminary matter, the Texas Supreme Court determined that Anadarko's physical occupation of the subsurface—without completing any segment of the wellbore to produce oil and gas from any point within the Lightning lease—was merely an exercise of surface rights derived from the ranch owner and did not constitute a trespass.[107] However, the court appeared to take seriously Lightning's claim that Anadarko's operation would necessarily remove some quantity of minerals by drilling and extracting the cuttings from the cylindrical volume of the wellbore within the Lightning lease. To the extent mineral molecules were embedded within those cuttings, the activity would unquestionably be considered a physical invasion and taking of Lightning's leasehold property right.

Nonetheless, the court found no trespass, stating that "ownership of property does not necessarily include the right to exclude *every* invasion or interference . . . ."[108] According to the court, "[w]hether the small amount of minerals lost through that process will support a trespass must, in the end, be answered by balancing the interests involved."[109] In performing this balancing test, the court first undertook a quantitative analysis and concluded that the Anadarko's drilling resulted in only a "small loss of minerals."[110] Next, the court evaluated "the interests of society and the interest of the oil and gas industry as a

[105] 520 S.W.3d 39 (Tex. 2017). In another subsurface migration case, the El Paso Court of Appeals reversed a no-evidence summary judgment in favor of the defendant, holding that improperly excluded testimony created material fact issues as to the causation and damages elements of the plaintiff's trespass claim. Iskandia Energy Operating, Inc. v. SWEPI LP, No. 08-22-00103-CV, 2023 Tex. App. LEXIS 8288 (Tex. App.—El Paso Oct. 31, 2023, no pet. h.). In a preface to its analysis, the court explained that *Lightning* should have guided the availability of the trespass claim but noted that the parties failed to address the role of the case in their arguments. *Id.* at *42.

[106] The Texas Supreme Court has noted a common-law distinction between the law of trespass when a claimant holds a possessory interest as opposed to a nonpossessory interest, such as a royalty or possibility of reverter. In the latter situation, no physical invasion occurs, and a claimant must show actual damages, rather than merely an invasion. *Coastal*, 268 S.W.3d at 10–11. However, in view of the explanation in *Coastal* that traditional trespass principles need not apply to invasions that occur miles beneath the surface, the actionability of a deep subsurface invasion against even a possessory interest absent actual damages is, at best, questionable.

[107] *See* discussion regarding subsurface ownership issues at Part III.B, *supra*.

[108] *Lightning*, 520 S.W.3d at 46.

[109] *Id.* at 50.

[110] *Id.* at 51.

whole"[111] and determined that the efficiencies achieved through off-lease drilling maximized recovery and minimized waste of oil and gas.[112]

Within a geothermal scenario in which injected fluids migrate to adjoining property, assessing exposure to a trespass claim requires a balancing under the principles of *Lightning*. Specifically, the damage to the individual adjoining property interest—which, in turn, is a function of the value of that interest—are evaluated relative to the interests of "the industry as a whole and society."[113]

Often, this risk will be low because the operation cannot reasonably be regarded as causing significant damage to the individual adjoining property owner. In many geothermal operations, water is produced to generate heat, and the produced water is then injected back into the formation in a condition substantially similar to that as it existed prior to being produced. The operator is not introducing fluids into the formation that are any more hazardous than those which existed in the formation before the operation. Therefore, the nature and composition of the migrating injected fluids likely do not pose a substantial trespass risk.

Moreover, in contrast to saltwater disposal and many storage operations, a core function of geothermal injection is pressure maintenance. In cases where the target zone consists of an aquifer or includes geopressured fluids in place prior to a geothermal operation, the absence of any material pressure change may mean that the injection and migration are not capable of causing measurable damage—for example, by interfering with operation of an oil or gas well on the adjoining property, or by forcing out fluids to a different depth in a manner that contaminates freshwater or washes out a zone prospective for oil and gas production.[114]

Even if an operation does introduce hazardous foreign fluids or pressure in a manner that materially alters conditions in adjoining property, courts must weigh the damage resulting from that interference against industrial and societal interests. Commentators have criticized this balancing-of-interests test as elevating the justifications for exceptions to common-law doctrines over the doctrines in a manner that precludes certainty and renders outcomes vulnerable to ideologies and policy preferences of individual judges.[115] Still, in cases where the value of the affected estate is minimal, if a geothermal operator can point to the public policy of promoting geothermal energy[116] and elicit judicial recognition of the interests of the geothermal industry and society in developing geothermal resources, a finding of trespass is unlikely.

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[111] *Id.*

[112] *Id.* at 50–51.

[113] *Id.* at 51.

[114] *See, e.g.*, Michael K. Reer, "Revisiting 'Waste,'" *49th Annual Ernest E. Smith Oil, Gas and Mineral Institute* (Univ. of Tex. Sch. of Law 2023).

[115] Schremmer, *supra* note 93, at 540.

[116] Tex. Nat. Res. Code § 141.002.

### *B. Usage of Existing Wellbores*

#### 1. Abandoned Wellbores and Equipment

The cost savings associated with utilizing existing wellbores and equipment may be essential to the economic viability of geothermal operations in a particular location. Consequently, geothermal developers considering retrofitting or utilizing existing wellbores must ensure that they have acquired the appropriate rights. When a well or equipment is not being actively used or possessed, the question of who holds those rights may require evaluating whether it is real or personal property.

Whether personalty has become a fixture so as to become part of the realty is determined primarily by the annexing party's intent and is generally a fact question.[117] Factors relevant to determining intent are the mode and sufficiency of the annexation, as well as the article's adaptation to the use and purpose of the realty.[118] Accordingly, the extent to which the article is affixed to and customized for the property influences its character as realty or personalty. In some cases, where trade fixtures have not been removed within a reasonable time, they may be considered abandoned and vested with the owner of the realty.[119] Often, the conduct of the operator and property owner and language allowing for removal of equipment may evidence an intent that affixed oilfield equipment remains personalty.[120] The paucity of cases on the subject matter poses a challenge for developers attempting to determine whether items such as installed casing and downhole equipment might qualify as personalty or realty.

Regardless, the calculation for a geothermal operator is easier if wellsite and downhole equipment are abandoned. Abandoned property qualifying as personalty is subject to "finders keepers law."[121] Unlike automatic reversion to a lessor upon termination of an oil and gas lease, "[t]itle to abandoned personalty vests in the first person lawfully reducing it to possession"[122] and "is no man's property until reduced to possession with the intent to acquire title."[123] Accordingly, a geothermal operator may acquire title to wellsite and downhole equipment consisting of abandoned personalty merely by reducing it to possession.

In contrast to abandoned personalty, the wellbores of abandoned wells and abandoned equipment qualifying as realty belong to the landowner upon termination of an oil and gas lease. When a geothermal operator acquires rights to develop geothermal resources by lease or conveyance from that landowner, the operator acquires rights analogous to those of a mineral owner

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[117] Logan vs. Mullis, 686 S.W.2d 605, 607–08 (Tex. 1985).

[118] *Id.*

[119] Terry v. Crosswy, 264 S.W. 718 (Tex. Civ. App.—Beaumont 1924, no writ).

[120] Vermillion v. Fidel, 256 S.W.2d 969, 972 (Tex. Civ. App.—Amarillo 1952, no writ).

[121] Trenolone v. Cook Expl. Co., 166 S.W.3d 495, 499 (Tex. App.—Texarkana 2005, no pet.).

[122] Pearson v. Black, 120 S.W.2d 1075, 1079 (Tex. Civ. App.—Eastland 1938, no writ); *see also Trenolone*, 166 S.W.3d at 500.

[123] *Trenolone*, 166 S.W.3d at 500–01 (quoting Gregg v. Caldwell-Guadalupe Pick-Up Stations, 286 S.W. 1083, 1084 (Tex. Comm'n App. 1926, holding approved)).

or an oil and gas lessee and may use so much of the premises as is reasonably necessary to develop the geothermal resources or to comply with the terms of the lease and effectuate its purpose.[124] To that end, abandoned wellbores and fixtures are subject to use by an operator for development of geothermal resources.

### 2. Orphaned Wells

Geothermal operators exploring the use of orphaned wells[125] may wish to avail themselves of a statutory procedure allowing for surface inspection and noninvasive testing. Under section 89.047(b)–(e) of the Texas Natural Resources Code, following an operator's nomination of a well, the Railroad Commission will authorize inspection and testing of the nominated for a 30-day period, during which the operator

> may visually inspect the well and all related equipment, tanks, and other facilities and may conduct noninvasive testing such as using a gauge to determine the pressure present at the wellhead but may not produce oil or gas from the well, reenter the well, pull tubing from or perform any other type of downhole work on the well, conduct a salvage operation on the well, or remove any tangible item from the well site.[126]

Subsection (f) then establishes a mechanism by which the nominor may be designated as operator of the well. Prior to the passage of Senate Bill 1210, the statute contemplated designation only for mineral operations.[127] Effective September 1, 2023,[128] the Railroad Commission "shall designate" a nominor as the orphaned well's operator if the nominor files a

> factually supported claim based on a recognized legal theory to a continuing possessory in . . . the geothermal energy and associated resources estate accessed by the well, as established by a current geothermal lease, a recorded deed conveying a fee interest in the geothermal estate or any other documentation of an interest in the geothermal estate.[129]

Ensuring that orphaned wells may be converted to emerging uses other than traditional geothermal production, the amended designation procedure is also available to a nominor filing a claim to "the geologic space accessed by the well for the purpose of an energy conservation well, as established by a recorded deed conveying a fee interest in the space accessed by the well or

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[124] Humble Oil & Ref. Co. v. Williams, 420 S.W.2d 133, 134 (Tex. 1967); *see* discussion at Part III.C.2, *supra*.

[125] An "orphaned well" is one "(A) for which the [Railroad Commission] has issued a permit; (B) for which production of oil or gas or another activity under the jurisdiction of the commission has not been reported to the commission for the preceding 12 months; and (C) whose operator's commission-approved organization report has lapsed." Tex. Nat. Res. Code § 89.047(a)(3).

[126] *Id.* § 89.047(e).

[127] S.B. 1210, *supra* note 61. Prior to amendment, the exclusive procedure for receiving designation as operator required filing a claim "to a continuing possessory right in the mineral estate accessed by the well, such as evidence of a current oil and gas lease or a recorded deed conveying a fee interest in the mineral estate." *Id.*; Tex. Nat. Res. Code § 89.047(f)(1)(A).

[128] S.B. 1210, *supra* note 61, § 3.

[129] *Id.* § 2; Tex. Nat. Res. Code § 89.047(f)(1)(B).

any other documentation of an interest in the space."[130] The amended statute defines "energy conservation well" as "a well used for the retention of energy that may be used to provide dispatchable generation of electricity for the power grid."[131] The breadth of this definition contemplates the kinds of geothermal storage operations described in Part II.B, as well as, perhaps, compressed-air storage and other applications.

#### 3. Marginal and Inactive Non-Abandoned Wells

When a geothermal operator takes over a well that has not been abandoned by an oil and gas operator, the acquisition may take the form of a leasehold or wellbore assignment. A geothermal operator should be aware that these assignments can result in an assumption of liability for matters arising in connection with oil and gas operations on the well. To the extent the geothermal operator wishes to maintain the lease or establish a right to a coproduced stream of minerals and geothermal resources, this kind of assignment may make sense. Alternatively, the oil and gas operator might surrender the leasehold interest in the individual wells as part of a coordinated transaction in which the geothermal operator acquires rights from the owner of the mineral or non-mineral estate, as appropriate.

### *C. Reasonable Use and Consumption in Exercise of Rights by Owner of Dominant Estate*

Proceeding from the view that an estate in a non-mineral subsurface resources is dominant as against the balance of the property—including an unsevered mineral estate[132]—it stands to reason that the owner of an interest in geothermal resources may, under the appropriate circumstances, use "such part and so much of the premises as is reasonably necessary" for development of geothermal resources on the property.[133] When the servient premises include minerals, and minerals are produced as part of the stream of fluids brought to the surface during geothermal operations, a dispute could arise over whether that production exceeds the operator's implied right to "use" the servient estate. Some geothermal operations may reinject produced minerals into the same zone in a form that does not compromise or imperil their future recovery. But when produced fluids contain natural gas released to the atmosphere, or when operations otherwise consume minerals or alter subsurface conditions in a manner that jeopardizes their future recoverability, the mineral owner may argue that the geothermal operator is wasting or consuming the servient estate, rather than merely using it.

*Sun Oil Co. v. Whitaker* involved a conflict over an oil and gas lessee's use of a water-supply well to produce freshwater for a waterflood operation.[134] De-

[130] S.B. 1210, *supra* note 61, § 2; Tex. Nat. Res. Code § 89.047(f)(1)(C).

[131] S.B. 1210, *supra* note 61, § 1; Tex. Nat. Res. Code § 89.047(a)(1-a).

[132] *See* discussion at Part III.C.4, *supra*.

[133] Sun Oil Co. v. Whitaker, 483 S.W.2d 808, 810 (Tex. 1972).

[134] *Id.* at 808.

spite the fact that the large quantities of water use endangered the groundwater supply needed for irrigation purposes, the Texas Supreme Court held that the lessee had "an implied right to waterflood because the waterflood operation [was] reasonably necessary to carry out the purposes of the lease."[135] The opinion does not undertake any conceptual distinction between freshwater use and freshwater waste or consumption. Presumably, some of the freshwater appropriated and injected by the lessee migrated to other property. Some of the water may have resurfaced as water produced with oil production, and perhaps that produced water was reinjected as part of the lessee's waterflood program. But to the extent that the water appropriated for waterflood operations remained recoverable to the landowner following initial injection, its utility had assuredly been compromised; in all probability, the character of the water had been altered by its injection into an oil-bearing formation and its production in commingled form. In the sense that the water appropriated by the lessee was transformed from freshwater to saltwater or brine, the freshwater was consumed or wasted. Even so, *Whitaker* held that the lessee's activities were reasonable use.

In *Guffey v. Stroud*, a dispute arose when the lessee of oil, but not gas, completed a well productive of gas, but not oil.[136] The Texas Supreme Court held for the holder of the gas rights, ruling that the oil lessee had no right to operate and produce from the gas well because the well, while productive of gas, was "a failure as an oil well."[137] But according to the court, "[t]he grant of the oil carried with it a grant of the way, surface, soil, water, gas and the like essential to the enjoyment of the actual grant of the oil."[138] Splitting from the judgment in a climactic scene penned by the Bard of Avon, the court rejected the notion that "all use of, or interference with, the gas in place was wrongful," stating, "[t]he rule in Shylock's case is not controlling."[139]

Thus, although Portia prevailed in her argument that Shylock's right was realizable only if a pound of flesh could be extracted without spilling a drop of blood, the oil lessee in *Guffey* was not barred from producing gas in association with oil. Just as the right to a pound of flesh includes "by necessary implication of law as much Christian blood as was necessary to be shed in the operation," a right to oil includes the right to "shed" a certain amount of gas and other attributes of the servient estate.[140] This conclusion aligns with the Texas Supreme Court's later recognition of "the fact that there is a certain amount of reasonable and necessary waste incident to the production of oil and gas" for which an operator is not liable.[141] And based on the court's disapproval of the Shakespearean rule, the implied right of reasonable use is not purely usufructuary. If a bond for flesh justifies spillage of blood, the developer of a dominant estate may waste or consume byproducts.

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[135] *Id.* at 811.

[136] 16 S.W.2d 527 (Tex. 1929).

[137] *Id.* at 528.

[138] *Id.*

[139] *Id.* (referencing William Shakespeare, *The Merchant of Venice*).

[140] *Id.*

[141] Eliff v. Texon Drilling Co., 210 S.W.2d 558, 562 (Tex. 1948).

These cases indicate that the reasonable-use doctrine does not necessarily preclude the owner of the dominant estate from using the servient estate in a manner that results in waste or consumption, as long as the use is otherwise reasonable. For geothermal operators seeking protection against claims that their operations waste or consume minerals and other attributes of the burdened premises, these cases offer a measure of protection.

### *D. Dominance and the Accommodation Doctrine*

Even when use of the servient estate is not unreasonable, conflicts may arise between a geothermal operator and the rights of the owners of the balance of the land—particularly when they have competing uses or plans for the property. Texas courts rely on the accommodation doctrine to resolve these conflicts.

Although the owner of a dominant estate has an implied right of reasonable use, that use must be exercised with "due regard" for the servient estate.[142] The substance of that duty is found in the accommodation doctrine, which imposes limitations on the owner of the dominant estate when the servient estate is subject to an existing use of the servient estate. In that event, the owner of a dominant estate must accommodate the servient use if (1) the dominant estate owner's use completely precludes or substantially impairs the existing use, (2) there is no reasonable alternative method available to the owner of the servient estate by which the existing use can be continued, and (3) there are reasonable, customary, and accepted methods available to the dominant estate owner that will allow for development of the dominant estate while allowing for continuation of the existing servient use.[143]

#### 1. Dominant Mineral Estate

Texas case law applying the accommodation doctrine focuses on the duty of the mineral owner or oil and gas lessee to accommodate existing surface uses. In *Lyle v. Midway Solar, LLC*, a solar developer constructed a solar facility under a lease covering land in which the mineral estate had previously been severed.[144] The owners of the mineral estate sued in trespass and breach-of-contract, arguing that the solar developer's array of facilities blanketing most of the property impaired their ability to develop the mineral estate, making the mineral estate less marketable. The El Paso Court of Appeals rejected the claims of the dominant mineral estate owners. In the words of the court, "[t]he rub . . . is that the mineral owners are not actively attempting to develop those minerals."[145] Although any action by the mineral owners was premature absent evidence of an attempt to develop or market the minerals, the court affirmed the applicability of the accommodation doctrine, explaining that if and when

[142] *Whitaker*, 483 S.W.2d at 810.

[143] Merriman v. XTO Energy, Inc., 407 S.W.3d 244, 249 (Tex. 2013).

[144] 618 S.W.3d 857 (Tex. App.—El Paso 2020, pet. denied).

[145] *Id.* at 862.

the mineral estate was developed, the solar developer "must yield to the degree mandated by the application of the accommodation doctrine."[146]

Similarly, in *Lightning*—where Anadarko planned to drilled through the subsurface of Lightning's leasehold estate—the court refused to grant relief based on "speculation" that the drilling and well structures would interfere with its right to develop.[147] Framing the accommodation doctrine as a "sound and workable basis for resolving conflicts," the Texas Supreme Court stated, "Lightning has advanced no reason that convinces us the doctrine will not be flexible enough to do so in the future."[148]

Under *Lyle* and *Lightning*, if geothermal resources are developed on land subject to an outstanding dominant mineral interest, interference with the ability to develop or market the mineral estate will not be actionable unless and until the mineral owner actually attempts to develop or market the minerals. Geothermal developers should prepare for the possibility that a dominant mineral estate owner may undertake marketing or development efforts that will generate a live conflict. In that event, the rights of the parties will be governed by the accommodation doctrine. But geothermal developers may also perform a business-risk analysis to evaluate the likelihood of mineral development in zones or depths targeted by a geothermal project. If a geothermal operation will not impact or will minimally impact zones prospective for mineral development, an outstanding dominant mineral estate may not be of concern.

### 2. Dominant Estate in Geothermal Resources

As discussed above, the right to develop geothermal resources may be dominant as against the balance of the property, including the mineral estate. In that scenario, if the land is subject to an existing use, the right to use the property for development of geothermal resources will be limited by the accommodation doctrine. If, for example, a geothermal developer wishes to conduct an operation that will completely preclude or substantially impair existing oil and gas production, and there is no reasonable alternative available to the oil and gas producer that will allow production to continue, then the geothermal developer will have to adopt any reasonable, customary, and accepted measures to accommodate the existing oil and gas production. Moreover, under *Lyle*, the mere existence of the oil and gas production is not an actionable interference with the right to develop geothermal resources absent genuine efforts to develop those resources.

### 3. Viability of Accommodation Doctrine to Resolve Claims to Control over Same Substance

A nettlesome problem arises if a geothermal developer produces and asserts control over fluids containing minerals that a mineral lessee wishes to produce—or, in reverse, if a mineral lessee produces fluids as a byproduct and

[146] *Id.* at 874.

[147] *Lightning*, 520 S.W.3d at 49.

[148] *Id.* at 50.

a geothermal developer wishes to utilize those fluids for generation of geothermal energy. Whenever the party seeking to exercise its rights has not taken genuine steps in pursuit of exploration or development, the requirement in *Lyle* and *Lightning* of a live conflict will weigh in favor of the existing use.

Parties pursuing development who clear that hurdle, however, will present a new test for the accommodation doctrine: If geothermal operations and mineral-development operations target the same substance, are reasonable and industry-accepted alternative methods available to the party carrying out the existing use that will permit development by the other party? And if not, does the party pursuing development have an alternative method of development by which the existing use can continue? Unlike the fact patterns prevalent in current case law describing conflicts between a landowner's use at the surface and an oil and gas operation surface,[149] rival claims to control of the same substance may require flexibility in the application of the accommodation doctrine to a degree not presently envisioned. Alternative methods could require coordination and sharing of control of produced substances under procedures that enable each party to realize the economic benefits of its estate.[150]

### *E. Coproduction of Minerals and Geothermal Resources*

When minerals are produced in conjunction with geothermal resources, waste of the produced minerals is not inevitable. In fact, the ability to produce minerals alongside is widely viewed as an asset to the burgeoning geothermal industry. Revenues from coproduced minerals may enhance the economics of a geothermal project or even prove necessary for its economic viability. Conversely, coproduction of geothermal resources offers a means of improving the economics of existing oil and gas operations.[151] Lurking beneath the enticement of enhanced profitability, however, are numerous legal issues that oil and gas and geothermal operators alike should consider prior to coproduction operations. Fundamentally, these issues stem from divergent ownership of minerals and geothermal resources. While Texas law provides substantial guidance, coproduction presents novel questions that Texas courts will be called upon to address.

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[149] *See, e.g.*, Getty Oil Co. v. Jones, 470 S.W.2d 618 (Tex. 1971), Tarrant Cnty. Water Control & Improvement Dist. No. One v. Haupt, Inc., 854 S.W.2d 909 (Tex. 1993); *Merriman*, 407 S.W.3d 244.

[150] The Texas Supreme Court hinted at the possibility of such a conflict 50 years ago when rejecting the argument that saltwater should belong to the mineral estate due to its salt content. Robinson v. Robbins Petroleum Corp., 501 S.W.2d 865, 867 (Tex. 1973) ("We are not attracted to a rule that would classify water according to a mineral contained in solution. Water is never absolutely pure unless it is treated in a laboratory. It is the water with which these parties are concerned and not the dissolved salt. If a mineral in solution or suspension were of such value or character as to justify production of the water for the extraction and use of the mineral content, we would have a different case. The substance extracted might well be the property of the mineral owner, and he might be entitled to use the water for purposes of production of the mineral…In either case the water itself is an incident of surface ownership in the absence of specific conveyancing language to the contrary. And in our case the saline content has no consequence upon ownership.").

[151] *See* discussion at Part II.F, *supra*.

1. Use of Geothermal Resources by Mineral Operator

Because the Geothermal Resources Act generally establishes ownership of geothermal energy and associated resources in the owner of the surface, a mineral producer may wonder whether it has the right to coproduce geothermal energy under the authority of its mineral lease. The answer to this question has two dimensions: whether the implied right of reasonable use permits geothermal coproduction and to what extent the servient estate owner has recourse for excess geothermal coproduction.

a. Implied Right Includes Right to Geothermal Coproduction

As discussed above, a dominant mineral owner has an implied right to use as much of the servient estate and in such a manner as is reasonably necessary to extract and produce the minerals.[152] This "implied easement"[153] is broad. In *Whitaker*, it entitled the oil and gas lessee to extract large quantities of groundwater for a waterflood operation, which the court regarded as reasonably necessary for mineral development.[154] In other cases, it has allowed mineral owners or lessees the right of ingress and egress, the right to construct roads, the right to take materials from the surface to construct lease roads, the right to dispose of saltwater and drill cuttings, the right to construct and operate pipelines, the right to conduct seismographic tests, and the right to construct temporary housing for employees.[155] Courts have interpreted this right as authorizing a dominant mineral owner "to produce all the oil possible and to use every reasonable means to do so."[156] The case law, therefore, strongly supports the right of an oil and gas developer to generate geothermal energy to power operations.

b. *Robinson* Limitations on Use

The right of reasonable use is not unlimited. In addition to the accommodation doctrine[157] and the rule prohibiting negligence,[158] the servient estate's use generally must benefit the dominant estate. For example, in contrast to *Whitaker*, the lessee in *Robinson v. Robbins Petroleum Corp*. was obligated to pay damages for producing saltwater from a tract within a 221-acre lease for operations on a waterflood unit that spanned thousands of acres when, as a matter of title, the surface owner was not subject to the waterflood unit.[159] The Texas Supreme Court explained that "[n]othing . . . authorized the mineral owner to increase the burden on the surface estate for the benefit of additional

[152] *Williams*, 420 S.W.2d at 134; *Merriman*, 407 S.W.2d at 249.

[153] *Jones*, 470 S.W.2d at 622.

[154] *Whitaker*, 483 S.W.2d at 811.

[155] Austin Brister & Kevin M. Beiter, "Divided Surface and Mineral Estates," *Univ. of Tex. Sch. of Law Fundamentals of Oil, Gas and Mineral Law* 8–9 (Mar. 26, 2020).

[156] Miller v. Crown Cent. Petroleum Corp., 309 S.W.2d 876, 878 (Tex. Civ. App.—Eastland 1958, writ dism'd).

[157] *See supra* Part IV.D.

[158] *Eliff*, 210 S.W.2d 558.

[159] 501 S.W.2d 865 (Tex. 1973).

lands," and noted there was "no proof in the record before us now of the necessity for the waterflood operation to obtain production of oil from the lands embraced by the . . . lease."[160]

Interestingly, the *Robinson* court prescribed a method for the trial court to calculate damages on remand, indicating that the surface owner's damages would be based on the value of the proportion of saltwater used for oil production from non-lease lands.[161] This damages model entails that even if a portion of the saltwater was reasonably necessary for production from within the lease, the oil and gas lessee had no right to benefit from the additional saltwater. But the damages model implies that the saltwater had value to the surface owner, and the court apparently viewed the excess saltwater production as increasing the burden on the surface estate.

c. Incidental Excess Benefits from Use

In some circumstances, *Robinson* may compel a mineral operator to obtain an agreement with the owner of the geothermal estate compensating the owner for coproduction. But *Robinson* does not mean that such an agreement is invariably required. When some portion of an operator's use is reasonably necessary for development of the dominant estate, and the remaining portion of the use does not increase the landowner's burden or result in a quantifiable loss, *Robinson* does not assure a remedy for the burdened landowner.

This limit to *Robinson* prompts an interesting question for an oil and gas operator who implements geothermal coproduction to power operations: If those geothermal operations generate more power than is needed to develop the minerals within the burdened estate (and any unit to which it is subject),[162] may the oil and gas operator sell that power or use it to power operations on nearby properties? Stated differently, in contrast to the production of excess saltwater in *Robinson*, may excess coproduction of geothermal resources be considered reasonable use on the grounds that it is merely incidental? As a practical matter, right-sizing a geothermal coproduction operation to deliver precisely the output that satisfies onsite operation is difficult, if not impossible. Therefore, an operator's entitlement to the benefits of incidental excess coproduction is of strategic importance.

In *Miller v. Crown Central Petroleum Corp.*, a surface owner subject to oil and gas leases sought damages and an injunction related to a pipeline that carried saltwater across his tract.[163] The pipeline served not only the leased premises but also other unitized tracts. The court appeared to hold that the surface owner's rights were subject to the unitization, thereby subjecting the surface owner to the burden of a use benefiting other tracts. However, it indicated this fact was not essential to its holding, stating:

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[160] *Id.* at 867.

[161] *Id.* at 868.

[162] Delhi Gas Pipeline Corp. v. Dixon, 737 S.W.2d 96 (Tex. App.—Eastland 1987, writ denied); Key Operating & Equipment, Inc. v. Hegar, 435 S.W.3d 794 (Tex. 2014).

[163] 309 S.W.2d 876 (Tex. Civ. App.—Eastland 1958, writ dism'd).

> More oil is being produced from [the surface owner's] land as a result of piping the salt water across it. The lessee is certainly not deprived of the right to do so merely because it also has the effect of producing more oil from other tracts not included in the leases of [the surface owner's] tracts but included in said unit.[164]

The uncertain role of unitization in the court's reasoning leaves open the possibility that the pipeline, although benefitting other tracts, was permissible as part of a system that increased production on the burdened tract.

In *Key Operating & Equipment, Inc. v. Hegar*, an operator pooled its 12.5% leasehold interest in a portion of one tract with its interest in a portion of an adjoining tract. A new well was drilled upon the unit in the adjoining tract.[165] The operator then used a road traversing the tract in which it held the 12.5% leasehold interest to develop and produce from the adjoining well. Displeased with the sudden surge in road traffic, the surface owners claimed trespass, arguing that the road was being used for the benefit of production from the adjoining tract. But the pooled parts of the tracts "no longer maintained separate identities," and production from the well on the adjoining tract was constructively considered production from the burdened tract.[166] Under this reasoning, the Texas Supreme Court held that the use of the road across the burdened tract was effectively for the benefit of production from the burdened tract.[167]

One can imagine an alternate universe with slightly different facts—for example, the 12.5% interest in the road-burdened tract could have been pooled with only a portion of the mineral estate in the adjoining tract. Under those facts, the operator would have been allowed to develop the well on the adjoining tract, subject to the obligation to account to the owner of the unpooled interest in the adjoining tract under cotenancy law.[168] In that scenario, only a portion of the use of the surface of the burdened tract would have occurred for the benefit of the pooled interests—and thus constructively for the benefit of production from the burdened tract. The remaining portion of the use of the burdened tract would have occurred for the benefit of production from an unpooled interest in the adjoining tract. Yet, it stretches the imagination to envision the court reaching a different result.

If using the road to benefit production from the unpooled adjoining interest would indeed be permissible, one explanation is that the benefit to the unpooled interest is purely incidental. Under cotenancy principles, the operator has the right to conduct precisely the same operation—with the same impact on the road-burdened tract—as it would if there were no unpooled interest and therefore no cotenancy in the adjoining tract. By this logic, if the scope and magnitude of the coproduction operation are no greater than the scope and magnitude that are reasonably necessary for powering the onsite mineral op-

[164] *Id.* at 878.

[165] 435 S.W.3d 794 (Tex. 2014).

[166] *Id.* at 799.

[167] *Id.* at 800.

[168] *See, e.g.*, Cox v. Davison, 397 S.W.2d 200 (Tex. 1965).

eration, a servient owner should not have a trespass claim against a mineral operator that generates excess coproduced geothermal resources.

This proposition finds support in *Cole v. Anadarko Petroleum Corp.*[169] In *Cole*, a landowner's excessive-use claims failed when a unit operator's activities at a central tank battery facility supported not only unit production but also non-unit production. According to the court, "the mere fact that incidental non-unit activities have taken place does not establish a cause of action absent evidence that these activities caused damage."[170] Under *Cole*, if the configuration of geothermal coproduction facilities is the same regardless of whether they generate excess energy, no damages arise from the configuration or physical footprint of the facilities even if they incidentally benefit other property.[171]

Of course, the configuration of facilities is distinguishable from production of excess geothermal energy.[172] Nonetheless, the logic of cases such as *Lightning* and *Lyle* may weaken a claim by the owner of the servient estate. Unless the servient estate owner can demonstrate quantifiable loss due to the excess coproduction or interference with an actual effort to develop or market the geothermal resources that are the subject of the excess coproduction, a claim for damages arising from incidental use is ill-fitting.

Indeed, for many coproduction scenarios, quantifiable loss may be difficult to establish. Arguably, if coproduction in connection with an oil and gas operation is the only economically viable means of accessing the geothermal resources, the geothermal resources hold no independent value—in which case the servient estate owner suffers no loss when they are developed alongside oil and gas. And under the holding in *Cole*, unavailability of damages precludes recourse for incidental excess geothermal coproduction. Its holding therefore provides a promising rationale for operators wishing to unlock the benefits of coproduction.

*Cole* does not expressly address the possibility of recovery by the owner of a burdened estate in assumpsit. Texas law permits "recovery under assumpsit for trespass" and provides that "an injured party may either recover for the actual injury, or under implied contract basis for the use and occupation of the land."[173] To the extent that assumpsit requires actionable trespass and injury,

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[169] 331 S.W.3d 30 (Tex. App.—Eastland 2010, pet. denied).

[170] *Id.* at 37.

[171] Clifton A. Squibb, "The Age of Allocation: The End of Pooling as We Know It?," 45 *Tex. Tech L. Rev.* 929, 936 (2013); Stephen K. Newton, "Issues of Excessive Surface Use in Multi-Lease Horizontal Development," 45 *Oil, Gas & Mineral Resources Law Sec. Rep. (State Bar of Texas) No. 1*, at 50 (Mar. 2021).

[172] Production of geothermal resources is not a consumption of property in the same manner as production and drainage of a finite and depletable resource; the resource is renewable, and subsurface heat available for a well will eventually recharge. However, during the practical economic lifespan of a well, its productivity may decline over time as the surrounding rock cools following heat transfer.

[173] Villarreal v. Grant Geophysical, Inc., 136 S.W.3d 265, 269 n.1 (Tex. App.—San Antonio 2004, pet. denied); *see also* Phillips Petroleum Co. v. Cowden, 241 F.2d 586, 592 (5th Cir. 1957) (explaining, "Texas belongs to the minority of states that permit a landowner to waive the trespass and sue in assumpsit for the reasonable value of the use and occupation").

the availability of recovery may be no greater in assumpsit than in trespass. Cases such as *Lightning*, *Lyle*, and *Cole* may therefore shield a coproducing operator from liability not only in trespass but also in assumpsit. Moreover, the recovery under assumpsit must be based on the "reasonable market value" of the use and occupation.[174] Importantly, the reasonable market value is "independent of the benefit . . . actually received from that use" by the occupying party.[175] Thus, the usefulness or profitability of coproduction to the operator has no relevance in assumpsit. Absent competition or a market for geothermal resources, the market value of the right to occupy the geothermal estate is likely nominal.

An action brought under a theory of unjust enrichment,[176] "a quasi-contractual doctrine that closely resembles assumpsit,"[177] faces similar obstacles. Arguably, coproduction does not unjustly enrich an operator when the coproduced resources are developed solely by the efforts of the owner of the dominant estate and are not otherwise economically recoverable by the owner of the servient estate. In short, the prospect of claims in assumpsit and unjust enrichment is not a formidable deterrent to coproduction.

Certainly, excess coproduced geothermal energy that is sold or used to power nearby operations will boost an oil and gas operator's revenue or decrease its costs. A largely untested question is whether the enhancement of profitability resulting from a dominant estate owner's use can justify that use: If a dominant use benefits other properties, but in so doing, renders the operations on the burdened property more profitable, then, arguably, the dominant use *does* benefit operations on the burdened estate. As noted above, courts have interpreted the implied-use doctrine as authorizing a dominant mineral owner "to produce all the oil possible and to use every reasonable means to do so."[178] If a mineral operator sells a portion of coproduced geothermal energy or uses it as a lower-cost alternative for powering nearby operations—and if those acts improve a mineral operator's income, thereby increasing the ultimate recovery and the life expectancy of the operation on the burdened property—then perhaps utilization of the excess coproduced geothermal energy is, in fact, reasonably necessary for development of the minerals. Although the damages model prescribed in *Robinson* suggests a landowner—at least one capable of demonstrating quantifiable loss—is entitled to compensation for

[174] *Villarreal*, 136 S.W.3d at 269 n.1; *Cowden*, 241 F.2d at 593.

[175] *Id.* For example, in *Galveston Wharf Co. v. Gulf, C. & S. F. R. Co.*, 10 S.W. 537 (Tex. 1889), when a railroad company inadvertently placed its track and facilities on the plaintiff's land, the value of the land in assumpsit was limited to the value for which it could have been leased absent the occupation. The special value and profitability of the occupied land to the occupant railroad company did not bear on the assumpsit value. For a discussion of these issues, see Ryan Clinton & Jad Davis, "Oil and Gas Damages," *State Bar of Tex. Damages in Civil Litigation Conference* (2015).

[176] *See, e.g.*, Phillips Petroleum Co. v. Texaco, Inc., 415 U.S. 125 (1974) (involving unjust enrichment claims by of natural-gas producer not compensated by gas purchaser for helium content of a delivered gas stream).

[177] Excess Underwriters at Lloyd's v. Frank's Casing Crew & Rental Tools, Inc., 246 S.W.3d 42, 50 (Tex. 2008).

[178] *Miller*, 309 S.W.2d at 878.

benefits from excess use that supports other lands, the theory that enhanced profitability might justify excess use was not before the court.

Regardless, absent an agreement with the burdened estate, the ratio of benefits derived from coproduction is relevant to coproduction's legitimacy. At a certain point, the financial return from an operator's use of the burdened estate may surpass the profitability of the operation ostensibly supported by the use. In those instances, continued development of the burdened estate might serve as a pretextual grip on the benefits derived from use of the servient estate; characterizing those benefits as "incidental" may not be appropriate.[179] Even if Texas courts adopt a forgiving posture toward dominant uses that produce excess benefits, the implied-use doctrine may reach its limit when a means becomes the end.

### 2. Use of Minerals by Geothermal Operator

Just as mineral operators might look to recover geothermal energy from the production stream, geothermal operators may capture hydrocarbons or other minerals from produced geothermal fluids. Those minerals can be sold or used as fuel, improving the economics of an operation. For coproducing geothermal operators, the foregoing considerations generally apply in reverse.

In many cases—including those where the mineral production incidentally exceeds the amount necessary to power onsite operations—coproduction will yield minerals in amounts that could not justify independent development. Although those minerals may have value when brought to the surface through coproduction, if independent development of those minerals would be economically irrational, production may not cause any measurable damage to the mineral owner. Likewise, if independent development of the minerals is not viable, the geothermal operator's interference with the right to develop the minerals causes no damage. And as discussed above, Texas cases have not squarely addressed whether an operator may claim reasonable use when excess coproduction indirectly furthers the dominant activity by enhancing profitability. Regardless of whether the doctrine of reasonable use might encompass excess benefits that enhance profitability, geothermal operators are more likely to exceed the right of implied use if the coproduced minerals have meaningful value independent of the coproduction, or if the benefits of coproduction eclipse the benefits arising from the dominant activity.

## V. CONCLUSION

Steadfastly erected with the boom-and-bust rhythms of the oil and gas industry, Texas real property law is an imposing edifice. Its scope offers an emerging geothermal community an expansive rulebook and a level of visibility on legal issues that is without parallel in other jurisdictions. Yet, as these advantages lure development, innovative applications will test the state's established legal principles in new and unforeseen ways. In endeavoring to reshape

[179] *Cf. Cole*, 331 S.W.3d 30.

the energy landscape, a pioneering geothermal industry may compel the refinement and advancement of Texas jurisprudence.