Rapid Communication

Local Groundwater Withdrawal Permitting Laws in the South-Western US: California in Comparative Context

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Key words Groundwater Management, Groundwater Withdrawal Permitting Laws, California Groundwater; Sustainable Groundwater Management Act

Article Impact Statement: Existing permitting regimes in the south-western USA can inform new regimes under California's Sustainable Groundwater Management Act.

Abstract

The Sustainable Groundwater Management Act (**SGMA**) aims to control, for the first time in California's history, the state's significant use and depletion of groundwater. SGMA gives local agencies a high degree of discretion in relation to a new permitting power, but the discretion is a double-edged sword: agencies gain maximum flexibility to tailor their regime

to local conditions, yet the statute provides no direction on appropriate components of a
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groundwater permitting regime. We introduce SGMA and the broader legislative context to its permitting power, and we explain the continuing common law context in which the legislation operates. This information is used as the foundation for a comparative legal analysis of fundamental elements of permitting regimes. We compare a selection of six other south-western permitting regimes established in legislation for areas recognized as requiring intensive management through permitting: “special permitting areas” (SPAs). We find that permitting regimes in south-western SPAs share a structure containing several almost universal elements, although the policy settings that apply to those elements vary widely. The established permitting regimes in the other south-western states’ SPAs may inform Californian agencies seeking to use their new permitting power for the first time, as well as water agencies further afield, as to important components of a permitting regime, and the different policy settings that could apply to those components. Californian local agencies, and its Department of Water Resources, which is charged with providing them technical advice, should have regard to these permitting possibilities.

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Introduction

The state of California accounts for the largest groundwater withdrawals within the United States (US)—16% of total groundwater withdrawals (Maupin et al 2014); this significant withdrawal of groundwater has resulted in notable depletion of groundwater and a range of adverse impacts (Galloway et al 1999, Famiglietti 2011). The Sustainable Groundwater Management Act of 2014 (**SGMA**) (California Water Code (**CWC**) ss10720-10737.8) aims to control, for the first time in California's history, the state's withdrawal of groundwater. SGMA uses principles of subsidiarity (Ostrom 2013), pursuing "the maximum degree of local control and flexibility consistent with [its] sustainability goals" (CWC s10725). A critical, and generally under-remarked, aspect of the legislation is that it clearly grants local agencies a broad new sustainability-focused power to require groundwater withdrawal permits (as distinct from well construction permits) (Nelson and Perrone 2016). SGMA gives local agencies discretion in relation to this permitting power, but the discretion is a double-edged sword. Agencies gain maximum flexibility to tailor their regime to local conditions, yet the statute leaves local agencies with no direction as to appropriate components of a groundwater permitting regime. State policy guidance on "best management practices" (**BMPs**) may provide this information, but it is not yet available (CWC s10729(d)(1)), <http://www.water.ca.gov/groundwater/sgm/bmps.cfm>).

A comparative analysis of established permitting regimes in the other south-western states can inform Californian agencies seeking to use their new permitting power for the first time as to the potential components of a permitting regime and the different policy settings that apply to those components in other jurisdictions. Previous legal analysis has been critical in

understanding groundwater management frameworks and providing inspiration from other states to help agencies implement SGMA (e.g., Aladjem and Sunding 2015). Existing literature has provided a foundation to understanding the impetus for improved groundwater management (Famiglietti et al 2011, 2015; Scanlon et al 2012); other legal elements of SGMA (eg Perona 2015; Aladjem and Sunding 2015); and comparisons of western groundwater laws generally, or groundwater governance more broadly (eg Megdal et al 2014; Spiegel 2010; Blomquist et al 2004; Bryner and Purcell 2003). Nevertheless, there has not been a comprehensive analysis of the many groundwater permitting regimes in the southwest.

We introduce SGMA and the broader legislative context to its permitting power and explain the continuing common law context in which the legislation operates. This information is used as the foundation for a comparative legal analysis focused on six fundamental elements of permitting regimes: (i) state-local power balance, (ii) legal source of rights to withdraw groundwater, (iii) permitting criteria, (iv) exemptions from permit requirements, (v) metering requirements, and (vi) penalties for violating a permit. To compare these six elements across the southwest, we identify one permitting regime within each of the south-western states. These regimes—referred to as “special permitting areas” (**SPAs**)--are established in or under legislation that recognizes the need for intensive management through permitting. We find that permitting regimes in south-western SPAs share a structure containing several almost universal elements, although the policy settings that apply to those elements vary widely. The better-established permitting regimes in the other south-western states’ SPAs may inform Californian agencies seeking to use their new power, as well as water agencies further afield. The comparison demonstrates that SGMA permitting provisions grant agencies a degree of

discretion that is unprecedented in the south-west. Californian local agencies, and its Department of Water Resources, which is charged with providing them technical advice, should have regard to these permitting possibilities in exercising their discretion.

The Sustainable Groundwater Management Act and its common law context

SGMA seeks to ensure that groundwater basins that are subject to significant pressure are managed by local “groundwater sustainability agencies” (**GSAs**) pursuant to “groundwater sustainability plans” (**GSPs**) that adopt sustainability goals (CWC ss10723.6–10724, 10727). SGMA’s key requirements apply to medium-or high-priority basins that cover 96 percent of California’s groundwater use (CDWR 2015). GSAs must implement measures targeted to ensuring these basins are managed within their sustainable yield, defined as a quantity of water that can be withdrawn annually, over the long term, without causing “an undesirable result” (CWC s 10721(u), (w)). That term is defined broadly as “chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply”, or any of the following effects where they are “significant and unreasonable”: reduction in groundwater storage, seawater intrusion, degraded water quality, land subsidence, and adverse impacts on beneficial uses of interconnected surface water. The ambitiousness of this goal is tempered by the legislation’s timelines: SGMA accepts “undesirable results” that occurred before 2015, and requires GSPs to achieve sustainability goals within 20 years (CWC ss10727.4(b)(1), (4)). The sustainability goal does not refer to impacts on

groundwater-dependent ecosystems (**GDEs**), but a GSP must include impacts on GDEs “where appropriate” (CWC s10727.4(l)).

Although SGMA provides for local control, GSAs are not immune from state influence. While GSAs are responsible for preparing and implementing GSPs, state agencies assist in developing and implementing GSPs (CWC s10729(b)) and publishing BMPs for sustainable management (CWC s10729(d)). State agencies review GSP implementation and achievement of the sustainability goal, and may recommend corrective actions in relation to both (CWC ss10733, 10733.4, 10733.8). The state may “step in” and make or implement a GSP if a GSP has not been adopted, is inadequate, or is not being implemented “in a manner that will likely achieve the sustainability goal” (CWC s10735.2).

SGMA provides GSAs with many groundwater quantity management tools to achieve their sustainability goals, including groundwater recharge projects, water imports, and voluntary land fallowing (CWC ss 10726.2, 10727.4). GSAs may impose fees on groundwater users, but only “to fund the costs of a groundwater sustainability program”, and seemingly not as a tool directly to influence extraction (CWC ss10730(a), 10730.2). The legislation also grants GSAs “additional” authorities to “regulate groundwater extraction.” GSAs may adopt “rules, regulations, ordinances, and resolutions” (CWC s10725.2) imposing spacing requirements between wells, requiring the rotation of wells in operation, suspending or limiting extractions from existing or proposed new individual wells or wells in the aggregate, “establishing groundwater extraction allocations”, or authorizing transfers of these allocations within the agency’s boundaries (CWC s10726.4(2), (3)).

The final provisions in relation to limiting extractions and giving effect to these limits through rules and regulations comprise the permitting power emphasized in this paper. To complement this permitting power, SGMA grants GSAs associated powers that are crucial to implementing permitting regimes, such as powers to require registration of wells, metering of withdrawals (a key current gap: Famiglietti et al 2011), and reporting of extraction, and to impose civil penalties on pumpers who extract more groundwater than they are entitled to under an agency rule (CWC ss10725.6, 10725.8, 10732). Additionally, the state, exercising its step-in power, may also impose restrictions on groundwater extraction (CWC s10735.8(c)(1)).

The SGMA permitting power arises in the context of California's complex common law doctrines, which create property rights in the right to use groundwater (*Katz v Walkinshaw* 1903). A GSA's permitting regime would presumably overlie and restrict the exercise of these rights, but may not quantify or change them (CWC ss 10720.5(b), 10726.4(2), 10726.8). Key differences between SGMA and California's common law system of groundwater rights suggest these additional restrictions could be significant.

- Permitting consistent with SGMA's sustainability standard may restrict basin-wide groundwater use more than the common law, since the former includes aspects relating to water quality, connected surface water, and impacts on the land surface that are broader than the latter's "safe yield" concept, defined as the volume of water "that can be extracted each year from an aquifer on a renewable basis", with a focus on recharge (Thompson et al 2013; Alley and Leake 2004).

- Common law rules grant individual landowners overlying percolating groundwater “correlative” rights to the resource (i.e., a “fair and just proportion,” considering the interests of neighbors), limited to “reasonable use” (*Katz v Walkinshaw* 1903). Additionally, non-overlying landowners may take any surplus water within the “safe yield” under the “first in time, first in right” doctrine of prior appropriation. In making individual allocations, GSAs have discretion to consider matters outside those relevant to the common law, including principles of equity, efficiency, or socially preferred water uses, as are common in other south-western US SPAs (discussed below).
- Local supervision of extraction through permitting would exceed that achieved in practice by the common law, under which a landowner can pump groundwater without first gaining permission (Foley-Gannon 2008) and potentially expensive and time-consuming lawsuits act as a deterrent to quantifying groundwater rights (Nelson 2012).

Placing SGMA along regulatory spectra of groundwater permitting regimes for special permitting areas in the south-western US

Our comparative analysis is focused on six fundamental elements of permitting regimes: (i) state-local power balance, (ii) legal source of rights to withdraw groundwater, (iii) permitting criteria, (iv) exemptions from permit requirements, (v) metering required by the permit, and (vi) penalties for violating a permit. The first two of the six elements situate the permitting regimes in the state’s overall groundwater governance system. The remaining four elements

promote sustainability by allowing an agency to scrutinise most (i.e., non-permit-exempt) proposed extractions to ensure they meet sustainability requirements (i.e., permitting criteria), to ensure that pumpers comply with volumetric and other limits (i.e., through metering) on permitted extractions, and to punish violations as a deterrent to others. We focus on elements of groundwater permitting regimes as they appear in written laws (and not shortage-sharing arrangements used after initial permits are granted or how permitting powers are used in practice).

Like California, other south-western states have recognized that certain regions—“special permitting areas” or SPAs—require intensive management of groundwater extraction, warranting a power to establish a permitting regime for withdrawals in those regions. Of the seven south-western US states (Arizona, California, Colorado, Nevada, New Mexico, Texas, and Utah)—close cousins in terms of climate and general legal structures—California was the last to introduce a clear, generally applicable groundwater permitting power. In addition to California’s high- and medium-priority basins, we identify one key type of intensively regulated sub-state SPA used to control groundwater extraction in each of the other south-western states: Arizona active management areas, Colorado tributary groundwater (the category to which most groundwater is presumed to belong: Bryner and Purcell, 2003), Nevada designated basins, New Mexico declared basins, Texas groundwater conservation districts, and Utah critical management areas (Figure 1). Where a state uses more than one type of SPA, the selected type corresponds most closely to high- and medium- priority basins, for which GSAs must formulate GSPs in California.

(i) Governance context: state-local power balance and legal source of groundwater rights

SPA groundwater permitting regimes operate in a framework influenced by how powers are allocated between state and local agencies (Figure 2(a)), and how statutes and the common law create and limit rights (Figure 2(b)). California appears, with Texas, at the most local-centric end of the spectrum of south-western SPAs. Texas' groundwater conservation districts formulate and administer permit rules, and the state may step in or give direction. In the five remaining south-western SPAs, a state agency has this primary role, with either a limited advisory role, or no formal role for local agencies. As in California, a variety of common law principles form the foundation of groundwater laws in the south-western states (Bryner and Purcell 2003). Whereas in California and Texas, groundwater property rights arise under common law principles alone, in most states, such rights cannot develop without a statutory permit (Figure 2(b)). Rarely (Arizona and Colorado), a state uses a hybrid system, under which the common law founds groundwater rights, but their exercise also requires a statutory permit, or meeting other statutory conditions.

(ii) Criteria for issuing groundwater permits

Unlike every other south-western SPA, a state statute does not guide GSAs on the criteria to be used in allocating permits. Common permitting criteria applying to multiple south-western states' SPAs include consistency with local management plans equivalent to GSPs and with principles of water conservation, public welfare, and preferred water uses, and not unacceptably affecting water levels or existing water rights (Figure 2(c)). The criterion of non-interference with existing water rights commonly includes considering existing surface

water rights and requiring, in some circumstances, mitigation for predicted impacts (Nelson 2015).

(iii) Exemptions from permit requirements

California does not require a GSA to exempt any groundwater extractor from a permit requirement. It contemplates that even small domestic (“de minimis”) uses (CWC s10721(e)) may be subject to allocation controls, and in that case, these uses may attract permit and extraction fees (CWC s10730(a)). SPAs in most south-western states set out statutory permit exemptions for domestic and livestock water use, and sometimes other uses (Figure 2(d)). The volume of water permissible for these permit-exempt uses varies dramatically, with Texas allowing exempt domestic users to extract up to 14 times more water than Nevada.

(iv) Metering of withdrawals

California explicitly allows, but does not require, GSAs to mandate metering of non-domestic uses. This aligns with legislation in every south-western state except Arizona and Utah, which mandate metering in their SPAs (Figure 2(e)).

(v) Penalties for permit violations

Metering supports compliance and enforcement in relation to groundwater permits (Holley and Sinclair 2013). Penalties for permit violations vary widely across the south-west, with GSAs possessing a comparatively meagre toolbox (Figure 2(f)). Monetary civil penalty provisions appear universally with respect to SPAs, but their value varies by a factor of 40 (\$250 in New Mexico to \$10,000 in Arizona per day of violation). Additional penalties are

available in a minority of states, including serious criminal penalties for large volumes of unauthorised groundwater use, and requirements to replace double the water unlawfully extracted.

Discussion

Permitting regimes in south-western SPAs share a structure containing several almost universal elements, although the policy settings that apply to those elements vary widely. That structure of common key elements provides useful information for GSAs developing a local permitting regime. GSAs may take this information into account as one factor in the many necessary to consider in determining locally appropriate policy settings. Overall, compared to groundwater regulation in other key south-western SPAs, SGMA provides notably few constraints on GSAs' powers to use extraction permitting regimes to pursue sustainability. GSAs have enormous discretion, and this can be seen as an opportunity or a limitation. In one way, discretion could be seen as an advantage to pursuing sustainability, since GSAs are not prevented from imposing relatively stringent requirements where this is required to achieve sustainability locally. Under SGMA, GSAs may comprehensively require permits for all extractions, with no exemptions required for particular purposes or volumes of use. This would allow agencies to manage and record all groundwater extracted in their territory, avoiding the uncontrolled cumulative effects that have occurred under permit exemptions in other south-western states, which are commonly considered problematic (Bracken 2010; Vinett and Jarvis 2012).

GSAs may also choose their own locally appropriate criteria for granting permits, without any state-imposed requirements (possibly due to uncertainty about how a groundwater permit system will interact with continuing common law groundwater rights: Smith 2015). Criteria used in other south-western states provide candidate criteria for consideration. Consistent with SGMA's broad sustainability goal and accompanying provisions, GSAs could go further than the permitting regimes for any south-western SPA by clearly referring to impacts on interconnected surface water and GDEs, as well as social equity or other considerations as relevant permitting criteria, consistent with their broad sustainability goals.

SGMA's wide discretionary permitting power might also be—and history suggests, likely will be—a challenge to pursuing sustainability. The lack of state constraint or a suggested structure in relation to GSAs' broad permitting powers might mean these powers go unused—casualties of a lack of political cover for regulating withdrawals that more constrained discretion might provide. Compared with other key south-western SPAs, SGMA's sparse permitting provisions contain a further disadvantage in their limited penalty provisions (low-level civil penalties only) relative to some other south-western SPAs. This may compromise enforcement of an agency's permitting regime.

Conclusion

SGMA represents a significant legislative leap for California groundwater regulation, granting local agencies wide powers to control groundwater extraction. Although adopting and implementing a sustainability plan is mandatory, significant discretion remains in the context of the permitting power. This discretion includes whether or not to use the permitting

power. If the power is used, this discretion also includes the identification of the fundamental elements of the regime, representing an opportunity to translate the desire for local control into a permitting regime precisely tailored to local circumstances. Past experience under the common law and prior legislation suggests that local agencies will face cultural and political barriers to controlling groundwater withdrawals stringently (Nelson 2012). A credible state step-in power, as well as good information through regulations or BMP guidelines about options for regulating groundwater withdrawals will be crucial to ensure that this momentous change in groundwater law leads to momentous change on the ground. Our data on southwestern groundwater permitting regimes points to both regime components and policy settings for GSAs to consider, as well as future work testing the effectiveness of permitting regimes by linking key aspects of a regime with trends in physical conditions.

Acknowledgements

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Figures and Figure Captions

Figure 1: Map of selected special permitting areas used in comparative legal analysis.

Footnote for Figure 1: Geospatial data was acquired from state government websites

(<http://uair.library.arizona.edu> (AZ), http://www.ose.state.nm.us/GIS/geospatial_data.php

(NM); <http://water.nv.gov/mapping/> (NV); <http://www.twdb.texas.gov/mapping/gisdata.asp>

(TX)) or personal communication with personnel from state government officials (Lee

Eschler (UT), Kevin Rein (CO)).

Figure 2: Regulatory spectra demonstrated by permitting regimes for groundwater extraction in special permitting areas in south-western US states (colors match the corresponding SPA map, Figure 1).

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WA

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ID

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SD

NE

NV

UT

CO

KS

CA

AZ

NM

OK

TX

Covered Special Permitting Areas

AZ Active Management Areas

a) Power Balance

Ariz Rev Stat Ann s 45-419 (West, Westlaw through Feb 17, 2016 of the 2nd Reg Sess of the 2016 52nd Legis) (area director appointed by state helps director develop and implement management plan); CWC ss 10723, 10735.4–10736; Colo Rev Stat s 37-92-501 (LEXIS through 1st Reg Sess of the 2015 70th Gen Assem); Nev Rev Stat s 534.030(5) (2014); NM Stat Ann ss 72-12-3(A), 72-12-20 (West, Westlaw through Ch 2 of the 2nd Reg Sess of the 2015 52nd Legis); Tex Water Code Ann ss 36.101, 36.1072 (West, Westlaw through the end of the 2015 Reg Sess of 84th Legis); Utah Code Ann s 73-5-15 (West, Westlaw through 2015 1st Spec Sess).

b) Legal Source of Rights

Ariz Rev Stat Ann s 45-462ff (West, Westlaw through Feb 17, 2016 of the 2nd Reg Sess of the 2016 52nd Legis); CWC s 10720.5(b); Colo Rev Stat ss 37-90-137, 37-92-102 (LEXIS through 1st Reg Sess of the 2015 70th Gen Assem); Nev Rev Stat s 534.020 (2014); NM Stat Ann s 72-12-1 (West, Westlaw through Ch 2 of the 2nd Reg Sess of the 2015 52nd Legis); Tex Water Code Ann s 36.002 (West, Westlaw through the end of the 2015 Reg Sess of 84th Legis); Utah Code Ann s 73-3-1 (West, Westlaw through 2015 1st Spec Sess).

c) Permitting Criteria

Ariz Rev Stat Ann ss 45-513 to -516 (West, Westlaw through Feb 17, 2016 of the 2nd Reg Sess of the 2016 52nd Legis); Colo Rev Stat ss 37-92-102, 37-92-305(9)(b) (LEXIS through 1st Reg Sess of the 2015 70th Gen Assem); Bar 70 Enterprises Inc v Tosco Corp, 703 P2d 1297, 1304 (Colo. 1983); Buffalo Park Dev Co v Mountain Mut Resorvoir Co, 195 P3d 674, 683 (Colo. 2008); Nev Rev Stat ss 534.110(4), 534.120, 533.368, 533.370 (2014); NM Stat Ann ss 72-12-2, 72-12-3 (West, Westlaw through Ch 2 of the 2nd Reg Sess of the 2015 52nd Legis). Guidelines for certain basins available at New Mexico Office of the State Engineer/Interstate Stream Commission, 'Water Rights Rules, Regulations and Guidelines' <<http://www.ose.state.nm.us/WR/WRrules.php>> accessed 7 March 2016; Tex Water Code Ann ss 36.113, 36.1132 (West, Westlaw through the end of the 2015 Reg Sess of 84th Legis); Utah Code Ann s 73-3-8 (West, Westlaw through 2015 1st Spec Sess).

d) Permit Exemptions

Ariz Rev Stat Ann s 45-454 (West, Westlaw through Feb 17, 2016 of the 2nd Reg Sess of the 2016 52nd Legis); Colo Rev Stat ss 37-92-602 (LEXIS through 1st Reg Sess of the 2015 70th Gen Assem); Nev Rev Stat s 534.180 (2014); NM Stat Ann ss 72-12-1.1 to -1.3 (West, Westlaw through Ch 2 of the 2nd Reg Sess of the 2015 52nd Legis); Tex Water Code Ann ss 36.117(a)–(b) (West, Westlaw through the end of the 2015 Reg Sess of 84th Legis).

e) Metering Withdrawals

Ariz Rev Stat Ann ss 45-604, 45-632 to -633 (West, Westlaw through Feb 17, 2016 of the 2nd Reg Sess of the 2016 52nd Legis); CWC s 10725.8; Colo Rev Stat ss 37-92-502(a)–(b), (6) (LEXIS through 1st Reg Sess of the 2015 70th Gen Assem); Nev Rev Stat s 534.110 (2014); NM Stat Ann s 72-12-27 (West, Westlaw through Ch 2 of the 2nd Reg Sess of the 2015 52nd Legis); NM Code R s 19.27.5(C)(1); Tex Water Code Ann s 36.111 (West, Westlaw through the end of the 2015 Reg Sess of 84th Legis); Utah Code Ann ss 73-5-4, 73-5-8 (West, Westlaw through 2015 1st Spec Sess).

f) Penalties for Violations

Ariz Rev Stat Ann ss 45-634 to -636 (West, Westlaw through Feb 17, 2016 of the 2nd Reg Sess of the 2016 52nd Legis); CWC s 10732; Colo Rev Stat ss 37-92-503 (LEXIS through 1st Reg Sess of the 2015 70th Gen Assem); Nev Rev Stat ss 534.190, 534.193, 534.195 (2014); NM Stat Ann ss 72-12-11, 72-12-15 (West, Westlaw through Ch 2 of the 2nd Reg Sess of the 2015 52nd Legis); Tex Water Code Ann ss 36.102(a)–(b), 36.119(b) (West, Westlaw through the end of the 2015 Reg Sess of 84th Legis); Utah Code Ann s 73-2-25 to -27, 76-10-202 (West, Westlaw through 2015 1st Spec Sess).

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Introduction

The state of California accounts for the largest groundwater withdrawals within the United States (US)—16% of total groundwater withdrawals (Maupin et al 2014); this significant withdrawal of groundwater has resulted in notable depletion of groundwater and a range of adverse impacts (Galloway et al 1999, Famiglietti 2011). The Sustainable Groundwater Management Act of 2014 (SGMA) (California Water Code (CWC) ss10720-10737.8) aims to control, for the first time in California's history, the state's withdrawal of groundwater. SGMA uses principles of subsidiarity (Ostrom 2013), pursuing "the maximum degree of local control and flexibility consistent with [its] sustainability goals" (CWC s10725). A critical, and generally under-remarked, aspect of the legislation is that it clearly grants local agencies a broad new sustainability-focused power to require groundwater withdrawal permits (as distinct from well construction permits) (Nelson and Perrone 2016). SGMA gives local agencies discretion in relation to this permitting power, but the discretion is a double-edged sword. Agencies gain maximum flexibility to tailor their regime to local conditions, yet the statute leaves local agencies with no direction as to appropriate components of a groundwater permitting regime. State policy guidance on "best management practices" (BMPs) may provide this information, but it is not yet available (CWC s10729(d)(1)), <http://www.water.ca.gov/groundwater/sgm/bmps.cfm>).

A comparative analysis of established permitting regimes in the other south-western states can inform Californian agencies seeking to use their new permitting power for the first time as to the potential components of a permitting regime and the different policy settings that apply to those components in other jurisdictions. Previous legal analysis has been critical in understanding groundwater management frameworks and providing inspiration from other states to help agencies implement SGMA (e.g., Aladjem and Sunding 2015). Existing

literature has provided a foundation to understanding the impetus for improved groundwater management (Famiglietti et al 2011, 2015; Scanlon et al 2012); other legal elements of SGMA (eg Perona 2015; Aladjem and Sunding 2015); and comparisons of western groundwater laws generally, or groundwater governance more broadly (eg Megdal et al 2014; Spiegel 2010; Blomquist et al 2004; Bryner and Purcell 2003). Nevertheless, there has not been a comprehensive analysis of the many groundwater permitting regimes in the southwest.

We introduce SGMA and the broader legislative context to its permitting power and explain the continuing common law context in which the legislation operates. This information is used as the foundation for a comparative legal analysis focused on six fundamental elements of permitting regimes: (i) state-local power balance, (ii) legal source of rights to withdraw groundwater, (iii) permitting criteria, (iv) exemptions from permit requirements, (v) metering requirements, and (vi) penalties for violating a permit. To compare these six elements across the southwest, we identify one permitting regime within each of the south-western states. These regimes—referred to as “special permitting areas” (**SPAs**)--are established in or under legislation that recognizes the need for intensive management through permitting. We find that permitting regimes in south-western SPAs share a structure containing several almost universal elements, although the policy settings that apply to those elements vary widely. The better-established permitting regimes in the other south-western states’ SPAs may inform Californian agencies seeking to use their new power, as well as water agencies further afield. The comparison demonstrates that SGMA permitting provisions grant agencies a degree of discretion that is unprecedented in the south-west. Californian local agencies, and its Department of Water Resources, which is charged with providing them technical advice, should have regard to these permitting possibilities in exercising their discretion.

The Sustainable Groundwater Management Act and its common law context

SGMA seeks to ensure that groundwater basins that are subject to significant pressure are managed by local “groundwater sustainability agencies” (**GSAs**) pursuant to “groundwater sustainability plans” (**GSPs**) that adopt sustainability goals (CWC ss10723.6–10724, 10727). SGMA’s key requirements apply to medium-or high-priority basins that cover 96 percent of California’s groundwater use (CDWR 2015). GSAs must implement measures targeted to ensuring these basins are managed within their sustainable yield, defined as a quantity of water that can be withdrawn annually, over the long term, without causing “an undesirable result” (CWC s 10721(u), (w)). That term is defined broadly as “chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply”, or any of the following effects where they are “significant and unreasonable”: reduction in groundwater storage, seawater intrusion, degraded water quality, land subsidence, and adverse impacts on beneficial uses of interconnected surface water. The ambitiousness of this goal is tempered by the legislation’s timelines: SGMA accepts “undesirable results” that occurred before 2015, and requires GSPs to achieve sustainability goals within 20 years (CWC ss10727.4(b)(1), (4)). The sustainability goal does not refer to impacts on groundwater-dependent ecosystems (**GDEs**), but a GSP must include impacts on GDEs “where appropriate” (CWC s10727.4(l)).

Although SGMA provides for local control, GSAs are not immune from state influence. While GSAs are responsible for preparing and implementing GSPs, state agencies assist in developing and implementing GSPs (CWC s10729(b)) and publishing BMPs for sustainable management (CWC s10729(d)). State agencies review GSP implementation and achievement

of the sustainability goal, and may recommend corrective actions in relation to both (CWC ss10733, 10733.4, 10733.8). The state may “step in” and make or implement a GSP if a GSP has not been adopted, is inadequate, or is not being implemented “in a manner that will likely achieve the sustainability goal” (CWC s10735.2).

SGMA provides GSAs with many groundwater quantity management tools to achieve their sustainability goals, including groundwater recharge projects, water imports, and voluntary land fallowing (CWC ss 10726.2, 10727.4). GSAs may impose fees on groundwater users, but only “to fund the costs of a groundwater sustainability program”, and seemingly not as a tool directly to influence extraction (CWC ss10730(a), 10730.2). The legislation also grants GSAs “additional” authorities to “regulate groundwater extraction.” GSAs may adopt “rules, regulations, ordinances, and resolutions” (CWC s10725.2) imposing spacing requirements between wells, requiring the rotation of wells in operation, suspending or limiting extractions from existing or proposed new individual wells or wells in the aggregate, “establishing groundwater extraction allocations”, or authorizing transfers of these allocations within the agency’s boundaries (CWC s10726.4(2), (3)).

The final provisions in relation to limiting extractions and giving effect to these limits through rules and regulations comprise the permitting power emphasized in this paper. To complement this permitting power, SGMA grants GSAs associated powers that are crucial to implementing permitting regimes, such as powers to require registration of wells, metering of withdrawals (a key current gap: Famiglietti et al 2011), and reporting of extraction, and to impose civil penalties on pumpers who extract more groundwater than they are entitled to under an agency rule (CWC ss10725.6, 10725.8, 10732). Additionally, the state, exercising

its step-in power, may also impose restrictions on groundwater extraction (CWC ss10735.8(c)(1)).

The SGMA permitting power arises in the context of California's complex common law doctrines, which create property rights in the right to use groundwater (*Katz v Walkinshaw* 1903). A GSA's permitting regime would presumably overlies and restrict the exercise of these rights, but may not quantify or change them (CWC ss 10720.5(b), 10726.4(2), 10726.8). Key differences between SGMA and California's common law system of groundwater rights suggest these additional restrictions could be significant.

- Permitting consistent with SGMA's sustainability standard may restrict basin-wide groundwater use more than the common law, since the former includes aspects relating to water quality, connected surface water, and impacts on the land surface that are broader than the latter's "safe yield" concept, defined as the volume of water "that can be extracted each year from an aquifer on a renewable basis", with a focus on recharge (Thompson et al 2013; Alley and Leake 2004).
- Common law rules grant individual landowners overlying percolating groundwater "correlative" rights to the resource (i.e., a "fair and just proportion," considering the interests of neighbors), limited to "reasonable use" (*Katz v Walkinshaw* 1903). Additionally, non-overlying landowners may take any surplus water within the "safe yield" under the "first in time, first in right" doctrine of prior appropriation. In making individual allocations, GSAs have discretion to consider matters outside those relevant to the common law, including principles of equity, efficiency, or socially preferred water uses, as are common in other south-western US SPAs (discussed below).

- Local supervision of extraction through permitting would exceed that achieved in practice by the common law, under which a landowner can pump groundwater without first gaining permission (Foley-Gannon 2008) and potentially expensive and time-consuming lawsuits act as a deterrent to quantifying groundwater rights (Nelson 2012).

Placing SGMA along regulatory spectra of groundwater permitting regimes for special permitting areas in the south-western US

Our comparative analysis is focused on six fundamental elements of permitting regimes: (i) state-local power balance, (ii) legal source of rights to withdraw groundwater, (iii) permitting criteria, (iv) exemptions from permit requirements, (v) metering required by the permit, and (vi) penalties for violating a permit. The first two of the six elements situate the permitting regimes in the state's overall groundwater governance system. The remaining four elements promote sustainability by allowing an agency to scrutinise most (i.e., non-permit-exempt) proposed extractions to ensure they meet sustainability requirements (i.e., permitting criteria), to ensure that pumpers comply with volumetric and other limits (i.e., through metering) on permitted extractions, and to punish violations as a deterrent to others. We focus on elements of groundwater permitting regimes as they appear in written laws (and not shortage-sharing arrangements used after initial permits are granted or how permitting powers are used in practice).

Like California, other south-western states have recognized that certain regions—"special permitting areas" or SPAs—require intensive management of groundwater extraction, warranting a power to establish a permitting regime for withdrawals in those regions. Of the

seven south-western US states (Arizona, California, Colorado, Nevada, New Mexico, Texas, and Utah)—close cousins in terms of climate and general legal structures—California was the last to introduce a clear, generally applicable groundwater permitting power. In addition to California’s high- and medium-priority basins, we identify one key type of intensively regulated sub-state SPA used to control groundwater extraction in each of the other south-western states: Arizona active management areas, Colorado tributary groundwater (the category to which most groundwater is presumed to belong: Bryner and Purcell, 2003), Nevada designated basins, New Mexico declared basins, Texas groundwater conservation districts, and Utah critical management areas (Figure 1). Where a state uses more than one type of SPA, the selected type corresponds most closely to high- and medium- priority basins, for which GSAs must formulate GSPs in California.

(i) Governance context: state-local power balance and legal source of groundwater rights

SPA groundwater permitting regimes operate in a framework influenced by how powers are allocated between state and local agencies (Figure 2(a)), and how statutes and the common law create and limit rights (Figure 2(b)). California appears, with Texas, at the most local-centric end of the spectrum of south-western SPAs. Texas’ groundwater conservation districts formulate and administer permit rules, and the state may step in or give direction. In the five remaining south-western SPAs, a state agency has this primary role, with either a limited advisory role, or no formal role for local agencies. As in California, a variety of common law principles form the foundation of groundwater laws in the south-western states (Bryner and Purcell 2003). Whereas in California and Texas, groundwater property rights arise under common law principles alone, in most states, such rights cannot develop without a statutory permit (Figure 2(b)). Rarely (Arizona and Colorado), a state uses a hybrid system, under

which the common law founds groundwater rights, but their exercise also requires a statutory permit, or meeting other statutory conditions.

(ii) Criteria for issuing groundwater permits

Unlike every other south-western SPA, a state statute does not guide GSAs on the criteria to be used in allocating permits. Common permitting criteria applying to multiple south-western states' SPAs include consistency with local management plans equivalent to GSPs and with principles of water conservation, public welfare, and preferred water uses, and not unacceptably affecting water levels or existing water rights (Figure 2(c)). The criterion of non-interference with existing water rights commonly includes considering existing surface water rights and requiring, in some circumstances, mitigation for predicted impacts (Nelson 2015).

(iii) Exemptions from permit requirements

California does not require a GSA to exempt any groundwater extractor from a permit requirement. It contemplates that even small domestic ("de minimis") uses (CWC s10721(e)) may be subject to allocation controls, and in that case, these uses may attract permit and extraction fees (CWC s10730(a)). SPAs in most south-western states set out statutory permit exemptions for domestic and livestock water use, and sometimes other uses (Figure 2(d)). The volume of water permissible for these permit-exempt uses varies dramatically, with Texas allowing exempt domestic users to extract up to 14 times more water than Nevada.

(iv) Metering of withdrawals

California explicitly allows, but does not require, GSAs to mandate metering of non-domestic uses. This aligns with legislation in every south-western state except Arizona and Utah, which mandate metering in their SPAs (Figure 2(e)).

(v) Penalties for permit violations

Metering supports compliance and enforcement in relation to groundwater permits (Holley and Sinclair 2013). Penalties for permit violations vary widely across the south-west, with GSAs possessing a comparatively meagre toolbox (Figure 2(f)). Monetary civil penalty provisions appear universally with respect to SPAs, but their value varies by a factor of 40 (\$250 in New Mexico to \$10,000 in Arizona per day of violation). Additional penalties are available in a minority of states, including serious criminal penalties for large volumes of unauthorised groundwater use, and requirements to replace double the water unlawfully extracted.

Discussion

Permitting regimes in south-western SPAs share a structure containing several almost universal elements, although the policy settings that apply to those elements vary widely. That structure of common key elements provides useful information for GSAs developing a local permitting regime. GSAs may take this information into account as one factor in the many necessary to consider in determining locally appropriate policy settings. Overall, compared to groundwater regulation in other key south-western SPAs, SGMA provides notably few constraints on GSAs' powers to use extraction permitting regimes to pursue sustainability. GSAs have enormous discretion, and this can be seen as an opportunity or a limitation. In one way, discretion could be seen as an advantage to pursuing sustainability, since GSAs are not prevented from imposing relatively stringent requirements where this is

required to achieve sustainability locally. Under SGMA, GSAs may comprehensively require permits for all extractions, with no exemptions required for particular purposes or volumes of use. This would allow agencies to manage and record all groundwater extracted in their territory, avoiding the uncontrolled cumulative effects that have occurred under permit exemptions in other south-western states, which are commonly considered problematic (Bracken 2010; Vinett and Jarvis 2012).

GSAs may also choose their own locally appropriate criteria for granting permits, without any state-imposed requirements (possibly due to uncertainty about how a groundwater permit system will interact with continuing common law groundwater rights: Smith 2015). Criteria used in other south-western states provide candidate criteria for consideration. Consistent with SGMA's broad sustainability goal and accompanying provisions, GSAs could go further than the permitting regimes for any south-western SPA by clearly referring to impacts on interconnected surface water and GDEs, as well as social equity or other considerations as relevant permitting criteria, consistent with their broad sustainability goals.

SGMA's wide discretionary permitting power might also be—and history suggests, likely will be—a challenge to pursuing sustainability. The lack of state constraint or a suggested structure in relation to GSAs' broad permitting powers might mean these powers go unused—casualties of a lack of political cover for regulating withdrawals that more constrained discretion might provide. Compared with other key south-western SPAs, SGMA's sparse permitting provisions contain a further disadvantage in their limited penalty provisions (low-level civil penalties only) relative to some other south-western SPAs. This may compromise enforcement of an agency's permitting regime.

Conclusion

SGMA represents a significant legislative leap for California groundwater regulation, granting local agencies wide powers to control groundwater extraction. Although adopting and implementing a sustainability plan is mandatory, significant discretion remains in the context of the permitting power. This discretion includes whether or not to use the permitting power. If the power is used, this discretion also includes the identification of the fundamental elements of the regime, representing an opportunity to translate the desire for local control into a permitting regime precisely tailored to local circumstances. Past experience under the common law and prior legislation suggests that local agencies will face cultural and political barriers to controlling groundwater withdrawals stringently (Nelson 2012). A credible state step-in power, as well as good information through regulations or BMP guidelines about options for regulating groundwater withdrawals will be crucial to ensure that this momentous change in groundwater law leads to momentous change on the ground. Our data on southwestern groundwater permitting regimes points to both regime components and policy settings for GSAs to consider, as well as future work testing the effectiveness of permitting regimes by linking key aspects of a regime with trends in physical conditions.

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Figures and Figure Captions

Figure 1: Map of selected special permitting areas used in comparative legal analysis.

Footnote for Figure 1: Geospatial data was acquired from state government websites

(<http://uair.library.arizona.edu> (AZ), http://www.ose.state.nm.us/GIS/geospatial_data.php

(NM); <http://water.nv.gov/mapping/> (NV); <http://www.twdb.texas.gov/mapping/gisdata.asp>

(TX)) or personal communication with personnel from state government officials (Lee

Eschler (UT), Kevin Rein (CO)).

Figure 2: Regulatory spectra demonstrated by permitting regimes for groundwater extraction in special permitting areas in south-western US states (colors match the corresponding SPA map, Figure 1).

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