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"The greatest boon which could be conferred on farmers and ditch-owners of California would be relief from the anxiety and expense of litigation over water rights."—Elwood Mead, 1903[1]

I. INTRODUCTION: THE END OF THE CALIFORNIA EXCEPTION IN GROUNDWATER

The rules of western water law obey western realities: this is a hallowed maxim. Begin with the reality of the western climate. Its harshness and aridity long ago dictated that western courts deviate from received common-law principles of reasonable and equitable use and adopt the doctrine of prior appropriation instead.[2] Move on to the West's topography; it must be respected so that it may be overcome. Because western rivers are often distant from good farmland, water rights must be severable from their native riparian lands so that water can be put to beneficial use on better soil downstream.[3] Finally, there is the West's pioneering legal culture. Because westerners mined before they farmed, and because they have always understood the necessities imposed upon them by aridity and topography, they have always embraced the legitimacy of the prior appropriation doctrine.[4] Suspicious of corporate interests and land and water monopolies, they wisely forbade speculation in and hoarding of water supplies.[5] These rules and realities are self-evident and mutually reinforcing. Even Mexican irrigators bereft of the blessings of the common law recognized that rights to the San Pedro were most definitely not like those to the Thames.[6]

But California follows different rules than the rest of the West. That is because California has its own natural realities, but also because California has the power to create artificial realities all its own—realities that exist nowhere else. California is thus an enduring insult to western conditions, to western sensibilities, and especially to western agriculture. There is no place like the San Joaquin Valley anywhere else in the West, much less the world. Acre for acre, it raised more wheat than any other state in the country, including Kansas when

1. ELWOOD MEAD, IRRIGATION INSTITUTIONS: A DISCUSSION OF THE ECONOMIC AND LEGAL QUESTIONS CREATED BY THE GROWTH OF IRRIGATED AGRICULTURE IN THE WEST 197 (1903).

2. Yunker v. Nichols, 1 Colo. 551, 553–54 (1872).

3. MEAD, *supra* note 1, at 169.

4. United States v. Rio Grande Dam & Irrigation Co., 174 U.S. 690, 704 (1899).

5. DAVID SCHORR, THE COLORADO DOCTRINE: WATER RIGHTS, CORPORATIONS AND DISTRIBUTIVE JUSTICE ON THE AMERICAN FRONTIER 28–31 (2012).

6. Boquillas Land & Cattle Co. v. Curtis, 213 U.S. 339 (1909).

Kansas was the "Wheat State."[7] But because the valley is temperate and does not suffer hard freezes, its farmers soon migrated to more valuable crops such as vegetables, citrus, grapes, and berries.[8] It is now home to the most lucrative crops grown in the United States—nut trees such as pistachios, almonds, and walnuts, not to mention pomegranates. Unlike populist movements in states such as Kansas, Nebraska, and the Dakotas, which banned or limited corporate ownership of farmland, California has rarely scrupled about the power and efficiency of corporate agriculture. It secured the Central Valley Project during the 1930s to bring in water from as far away as Lake Shasta to the San Joaquin River Basin.[9] Faced with the Reclamation Act's quaint 160-acre limitation on federal irrigation water, California bonded the State Water Plan and the California Aqueduct to supply much larger farms.[10]

Perhaps most exceptional of all, though, were the Central Valley's groundwater supplies: plentiful, easy to access, recharged by percolation from the Coastal and Sierra Nevada Ranges, and wonderfully, intentionally, completely unregulated. Groundwater was the Central Valley's "ace-in-the hole," freely accessible during surface water restrictions.[11] So much for the sanctimony of western courts, and of the "imperative necessity" of prior appropriation rights which rise to the "dignity of a distinct usufructuary estate."[12] Federal Reclamation water, state project water, and landowner-controlled groundwater together irrigate the Central Valley. For most of its 170-year-old history, agriculture across California has exploited the state's exceptional natural bounties, employed an exceptional water-supply infrastructure for surface water, and steadfastly maintained a glaring legal exception for the permitting and regulation of groundwater.

That exception is ending. Global climate change has reduced California's greatest water resource, its Sierra Nevada snowpack. Global warming has delayed snowfall to later in the winter and advanced snowmelt to earlier in the spring, undercutting the assumptions of stationarity that were part of the design of federal and state water infrastructure engineered nearly a century ago. Reservoirs designed to capture and hold runoff through the summer months for irrigation use must now regularly release early spring inflows to avoid flooding.[13] Irrigators have also done their part. Over the past century they have over-pumped the Central Valley Aquifer to such an extent that its geological substrates have

7. MARK ARAX, THE DREAMT LAND: CHASING WATER AND DUST ACROSS CALIFORNIA 181 (2019).

8. MEAD, *supra* note 1, at 180–83.

9. NORRIS HUNDLEY, JR., THE GREAT THIRST: CALIFORNIANS AND WATER: A HISTORY 247–76 (rev. ed., 2001).

10. *Id.* at 276–91.

11. Joseph L. Sax, *We Don't Do Groundwater: A Morsel of California Legal History*, 6 U. DENV. WATER L. REV. 269, 270–71 (2003).

12. Coffin v. Left Hand Ditch Co., 6 Colo. 443, 446, 449 (1882).

13. PETER H. GLEICK, WATER: THE POTENTIAL CONSEQUENCES OF CLIMATE VARIABILITY AND CHANGE FOR WATER RESOURCES OF THE UNITED STATES 85 (2000).

collapsed and subsided by over thirty feet in some areas—probably the largest anthropogenic change in land-surface elevation in the world.[14]

Over-pumping during the long drought that began in 2006 reached its literal breaking point during the 2010s, as land subsidence ruptured Central Valley canals—a tragicomic case of conjunctive mismanagement.[15] Faced with a water-supply failure from the summits of the Sierra Nevada to the subsurface of the San Joaquin Valley, California finally enacted comprehensive groundwater regulation legislation. As its title denotes, the Sustainable Groundwater Management Act of 2014 ("SGMA") requires the sustainable management of the state's 515 groundwater basins, preferably through groundwater sustainability plans ("GSPs") designed and approved by local groundwater sustainability agencies ("GSAs").[16]

SGMA is the most ambitious groundwater legislation in the United States in more than a generation, exceeding the goals of the Arizona Groundwater Management Act of 1980. The daunting problem of California groundwater overuse, and California's sudden and firm commitment to achieving meaningful and ideally sustainable groundwater use, raise questions of the utmost importance for California agriculture. How will irrigators respond to SGMA's statutory imperatives? Will they adopt and obey GSPs—management plans overlying their correlative property rights to use groundwater—or will they trigger groundwater adjudications to define their respective legal rights? In 2015, the California legislature anticipated this very question.[17] If they focus on the former option, how will irrigators meet SGMA's sustainability goals—by requiring increased irrigation efficiency, the permanent retirement of irrigated ground, rotational fallowing, categorical reductions in pumping, changes in cropping, or some mixture of all the above? How will GSPs confront longstanding tensions among groundwater irrigators, municipalities, underserved water communities, and conservationists concerned about groundwater-dependent ecosystems? Policy options, including water markets, abound. If irrigators pursue the adjudicatory route, how will California courts reconcile SGMA with California's correlative rights groundwater regime, and how will courts confront their own inconsistent precedents from past adjudications? Are GSPs that go too far in reducing groundwater pumping vulnerable to takings challenges? Are groundwater adjudications that confirm SGMA-induced pumping reductions vulnerable as judicial takings? Ultimately, what does "sustainability" even mean for California groundwater—and California agriculture? These are rich policy and legal

14. William M. Alley et al., *Sustainability of Ground-Water Resources*, U.S. GEOLOGICAL SURVEY CIRCULAR 1186, at 20 (1993).

15. Bettina Boxall, *Overpumping of Central Valley Groundwater Creating a Crisis, Experts Say*, L.A. TIMES, Mar. 18, 2015.

16. CAL. WATER CODE § 10720.1 (West 2020).

17. *Id.* §§ 10720.1(i), 10720.5(c), 10737.2.

questions. Irrigators, groundwater managers, water lawyers, think tanks, and California's State Water Resources Control Board ("SWRCB") are wrestling with them as they work through the SGMA process.

Most of these and other questions are presently unanswerable; it is simply too early in the SGMA process to know. Like other states, California has, through SGMA, enacted groundwater management legislation that knowingly avoids or fundamentally conflicts with longstanding property doctrines in groundwater. This is demonstrable proof that both the water law doctrines themselves and the owners who putatively enjoy their protections have failed to protect the groundwater systems upon which their rights depend—that is, to achieve a functionally sustainable groundwater supply. In this regard, California is anything but exceptional. Yet the end of California's water exceptionalness has a bright side. California's legislative recognition of its own failures in groundwater management, and SGMA's commitment to address those failures, provide an opportunity to glean lessons from other states that have recognized and reacted to similar structural and doctrinal failures. Specifically, there is an opportunity to review how irrigators themselves have devised binding groundwater management plans that achieve substantial but tolerable reductions in groundwater use. In many of California's over-drafted groundwater basins, the hardest question will be how to allocate groundwater supplies among large numbers of overlying irrigators.[18]

For the myriad of questions that SGMA raises, this question may have useful and timely answers found elsewhere—specifically, in the recent Kansas groundwater experience. This Article brings that experience to bear upon SGMA and finds a fair amount of promise there. Part I provides a brief schematic survey of the large and complex subject of California groundwater law, by describing its founding doctrinal and jurisdictional principles, its evolution through groundwater adjudications, and the contours of the modern California groundwater right itself. With this survey as background, Part I concludes with a description of the structure and substance of SGMA, emphasizing the challenges it faces in negotiating between state and local control, between hydrological and legal realities, and between collective groundwater management and individual rights adjudication. Part II provides a similar survey of Kansas groundwater law, starting with its statutory beginnings in 1945 through the groundwater revolution of the late 1950s through the 1970s, a period which quietly but effectively transformed groundwater doctrine and created jurisdictional divides between state and local control. These developments produced the modern Kansas groundwater right, an often-awkward hybrid combining the doctrinal features of prior appropriation with effective operational features suggestive of the reasonable use and correlative rights doctrines. By the turn of the twenty-first

18. Eric Garner et al., *The Sustainable Groundwater Management Act and the Common Law of Groundwater Rights—Finding a Consistent Path Forward for Groundwater Allocation*, 38 U.C.L.A. J. ENVTL. L. & POL'Y 163, 201 (2020).

century, Kansas faced similar polarities that California now faces with SGMA: polarities between state and local jurisdiction, between hydrological and legal realities, and between the policy imperatives of collective management and the stubborn facts of individual rights.

Why look to Kansas of all places? Despite the hydrological, jurisdictional, and doctrinal differences between California and Kansas groundwater, there is nonetheless a compelling structural similarity across both states. Both states have recently enacted important legislation to address the problem of groundwater depletion: Kansas created a new type of groundwater management area—the Local Enhanced Management Area ("LEMA") in 2012—while California enacted SGMA in 2014. Out of both political and practical necessity, each state has assigned the problem to local agencies, which in western Kansas and the Central Valley are dominated by irrigators and agribusiness interests.

With these similarities in mind, Part III of this Article reviews the most prominent features of collective groundwater management plans in Kansas—especially those common to the three LEMAs that have been established across the High Plains-Ogallala Aquifer since 2013. These are not small areas: collectively, they comprise over 5,500 square miles, roughly the size of Connecticut. Irrigators have put these plans together relatively quickly. Yet the choices they have so far made to achieve meaningful groundwater conservation have been revealingly consistent, both in their shared sense of what constitutes substantial but tolerable reductions in groundwater use, but also in their essentially equitable apportionment of how to achieve those reductions—choices that reveal a deliberate ambivalence about the governing doctrines of Kansas water law. These findings provide grounds for optimism about SGMA's future. Part IV distills the Kansas groundwater management experience into a series of conclusions that may be of use to those working through the demands of the SGMA process in California. Because they originate in such different legal contexts, the Kansas and California groundwater experiences may even provide principled instructions for achieving meaningful groundwater conservation across the West—a useful template for every state in between them.

II. CALIFORNIA GROUNDWATER LAW: A SCHEMATIC REVIEW

A. The Founding Principles

California groundwater law essentially rests upon a tripod of common-law doctrine, statutory jurisdiction, and the constitutional rule of reasonable use. Because every leg of the tripod consists of roughly joined segments, the legal tripod has wobbled for over a century.

The common-law doctrinal leg is that of correlative rights, established in

Katz v. Walkinshaw over a century ago and complicated regularly ever since.[19] *Katz* rejected the rule of capture for groundwater and replaced it with the correlative rights doctrine, which allocates a usufructuary right to a "fair and just portion" of the groundwater supply to each overlying landowner.[20] These rights are similar to riparian rights, because they can be asserted at any time, and subsequent correlative rights are entitled to equal dignity with existing rights.[21] Where the groundwater basin is in a condition of overdraft—that is, where the groundwater supply exceeds the safe annual yield of the groundwater basin—then use is restricted to overlying landowners based on their reasonable needs.[22] Yet where groundwater is available in excess of overdraft, and overlying owners do not need such surplus water, then the correlative rights doctrine allows for appropriative rights; put another way, out-of-basin pumpers who are pumping within a basin's safe yield are treated as appropriators.[23] Because some of the most important groundwater disputes in California history have concerned conflicts between out-of-basin users (usually cities and municipal water providers) and in-basin users (often irrigators), determinations of whether a basin is in overdraft, and what constitutes safe yield, have been fundamental to deciding whether valid appropriative rights exist under the correlative rights doctrine.[24] As briefly discussed below in Section I.B., these conflicts eventually provided California courts with an opportunity to recognize significant modifications of the correlative rights doctrine: those of prescription and, later, of mutual prescription. Under these modifications, each non-overlying pumper in a groundwater basin can acquire prescriptive rights against both overlying owners and prior appropriators by pumping in excess of safe yield for the prescriptive period.[25]

California's common-law correlative rights doctrine thus actually incorporates three doctrinal segments. It limits in-basin, on-parcel water use to a fair and proportionate share. It allows for out-of-basin, off-parcel appropriative rights, provided groundwater supplies are available in excess of safe yield. And under certain adjudicated situations, it recognizes prescriptive rights for out-of-basin pumpers.

The second wobbly leg of California groundwater law is jurisdiction. Under § 1200 of the California Water Code, originally enacted in 1913, the SWRCB has

19. Katz v. Walkinshaw, 141 Cal. 116 (1903).

20. *Id.* at 136.

21. Burr v. Maclay Rancho Water Co., 154 Cal. 428, (1908); *see* Marion Kirkwood, *Appropriation of Percolating Water*, 1 STAN. L. REV. 1, 4–7 (1948).

22. Tehachapi-Cummings Cty. Water Dist. v. Armstrong, 49 Cal. App. 3d 992, 925–27 (1975). What constitutes "overlying land" or "overlying use" has not been clearly defined, but in-basin pumpers qualify as overlying landowners. ANTHONY DAN TARLOCK & JASON ANTHONY ROBISON, LAW OF WATER RIGHTS AND RESOURCES § 4.14, at 194 (2020 ed.).

23. TARLOCK & ROBISON, *supra* note 22, at 194.

24. City of Los Angeles v. City of San Fernando, 14 Cal. 3d 199, 224 (1975).

25. City of Pasadena v. City of Alhambra, 33 Cal. 2d 908, 908 (1949); TARLOCK & ROBISON, *supra* note 22, § 4.17, at 199.

permitting and regulatory authority over surface waters of the state, which includes "subterranean streams flowing through known and definite channels."[26] The third category of California water—percolating groundwater—is beyond the state's jurisdiction and is not subject to statutory adjudications.[27] This leg extends back to 1899, when the California Supreme Court decided *Los Angeles v. Pomeroy*, a quintessential case of legal instrumentalism.[28] *Pomeroy* was an eminent domain case concerning the value of a narrow strip of land adjacent to the Los Angeles River. If the alluvial groundwater beneath the condemned land could be classified as a "subterranean stream," then it was legally part of the river; therefore, Los Angeles did not have to pay compensation for the strip's water supplies because the city held recognized pueblo rights to the river. But if the water was instead "percolating water," it was part of the condemned estate in land, and the city would have to pay compensation for the water's value—because prior to *Katz*, the rule of capture (or absolute ownership) was widely perceived as the prevailing rule for percolating groundwater in California.[29] The judicial assumption or premise that the rule of capture governed groundwater created the need, under the circumstances of *Pomeroy*, for California's "subterranean stream doctrine."[30] As Professor Sax has written:

> [E]ither Los Angeles had to lose a case that the court undoubtedly believed the city deserved to win, or the court had to look to a legal theory that solved the immediate problem before it, but created a hydrologically untenable distinction among groundwater at different stages of its voyage through the San Fernando Valley. The *Pomeroy* court chose to decide in favor of a result that protected Los Angeles' treasury at the expense of a coherent legal theory.[31]

Section 1200 effectively codified *Los Angeles v. Pomeroy*. Ever since, California courts and the SWRCB have struggled with applying the antiquated legal categories of "subterranean streams" and "known and definite channels" to long-known hydrological realities.[32] Such categories "are inapt, and efforts to fit water into the law's categories by using these technical-sounding classifications

26. CAL. WATER § 1200 (West 2020).

27. *Id.* § 2500.

28. City of Los Angeles v. Pomeroy, 124 Cal. 597 (1899).

29. Sax, *supra* note 11, at 276–80.

30. *Id.* at 280, 283.

31. *Id.* at 280.

32. For example, in N. Gualala Water Co. v. State Water Res. Control Bd., 139 Cal. App. 4th 1577, 1585–86 (2006), the SWRCB successfully defended its interpretation of Section 1200 and *Pomeroy* according to a four-part test for determining jurisdiction that it had developed internally following a 1999 decision, *In re* Garrapata Water Co., State Wat. Res. Control Bd. Dec. No. 1639 (June 17, 1999).

give the enterprise a somewhat daffy air."[33] Like their judicial counterparts in other western states that segregate their legal regimes for surface and groundwater, California judges faced with deciding these classifications lament the segregation.[34] Because "percolating groundwater" is thus outside of the state's jurisdiction, the regulation of groundwater pumping in California was, until SGMA, entirely a matter of local regulation. Indeed, the most knowledgeable water law expert on the California bench wrote nearly fifty years ago that it is indeed "curious that although regulation of surface waters is properly a responsibility of the State, groundwater regulation is somehow viewed as a 'local' concern . . . ."[35]

The third (and most stable) leg of the California groundwater tripod is the constitutional rule of reasonable use—the most important component of modern California water law.[36] This leg owes its existence to a San Joaquin Valley case, *Herminghaus v. Southern California Edison Co.*[37] In *Herminghaus*, the California Supreme Court held that the riparian doctrine, established alongside that of prior appropriation for surface use,[38] entitled riparian landowners to nothing less than the entire flow of the San Joaquin River on the grounds that it "constitutes a reasonable use thereof within the intent and meaning" of the English common law which California had adopted at statehood—thereby blocking any appropriation of the river's water supply by an upstream utility.[39] Riparian landowners thus held vested rights to the river's full flows, even if they used the water wastefully.[40] The court's pure and severe application of the riparian rights doctrine, and the waste and impracticality it explicitly condoned, provoked public outrage and an immediate public reaction. By popular initiative, California amended its constitution in 1928 to prohibit unreasonable use: "the right to water or to the use or flow of water in or from any natural stream . . . shall be limited to such water as shall be reasonably required . . . and such right

33. Sax, *supra* note 11, at 273.

34. *See, e.g.*, N. Gualala Water Co., 139 Cal. App. 4th at 1590–91, ("As the present case illustrates, classification disputes in this field quickly take on an Alice-in-Wonderland quality because the legal categories . . . are drawn from antiquated case law and bear little or no relationship to hydrological realities."); Collier v. Arizona Dept. of Water Res., 722 P.2d 363, 366 (Ariz. Ct. App. 1986) ("Arizona water law has developed into a bifurcated [legal] system in which percolating groundwater is regulated under a set of laws completely distinct from the laws regulating surface water. While this bifurcation provides a workable legal system, it often ignores the scientific reality that groundwater and surface water are often connected."); Spear T Ranch, Inc., v. Knaub, 269 Neb. 177, 183 (Neb. 2005) ("But Nebraska water law ignores the hydrological fact that ground water and surface water are inextricably linked. Instead of an integrated system, we have two separate systems, one allocating streamflows and the other allocating ground water.").

35. Sax, *supra* note 11, at 301 (quoting now-Justice Ronald Robie, when he was a lawyer for the SWRCB in 1973).

36. HUNDLEY, *supra* note 9, at 245 (quoting GOVERNOR'S COMMISSION TO REVIEW CALIFORNIA WATER RIGHTS LAW, FINAL REPORT 9 (1978)).

37. 200 Cal. 81 (1926).

38. Lux v. Haggin, 69 Cal. 255, 349 (1886).

39. Herminghaus v. Southern California Electric Co., 200 Cal. 81, 104–05, 111–12 (1926).

40. HUNDLEY, *supra* note 9, at 245.

does not and shall not extend to the waste or unreasonable use . . . of water."[41] The reasonable use requirement, once a "sleeping giant" of California water law, has awakened and stalked the law as a "Bigfoot" at least since the 1970s.[42]

The amendment essentially reversed *Herminghaus* and adjusted the relationship between California's two categories of surface water rights—riparian rights and appropriative rights.[43] But the constitutional language is more expansive, encompassing "the right to water," of which the right "to the use or flow of water in or from any natural stream" is a part.[44] That expansiveness makes sense given the earlier decision in *Katz* to adopt the principle of reasonable use that animates the correlative rights doctrine. As the court in *Katz* noted, only if there is groundwater in excess of the reasonable needs of the overlying owners may water be exported for use on non-overlying lands.[45] Modern case law has confirmed the importance of the reasonable use limitation for California groundwater.[46] Reasonable use is "an inherent limitation on all water rights" in California, whether they are subject to the SWRCB's jurisdiction or not.[47] As the California Supreme Court noted, "the courts have concurrent jurisdiction with the legislatively established administrative agencies to enforce the self-executing provisions of Article X, section 2. Private parties thus may seek court aid in the first instance to prevent unreasonable water use . . . ."[48] Within the context of integrating the management of surface water and groundwater supplies, courts have constitutional authority "to unify the law of surface and groundwater rights situationally where unintegrated management and regulation would result in unreasonable use. And the courts have this constitutional power despite the general legal distinction [in California] between the surface water and groundwater systems."[49]

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41. CAL. CONST. art. X, § 2 (originally codified as CAL. CONST. art. XIV, § 3).

42. HARRISON DUNNING, WATER ALLOCATION IN CALIFORNIA: LEGAL RIGHTS AND REFORM NEEDS 29 (1982); Brian E. Gray, *In Search of Bigfoot: The Common Law Origins of Article X, Section 2 of the California Constitution*, 17 HASTINGS CONST. L. Q. 225, 226, 272 (1989).

43. Peabody v. City of Vallejo, 2 Cal. 2d 351, 363–64, 384 (1935).

44. CAL. CONST. art. X, § 2.

45. Katz v. Walkinshaw, 141 Cal. 116, 135–36 (1903). As Professor Gray has noted, the decision in *Katz* to modify the common law of groundwater by incorporating the doctrine of reasonable use was an effort to ensure that "the law comports with the environment and economy of California . . . ." Gray, *supra* note 42, 257 n.163.

46. Light v. State Water Res. Control Bd., 226 Cal App. 4th 1463, 1479 (2014), as modified of denial of reh'g (July 11, 2014) (quoting People ex. Rel. State Water Resources Control Bd. V. Forni, 54 Cal App. 3d 743, 750 (1976)) ("The rule of reasonableness is now 'the overriding principle governing the use of water in California.'"); *see, e.g.*, Allegretti & Co. v. County of Imperial, 138 Cal. App. 4th 1261, 1279 (2006) ("Allegretti's [groundwater right] is nonetheless restricted to a reasonable beneficial use consistent with article X, section 2 of the California Constitution.").

47. Brian E. Gray, *The Property Right in Water*, 9 HASTINGS W-NW J. ENVTL. L. & POL'Y 1, 10 (2002).

48. Envtl. Defense Fund, Inc. v. East Bay Mun. Utility Dist., 26 Cal. 3d 183, 200 (1980).

49. Brian E. Gray, *The Reasonable Use Doctrine in California Water Law and Policy*, in ALLISON LASSITER ED., SUSTAINABLE WATER: CHALLENGES AND SOLUTIONS FROM CALIFORNIA 83, 97 (2015).

Placed on the ground of the Central Valley, the legal tripod of California groundwater can be shortened, simplified, and stabilized—at least for the comparative purposes of this Article. The valley is dominated by irrigators using groundwater on their own lands or within their respective groundwater basins, where pumping substantially exceeds safe yield conditions. Thus, the common-law doctrinal leg can be simplified by ignoring the complexities of appropriative rights and mutual prescription—complexities that have driven the most prominent adjudications of California groundwater.[50] The jurisdictional leg can be similarly simplified by collapsing surface water and "subterranean streams," leaving only the "percolating" groundwater of the Central Valley Aquifer—supplies that are safely beyond the SWRCB's jurisdictional reach pursuant to § 1200 of the California Water Code. Admittedly, this simplification ignores some of the Valley's most important water supplies. These include the Kings, Kern, and San Joaquin Rivers and their alluvial aquifers, which supply groundwater-dependent ecosystems such as the Kern and Pixley National Wildlife Refuges, precious remnants of what used to be Tulare Lake. Such supplies are regulated under distinct state and federal legal regimes.[51] Because this Article is limited to how groundwater irrigators can reach consensus over their mutual use of the Central Valley Aquifer, it treats this groundwater supply largely as geologists do—as a single, functionally unconfined, and heterogeneous aquifer, in which the vertical movement of groundwater depends primarily on the properties of the aquifer's fine-grained sediments and the local influences of irrigators' high-capacity wells.[52] The third constitutional leg does not need simplification: California's constitutional command of reasonable use extends to all of the groundwater supplies of the Valley.[53] For the purposes of this Article, these simplifications seem reasonable enough.

B. The Principles, Adjudicated

The long and tortured history of California groundwater adjudications generally shows that such a legal simplification is tolerable, because the courts have not made a fetish of received doctrine. These adjudications can be divided into four phases.[54] The first phase began in 1949 when the California Supreme

50. *See generally* WILLIAM BLOMQUIST, DIVIDING THE WATERS (1992); *see infra* Section I.B.

51. The water supplies of national wildlife refuges enjoy substantial protections under federal wildlife law. *See, e.g.*, National Wildlife Refuge System Improvement Act, 16 U.S.C. § 668dd(a)(1) (2020) (effective Oct. 30, 1998).

52. THOMAS E. REILLY ET AL., GROUND-WATER AVAILABILITY IN THE UNITED STATES: U.S. GEOLOGICAL SURVEY CIRCULAR 1323, at 44 (2008).

53. Garner et al., *supra* note 18, at 185.

54. This and the following several paragraphs rely substantially on a recent analysis of California groundwater adjudications, *see generally*, Leon Szeptycki et al., *A Flexible Framework or Rigid Doctrine? Assessing the Legacy of the 2000 Mojave Decision for Resolving Disputes over Groundwater in California*, 37 STAN. ENVTL. L. J. 185, 211–38 (2018). The author would like to extend his thanks to two of the article's authors, Professor Szeptycki and Professor William Blomquist, for their helpful discussions of these

Court decided *City of Pasadena v. City of Alhambra*, a case concerning the long-overdrafted Western Unit of the Raymond Basin.[55] The adjudication pitted two archetypical groundwater interests against each other—cities that were not overlying landowners and longstanding irrigators who were. Under the correlative rights doctrine of *Katz*, the cities—as appropriators—risked losing their share of the safe yield of the basin. Conversely, under the doctrine of prescriptive rights, overlying irrigators and other pumpers risked losing their water rights to the cities. Faced with the real risk posed by these doctrinal polarities, the parties reached a settlement and stipulated judgment that relied upon a simple principle: all parties would reduce their pumping by a proportional amount necessary to restore the basin to safe yield.[56] That principle ripened into the doctrinal innovation of mutual prescription, which ultimately justified the settlement: all of the pumpers had established equal rights of mutual prescription against each other because the basin was overdrafted. Thus, all of the water users were required to proportionately reduce their pumping to correct that overdraft, regardless of their status as appropriator or overlying landowner.[57] The result of the mutual prescription doctrine—proportionate reductions regardless of pumping class—was probably more important than the doctrine itself. That is because the result gave the court grounds to approve the settlement based on more general rules of equity and the public interest.[58] *City of Pasadena's* "doctrinal choreography" of mutual prescription, and its practical equity of proportionate reductions, provided a template for many groundwater adjudications for the next several decades.[59]

The dancing changed in 1975 when the California Supreme Court issued its decision in *City of Los Angeles v. San Fernando*, a decades-long, highly complex case involving mostly municipal groundwater interests.[60] The trial court followed the methodology of *City of Pasadena*—mutual prescription and proportionate reductions—but the Supreme Court reversed, changing California groundwater adjudication law in two important ways. First, it announced a newfound hesitancy about prescriptive rights (and proportionate reductions) because municipalities and other public entities—often the largest water users involved in such adjudications—were immune from prescription. That returned the factually complicated matter of determining individual groundwater rights to the center of the adjudicatory process. Second, the California Supreme Court introduced the methodology of equitable apportionment as an alternative approach to

adjudications and other issues involving California groundwater.

55. City of Pasadena v. City of Alhambra, 33 Cal. 2d 908, 921–22 (1949); BLOMQUIST, *supra* note 48, at 79–80.

56. Szeptycki et al., *supra* note 52, at 194.

57. *City of Pasadena*, 33 Cal. 2d at 935.

58. *Id.* at 933.

59. Szeptycki et al., *supra* note 52, at 194.

60. City of Los Angeles v. City of San Fernando, 14 Cal. 3d 199 (1975).

adjudicating groundwater use—a methodology used by the Supreme Court of the United States in interstate water litigation.[61] Although in dicta, the recourse to equitable apportionment made sense as a practical critique of mutual prescription. However, it was an odd choice doctrinally. As of the date of the *San Fernando* decision, the interstate cases which had actually accomplished interstate allocations were primarily those involving western states which followed the prior appropriation doctrine.[62] Thus, for priority of appropriation to be a "guiding principle" in California groundwater adjudications clashed with the state's longstanding adherence to the correlative rights doctrine.[63] *San Fernando's* departure from *Pasadena* killed that adjudication, created serious problems for subsequent adjudications, and produced a disconcerting level of uncertainty about the actual attributes of a California groundwater right.[64]

That uncertainty continued as a consequence of the third major groundwater adjudication in California, *City of Barstow v. Mojave Water Agency* ("*Mojave*"), decided in 2000.[65] In fighting the last war, as lawyers are wont to do, most of the parties to this extraordinarily complex adjudication followed the apparent precepts and practical commands of *San Fernando*. They pursued a settlement path guided by equitable apportionment, as well as a deliberate avoidance of strictly determining or enforcing individual rights, on the grounds that such strictness would likely violate the California Constitution's commands of reasonable use and the avoidance of waste.[66] The California Supreme Court once again changed directions and rejected that approach. It rejected the use of equitable apportionment that it had apparently blessed in *San Fernando* for determining groundwater allocations between overlying owners, appropriators, and those claiming prescriptive rights. It rejected the avoidance of classifying and prioritizing individual rights as rationalized by Article X, Section 2 of the state constitution.[67]

After *Mojave*, neither the practical instrumentalism of mutual prescriptive rights as established in *Pasadena* in 1949 nor the collective approach of equitable

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61. *Id.* at 265 & n.61 (citing Nebraska v. Wyoming, 325 U.S. 589 (1945).

62. *See*, *e.g.*, Wyoming v. Colorado, 259 U.S. 419, 464 (1922) (equitable apportionment based primarily on the respective states' adherence to the prior appropriation doctrine); Nebraska v. Wyoming, 325 U.S. 589, 618 (1945) (equitable apportionment based on prior appropriation but including other important factors as well). Since 1945, the Supreme Court of the United States has not equitably apportioned interstate water supplies. The Court maintained its general allegiance to prior appropriation as a guiding principle for equitable apportionment in Colorado v. New Mexico, 459 U.S. 176 (1982), and again in the same case, Colorado v. New Mexico, 467 U.S. 310 (1984).

63. City of Los Angeles, 14 Cal. 3d at 266 & n.61 (quoting Nebraska v. Wyoming, 325 U.S. 589, 618 (1945).

64. Szeptycki et al., *supra* note 52, at 197–200.

65. City of Barstow v. Mojave Water Agency, 23 Cal. 4th 1224 (2000).

66. Szeptycki et al., *supra* note 52, at 205–06.

67. Mojave Water Agency, 23 Cal. 4th at 1243–50. For a detailed history of the case, *see* J. M. Miller, *When Equity Is Unfair—Upholding Long-Standing Principles of California Water Law in* City of Barstow v. Mojave Water Agency, 32 MCGEORGE L. REV. 991 (2001).

allocation blessed in *San Fernando* in 1975 were legally viable methods of adjudicating groundwater rights. *Mojave* can be read pessimistically as reaffirming a formalistic and individualistic approach to adjudicating groundwater rights—a discouraging development given the cost and complexity of adjudications.[68] Yet *Mojave* can also be read optimistically, seeing in the decision the potential to accommodate the recognition of individual rights and priorities without foreclosing the ability of the parties and the trial courts to reach creative and effective resolutions of groundwater adjudications.[69] A recent empirical study analyzed the seven groundwater adjudications that have been completed since *Mojave*, to evaluate the case's actual effects on those adjudications and to limn any lessons they may hold for the design and implementation of GSPs under SGMA.[70] Its authors reached a number of encouraging conclusions. In five of the seven adjudications, the parties and the courts reached relatively quick settlements using creative groundwater management solutions—and, importantly, by finessing the property rights rules for California groundwater.[71] They did so largely by "effectively adopting a clear rule of supremacy of overlying rights, while also setting up a system for reallocating those rights to urban users into the future."[72]

C. SGMA

California long resisted the regulation of groundwater under a permit system, largely because of opposition from irrigation interests in the San Joaquin Valley.[73] But the long drought that began at least in 2006 forced the state to recognize the crisis caused by unregulated pumping. In typical California fashion, it enacted SGMA—a comprehensive regulatory plan for California groundwater. It took effect on January 1, 2015, and amendments clarifying its legislative intent took effect in 2016.[74] SGMA fills twelve chapters of the California Water Code, along with multiple cross-references to existing procedures for groundwater adjudications. Reduced to its essentials, SGMA pursues two goals: (1) the sustainable management of the state's groundwater

68. *See, e.g.*, Eric Garner, *Right Back Where We Started from: The Last 25 Years of Groundwater Law in California*, 36 MCGEORGE L. REV. 413 (2005).

69. *See, e.g.*, R. McGlothlin & J. Acos, *The Golden Rule* of Water Management*, 9 GOLDEN GATE ENVTL. L. J. 109 (2016).

70. Szeptycki et al., *supra* note 52, at 188.

71. *Id.* at 185–86.

72. *Id.* at 211.

73. Barbara Andrews & Sally Fairfax, *Groundwater and Intergovernmental Relations in the Southern San Joaquin Valley of California: What Are All These Cooks Doing to the Broth?*, 55 U. COLO. L. REV. 145, 152–53 (1984).

74. For a procedural history of the enactment of the SGMA, *see* Tina Cannon Leahy, *Desperate Times Call for Sensible Measures: The Making of the California Sustainable Groundwater Management Act*, 9 GOLDEN GATE U. ENVTL. L.J. 5 (2016).

basins; and (2) the achievement of that goal primarily through the work of local agencies, rather than the SWRCB or the state Department of Water Resources ("DWR").[75]

SGMA defines what is sustainable for groundwater usage—whether as a "sustainability goal," "sustainable groundwater management," or "sustainable yield." Within the historical context of California's groundwater adjudications between *Pasadena* and *Mojave*, these are terms suggestive of layers of common-law definitions.[76] But as a statute, SGMA defines sustainability as something that avoids an "undesirable result," which consists of the following:

> (1) Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.
> (2) Significant and unreasonable reduction of groundwater storage.
> (3) Significant and unreasonable seawater intrusion.
> (4) Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
> (5) Significant and unreasonable land subsidence that substantially interferes with surface land uses.
> (6) Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.[77]

Notably, these "undesirable results" are themselves qualified by what decision-makers determine to be both "significant" and "unreasonable." They are not to be confused with how a hydrogeologist would determine sustainability.[78]

SGMA next sets forth the procedures by which to achieve this definition of sustainable groundwater management. While local agencies take the lead, the state plays an important supervisory role. SGMA either recognizes existing local agencies or allows a local agency or combination of agencies to decide to become the GSA for their overlying groundwater basin.[79] Once the GSA has been formed, and the state has recognized it, the GSA's primary duty is to develop a binding GSP. SGMA requires that GSAs for high- and medium-

75. CAL. WATER § 10720.1 (West 2020).

76. Garner et al., *supra* note 18, at 173–77.

77. CAL. WATER § 10721(x).

78. For a critique of the SGMA's approach to sustainable yield, *see* John J. Perona, *A Dry Century in California: Climate Change, Groundwater, and a Science-Based Approach for Preserving the Unseen Commons*, 45 ENVTL. L. REV. 641 (2015).

79. CAL. WATER § 10723.

priority basins complete their GSPs by 2020 or 2022, depending upon the basin; the DWR had earlier established the priority of these basins.[80] Many GSPs have already been submitted, and several propose retiring groundwater-irrigated acreage as a means to reach SGMA's sustainability goals. Indeed, permanent land fallowing may be an unpleasant feature of GSPs in primarily agricultural areas such as the San Joaquin Valley.[81]

Once the GSP is adopted, it must achieve its sustainability goals within twenty years, but extensions of five to ten years and even longer are available if the GSA can show good cause for the extension.[82] Importantly, the GSP must consider the interests of all beneficial users of groundwater and not just those who hold water rights; the latter include environmental users of groundwater, Native American tribes, and disadvantaged communities.[83] DWR reviews the local GSP to ensure compliance with SGMA's sustainability goals, and it must review the plan at least every five years.[84]

SGMA similarly divides the power to regulate pumping to achieve the sustainability goals of the GSP. The GSAs are endowed with clear authority to require wells to be registered and equipped with meters.[85] They can also impose well spacing on new wells, regulate pumping to minimize well interference, and even suspend pumping to meet the requirements of the GSP.[86] GSAs also have the power to impose civil penalties against pumpers who violate the specific rules of the GSP, or bring a court action to do the same.[87] Again, the state serves as the backstop: if the SWRCB determines that a GSP is deficient in meeting SGMA's sustainability goals, it can intervene and place the basin on probationary status, identify the plan's problems, and develop its own interim plan as necessary—until the GSA reforms its GSP.[88] While SGMA seeks to secure a maximum degree of local control, it is consistently clear that the state, through DWR and the SWRCB, will oversee the management process to ensure that local GSAs are in fact meeting the act's sustainability goals.[89]

The most telling aspect of SGMA is its treatment of water rights. There is a clear tension within the Act between the security of groundwater rights established according to California property law and the sustainability goals imposed by SGMA.[90] SGMA attempts to alleviate this tension by consistently

80. *Id.* §§ 10720.7, 10933(b)(8).
81. TARLOCK & ROBISON, *supra* note 22, § 4.15, at 198.
82. CAL. WATER § 10727.2.
83. *Id.* § 10723.2.
84. *Id.* §§ 10733, 10733.4, 10733.8.
85. *Id.* §§ 10725.6, 10725.8.
86. *Id.* § 10726.4.
87. *Id.* §§ 10726.4, 10732.
88. CAL. WATER §§ 10735.2, 10735.4, 10735.8, 10736.
89. *Id.* § 10725.
90. *Id.* § 10720.1. For an excellent recent discussion of this tension, *see* Garner et al., *supra* note 18.

deferring to the former: it takes pains to state that the act neither determines property rights in the use of groundwater established at common law, nor functions as a commentary on them.[91] The local agencies have no power to create such property rights: GSAs do not have the power to issue well permits, and GSPs do not function as a determination of groundwater rights.[92] SGMA similarly defers to the groundwater adjudication process: adjudicated basins are mostly exempt from SGMA's requirements, but ongoing adjudications must be managed to minimize interference with a GSP.[93] The 2015 amendments to SGMA were generally focused on streamlining the adjudication process for groundwater basins, so that adjudications could not raise procedural opportunities to delay the implementation of GSPs in high- and medium-priority basins.[94]

D. The Coming Collisions in the post-SGMA Legal Landscape

The enactment of SGMA in 2014 has forced the statutory imperative of sustainability upon the legal regime of California groundwater. As a consequence, massive collisions almost certainly await. Begin with the property right in California groundwater: it is the logical starting place.[95] The individual, overlying right was conceived over a century ago according to the correlative rights doctrine in *Katz.* It fell under the governance of the constitutional mandate of reasonable use. It has endured the instrumentalist and doctrinal oscillations created by adjudications ever since *Pasadena*—oscillations largely forced by relentless municipal growth. But in agriculturally dominated basins such as the San Joaquin Valley, SGMA has forced the right to confront its own attributes, as legal doctrine collides with groundwater depletion. What was reasonable in the pre-SGMA world is not sustainable in a post-SGMA world.

The other collisions are similarly daunting and probably unavoidable. Local GSA control of the GSP will likely collide with the state's power to take over the process if DWR and the SWRCB find the GSP to be deficient. The administrative law and procedure of SGMA will collide with the legal process of adjudications. Agricultural interests and overlying pumpers will predictably collide with municipalities and other parties with appropriative and prescriptive rights and claims. And in primarily agricultural basins, there will be collisions between agricultural interests themselves: between resident and non-resident growers, as well as between longer-established growers of traditional Central Valley crops and *arriviste* nut growers.[96]

91. *See* CAL. WATER §§ 10720.5, 10720.8.

92. *Id.* § 10726.4.

93. *Id.* § 10720.8.

94. *Id.* §§ 10720.1(i), 10720.5(c), 10737.2.

95. Garner et al., *supra* note 18.

96. ARAX, *supra* note 7, at 299–341 (describing the agricultural empire of the Wonderful Company and its founder, Stewart Resnick, of Beverly Hills, a non-agricultural region of southern California).

III. KANSAS GROUNDWATER LAW: A SCHEMATIC REVIEW

Kansas used to resemble the Central Valley. Millions of years ago, its western portion was a vast inland sea, even bigger than Tulare Lake. At the end of the last ice age—about 12,000 years ago—it received the sands, gravels, and melting glacial waters of the Rocky Mountains, which together deposited themselves into what is now the High Plains-Ogallala Aquifer. When Kansas became a territory in 1854, its western boundary extended to the eastern slope of the Colorado Rockies, giving it territorial rights to mountain rivers, such as the South Platte and the Arkansas. But once Kansans became aware of these blessings, they did not last very long. The Colorado Gold Rush of 1859 convinced Kansas territory to cede its western holdings to Colorado in 1861. A decade or so later, Kansas surface irrigators started diverting the Arkansas River near the state line, taking every drop that flowed out of Colorado.[97]

Unlike California, Kansas largely depends upon foreign sources for its water. It depends upon foreign places, the rivers that arise upstream in Colorado and Nebraska but contribute relatively small, highly variable surface water supplies. It also depends upon a foreign time, the geological past that produced the High Plains-Ogallala Aquifer. These groundwater supplies are substantial and dependable, but they are largely non-renewable.

Kansas water law also used to resemble California's, but that too has changed. Like California, Kansas adopted the English common law in the 1850s, recognized the prior appropriation doctrine soon thereafter, and developed a relatively uneventful legal regime combining the riparian and prior appropriation doctrines.[98] Even the doctrines did not clash: Kansas has no epic cases such as *Lux v. Haggin* because it allocated the humid, eastern portion of the state to the former doctrine and the dry, High Plains portion to the latter. However, a series of legal setbacks in the 1940s exposed the obvious deficiencies of Kansas's legal regime. Interstate litigation and federal water resources planning both put a premium on the state's ability to quantify its water supplies, something difficult to achieve under the riparian doctrine.[99] And in 1944, the Kansas Supreme Court held that the state's water law was ineffectual regarding groundwater.[100]

97. JAMES SHEROW, WATERING THE VALLEY: DEVELOPMENT ALONG THE HIGH PLAINS ARKANSAS RIVER, 1870–1950, at 79–92 (1991).

98. Burke W. Griggs, *Beyond Drought: Water Rights in the Age of Permanent Depletion*, 62 U. KAN. L. REV. 1263, 1273–79 (2014).

99. *Id.* at 1278.

100. State *ex rel.* Peterson Co. v. Bd. of Agric., 149 P.2d 604, 607–09 (Kan. 1944).

A. The Founding Principles of Kansas Water Law

In response to these challenges, Kansas enacted the Kansas Water Appropriation Act of 1945 ("KWAA"), comprehensively rewriting the state's water law.[101] The framers of the KWAA studied the water laws of all the western states, and the California experience informed their work.[102] The KWAA codified the doctrine of prior appropriation statewide for all of the state's water supplies, including groundwater.[103] The KWAA established a permit requirement for all non-domestic rights and provided a statutory procedure by which pre-1945 rights were recognized and permitted as vested rights.[104] It placed jurisdiction over all of the state's waters and water supplies under the Chief Engineer of the state's division of water resources ("KDA-DWR"), a subordinate division of the Kansas Department of Agriculture.[105] It expressly forbids the acquisition of water rights by adverse possession or use, thus foreclosing the possibility of prescriptive rights.[106]

Compared to the wobbly tripod of California groundwater law, the KWAA appears to enjoy a much more stable design. The doctrinal leg consists of just one segment, that of prior appropriation; it repudiated the riparian doctrine and leaves no room for any other. Same for the jurisdictional leg: all the waters of the state fall under the chief engineer's jurisdiction and not that of any local agency. Finally, the KWAA mandates reasonable use and prohibits waste, rendering unnecessary any constitutional provision to that effect.

B. The Principles, Compromised

Yet Kansas groundwater law soon developed destabilizing flaws. The principal doctrinal flaw was latent in the application of the prior appropriation doctrine to the vast but non-renewable supplies of the High Plains-Ogallala Aquifer. The original version of the KWAA required the Chief Engineer of KDA-DWR to put water to beneficial use by granting water rights, provided the water was available and its use did not impair existing rights; this is a standard duty under the prior appropriation doctrine.[107] But the Ogallala posed a problem for the doctrine in its pure form. During the 1950s, the Ogallala's largely

101. Kansas Water Appropriation Act of 1945, ch. 390, § 1 (codified at KAN. STAT. ANN. §§ 82a-701 to 82a-745, 42-303, 42-313 (2020)); *see generally* John C. Peck, *The Kansas Water Appropriation Act: A Fifty-Year Retrospective*, 43 U. KAN. L. REV. 735, 736 (1995).

102. Griggs, *supra* note 96, at 1276–79.

103. KAN. STAT. ANN. §§ 82a-702, 82a-706, 82a-721 (2020).

104. *Id.* §§ 82a-705, 82a-709, 82a-704a, 82a-704b.

105. *Id.* §§ 82a-702, 82a-706.

106. *Id.* § 82a-705.

107. Kansas Water Appropriation Act of 1945, ch. 390, § 1 (codified at KAN. STAT. ANN. §§ 82a-701 to 82a-745, 42-303, 42-313 (2020)). The Kansas rule was essentially the same as those of other prior appropriation jurisdictions with permit requirements, such as Wyoming. *See, e.g.*, WYO. STAT. ANN. § 41-4-503 (2020).

undeveloped water supplies were available for beneficial use well in excess of the needs of existing rights; but any development of the aquifer would necessarily lower groundwater levels, impairing existing rights under the 1945 standard. To enable the development of the aquifer, Kansas softened the impairment standard for granting new water rights in 1957 by defining it as impairment "beyond a reasonable economic limit."[108] Henceforth, KDA-DWR could grant junior rights whose use lowered groundwater levels. Holders of senior rights to the Ogallala retained their ability to protect their rights in times of shortage: the statutory sections for the administration of rights were left intact.[109]

This redefinition of impairment for granting new rights, together with KDA-DWR's liberal policy of granting new Ogallala rights without regard to the aquifer's long-term water supply, soon produced a regional problem of severe over-appropriation.[110] KDA-DWR pursued the practice of granting new Ogallala rights according to the net irrigation requirement ("NIR") of the appurtenant land.[111] By the late 1970s, Kansas had, at least in some regards, effectively replaced the prior appropriation doctrine with something practically similar to the correlative rights doctrine.[112] Landowners obtained the legal right to pump the NIR of their crops, a regulatory approximation of a "just and fair" proportion of the underlying groundwater supply.[113] And corn, not wheat, became the default crop.[114] Irrigators with senior rights did not bring impairment complaints, and they had their reasons. There was still enough water, and many who held senior rights also held junior ones.[115] This doctrinal revolution went largely unnoticed, probably because it was incomplete: prior appropriators could still protect their rights.

The jurisdictional realities of Kansas water law soon underwent a significant evolution as well. The Kansas Groundwater Management District Act ("KGMDA") was enacted in 1972.[116] Soon after its enactment, five groundwater management districts ("GMDs") were established during the 1970s. Collectively, the GMDs cover almost all of the ground overlying the High Plains-Ogallala in

108. KAN. STAT. ANN. § 82a-711 (Kan. L. 1957, ch. 539, § 16) (1957). For more on the 1957 amendments to the KWAA, *see* Peck, *supra* note 99, and Griggs, *supra* note 96.

109. KAN. STAT. ANN. §§ 82a-716, 82a-717a (2020); for an exemplary discussion, *see* Garetson Bros. v. American Warrior, Inc., 51 Kan. App. 2d 370, 380–82 (2015).

110. Griggs *supra* note 96, at 1285; John C. Peck, *Groundwater Management in Kansas: A Brief History and Assessment*, 15 KAN. J.L. & PUB. POL'Y 441, 443 (2006).

111. Griggs, *supra* note 96, at 1285.

112. *Id.* at 1305; A. Dan Tarlock, *Prior Appropriation: Rule, Principle, or Rhetoric?* 76 N.D. L. REV. 881, 900–01 (2000).

113. KAN. ADMIN. REGS. § 5-5-12 (2020) (net irrigation requirements by county).

114. KAN. ADMIN. REGS. § 5-24-2(c)(2)(A)(ii).

115. Griggs, *supra* note 96, at 1298–1304.

116. Act of Mar. 17, 1972, ch. 386, § 1–16, 1972 Kan. Sess. Laws 1416–30 (codified at KAN. STAT. ANN. §§ 82a-1020 to 82-1035) (amended 1978); *see* John C. Peck, *Kansas Groundwater Management Districts*, 29 U. KAN. L. REV. 51 (1980).

Kansas. GMDs have the authority to tax, to purchase and sell real property (including water rights), and to draft regulations for water use within their respective districts.[117] If approved by the Chief Engineer, these regulations become binding and enforceable by the Chief Engineer; the GMDs have no independent administrative or legal authority.[118] However, because they encompass most of the irrigation in Kansas, the GMDs have become the state's most powerful water-related interest group.

By the late 1970s, the depletion of the High Plains-Ogallala Aquifer had become all too apparent in Kansas. Local irrigation interests took the initiative to amend the KGMDA in 1978, providing for the establishment of Intensive Groundwater Use Control Areas ("IGUCAs").[119] Based generally on similar legislation in Oregon, the IGUCA statutes enable the Chief Engineer (either on his own initiative, on the recommendation of a GMD, or by the submission of a petition of 5% of the water rights owners within a GMD) to conduct hearings to consider whether a particular area is suffering from excessive declines in surface flows or of groundwater levels, from a decline in water quality, or from a situation where groundwater withdrawals exceed recharge.[120] If the Chief Engineer makes such a finding, he then conducts a second hearing to consider whether and how to impose appropriate "corrective control provisions" that will remedy the situation—most importantly, whether to impose reductions in pumping.[121] After this second hearing, the Chief Engineer orders the establishment of an IGUCA for the area under consideration and imposes the corrective control provisions.[122] These provisions do not require the administration of junior rights by strict priority; the Chief Engineer enjoys regulatory leeway in this regard.[123]

Since 1978, the Chief Engineer has established eight IGUCAs in Kansas—most of them to protect surface flows from impairment caused by excessive groundwater pumping.[124] The most contentious IGUCA to date was undertaken to protect the surface rights of the Cheyenne Bottoms State Wildlife Area, an important refuge for migratory birds that depends on the flows of Walnut Creek in west-central Kansas.[125] In the Walnut Creek IGUCA (1992), the Chief

117. KAN. STAT. ANN. § 82a-1028 (2020).

118. *Id.* § 82a-1028(o).

119. Leland E. Rolfs, *Comparing and Contrasting the Roles of the Division of Water Resources and the Groundwater Management Districts in Groundwater Management and Regulation*, 15 KAN. J. L. & PUB. POL'Y 505, 509–10 (2006).

120. KAN. STAT. ANN. §§ 82a-1036, 82a-1037.

121. *Id.* § 82a-1038(a)–(b).

122. *Id.* § 82a-1038(b).

123. *Id.* § 82a-1038(c).

124. *See Intensive Groundwater Use Control Areas (IGUCAs)*, KANSAS DEPARTMENT OF AGRICULTURE, DIVISION OF WATER RESOURCES, https://agriculture.ks.gov/divisions-programs/dwr/managing-kansas-water-resources/intensive-groundwater-use-control-areas (last visited Mar. 17, 2021) (on file with the *University of the Pacific Law Review*).

125. *See* John C. Peck, *Property Rights in Groundwater—Some Lessons from the Kansas Experience*, 12

Engineer established a safe yield for the Walnut Creek Basin and ordered pumping reductions to achieve that yield. The reduction order did not follow the strict priorities of the rights which were impairing the wildlife area's senior surface right; rather, it reduced groundwater use according to three tranches of priority.[126] Vested, or pre-1945 rights, suffered no reductions. Rights with priorities between 1945 and 1965 suffered reductions—between 22% and 33%. Rights junior to 1965 suffered much higher reductions—between 64% and 71%.[127] The Walnut Creek IGUCA restored some degree of safe yield to an over-drafted groundwater basin; Professor John C. Peck has compared the result to the *Pasadena* adjudication in this regard.[128]

But the Chief Engineer has imposed no IGUCAs over the High Plains-Ogallala Aquifer. He has not taken the initiative to do so himself, nor has any GMD or the members of any GMD. More broadly, the Chief Engineer has almost entirely avoided administering water rights according to priority over the non-renewable Ogallala. As a group, Kansas water rights owners have almost entirely avoided requesting the usual tools in a water-short situation—priority administration, impairment investigations, and water rights adjudications.[129] Largely as a consequence, depletion rates across the High Plains-Ogallala Aquifer have continued and even accelerated.

C. Reasons for Owners' Lack of Initiative and State Regulatory Inaction

Given that Kansas water law has long-established property rules and management tools that can reduce groundwater depletions, why have the KDA-DWR or Kansas water rights owners not deployed them? The first answer is over-appropriation.[130] Because most of the High Plains-Ogallala Aquifer is effectively not replenishable (with typical recharge in the 1% to 3% neighborhood), that over-appropriation is only becoming worse, especially as corn and soybean hybrids, together with improved irrigation technology, allow full irrigation in areas previously considered non-irrigable. As a result, even if

KAN. J.L. & PUB. POL'Y 493, 499 (2003) (recounting the Walnut Creek IGUCA's origin).

126. *Id.*

127. *Id.*

128. *Id.* at 505. Peck correctly notes that the comparison is a rough one, since the KWAA expressly prohibits prescriptive rights (KAN. STAT. ANN. § 82a-705).

129. *But see* Garetson Bros. v. American Warrior, Inc., 51 Kan. App. 2d 370 (2015) (enjoining a junior groundwater right that KDA-DWR had found to be impairing a senior right. 51 Kan. App.2d 370 (2015). The injunction was subsequently made permanent. Garetson Bros. v. American Warrior, Inc., 56 Kan. App. 2d 623 (2019). Notably, plaintiffs brought their impairment case directly to the district court; they did not pursue the administrative remedy set forth in the KWAA. Such an independent defense of property rights alarmed the Kansas Legislature, which promptly amended the procedural statutes related to impairment, henceforth requiring all impairment claims to be filed with the Chief Engineer as a prerequisite to seeking judicial relief. Kan. Laws 2017, ch. 55, §§ 1–2 (codified at KAN. STAT. ANN. §§ 82a-716, 82a-717a).

130. *See supra* text accompanying note 108.

every Kansas water right owner is acting within their legal rights (and nearly all water rights owners do comply with the limitations of their permits), then these depletions will continue to get worse.

The second answer has to do with the essentially reactive function of the office of the Chief Engineer when it comes to water rights administration. The KWAA requires him to protect water rights, but typically only when owners request them to be protected.[131] Because Kansas water rights owners are largely complying with the law by staying within the annual authorized quantities of their water rights, and because irrigators have decided (both individually and collectively) to not request the Chief Engineer to step in and order reductions, he is loath to take independent action. Ordering reductions in pumping might constitute an uncompensated taking under the Fifth Amendment of the U.S. Constitution (along with parallel and stronger provisions under the Kansas Constitution).[132] The likelihood of such a finding is probably small,[133] but the political specter of takings haunts the minds of Kansas regulators. And while the Chief Engineer has the statutory duty to protect water rights when their owners request it, he does not have the duty to save the aquifer. Strong political interests, especially the large irrigators who dominate the membership and policy of the GMDs, have made clear that they would retaliate politically in the event of such a positive direction by the Chief Engineer. The office is structurally compromised in this regard: no other state water engineer in the West answers to a secretary of agriculture, who in turn accommodates the agriculture industry.[134]

Finally, Kansas groundwater irrigators have not used these rules and tools because they strike them as too powerful and unpredictable.[135] Under Kansas's prior appropriation regime, an impairment investigation can lead to the administration of junior rights and the reduction of junior groundwater pumping. But very few irrigators have filed impairment complaints because priority administration in a groundwater context can have far-reaching effects.[136] In a "neighborhood" of groundwater rights, protecting one right can mean administering as many as a dozen nearby rights, where the Chief Engineer finds that their cones of depression intrude upon the senior right.[137] This creates an all-or-nothing situation that makes irrigators hesitant to file an impairment complaint. Moreover, many holders of senior groundwater rights hold junior

131. KAN. STAT. ANN. § 82a-706b (2020); KAN. ADMIN. REGS. §§ 5-4-1, 5-4-1a (2020).

132. Peck, *supra* note 123 at 504–06.

133. Dave Owen, *Taking Groundwater*, 91 WASH. U. L. REV. 253, 254 (2013).

134. KAN. STAT. ANN. §§ 74-506b, 82a-1901 (2020). The secretary of agriculture, who holds her or his appointment from the Governor, repeatedly overruled water rights administration decisions made by the chief engineer to protect the senior surface rights held by the Quivira National Wildlife Refuge. The outlawry has prompted litigation. Audubon of Kan., Inc., v. U.S. Dept. of the Interior, No. 2:21-CV-02025, 2021 WL 151768 (D. Kan. Jan. 15, 2021).

135. Griggs, *supra* note 96, at 1291.

136. *Id.* at 1299–1300, 1300 ("sixteen impairment complaints out of nearly 40,000 groundwater rights? That is not a tragedy; it seems more like a farce.").

137. *See supra* note 127.

rights as well, and so protecting the former might require shutting off the latter.[138] As we will see below in Part III of this Article, groundwater irrigators in Kansas tend to disfavor the severe logic of prior appropriation, and usually prefer that a reduction in groundwater pumping be leveled against all rights equally rather than according to priority.

The same concern largely explains why irrigators have not requested an IGUCA over the Ogallala. They fear that the public hearing process, which allows anyone to provide testimony, might place facts and expert opinion into the record that argue for corrective control provisions far in excess of what they might deem to be acceptable reductions in water use. An order that emerges from the IGUCA process may very well be too severe for the very irrigators who requested pumping reductions in the first place.[139]

D. Predictable Self-Regulation: Local Enhanced Management Areas

How, then, to remedy a situation where irrigators are leery of deploying the legal tools to protect their water rights and extend the practical life of the High Plains-Ogallala Aquifer? Irrigators and KDA-DWR recognized two needs. There is a need for local water users to generate their own plans for reducing groundwater depletions. The landscape of groundwater management across the Great Plains is littered with centrally imposed water conservation plans that irrigators have rejected for being excessive in their reductions and politically unpalatable for their lack of sensitivity to the concept of "local control."[140] There is also the need for the water reduction plans to be hydrologically meaningful and legally enforceable.

During 2010 and 2011, there emerged a critical mass of groundwater irrigators, mostly in Northwest Kansas Groundwater Management District No. 4, who were willing to commit to a significant reduction in their water usage. But these irrigators were unwilling to trust the IGUCA process due to its potential unpredictability. In response, legislation enacted in 2012 provides for the establishment of Local Enhanced Management Areas, or LEMAs.[141]

The LEMA statute follows the main steps of the IGUCA statutes but with some important procedural protections for irrigators who are interested in long-term groundwater conservation. Under the statute, the GMD can submit a local

138. Indeed, this was one of the reasons why the Walnut Creek IGUCA (*see supra* text accompanying notes 123–26) did not provoke a sustained judicial challenge: holders of pre-1965 rights, which suffered comparatively smaller reductions, also held many post-1965 rights, which suffered comparatively greater reductions. A judicial resolution imposing strict priority administration according to the KWAA might have well imposed greater reductions in overall pumping.

139. Griggs, *supra* note 96, at 1291.

140. *Id.* at 1311; Peck, *supra* note 123, at 505–06.

141. 2012 Kan. Sess. Laws 382 (codified at KAN. STAT. ANN. § 82a-1041 (2020)).

enhanced management plan to the Chief Engineer for review.[142] Such a plan may include proposed reductions in water use, methods to improve the temporal flexibility of water use, and means by which to transfer water between water rights holders. At this review stage, the Chief Engineer evaluates the plan to determine whether it is acceptable for consideration; after review, he communicates with the GMD to recommend changes, express his reservations, and provide other feedback. Where KDA-DWR has determined that a LEMA proposal is deficient, the Chief Engineer has returned the plan to the GMD for revisions.[143]

After this review period, if the Chief Engineer decides that the local enhanced management plan is sound, he initiates proceedings for the establishment of a LEMA.[144] These proceedings consist of at least two hearings. At the first hearing, the Chief Engineer appoints a hearing officer to consider, among other things, whether the area in question is suffering from excessive declines in surface flows of groundwater levels, from a decline in water quality, or from a situation where groundwater withdrawals exceed recharge.[145] If the hearing officer finds that any such conditions exist, then the Chief Engineer sets a second public hearing to consider the merits of the LEMA plan and whether it should be adopted.[146]

At the second public hearing (or hearings), there is an important difference from the IGUCA process: the scope of the hearing is limited to the plan put up by the sponsoring GMD.[147] The Chief Engineer is thus statutorily prohibited from considering alternative LEMA plans. The plan in question may not be substantively amended, limiting uncertainty and potential changes offered by outside parties or the state. The only question before the Chief Engineer at this stage is whether to accept the proposed plan. Based on the evidence submitted at the hearings, the Chief Engineer can accept the plan as proposed, reject it, send it back to the GMD for revisions and resubmission; if he decides that it passes muster, then he issues an order of designation setting forth the local enhanced management plan in detail.[148] As an order of the Chief Engineer, enforcement of the plan falls to KDA-DWR, and not to the GMD, thus taking the onus of enforcement off of the local groundwater interests who (somewhat paradoxically)

142. KAN. STAT. ANN. § 82a-1041(a) (2020).

143. *See, e.g.*, Letter from David W. Barfield, Chief Engineer, Division of Water Resources, to Darrell Wood, President, Big Bend Groundwater Management District No. 5 (July 30, 2019) (responding to the KDA-DWR's response to the 2019 LEMA proposal made by the Big Bend Groundwater Management District No. 5), https://agriculture.ks.gov/docs/default-source/dwr-water-appropriation-documents/2019-07-30formalresponsetofeb2019lema_request.pdf?sfvrsn=e5d688c1_0 (on file with the *University of the Pacific Law Review*).

144. KAN. STAT. ANN. § 82a-1041(a).

145. *Id.* §§ 82a-1041(b), 82a-1036.

146. *Id.* § 82a-1041(e).

147. *Id.* § 82a-1041(c).

148. *Id.* §§ 82a-1041(d)–(f).

championed "local control" in the first place.[149] The order is subject to both administrative and judicial review under Kansas administrative law.[150]

In short, the LEMA statute combines local control over the groundwater management plan with the central enforcement authority held by KDA-DWR over the administration of water rights and IGUCAs. As we will see in Part III of this Article, this combination has produced meaningful groundwater conservation across western Kansas.

IV. LEMAS IN KANSAS

Since 2013, the Chief Engineer has approved three LEMAs. The LEMA concept has attracted national attention as a means to achieve meaningful groundwater conservation without running afoul of the legal protections afforded to the western groundwater right.[151] Section A of this Part distills the three approved LEMA plans into eight principal features. Section B surveys the most notable legal, economic, and hydrological findings based on analyses of the LEMAs so far.

A. A Distillation of the Relevant LEMA Features

The three LEMAS are located in northwest and western Kansas. In 2012, Northwest Kansas Groundwater Management District No. 4 ("GMD4") submitted the first LEMA plan to KDA-DWR for the Sheridan-6 "High Priority Area," a designation for areas facing severe groundwater declines. The Chief Engineer approved the Sheridan-6 LEMA in 2013; it consists of ninety-nine sections across six townships in Sheridan and Thomas Counties.[152] The Sheridan-6 LEMA was renewed in 2017 for another five-year period, and its management programs are almost identical to its predecessor.[153] The success of the Sheridan-6 LEMA led to GMD4 securing the Chief Engineer's approval of a second one,

149. *Id.* §§ 82a-1041(h), 82a-1901. However, the Chief Engineer may delegate enforcement authority to the GMD. *Id.* § 82a-1041(f).

150. *Id.*

151. *See, e.g.*, *Sip It Slowly: Farmers in Kansas Are Starting to Adapt to Declining Stocks of Groundwater*, THE ECONOMIST (Sept. 28, 2013), http://www.economist.com/news/united-states/21586874-farmers-kansas-are-starting-adapt-declining-stocks-groundwater-sip-it-slowly (on file with the *University of the Pacific Law Review*); Laura Parker, *What Happens to the U.S. Midwest When the Water's Gone?*, NATIONAL GEOGRAPHIC (Aug. 2016), http://www.nationalgeographic.com/magazine/2016/08/vanishing-midwest-ogallala-aquifer-drought/.

152. Sheridan 6 Local Enhanced Mgmt. Area, 12-Water-8366, at 24–25, 28–29 (2013) (Order of Designation Approving the Sheridan 6 Local Enhanced Management Area within Groundwater Management District No. 4) [hereinafter 2013 GMD4 Sheridan-6 LEMA]. The author represented the Chief Engineer in this matter.

153. Sheridan 6 Local Enhanced Mgmt. Area in Sheridan and Thomas Ctys., Kan., 001-DWR-LEMA-2017, at 5 (2017) (Order of Designation Regarding the Sheridan 6 Local Enhanced Management Plan for 2018-2022) [hereinafter 2017 GMD4 Sheridan-6 LEMA].

across the entire district, in 2018; it comprises ninety-five townships across the ten counties included within the district's boundaries.[154] And late in 2020, Western Kansas Groundwater Management District No. 1 ("GMD1") secured the Chief Engineer's approval of a LEMA for the sixteen townships of Wichita County that are within the boundaries of GMD1.[155] An earlier effort by GMD1 to establish a district-wide LEMA failed by a narrow vote within the GMD, and did not proceed to the hearing stage.

A review of the groundwater management plans approved for these three LEMAs reveals eight relevant features, which for the most part are reasonably consistent. What follows is a distillation of these features.

1. Pumping Goals During the LEMA Period

Each of the plans begins with a goal establishing the maximum amount of total groundwater to be pumped within the LEMA during a five-year period. The 2013 Sheridan-6 LEMA set a goal of restricting all non-domestic groundwater pumping to no more than 114,000 acre-feet for the five irrigation seasons between 2013 and 2017, a reduction designed to reduce pumping by 20% compared to historic pumping levels.[156] Its 2017 successor increased that total to 117,600 acre-feet for 2018–2022, because 3,600 acres that had been enrolled in federal conservation programs during the first Sheridan-6 LEMA period had come out of those programs and were irrigating again.[157] The GMD4 District-Wide LEMA of 2018 limits total groundwater withdrawals for all appropriation rights to 1.7 million acre-feet for the 2018–2022 LEMA period.[158] As discussed below in subsection 5, this LEMA excludes vested or pre-1945 rights from regulation. The 2020 GMD1 LEMA sets a five-year limit on irrigation withdrawals of 246,883 acre-feet, a reduction designed to reduce pumping by 15% compared to historic pumping levels.[159]

All of the LEMAs established so far are temporary and share a five-year duration.[160] There is no requirement in the LEMA statute for a LEMA to be

154. Groundwater Management District No. 4 District Wide Local Enhanced Mgmt. Area in Cheyenne, Decatur, Gove, Graham, Logan Rawlins, Sheridan, Sherman, Thomas, and Wallace Ctys., Kan., 002-DWR-LEMA-2017, at 35–37 (2018) [hereinafter 2018 GMD4 District-Wide LEMA].

155. Wichita County Local Enhanced Mgmt. Area in Wichita Cty., Kan., 001-DWR-LEMA-2020, Exhibit A, at 3 (2020) (Order of Decision Accepting the Management Plan for the Wichita County Local Enhanced Management Area) [hereinafter 2020 GMD1 LEMA].

156. 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 25, 29.

157. 2017 GMD4 Sheridan-6 LEMA, *supra* note 150, at 6–7. These programs include the Environmental Quality Incentives Program (EQIP) and the Agricultural Water Enhancement Program (AWEP), both sponsored by the Natural Resources Conservation Service of the U.S. Department of Agriculture.

158. 2018 GMD4 District-Wide LEMA, *supra* note 151, at 42.

159. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, at 2.

160. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, at 2; 2018 GMD4 District-Wide LEMA, *supra* note 151, at 43; 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 29; 2017 GMD4 Sheridan-6 LEMA, *supra* note 150, at 8.

permanent, temporary, or of any particular duration. The statute requires that the local enhanced management plan be substantial, and KDA-DWR has accepted these five-year plans as meeting that threshold requirement.[161] The irrigators who developed these plans did not want to commit to permanent reductions. Instead, as described in subsection 8 below, the plans share an expectation that if they are successful, then they should be renewed for a successive five-year period, as the Sheridan-6 LEMA has been.

2. Prior Appropriation Rights

The most important doctrinal aspect of the LEMA plans is that they almost completely disregard the priority system in setting individual pumping allocations. In both generations of the Sheridan-6 LEMA, all irrigation rights are reduced regardless of priority.[162] The 2018 GMD4 District-Wide LEMA and the 2020 GMD1 LEMA reduce all appropriation rights (defined in the KWAA as post-1945 rights[163]) regardless of priority.[164] But these two LEMAs have exceptions for vested rights, which the KWAA defines as pre-1945 rights subsequently recognized under its statutory procedures.[165] This division into pre- and post-1945 rights is not as important as it first appears largely because few large groundwater irrigation rights were developed in western Kansas prior to the enactment of the KWAA. The issue of vested rights is discussed below in subsection 5.

However, the LEMA plans do not disregard priority in protecting individual water rights. In times of water shortage, an owner is entitled to the protections of priority if the Chief Engineer determines that her right is being impaired by other rights.[166] The LEMA plans expressly maintain that entitlement, but recommend to the Chief Engineer that he consider the requirements of the plan in resolving the impairment matter.[167] These are sensible requests, because the Kansas regulations have distinct procedures for situations involving discrete well-to-well impairment[168] and for those involving a regional decline in aquifer levels.[169] The latter situation is the general motivation for the LEMAs in the first place. Thus,

161. KAN. STAT. ANN. § 82a-1041(a) (2020).

162. 2017 GMD4 Sheridan-6 LEMA, *supra* note 150, at 12; 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 29.

163. KAN. STAT. ANN. § 82a-701(e).

164. 2020 GMD1 LEMA, *supra* note 152, at 4, and Exhibit A, at 3; 2018 GMD4 District-Wide LEMA, *supra* note 151, at 43, and Attachment 1, 11.

165. KAN. STAT. ANN. §§ 82a-701(d), 82a-704a.

166. KAN. STAT. ANN. §§ 82a-706b, 82a-707(c); KAN. ADMIN. REGS. §§ 5-4-1, 5-4-1a (2020).

167. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, at 3, 9; 2018 GMD4 District-Wide LEMA, *supra* note 151, Exhibit 1, at 9; 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 38–39.

168. KAN. ADMIN. REGS. § 5-4-1.

169. KAN. ADMIN. REGS. § 5-4-1a.

the 2013 Sheridan-6 LEMA expressly provides for a water right owner to bring a well-to-well impairment complaint; but if the Chief Engineer finds that the impairment is the result of a regional lowering of the water table, the LEMA plan gives the Chief Engineer latitude in determining the "appropriate resolution" of such impairment.[170]

3. Practical and Flexible Allocations During the LEMA Period

The LEMAs order the reduction of groundwater pumping according to several practical factors. The most prevalent factor is recent pumping levels, not the certified annual authorized quantity of the perfected water rights. Because of over-appropriation and aquifer-wide depletion, very few groundwater rights in western Kansas can pump the annual quantities and at the pumping rates described in their water rights certificates. The framers of the LEMAs recognized the obvious: meaningful reductions had to be based on recent pumping levels, not the "paper water" described in the water rights certificates. In the 2013 GMD4 Sheridan-6 LEMA, all irrigation rights were limited to a five-year allocation of eleven inches annually—or fifty-five inches total—for each "designated eligible acre," which is the appurtenant acreage for each water right actually irrigated in either 2010, or the highest acreage irrigated between 2007 and 2010.[171] The allocation of each water right is individually quantified in the LEMA order.[172]

The temporal flexibility of the allocations is a critical aspect of the LEMAs. An irrigator in the GMD4 Sheridan-6 LEMA can use the fifty-five inches per designated eligible acre however he deems appropriate over the five-year period, provided he does not pump more than the right's annual authorized quantity in any given year.[173] The second-generation Sheridan-6 LEMA maintains this allocation method but rewards conservation by allowing a five inch per acre carryover for any unused allocation from the original's 2013–2017 period.[174]

The other two LEMAs follow this same temporal flexibility but take a different approach to their respective five-year allocations. In the 2018 GMD4 District-Wide LEMA, pumping is limited according to the groundwater situation within the specific township. Annual pumping amounts range from 12.9 inches annually (for a five-year allocation of 64.5 inches) in the most-depleted townships, to up to 18 inches annually for a five-year allocation of 90 inches in the least-depleted ones.[175] The latter figure, while enjoyed by senior rights in

170. 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 38–39.

171. *Id.* at 26, 29–30.

172. *Id.*

173. *Id.* at 32.

174. 2017 GMD4 Sheridan-6 LEMA, *supra* note 150, at 6.

175. 2018 GMD4 District-Wide LEMA, *supra* note 151, at 43, and Attachment 1, at 11. The attentive reader has noticed that the 2017 GMD4 Sheridan-6 LEMA is wholly within the boundaries of the 2018 GMD4 District-Wide LEMA. GMD4 was alert to this issue and has resolved it by requiring that the most restrictive allocation applies in the event of a conflict. 2017 GMD4 Sheridan-6 LEMA, *supra* note 150, at 13.

western Kansas, is in excess of the current NIR for many of the counties in western Kansas, and so imposes little or no reductions in pumping.[176] The baseline for the district-wide reductions is the maximum reported irrigated acres under the individual water right between 2009 and 2015.[177] There is a detailed appeals process for challenging the determination of eligible acres.[178] No water right is reduced more than 25% from the average historical pumping amounts of that seven-year period, unless it would allow more than eighteen inches per acre to be pumped.[179] Like the GMD4 Sheridan-6 LEMA, the district-wide LEMA envisions its own renewal. In that case, the GMD4 board will consider allowing a 10% carryover of the LEMA's allocations for the successive LEMA period.[180]

The 2020 GMD1 LEMA involves severely crippled groundwater rights, and its method of allocation reflects that dire reality.[181] The five-year allocations apply to all irrigation rights and to all voluntarily-enrolled vested rights.[182] The LEMA allocations require a 14.7% reduction in water use over the five-year period, compared to the "historical usage" of 2009–2015 pumping levels. This is less than the 20.02% reduction estimated by the Kansas Geological Survey to be required to stabilize groundwater levels for the next decade or two, but the 14.7% reduction will be sufficient to extend the practical usable lifetime of the aquifer at a saturated thickness of fifteen feet from seven to sixteen years.[183] The LEMA applies the reduction to two classes of water rights. For the most crippled water rights, where the "historical usage" of 2009–2015 is 20% or less of the annual authorized quantity set forth in the individual water rights certificate, then the five-year allocation is simply five times the historical usage.[184] No further reductions are required of this class of water right. For less severely crippled rights, where the historical usage is more than 20% of the rights' annual authorized quantities, then the five-year allocation is the greater of the following amounts: 20% of the annual authorized quantity multiplied by five, or 75% of historical usage multiplied by five, a "conservation factor."[185] The 2020 GMD1 LEMA also contains detailed procedures for appealing allocations.[186] The irrigators within the 2020 GMD1 LEMA have struck a bargain with themselves,

176. KAN. ADMIN. REGS. § 5-5-12 (2020).

177. 2018 GMD4 District-Wide LEMA, *supra* note 151, at 45.

178. *Id.* 45–46.

179. *Id.* at 44.

180. *Id.*

181. Most of the aquifer within Wichita County is below the minimum saturated thickness required to support well yields at 200 gallons per minute (gpm) under a 90-day pumping scenario with 200 gpm wells on quarter sections. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, Attachment F, at 20. The irrigation of corn in western Kansas generally requires a 400 gpm well pumping over a 100-day irrigation season.

182. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, at 4–5.

183. *Id.* at 8–9.

184. *Id.* Exhibit A, at 4.

185. *Id.* Exhibit A, at 1, 4.

186. *Id.* Exhibit A, at 9–11.

playing for as much time as the aquifer will allow under moderate reductions in use.

4. Flexibility of Water Usage Across Water Rights and Appurtenant Land

The LEMAs also permit the combination of individual groundwater rights into one or more allocations, and allow water supplies from one right within such an allocation to be transferred to a different point of diversion or place of use. This is a significant deviation from the statutory and regulatory provisions of the KWAA, which would otherwise require changes in the underlying rights to be approved by application to the chief engineer on an individual basis and subjected to the no-injury rule.[187] Both iterations of the GMD4 Sheridan-6 LEMA allow individual rights to be combined into a single allocation. Multiple allocations can be combined into an irrigation allocation account, which can be apportioned across the individual, constituent water rights' discrete points of diversion within that account—provided, of course, that the total allocation account and the annual authorized quantities of its individual constituent rights are not exceeded.[188] Irrigation allocations can be transferred to a different place of use or point of diversion; in the event of such a transfer, GMD4 does the accounting work—not KDA-DWR.[189]

The other two LEMAs have less flexible provisions for allocating multiple rights across points of diversion and places of use. In the 2018 GMD4 District-Wide LEMA, wells pumping to a common irrigation system or systems receive a single allocation for the total acres irrigated by the system.[190] The 2020 GMD1 LEMA uses the term "combined well unit" to describe multiple rights diverting water from the same source of supply and physically tied together for the distribution of irrigation water. Wells within a combined well unit can share the combined quantity of their individual LEMA allocations, but again, no individual right can exceed its annual authorized quantity.[191] All such units must be enrolled in the first year of the LEMA period (2021) and be approved by both the GMD1 board and KDA-DWR prior to their implementation.[192]

It should be noted, however, that the attributes of the groundwater rights underlying these allocations do not change. The allocations do not effect any permanent alteration of the underlying water rights.[193] Changes to these "base

187. KAN. STAT. ANN. § 82a-708b (2020); KAN. ADMIN. REGS. §§ 5-5-1 to 5-5-16 (2020).

188. 2017 GMD4 Sheridan-6 LEMA, *supra* note 150, at 9–10; 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 30–31.

189. 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 31.

190. 2018 GMD4 District-Wide LEMA, *supra* note 151, at 43. Where the places of use for a common irrigation system span two zones with different pumping allocation levels, then the total allocation is based on a weighted average of allocations based on the irrigated acres in each zone. *Id.*

191. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, at 1, 7.

192. *Id.*

193. *Id.* Exhibit A, at 4.

water rights" must be performed according to the standard KWAA statutes and regulations for evaluating applications to change water rights.[194] Allocations can be increased or decreased by the purchase or sale of water rights.[195]

5. Preferential Treatment of Vested and Non-irrigation Rights

Irrigation use accounts for almost all water pumped across the LEMAs.[196] That has allowed the GMDs to include preferential treatments for smaller, non-irrigation uses, reducing their allocations by lesser amounts or not reducing them at all. In both iterations of the GMD4 Sheridan-6 LEMA, stockwatering rights were reduced by 20% for their respective five-year allocations.[197] Because irrigators sell much of their corn and grain sorghum to local feedlots, the preferential treatment for stockwatering rights makes sense. Recreational rights in the Sheridan-6 LEMA suffered only a 10% reduction in their annual authorized quantities for their five-year allocations.[198]

The other two LEMAs treat vested rights and non-irrigation rights even more favorably. In the 2020 GMD4 District-Wide LEMA, vested rights that draw from an alluvial water supply are exempt from reductions.[199] Stockwatering uses are "encouraged" but not required to use 90% of their allowable use under the KWAA regulations.[200] Municipal users are similarly "encouraged" but not required to reduce water use, and all other non-irrigation rights are urged to use best management practices.[201] The 2020 GMD1 LEMA completely exempts vested rights from LEMA reductions; but vested rights may voluntarily enroll in the LEMA and thus partake of the temporal and spatial flexibility provided by the allocations. Once enrolled, however, vested rights may not be withdrawn during the five-year LEMA period.[202] The 2020 GMD1 LEMA does not subject non-irrigation uses to reductions because those uses account for less than 4% of all water usage in the area.[203] Stockwatering rights, municipal rights, industrial

194. *See, e.g.*, 2018 GMD4 District-Wide LEMA, *supra* note 151, at 44.

195. 2013 GDM4 Sheridan-6 LEMA, *supra* note 149, at 33–34 (for stockwatering rights).

196. For example, non-irrigation rights make up approximately 7.7% of all water rights in GMD4. 2018 GMD4 District-Wide LEMA, *supra* note 151, at 34.

197. 2017 GMD4 Sheridan-6 LEMA, *supra* note 150, at 10 (reducing the regulatory maximum reasonable quantity for livestock from 15 gallons per head per day as set forth in KAN. ADMIN. REGS. § 5-3-22 (2017) to 12 gallons per head per day in the LEMA); 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 33–34.

198. 2017 GMD4 Sheridan-6 LEMA, *supra* note 150, at 11; 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 34.

199. 2020 GDM1 LEMA, *supra* note 152 Exhibit A, at 2.

200. 2018 GMD4 District-Wide LEMA, *supra* note 151, at 44. Such a reduction would limit stock uses to 13.5 gallons per head per day, using the 15-gallon per head per day limit in KAN. ADMIN. REGS. § 5-3-22 (2020).

201. 2018 GMD4 District-Wide LEMA, *supra* note 151, at 44.

202. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, at 2–3, 5.

203. *Id.* Exhibit A, at 3, 11.

rights, recreational rights, and domestic rights are instead encouraged to use water more efficiently and engage in voluntary conservation measures.[204]

6. Enhanced Civil Penalties for Violations

One of the most revealing characteristics of the LEMA orders is their enhanced civil penalty provisions: the irrigators who devised the LEMAs clearly want violators to pay a heightened price. Under the civil penalty provisions of the KWAA, the standard monetary penalty for over-pumping is $500 per day that over-pumping was occurring, with a maximum penalty period of twenty days and a maximum suspension of one year of water use.[205] In cases of repeat offenses and substantial over-pumping violations, the Chief Engineer has discretion to impose more severe penalties up to $1,000 per day, reductions in future pumping equal to twice the amount of water over-pumped (but not to exceed the annual authorized quantity of the right), and up to five-year suspensions of the water right.[206] However, the regulations contain numerous mitigating factors, such as the absence of gross negligence or intentional noncompliance, or the prompt correction of the violation upon KDA-DWR's notification of the violation. These make such harsh penalties a rarity.[207]

By contrast, the civil penalty provisions for most of the LEMAs are stiffer and leave no room for the Chief Engineer's discretion. In the GMD4 Sheridan-6 LEMA, exceeding the annual authorized quantity of any single water right shall result in a $1,000 fine, and exceeding any allocation quantity by less than four acre-feet during the five-year LEMA period shall result in a $1,000 fine for every day pumping was taking place in excess of the allocation.[208] Any violation in excess of four acre-feet results in an automatic two-year suspension of the water right and to all rights in a combined allocation account—effectively putting the owner out of the irrigation business for two years.[209] Other civil penalties are expressly made available under the KWAA.[210] Finally, there is the locals' duty to snitch: if GMD4 learns of any violation of the LEMA order, it has the express obligation to report the violation to KDA-DWR and to assist KDA-DWR.[211] These civil penalty provisions were renewed in the second generation of the Sheridan-6 LEMA.[212] The 2018 GMD4 District-Wide LEMA contains similar penalties and allows fines up to $10,000 for exceeding the allocation limits.[213]

204. *Id.* Exhibit A, at 6–7.
205. KAN. ADMIN. REGS. §§ 5-14-10(e), 5-14-10(m) (2020).
206. *Id.* § 5-14-12(e).
207. *Id.* § 5-14-12(f).
208. 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, 37–38.
209. *Id.* at 38.
210. *Id.* (citing KAN. STAT. ANN. § 82a-737 (2013)).
211. *Id.*
212. 2017 GMD4 Sheridan-6 LEMA, *supra* note 150, at 11.
213. 2018 GMD4 District-Wide LEMA, *supra* note 151, at 47.

The 2020 GMD1 LEMA is the only LEMA which does not impose a stricter civil penalty regime than that of the KWAA.[214]

7. Monitoring, Water Use Reporting, and Meter Tampering Burdens

The heightened civil penalty provisions of the LEMAs accompany increased groundwater monitoring, more extensive water use reporting requirements, and a significant change in the evidentiary burdens concerning insufficient meter information. They require additional monitoring wells, some of which are equipped with a continuous pressure transducer to enable hourly measurements. The GMDs operate and maintain these wells and cooperate with KDA-DWR in obtaining and analyzing the meter data.[215] Irrigators in the GMD4 Sheridan-6 LEMA as well as the 2018 GMD4 District-Wide LEMA must report their water use more frequently, as often as every two weeks; these requirements are in addition to the annual water use requirements imposed by the KWAA.[216]

A perhaps more telling feature is how the LEMAs deal with the possibility of meter tampering. In both the GMD4 Sheridan-6 LEMA and the 2020 GMD1 LEMAs, if either the GMD or KDA-DWR questions the meter readings, and the irrigator does not provide pumping records, then the water right shall be presumed to have diverted its full annual authorized quantity for the year in which the GMD requested the well record. Any issues regarding meter inaccuracy lead to the same presumption.[217] The 2018 GMD4 District-Wide LEMA goes even further. If the GMD learns of any meter tampering or other meter-related dishonesty, then the GMD board shall recommend a five-year suspension of the water right, and further, that it be stripped of its remaining assigned allocation quantities.[218] The change in the presumption means that neither KDA-DWR nor the GMD needs to prove that the records and meters under review have been doctored. Clearly, the irrigators want the strongest penalties possible for such violations.[219] But because LEMAs are established by order of the Chief Engineer, only KDA-DWR has actual enforcement and civil penalty authority. Thus, the GMDs and KDA-DWR cooperate in water use accounting.[220]

214. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, at 7.

215. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, at 7; 2017 GMD4 Sheridan-6 LEMA, *supra* note 150, at 11-12; 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 39–40.

216. 2018 GMD4 District-Wide LEMA, *supra* note 151, 47–48; 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, 34–35.

217. 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, 34–35.

218. 2018 GMD4 District-Wide LEMA, *supra* note 151, at 47.

219. At one meeting in Hoxie, Kansas, in 2011 in which the author was present in his professional capacity representing the Chief Engineer, irrigators proposed that pumping and metering violations of LEMA orders be classified as felonies, and wrongdoers punished accordingly—provided that they first receive a fair trial. Sadly, this proposal did not gain traction in the legislature.

220. 2018 GMD4 District-Wide LEMA, *supra* note 151, at 49; 2013 GMD4 Sheridan-6 LEMA, *supra*

8. Annual Reviews and Reviews for LEMA Renewals

Finally, all of the LEMAs establish committees and procedures to review the operations of the individual LEMA, both on an annual basis and with the longer-term goal of renewing the LEMA for a successive period. The committees consist of irrigators within each LEMA as well as representatives from KDA-DWR.[221] They conduct annual reviews and produce annual reports covering the following required subjects: water use data; groundwater level information; economic data; whether the allocations of individual rights have concentrated or distorted the geographic distribution of diversions and water use within the LEMA; violations and meter-data issues related to violations; enforcement issues; new and enhanced groundwater management options; and any recommended modifications to the existing LEMA order.[222] The metering provisions of the LEMA orders are a specific subject of annual reviews; if the committee deems them to be ineffective, then it shall recommend changes to the Chief Engineer.[223]

The most important review issue is probably that of whether to renew the LEMA for a successive period. Each of the LEMAs provide for such a formal review to be performed in the last year or eighteen months of the LEMA under review. The review covers the same subjects as those in the annual reviews but considers the overall impacts of the LEMA. The most important of these impacts are as follows: the economic impacts of the pumping reductions; changes in water levels and changes in their rate of decline; whether the increased flexibility afforded by the LEMA allocations substantially increased water use in the LEMA, or raised other concerns; and the impact of the LEMA on the "local public interest."[224] The ultimate matters of consideration are whether to extend the LEMA for another period, whether to expand the boundaries of the LEMA, and whether to consider any additional LEMA plans for the future.[225]

B. Early Legal, Economic, and Hydrological Findings Concerning LEMAs

Since the first LEMA was established in 2013, the LEMA approach to groundwater conservation has gained the attention of water experts working across several professional disciplines. Because all owners of non-domestic

note 149, at 36–37.

221. 2017 Sheridan-6 LEMA, at 12; 2018 GMD4 District Wide LEMA, *supra* note 151, at 49; 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 41.

222. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, at 8; 2018 GMD4 District-Wide LEMA, *supra* note 151, at 49–50; 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 41–42.

223. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, at 8; 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 36.

224. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, at 8, 2018 GMD4 District-Wide LEMA, *supra* note 151, at 50; 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 42.

225. 2020 GMD1 LEMA, *supra* note 152, Exhibit A, at 9; 2018 GMD4 District-Wide LEMA, *supra* note 151, at 50; 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 42.

Kansas water rights must report their annual diversion amounts and acreages, and because KDA-DWR and the Kansas Geological Survey operate an extensive statewide network of groundwater monitoring wells, Kansas enjoys an unusually rich record of water data. This data has enabled economists and scientists to reach confident conclusions about the specific impacts of LEMA-style groundwater management.

But first, there are the legal issues: for a LEMA to exist, it must withstand legal challenges. Because the IGUCA and LEMA statutes allow the Chief Engineer to order reductions in groundwater pumping across groundwater rights within the subject area, the establishment of such areas has provoked some predictable but so far unsuccessful legal challenges.[226] Neither generation of the Sheridan-6 LEMA was challenged, nor was the 2020 GMD1 LEMA.[227] However, a group of irrigators within GMD4 raised a substantial legal challenge to the 2018 GMD4 District-Wide LEMA.[228] While they lost their case and did not appeal, two aspects of their challenge—and KDA-DWR's response—merit comment.

One aspect concerns that of the prior appropriation doctrine. The plaintiffs alleged that the LEMA statute, as well as the establishment of the 2018 GMD4 District-Wide LEMA, violated the KWAA by impermissibly deviating from the prior appropriation doctrine that the KWAA codifies. As set forth above, the LEMA statute does not require the corrective control provisions of a LEMA to be imposed upon groundwater rights according to strict priority; rather, it contains a precatory recommendation that priority be followed "insofar as may be reasonably done."[229] Based on the LEMA statute's language, the district court easily disposed of the plaintiffs' prior appropriation argument: "Had the Legislature meant for the prior appropriation doctrine to apply to LEMAs and IGUCAs then there would have been mention of it within the statute. Instead, the Legislature authorized the corrective controls that directly and unambiguously contravene the prior appropriation doctrine."[230] The district court similarly dismissed the plaintiffs' argument that the preferential treatment of non-irrigation uses violated the KWAA's use-blind prior appropriation provisions. It found that such treatment was reasonable based on the fact that non-irrigation uses constituted a tiny fraction of overall water use in GMD4.[231]

A second aspect concerns takings. The plaintiffs argued that the GMD4

226. For potential legal challenges to IGUCAs, *see* Peck, *supra* note 123, at 504–06.

227. *See* 2017 GMD4 Sheridan-6 LEMA, *supra* note 150, at 5.

228. Friesen v. Barfield, No. 2018-CV-000010, (Gove Cty., Kan. Dist. Court Oct. 15, 2019). The decision is available at https://agriculture.ks.gov/docs/default-source/dwr-water-appropriation-documents/friesen-memorandum-decision-101519.pdf?sfvrsn=7bfd89c1_0 (on file with the *University of the Pacific Law Review*).

229. KAN. STAT. ANN. § 82a-1041(f)(2) (2020).

230. *Friesen*, No. 2018-CV-000010, at 24.

231. *Id.* at 16.

District-Wide LEMA plan committed takings because it retroactively reduced vested groundwater rights and constituted a regulatory taking of both vested and appropriation rights.[232] The district court rejected these arguments, based on the court's characterization of the property rights under review and according to Kansas's version of the *Penn Central* test.[233] Because the LEMA plan was temporary, the underlying water rights subject to the five-year corrective control provisions had not been subject to an impermissible taking—apparently suggesting that only a permanent reduction would raise constitutional concerns.[234] The court similarly emphasized that the "character of the governmental action" under *Penn Central* and its Kansas progeny was to promote the public "common good" of regional groundwater conservation.[235] In fact, the court noted that the plaintiffs "may even gain an economic benefit from the reduced water usage" imposed by the LEMA.[236]

These two aspects of the decision are not controversial. Yet KDA-DWR, for understandable reasons, has apparently developed a sensitivity to the plaintiffs' legal arguments. In responding to the allegation that LEMAs might run afoul of the prior appropriation doctrine, the Chief Engineer has emphasized how the LEMA orders have upheld and maintained the doctrine by expressly allowing for senior rights to bring impairment actions against junior rights, and by noting that the "base water rights"—and their attendant priorities—remain unaffected by LEMA allocations. That includes impairment actions brought against junior uses that are subject to smaller reductions in their allocations because their economic value is greater than that of irrigation use.[237]

Next, the plaintiffs' takings arguments may help explain why all of the LEMA orders establish temporary, five-year management plans, as the GMDs intended. Reductions in water use dictated by the prior appropriation doctrine raise no takings issues: an express condition of a prior appropriation right is its priority, which entitles the owner to divert water when it is available in excess of prior rights.[238] But LEMA plans apply their pumping reductions without regard to priority, leaving that classic takings defense unavailable.[239] This largely explains why, but also how, KDA-DWR has stressed that takings fears are "unfounded": because the five-year allocations do not permanently change the underlying water rights, they do not limit the amount of water that can be

232. *Id.* at 16–17.

233. Frick v. City of Salina, 290 Kan. 869 (2010).

234. *Friesen*, No. 2018-CV-000010, at 17. The court supplied no authority for the proposition that only permanent changes can effect a regulatory takings.

235. *Id.* at 18–19.

236. *Id.* at 18.

237. 2018 GMD4 District-Wide LEMA, *supra* note 151, at 34 ([i]n the case of an impairment, priority administration would be applied and the type of use would not be considered."); *see also supra* text accompanying notes 163–67.

238. *E.g.*, Kobobel v. Dep't of Nat. Res., 249 P.2d 1127 (Colo. 2011).

239. *See supra* text accompanying notes 159–61.

pumped in any single year (within the annual authorized quantity of the right), and they will be evaluated at the end of the five-year period to determine whether they should be continued.[240]

Moving from law to economics, early findings show that the LEMAs have allowed groundwater irrigators to achieve substantial reductions in groundwater pumping without suffering substantial decreases in their revenue. A five-year study commissioned to evaluate the economic impacts of the first-generation GMD4 Sheridan-6 LEMA produced promising results.[241] It compared water usage, cropping practices, and economic outcomes for the LEMA with nearby irrigated acreage outside the LEMA's boundaries. Irrigators within the Sheridan-6 LEMA reduced their total groundwater use by over 23%, reduced their average groundwater use per acre by 16%, and reduced their irrigated crop acreage by 10.9%.[242] Economic data supplied by the irrigators "suggests that producers within the LEMA boundary have been able to reduce groundwater use with minimal impact on cash flow."[243] These findings are consistent with an earlier study of the Walnut Creek IGUCA, which found that irrigators were able to mitigate their initial losses by growing higher-value crops and improving their water-use efficiencies.[244] The Sheridan-6 LEMA study's interim findings played an important role in the renewal of the LEMA in 2017.[245] One of the renewal order's findings of fact noted that the first-generation LEMA was "effective," producing a significant decrease in the rate of decline of the aquifer, and thus extending its practical life but without causing a significant decrease in profitability to irrigators.[246] Moreover, it should be noted that neither the Walnut Creek IGUCA study nor the Sheridan-6 LEMA study evaluated an important factor: how the conservation of groundwater supplies has protected the value of the irrigated land.

Most importantly, there is the groundwater supply itself. Hydrological analyses of the Sheridan-6 LEMA have revealed the conservation potential of LEMAs. Hydrogeologists studying the GMD4 Sheridan-6 LEMA since 2013 have produced several research articles using pumping and water-level data to assess the impact of its required pumping reductions. In the first study, factoring

240. 2018 GMD4 District-Wide LEMA, *supra* note 151, at 34.

241. Bill Golden, *Monitoring the Impacts of Sheridan County 6 Local Enhanced Management Area, Final Report for 2013-2017*, KAN. ST. U. (Nov. 15, 2018), https://www.agmanager.info/sites/default/files/pdf/SheridanCounty6_LEMA_2013-2017.pdf (on file with the *University of the Pacific Law Review*).

242. *Id.* at 7.

243. *Id.*

244. Bill B. Golden & John C. Leatherman, *Impact Analysis of the Walnut Creek Intensive Groundwater Use Control Area*, 47 J. REGIONAL ANALYSIS & POL'Y 176 (2017).

245. Bill Golden & Kellen Liebsch, *Monitoring the Impacts of Sheridan County 6 Local Enhanced Management Area, Interim Report for 2013-2016*, CIRCLE OF BLUE (2017), https://circleofblue.org/wp-content/uploads/2018/03/Sheridan6LEMAstudy.pdf (on file with the *University of the Pacific Law Review*).

246. 2017 GMD4 Sheridan-6 LEMA, *supra* note 150, at 7.

in the impact of climatic conditions on pumping, they found that the average annual groundwater pumping in the LEMA has been reduced by about 29%, and the rate of water-level decline by about 67%.[247] The study also found that "practically feasible" reductions of 10%–20% can have a larger impact on water-level decline rates than was previously known. Larger reductions of 20%–30% would stabilize water levels in that area of northwest Kansas for the next decade or two.[248] This work shows that modest reductions in annual pumping can have a large impact on rates of groundwater decline, extending by more than a proportionate amount the duration of a typical HPA water right thanks to long-term recharge from irrigation return flows that have previously gone unrecognized.[249]

A second, 2019 study of the Sheridan-6 LEMA made similarly promising conclusions. It found that the LEMA surpassed its stated goals for reduced water use, conserving enough water within the local aquifer to provide over 1.4 years' worth of historic water needs. Yet irrigators made only minor adjustments to total irrigated acres to meet the mandated pumping reductions; instead, they employed more efficient water management and grew less water-intensive crops.[250] Moreover, farmers were apparently able to maintain their pre-LEMA net profit levels, despite lower yields due to reduced input and energy costs.[251] A 2020 study largely reaffirms these results.[252]

V. HIGH PLAINS LESSONS FOR THE CENTRAL VALLEY

A. The Appropriateness of the Comparison

What can California learn from the Kansas LEMA experience so far? Having reviewed the states' distinct legal regimes for groundwater in Part II, and having dissected the LEMA plans in Part III, the differences but especially the similarities between the two states become more visible.

Obviously, there are distinct differences in hydrology, doctrine, and jurisdiction. SGMA requires the sustainability that it defines, while the LEMAs the Kansas Chief Engineer has so far approved are limited to non-renewable, substantially depleted portions of the High Plains-Ogallala Aquifer. Unlike

247. James J. Butler, Jr., Donald O. Whittemore, B. Brownie Wilson & Geoffrey C. Bohling, *Sustainability of Aquifers Supporting Irrigated Agriculture: A Case Study of the High Plains Aquifer in Kansas*, 43 WATER INT'L 815, 818–21 (2018).

248. *Id.* at 825.

249. *Id.* at 819–25.

250. Jillian M. Deines, Anthony D. Kendall, James J. Butler & David W. Hyndman, *Quantifying Irrigation Adaptation Strategies in Response to Stakeholder-Driven Groundwater Management in the US High Plains Aquifer*, ENVTL. RES. LETTERS, Apr. 2019.

251. *Id.* at 9.

252. J. J. Butler Jr., G.C. Bohling, D. O. Whittemore & B. B. Wilson, *Charting Pathways Toward Sustainability for Aquifers Supporting Irrigated Agriculture*, 56 WATER RESOURCES RES., OCT. 2020.

California, LEMAs exist within a prior appropriation system in which senior rights holders can bring impairment actions according to that doctrine, and the LEMA plans explicitly allow for such actions. And unlike SGMA mandates, Kansas LEMAs are voluntary initiatives.

But these distinctions are not disqualifying; indeed, the similarities between the states' groundwater situations are ultimately more compelling. First, the LEMA management tool also applies to renewable groundwater basins where sustainable management is possible—and where sustainable management will likely be required. The most pressing example is in west-central Kansas, where groundwater pumping has impaired the senior surface-water rights of the Quivira National Wildlife Refuge, a wetland of international importance. Big Bend Groundwater Management District No. 5 (GMD5) has proposed several iterations of a LEMA, none of which have yet to secure the approval of the Chief Engineer.[253] Federal law clearly mandates the sustainable management of water supplies upon which national wildlife refuges depend, in statutory and regulatory terms far less compromising than the lawyerly definitions found in SGMA.[254] The Walnut Creek IGUCA, whose substantive statutory tools are identical to those of a LEMA, was established to restore a groundwater basin to at least some degree of sustainable management.[255] The showdown at Quivira will likely create a situation quite similar to SGMA. Pumpers will likely pursue a LEMA plan establishing proportional pumping levels to save them from the draconian application of the prior appropriation doctrine; and federal law will likely require that plan to achieve sustainability.

Moreover, neither SGMA nor the Kansas LEMAs insist upon strict adherence to rigid water law doctrine. As described in Part II, California's groundwater experience has embraced a multitude of doctrinal approaches. Since *Katz*, California's doctrine of correlative rights has recognized proportional rights for overlying landowners; however, it has also recognized both appropriative and prescriptive rights for off-tract users.[256] Overlying landowners have long been able to pursue an impairment action against the unreasonable and inequitable pumping of their neighbors, pursuant to *Katz* and its progeny; they just cannot

253. *See supra* text accompanying notes 132 and 141.

254. *See, e.g.*, National Wildlife Refuge System Improvement Act, 16 U.S.C. § 668dd(a)(4)(B) (2020) (requiring the maintenance of "biological integrity, diversity, and environmental health" of the National Wildlife Refuge System); Policy on Maintaining the Biological Integrity, Diversity, and Environmental Health of the National Wildlife Refuge System, 66 Fed. Reg. 3,810, 3,818 (Jan. 16, 2001) (defining "environmental health" as that term is used in 16 U.S.C. § 668dd(a)(4)(B) to mean the "[c]omposition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions"); and *id.* (defining "historic conditions" to mean "[c]omposition, structure, and functioning of ecosystems resulting from natural processes that [the U.S. Fish and Wildlife Service] believe[s], based on sound professional judgment, were present prior to substantial human related changes to the landscape."). For the compromised language of sustainability in the SGMA, *see supra* text accompanying notes 75–76.

255. *See supra* text accompanying notes 123–25, 145–46.

256. *See supra* text accompanying notes 20–25.

pursue the action under the prior appropriation doctrine.[257] California's groundwater adjudications have produced a wide spectrum of doctrinal approaches to groundwater allocation.[258] SGMA recognizes this relatively irenic embrace by avoiding any commentary on or commitment to property rights in groundwater.[259] In Kansas, the IGUCA and LEMA statutes substantially compromise the prior appropriation doctrine, allowing for the same pumping reductions across hundreds of groundwater rights with discrete priorities.[260] Priority of right is simply not a management priority in these areas. Local irrigators could have made it so, but they have not. Likewise, the LEMA plans contain prominent use preferences, privileging the type of use made of water over the water right's temporal priority.[261]

Finally, there are clean parallels between the states' procedural approaches. The California GSA operates much as a Kansas GMD does: it authors a GSP, as the Kansas GMD authors a LEMA plan. The state reviews the local plan: in California, DWR and the SWRCB review the local GSA's GSP; and in Kansas, the Chief Engineer of KDA-DWR reviews the LEMA plan. Where the state finds the local plan to be deficient, it returns the plan to the local agency for reformation and improvement.

On balance then, the comparison between groundwater conservation plans under SGMA and those under Kansas law is more than an academic exercise. That comparison yields three useful lessons.

B. Lesson One: Beware of Bluewashing

The first lesson is to beware of "bluewashing"—the tendency to portray water conservation plans as hydrologically meaningful, when in fact they are not.[262]

Part III revealed significant differences in the pumping reductions required by the three LEMA plans: the Kansas Chief Engineer has approved strong plans, but he has also approved weak, bluewashing plans. Both generations of the Sheridan-6 LEMA plan are strong plans: they have reduced groundwater pumping by approximately 29%, thereby substantially reducing the rate of water-decline level by about 67%.[263] The other plans are weak by comparison. Large areas of the 2018 GMD4 District-Wide LEMA are subject to little or no pumping

257. Tehachapi-Cummings Cty. Water Dist. v. Armstrong, 49 Cal. App. 3d 992, 1001 (1975) (discussing numerous cases).

258. *See supra* Section I.B.

259. *See supra* text accompanying notes 89–90.

260. *See supra* text accompanying notes 121, 159–62.

261. *See supra* text accompanying notes 195–201.

262. *See, e.g.*, *Bluewashing: Why the Bottled Water Industry's EcoFriendly Claims Don't Hold Water*, FOOD & WATER WATCH (Mar. 2010), http://docshare02.docshare.tips/files/2864/28640326.pdf (on file with the *University of the Pacific Law Review*).

263. *See supra* text accompanying notes 244–49.

reductions, belying its claim to be "district-wide."[264] The 2020 GMD1 LEMA claims the ambition of a 14.7% reduction in pumping, but actual reductions will probably be significantly smaller than that figure.[265] The most crippled rights suffer no reductions at all, and the GMD1 appeals process appears to allow irrigators the option of reclassifying their water rights for the lower level of groundwater reductions.[266] Nonetheless, the Chief Engineer has approved these weak plans, apparently because they meet very modest five-year goals.[267]

Yet the Chief Engineer has also denied weak plans. Since 2017, KDA-DWR has consistently rejected successive iterations of a LEMA plan put forth by GMD5 to address the impairment of the senior surface water right held by U.S. Fish and Wildlife Service on behalf of the Quivira National Wildlife Refuge.[268] KDA-DWR has rejected these plans principally because they have yet to recommend reductions in pumping and rely instead upon changes in irrigation mechanics and the development of a stream augmentation project.[269]

Why the disparity among LEMA plans? The first reason is hydrological. In non-renewable groundwater basins such as GMD1, where pumping has severely and permanently depleted the aquifer, any reductions in pumping levels that slow the rate of decline appear to satisfy the general conditions of the LEMA statute and thus provide sufficient grounds for approval by the Chief Engineer.[270] Sometimes, the simplest explanation is the best one. The Chief Engineer does not want to impede local groundwater conservation efforts, even if those efforts may not achieve much over the long term.

That bureaucratic tendency provides the second reason for the disparity among LEMA plans—the politics of groundwater jurisdiction. Groundwater irrigation communities generally see themselves differently than surface-water irrigation communities, and view the regulation of their water rights differently as well.[271] Surface-water communities hold senior rights and depend on rivers and streams that flow across different regions of a state; they often divert water from a distant basin.[272] By contrast, groundwater irrigation communities hold

264. *See supra* text accompanying notes 172–76.

265. *See supra* text accompanying notes 178–80.

266. *See supra* text accompanying notes 181–83.

267. 2020 GMD1 LEMA, *supra* note 152, at 25; 2018 GMD4 District-Wide LEMA, *supra* note 151, at 38.

268. *See supra* text accompanying note 141. The GMD5 LEMA plans have not been included in this Article because KDA-DWR has yet to approve them; litigation over the Quivira National Wildlife Refuge (*see supra* note 132) may force the substantial revision of whatever LEMA plan is ultimately approved.

269. *See supra* note 141.

270. KAN. STAT. ANN. § 82a-1041(a) (2020) (referencing KAN. STAT. ANN. § 82a-1036(a)–(d)).

271. *See generally* Burke W. Griggs, *The Political Cultures of Irrigation and the Proxy Battles of Interstate Water Litigation*, 57 NATURAL RESOURCES J. 1 (2018).

272. *See, e.g.*, GREGORY H. HOBBS, JR. & MICHAEL WELSH, CONFLUENCE: THE STORY OF GREELEY WATER (2020) (describing the water-supply networks of the City of Greeley and the Northern Colorado Water Conservancy District); PATRICIA NELSON LIMERICK WITH JASON L. HANSON, A DITCH IN TIME: THE CITY, THE

relatively junior rights and can claim that "their" water supplies are essentially local—and state statutes often support these claims.[273] Given the political power of groundwater districts across the West, it is easy to see why a state water engineer will approve local initiatives for strong groundwater conservation plans. Regarding the GMD4 Sheridan-6 plans, the locals wanted substantial pumping reductions, the ambition of the LEMA statute is to promote such reductions, and the KWAA explicitly requires the Chief Engineer to conserve the state's water resources.[274] Approving their plan was relatively straightforward.

The harder issue arises when the local GMD puts forth a weak plan. The locals want it sufficiently to invest in developing such a plan, but the Chief Engineer probably has his doubts about the hydrological effectiveness of a weak plan over the long term. In this situation, we are seeing the effective deference of the Kansas Chief Engineer to the local GMD, both in substantive matters of water regulation—over which only the Chief Engineer has jurisdiction—and over procedural matters as well. Chief Engineer Earl Lewis admitted as much in approving the weak 2020 GMD1 LEMA plan:

> The LEMA statute allows groundwater management districts and their members to control the destiny of their water use. In this case, GMD 1 submitted a request for the establishment of the WHC LEMA Management Plan, with the goal of limiting irrigation withdrawals. GMD 1's Board of Directors evaluated various methods and determined the provisions within the WHC LEMA Management Plan were the best means to achieve the stated goals. The decisions made by GMD 1's Board of Directors are reasonable, lawful, and appropriate and, as such, deference should be given to their decisions.[275]

This is hardly a ringing endorsement of the LEMA plan's substantive measures, but it is a remarkably candid statement of deference to a local groundwater irrigation community.

Litigation may well provide a third reason for the LEMA plans' regulatory disparities. The 2013 GMD4 Sheridan-6 LEMA adopted a strong plan, but one based on consensus: the irrigators within that 99-square mile area had participated closely in the plan's development and were largely committed to it. As the manager of GMD4 stated, "[i]n the end, the consensus was that consensus was the preferred approach."[276] Both the proponents of the GMD4 Sheridan-6

WEST, AND WATER (2012) (describing those of Denver Water).

273. *See, e.g.*, KAN. STAT. ANN. § 82a-1020 (establishing "the right of local water users to determine their destiny with respect to the use of groundwater insofar as it does not conflict with the basic laws and policies of the state of Kansas").

274. KAN. STAT. ANN. §§ 82a-1041, 82a-706.

275. 2020 GMD1 LEMA, *supra* note 152, at 22.

276. 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 14 (testimony of Mr. Wayne Bossert, Manager of GMD4).

LEMA and KDA-DWR were prepared for a legal challenge to the plan, but none arose. The local consensus over the plan probably explains why its renewal in 2018 did not provoke a legal challenge as well. By contrast, the 2018 GMD4 District-Wide LEMA did provoke a legal challenge, but one that failed at the district court level and was not appealed.[277] The much larger size of the district-wide LEMA enabled a greater number of plaintiffs to support the lawsuit—plaintiffs who were not as closely involved in the development of the district-wide LEMA plan as their counterparts in the Sheridan-6 LEMA had been. Moreover, the gravamen of that challenge was about the LEMA statute and less about the specific factual findings of KDA-DWR—largely enabling the district court to defer to the legislature and to the agency record.[278] The 2020 GMD1 LEMA did not provoke a legal challenge. While it can be difficult to discern why the litigation dog does not bark, the relatively small size of that LEMA, together with its relatively weak provisions, may well explain the silence.[279]

The litigation in GMD5 is of a different order and has placed KDA-DWR into a different posture. In 2016, the Chief Engineer found that junior groundwater pumping within GMD5 was impairing the senior surface water right at the Quivira National Wildlife Refuge.[280] Since then, GMD5 has put forth several LEMA plans to address that impairment, all of which the Chief Engineer has rejected, prompting an administrative challenge in 2019 that remains pending.[281] Meanwhile, in early 2021, a third-party environmental plaintiff brought an action in federal court, alleging that federal law requires the full protection of the refuge's senior water right.[282] At present, then, the Chief Engineer finds his office placed between a GMD that is hostile to a stronger LEMA plan and an environmental plaintiff that is demanding the full restoration of the groundwater supply upon which the refuge's streamflows largely depend. Either remedy—a water rights administration plan or a LEMA plan—would require substantial and likely permanent pumping reductions. Significantly, the environmental plaintiff's challenge depends largely upon the chief engineer's

277. *See supra* text accompanying notes 225–33.

278. *Id.*

279. *See supra* text accompanying note 152.

280. DAVID W. BARFIELD, CHIEF ENGINEER, DIVISION OF WATER RESOURCES, KANSAS DEPARTMENT OF AGRICULTURE, FINAL REPORT OF THE CHIEF ENGINEER CONCERNING A CLAIM OF WATER RIGHT IMPAIRMENT IN THE MATTER OF WATER RIGHT FILE NO. 7,571 OWNED AND OPERATED BY THE U.S. FISH AND WILDLIFE SERVICE (2016), https://agriculture.ks.gov/docs/default-source/wms---impairment-reports/final-impairment-report-quivira-20160715.pdf?sfvrsn=ad2ab8c1_4 (on file with the *University of the Pacific Law Review*).

281. Quivira Nat'l Wildlife Refuge, 19 WATER 16274 (2019) (Order Denying Petition for Stay of Proceedings and Granting Petition for Administrative Review Submitted by Big Bend Groundwater Management District No. 5 and Notice of Prehearing Conference), https://agriculture.ks.gov/docs/default-source/dwr-water-appropriation-documents/20190830_19-water-16274---order-denying-petition-for-stay-and-granting-petition-for-review-and-notice-of-prehearing-conference.pdf?sfvrsn=ed4a89c1_0 (on file with the *University of the Pacific Law Review*).

282. *See supra* note 141. The author represents the plaintiff in this action.

uncontested finding of impairment.[283] This posture probably explains why he has yet to approve a weak LEMA in GMD5. Any LEMA plan that does not address the impairment of the wildlife refuge would contradict the chief engineer's impairment finding; if approved, a weak LEMA plan could expose KDA-DWR to considerable legal peril if the court finds that the agency did not sufficiently protect the refuge's senior water right. Both are sound reasons for rejecting a weak LEMA plan.

In sum, there is a structural tendency within the LEMA process, inherent within the relationship between the Chief Engineer and the GMDs, to defer to the local agency on matters of pumping reductions—unless there are previous agency decisions or credible litigation threats that serve to counter such deference. Absent such decisions and threats, the Chief Engineer will probably approve weak, bluewashing plans.

How, then, to apply that lesson to SGMA? The architects of GSPs need to be vigilant to three interrelated areas of the SGMA process which are vulnerable to bluewashing. The first area concerns SGMA's statutory sustainability mandates. Granted, these mandates militate against some of the weaknesses that are discernible in the LEMA plans. While the IGUCA and LEMA statutes can remedy groundwater overdraft over the long term, unlike SGMA, they do not require reaching a sustainability goal.[284] In California, GSAs will wrestle with these mandates. GSAs will likely exploit SGMA's self-referential definition of sustainability to the fullest—something that avoids "an undesirable result," which in turn hinges upon whether a particular hydrological problem is "significant and unreasonable"—taking legalistic advantage of the statutory language as well as its meanings within the context of earlier adjudications.[285] In this regard, SGMA promises to generate a substantial body of case law construing the precise meaning of its arguably precatory language.

But there will be a limit to how far that language can be exploited. In several important situations, federal environmental law will likely impose clearer and more stringent standards of groundwater conservation. The "no jeopardy" requirements of Section 7 of the Endangered Species Act ("ESA")[286] and the "take" prohibition in Section 9 of the ESA[287] provide immediate baseline standards for SGMA's requirement to consider the water needs of groundwater-dependent ecosystems.[288] Federal wildlife refuge law provides even clearer standards.[289] The litigation and settlement of federal reserved water rights claimed by Native American tribes should produce clear, long-term pumping

283. *See supra* note 277.

284. KAN. STAT. ANN. §§ 82a-1036(a)-(d), 82a-1041(a) (2020); *see supra* text accompanying notes 122–26.

285. CAL. WATER § 10720.1(x) (West 2020); *see supra* text accompanying notes 74–76.

286. 16 U.S.C. § 1536(a)(2) (2020).

287. 16 U.S.C. § 1538(a)(1)(B).

288. CAL. WATER § 10723.2.

289. *See supra* note 251.

limits on non-tribal groundwater users.[290] SGMA could even enable some useful gap-filling. Its requirements to protect against water-quality degradation and to consider the needs of disadvantaged communities could lead GSAs to impose pumping limits and require injection wells in order to protect against contaminant plumes.[291]

The second area where SGMA appears to be vulnerable to bluewashing is that of procedure. Given the structure of SGMA, it may seem simple enough to achieve sustainable long-term management of groundwater: if the GSA proposes a deficient plan, the SWRCB can simply intervene and impose one of its own.[292] Woe to the naïve bureaucrat who reads SGMA that way. The Kansas groundwater experience shows how centrally imposed groundwater management plans are politically unpalatable—to the point of becoming practically impossible. The Chief Engineer has long had the power to impose IGUCA plans on his own initiative, but he has not done so.[293] SGMA recognizes this political reality in its structure, just as the LEMA statute does; indeed, that is the distinctive characteristic of the latter.[294] With that reality in mind, it seems highly implausible that the SWRCB will be intervening with supervening GSPs. Much more probable is an iterative process through which the SWRCB and the GSA work together to reform GSPs into a satisfactory state. That is what has occurred with the Kansas LEMAs: for all the GMDs' procedural autonomy over the management plan, and their common-enough antipathy to KDA-DWR, they have nonetheless relied heavily upon the expertise of the state.[295] SGMA clearly provides for similar state assistance.[296] The GSAs want their GSPs to be approved, and the SWRCB wants SGMA to succeed. Deference to local management pervades the politics of groundwater jurisdiction.

Therein, however, lies a serious hydrological danger. Neither the state nor the local GSA will likely insist upon pumping reductions and limitations necessary to protect the subject groundwater basin as a functioning hydrological system. This is the third and most worrisome area where the SGMA process is vulnerable to bluewashing—the closed basin problem.[297]

The closed basin problem exists across the West. Under pre-development conditions, both surface water and groundwater basins transmit water supplies by

290. *E.g.*, Agua Caliente Band of Cahuilla Indians v. Coachella Valley Water Dist., 849 F.3d 1262 (9th Cir. 2017) (holding that the federal reserved water rights doctrine for Native American tribes applies to groundwater supplies); CAL. WATER § 10732.2.

291. CAL. WATER §§ 10721(x)(4), 10732.2.

292. *See supra* text accompanying notes 86–87.

293. KAN. STAT. ANN. § 82a-1036 (2020); *see supra* text accompanying notes 127, 129-32.

294. *See supra* text accompanying notes 145–46.

295. *See, e.g.*, 2020 GMD1 LEMA, *supra* note 152, at 8–9, 14–15 (relying upon the Kansas Geological Survey and KDA-DWR in devising and implementing the LEMA plan).

296. CAL. WATER § 10729.

297. For other critiques, *see* Perona, *supra* note 76.

surface flows, groundwater baseflow to surface waters, and lateral subsurface flow. These basins receive inflows and drain their outflows. Yet even moderate amounts of groundwater pumping can lower groundwater levels, preventing the drainage of water from these basins, effectively closing them. Water supplies that used to flow across and through the basin are captured by pumping; most of the formerly flowing groundwater exits the basin not through baseflow or lateral subsurface flow, but through evapotranspiration by irrigated crops and land. Because the dissolved solids in groundwater can no longer escape through baseflow and lateral subsurface flow, the newly closed basins suffer increasing concentrations of salts, arsenic, uranium, and other contaminants; the formerly open basin turns into a "salt sink."[298]

As a consequence of this process, known as "anthropogenic basin closure," formerly open basins in the Central Valley such as the Tulare Lake Basin are suffering from induced concentrations of salts similar to those found in naturally-closed basins such as Death Valley or the Great Salt Lake.[299] A variation of this problem is also occurring in the Arkansas River Valley of eastern Colorado and western Kansas. There, groundwater irrigation has lowered the alluvial aquifer; polluted irrigation return flows have percolated down to the aquifer, concentrating geogenic heavy metals in the alluvium. In 2016, Colorado delivered between eight and ten tons of geogenic uranium to Kansas via the Arkansas River, and concentrated pollutants have also seeped into the High Plains-Ogallala Aquifer, forcing the town of Kinsley, Kansas to build a reverse-osmosis drinking water treatment plant.[300] Left unchecked, the closed basin problem will inevitably render groundwater supplies unusable without expensive desalination and other treatment—treatment that is probably not economical at the scale necessary for large-scale irrigation.

In the abstract, the solution to the closed basin problem is simple: impose a groundwater management regime that reopens the basin by restoring and maintaining sufficient inflows and outflows. Such a regime would reduce pumping to amounts necessary to maximize recharge and to maintain open, flowing conditions. A necessary component of such a regime would likely be aquifer storage, which would enable stable and higher groundwater levels, helping to keep the basin open.[301] But that simple—and hydrologically necessary—solution would almost certainly require reductions in groundwater pumping well beyond those necessary to attain the "squishy" statutory requirements of SGMA. GSAs and the SWRCB will need to fight the long-

298. Richard A. Pauloo et al., *Anthropogenic Basin Closure and Groundwater Salinization (ABSCAL)*, J. HYDROLOGY, Feb. 2021. I would like to thank Dr. Pauloo and Professor Graham Fogg for their helpful explanations of this phenomenon.

299. *Id.*

300. DONALD WHITTEMORE, KAN. GEOLOGICAL SURVEY, ESTIMATED ANNUAL URANIUM LOADS IN THE ARKANSAS RIVER ENTERING KANSAS 2012-2016, KANSAS GEOLOGICAL SURVEY OPEN-FILE REPORT NO. 2017-2 (2017).

301. Pauloo et al., *supra* note 295.

established institutional tendency of considering river and groundwater basins essentially as the sum of their discrete water rights claims under a typical safe yield analysis.[302] SGMA's statutory requirement to consider previously unrecognized uses such as environmental users of groundwater is not, in itself, sufficient. Such consideration may force the reapportionment of the safe yield of the basin, but if that total safe yield figure does not incorporate groundwater amounts necessary to maintain an open basin, SGMA will fail its mandate to reverse "significant and unreasonable degraded water quality" over the long term.[303]

C. Lesson Two: Doctrine is Negotiable

The second lesson to be gleaned from the LEMA experience so far is that water law doctrine can be fundamentally negotiable. In Kansas, negotiability has proven to be perhaps the most important component in reaching consensus about basin-wide reductions in groundwater pumping.

As described above in Section II.A, the LEMAs provide consistent examples of owners modifying several of the cardinal rules of the prior appropriation doctrine as it is codified in Kansas. They have compromised over priority. Pumping reductions apply to all appropriation rights dedicated to irrigation without regard to priority, but owners of senior rights can still bring impairment claims against junior rights.[304] Instead of annual pumping limits, they have adopted multi-year allocations to allow them greater temporal flexibility.[305] They have accomplished substantial geographical flexibility by allowing water usage across different points of diversion and different places of use.[306] And they have established clear use preferences, imposing lesser (if any) pumping reductions on higher-value uses such as stockwatering, municipal, and recreational rights than they have upon irrigation rights.[307]

Such negotiations over the prior appropriation doctrine in Kansas raise hopeful signs for how GSAs and irrigators can negotiate across the generally wider latitude of California's correlative rights doctrine. SGMA neither creates, nor determines, nor comments upon California's common-law property rights regime.[308] SGMA does not displace the common law.[309] But where the common law is silent, GSPs can articulate rules. Thus, there is an opportunity within the

302. *E.g.*, safe yield analyses performed as part of the groundwater adjudications described in *supra* Section I.B.

303. CAL. WATER § 10721(x)(4) (West 2020).

304. *See supra* Subsection III.A.2.

305. *See supra* Subsection III.A.3.

306. *See supra* Subsection III.A.4.

307. *See supra* Subsection III.A.5.

308. *See supra* text accompanying notes 89–90.

309. Envtl. Law Found. v. State Water Res. Control Bd., 26 Cal. App. 5th 844 (2018).

SGMA process to establish creative, consensus-based, and effective descriptions of allowable water usage without running afoul of California water law. Put another way, SGMA provides room for the kind of "doctrinal choreography" and practical equity that *Pasadena* achieved—but with statutory protections previously unavailable under the common law.[310] Because the correlative rights doctrine imposes fewer limitations than the prior appropriation doctrine does, the dancing can be freer and safer.

GSAs can negotiate and modify the correlative rights doctrine pursuant to SGMA in many of the same ways as GMDs have negotiated and modified the prior appropriation doctrine in Kansas. First, through voluntary agreements within a GSP, they can reach compromises over priority—in the California sense of that term. They can adjust the relationship between overlying, correlative rights and off-tract appropriative rights by applying the same level of pumping reductions to both classes of rights; there need not be a hierarchy between the classes. And just as appropriators in LEMAs retain the "backstop" ability to bring impairment actions, overlying landowners could bring protective actions against out-of-basin users, or make contractual arrangements allowing the latter to keep pumping. Because overlying tract owners can raise their inchoate rights at any time against out-of-basin appropriators, such a provision will likely become attractive.[311]

Second, GSAs will likely adopt the temporal flexibility afforded by multi-year allocations of water use and the geographical flexibility afforded by temporary and permanent transfers within the boundaries of the GSA. SGMA provides for both of these management tools.[312] Converting annual authorized quantities of use into five-year allocations is a common enough approach to dealing with groundwater overdraft in prior appropriation states.[313] Carryovers across multi-year allocation periods could reward conservation, similar to what has been done in the GMD4 Sheridan-6 LEMA.[314] Like the LEMA plans, SGMA's carryover provision is annual but sets a five-year limit.[315] SGMA's provision for geographical flexibility within the GSA's subject basin accords with longstanding California's correlative rights doctrine, which treats all in-basin pumpers as overlying owners.[316]

Statute, however, will impose some limits on the geographical flexibility of pumping allocations—especially § 1200.[317] In a relatively recent but pre-SGMA

310. Szeptycki et al., *supra* note 52, at 194.

311. Wright v. Goleta Water Dist., 174 Cal. App. 3d 74 (1985).

312. CAL. WATER § 10726.4(a)(3)–(4) (West 2020).

313. *E.g.*, Briggs v. Golden Valley Land & Cattle Co., 97 Idaho 427, 431–32 (1976) (discussing five-year allocations); KAN. STAT. ANN. § 82a-736 (2020) (allowing five-year "flex accounts" for individual groundwater rights).

314. *See supra* text accompanying note 171.

315. CAL. WATER § 10726.4(a)(4).

316. *E.g.*, Burr v. Maclay Rancho Water Co., 154 Cal. 428, (1908).

317. *See supra* text accompanying notes 26–35.

case, the SWRCB secured judicial approval of the board's updated test for determining whether a groundwater formation qualified as a "subterranean stream flowing through known and definite channels" or was instead classified as "percolating groundwater."[318] The decision was hailed as a "major step forward toward the integration of ground and surface water rights" in California.[319] SGMA builds on that decision. Moving groundwater pumping into a geological formation that qualifies as a "subterranean stream" would clearly run afoul of SGMA's call to avoid depletions of interconnected surface water.[320]

Third, GSAs could craft use preferences within their GSPs. The Kansas LEMAs either subject higher-value uses to lesser pumping reductions or none at all.[321] Similar provisions could be tailored to address the economic diversity of crops within the San Joaquin Valley, from lower-value crops such as hay and alfalfa to high-value crops such as almonds. In the abstract, a use preference seems economically rational. However, the much higher value of California crops (and the vertically-integrated aspects of many California agribusinesses) may reduce the appeal of a use preference. High Plains irrigators dedicate much of their acreages to growing feed grains (corn, soybeans, and grain sorghum) for beef and dairy cattle, hogs, and other livestock; they sell a large part of their harvests to feedlots and other large-scale buyers such as ethanol plants. Thus, it is in most irrigators' self-interest to adopt LEMA provisions that protect the buyers of their output.[322] California irrigators, who focus largely on the consumer market, do not suffer the same level of dependence on higher-value uses.

D. Lesson Three: Trustworthy Data and Data Analysis are Crucial to Promoting a Culture of Conservation

The final and perhaps most intriguing lesson from the LEMA experience concerns a resource that, like groundwater, is in a state of serious depletion across the country: trust. The LEMA statute emerged because local irrigators did not trust the procedures of the IGUCA statutes to safeguard their local management initiatives; the LEMA statute distinguishes itself by providing such safeguards.[323] The first LEMA, the 2013 Sheridan-6 LEMA, emerged from a

318. N. Gualala Water Co. v. State Water Res. Control Bd., 139 Cal. App. 4th 1577 (2006) (approving the four-part test to determine whether the SWRCB has jurisdiction over groundwater that flows in a subsurface channel, as adopted in *In re* Garrapata Water Co., State Water Res. Control Bd. Dec. No. 1639 (June 17, 1999)).

319. TARLOCK & ROBISON, *supra* note 22, § 4:37, at 241.

320. CAL. WATER § 10721(x)(6).

321. *See supra* Subsection III.A.5.

322. *See, e.g.*, 2020 GMD1 LEMA, *supra* note 152, at 12 (describing the testimony of Mr. Kyle Spencer, Manager of GMD1, which stressed that the LEMA plan was "developed to minimize economic disruption in Wichita County, and that stock and industrial users are common primary economic drivers that often consume the commodities created by the irrigation water rights").

323. *See supra* text accompanying notes 137, 145–47.

shared commitment to groundwater conservation among a limited number of irrigators who trusted each other enough to develop a serious groundwater conservation plan, one that would affect all of their water rights equally. They trusted the plan because it was anchored in hydrogeological data—pumping amounts, pumping rates, and local groundwater levels—that was both publicly available and widely trusted. Kansas has long required water-use reporting, and imposes civil penalties for failing to report as well as misdemeanor penalties for reporting false information.[324] Over 99% of Kansas water rights owners comply with these requirements.[325] The development of the LEMA plans has depended substantially upon such user-reported data, but also upon the independent well measurements and analyses of the Kansas Geological Survey, whose work Kansas irrigators clearly hold in high regard.[326] The orders establishing the LEMAs have detailed and exceptional provisions for water-use reporting and monitoring.[327] Just as importantly, they set forth different burdens and presumptions for establishing pumping violations, and impose considerably more severe penalties where such violations are established.[328]

California groundwater irrigators are no better or worse than their Kansas counterparts, but they occupy a much different regulatory situation, and thus have a much different relationship with pumping and monitoring data. Because pumping was effectively unregulated before the advent of SGMA, California irrigators have not been required to meter or monitor their wells. In the context of long-established non-regulation, mandatory metering and reporting requirements can promote the suspicion among irrigators that the state is planning to curtail pumping—a suspicion that is not necessarily unjustified. In many western states, groundwater metering requirements are remarkably recent.[329] SGMA clearly grants GSAs the power to require well registration, metering, and groundwater level monitoring.[330]

In the meantime, hydrogeologists and other scientists have developed sophisticated ways to otherwise measure the impacts of pumping on the San Joaquin Valley's groundwater systems. Unlike their data-rich colleagues in Kansas, they lack direct pumping and water-use information. Yet scientists have discovered impressive ways to compensate for this data drought. For example, they have developed a combination of satellite-based interferometic synthetic aperture radar (InSAR) and continuous global positioning systems (GPS), along with conventional surface flow routing, precipitation, and runoff data.[331] This

324. KAN. STAT. ANN. § 82a-732 (2020).

325. John C. Peck & Burke W. Griggs, *Groundwater Law and Management: The Asia (IWMI)-Kansas Program*, 41 CREIGHTON L. REV. 315, 332 (2008).

326. *E.g.*, 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 12.

327. *See supra* Subsection III.A.7.

328. *See supra* Subsections III.A.6–7.

329. *E.g.*, 1998 Idaho Sess. Laws 595, codified at IDAHO CODE § 42-701 (2020).

330. CAL. WATER §§ 10725.6, 10725.8, 10727.2 (West 2020).

331. Wesley R. Neely et al., *Characterization of Groundwater Recharge and Flow in California's San*

hybrid approach does more than estimate groundwater pumping by the rough proxy of land subsidence. GPS-enhanced InSAR measures land surface deformations and displacements—the geological responses to groundwater pumping—at an impressively small land-area scale of 100 meters on a side. This data, interpreted in tandem with conventional surface water data, has enabled scientists to locate and describe groundwater recharge locations and lateral groundwater flow paths.[332] This research has produced nothing less than a finely resolved map of the seasonal groundwater dynamics of the San Joaquin Valley.

Between the new powers vested in GSAs to impose metering and monitoring and the advanced state of remote analysis, SGMA has spurred remarkable advancements in what California irrigators know about their individual and collective pumping impacts. But two questions loom large. Will pumpers trust that data and analysis—and the motives behind it? And if they do, will they support their local GSA in imposing penalties—including, potentially, severe ones—for those who violate the provisions of a GSP?[333]

The Kansas experience may be less helpful in answering these questions. Most importantly, LEMAs are voluntary, while GSPs are not. Proponents of the GMD4 Sheridan-6 LEMA earnestly wanted the plan to succeed and recognized the personal and institutional trust required to do so; the prospect of failure raised the specter of shame.[334] Irrigators within a California GSA may not have the same authorial interest or pride in their GSP as their Kansas counterparts. Irrigators across the Central Valley will likely view SGMA essentially as state-imposed, top-down regulation, and hardly as an opportunity to find creative ways to conserve groundwater. But they will still have strong incentives for developing effective compliance mechanisms—most importantly, to avoid the SWRCB from intervening to force the reformation of a GSP.[335] Because California groundwater was basically unregulated until the onset of SGMA, there is little of the regulatory inertia that might otherwise impede the adoption of creative and effective enforcement mechanisms.

VI. CONCLUSION

Comparisons such as the one put forth in this Article are fraught with hazards—even within the narrow category of American groundwater management. But they are not merely academic. Most of California's agricultural economy depends upon whether it can achieve the grand ambitions set forth in

Joaquin Valley from InSAR-observed Surface Deformation, WATER RESOURCES RES., Apr. 2021.

332. *Id.*

333. CAL. WATER §§ 10726.4, 10732.

334. 2013 GMD4 Sheridan-6 LEMA, *supra* note 149, at 24 ("[U]nless this LEMA is renewed for a longer period, then the work and cooperation of GMD4, KGS and DWR will be largely wasted, and remembered as little more than a gesture.").

335. *See supra* text accompanying note 86.

SGMA. The Central Valley Aquifer has at least three times the water storage capacity than California's entire surface reservoir storage capacity.[336] Whether that aquifer is sustained, depleted, or destroyed will determine the Central Valley's future. In looking for ways to implement SGMA's grand ambitions, California could do worse than to look beyond its borders and linger a bit across the High Plains of western Kansas.

As this Article has argued, there are lessons to be found there. Thanks to the pioneering work of Elinor Ostrom, Edella Schlager, William Blomquist, and others, we have learned that the use of common-pool groundwater resources can be governed effectively and that effective governance displays common principles and institutional arrangements.[337] (They have also tended to look most often to California.) This Article has attempted to show that there is an overall, practical similarity between the Kansas groundwater experience and what California currently faces; there is also enough in the Kansas LEMA record so far to attend usefully to practices.[338] Most importantly, Kansas groundwater irrigators have achieved a workable and proactive consensus about groundwater conservation, one that applies across their discrete, conflicting water rights and their distinct groundwater situations. Lee Anne Fennell has memorably articulated "Ostrom's Law" to hold that "a resource arrangement that works in practice can work in theory."[339] Practices that work in Kansas may work in California, and that common effectiveness may enable us to recognize regularities across their diverse hydrological and legal contexts. Then, perhaps, a theory or a set of theories about locally-driven groundwater conservation mandates will emerge, allowing us to assess which models work in which contexts, and to "thereby dodge both misguided efforts at transplantation and missed opportunities to tap into transferable lessons."[340] Let us hope there is time to do so in California. In many parts of Kansas, it is nearly too late.

336. Pauloo et al., *supra* note 295.

337. *E.g.*, ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1990); Edella Schlager, *Challenges of Governing Groundwater in U.S. Western States,* 14 HYDROGEOLOGY J. 350 (2006); BLOMQUIST, *supra* note 48.

338. *See supra* Section IV.A.

339. Lee Anne Fennell, *Ostrom's Law: Property Rights in the Commons,* 5 INTL. J. COMMONS 9, 10 (2011).

340. *Id.*

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