



A GUIDE TO WATER QUALITY REQUIREMENTS UNDER THE SUSTAINABLE GROUNDWATER MANAGEMENT ACT

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LIST OF ACRONYMS

BMPs	Best Management Practices	GWPA	Groundwater Protection Areas
CalEPA	California Environmental Protection Agency	HRS	Hazardous Ranking System
CALPIP	California Pesticide Information Portal	ILRP	Irrigated Lands Regulatory Program
CAF	Confined Animal Facilities	LLNL	Lawrence Livermore National Laboratory
CAO	Cleanup and Abatement Orders	MCL	Maximum Contaminant Level
CCR	California Code of Regulations	NPL	National Priorities List
CDO	Cease and Desist Order	NWIS	National Water Information System
CDPH	California Department of Public Health	PBP	Priority Basin Project
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PUR	Pesticide Use Reporting
CERS	California's Environmental Reporting System	RCRA	Resource Conservation and Recovery Act
CIWQS	California Integrated Water Quality System	RGMP	Regional Groundwater Monitoring Program
DDW	Division of Drinking Water	SDWA	Safe Drinking Water Act
DOC	Department of Conservation	SGMA	Sustainable Groundwater Management Act
DOD	Department of Defense	SMC	Sustainable Management Criteria
DOGGR	Division of Oil, Gas, and Geothermal Resources	SWRCB	State Water Resources Control Board
DPR	Department of Pesticide Regulation	TRI	Toxic Release Inventory
DQO	Data Quality Objectives	UR No. 4	Undesirable Result Number 4
DTSC	Department of Toxic Substances Control	UIC	Underground Injection Control
DWR	Department of Water Resources	USDW	Underground Source of Drinking Water
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act	USEPA	U.S. Environmental Protection Agency
GAMA	Groundwater Ambient Monitoring and Assessment	USGS	U.S. Geological Survey
GSA	Groundwater Sustainability Agency	UST	Underground Storage Tanks
GSP	Groundwater Sustainability Plan	WDR	Waste Discharge Requirement



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1. EXECUTIVE SUMMARY

California's Sustainable Groundwater Management Act (SGMA) requires Groundwater Sustainability Agencies (GSAs) develop Groundwater Sustainability Plans (GSPs) that achieve sustainability within twenty years of Plan adoption. Meeting this goal requires GSAs to avoid causing any of the six undesirable results that are central to SGMA, including undesirable result number 4 (UR No. 4) – “significant and unreasonable degraded water quality” throughout the basin.

Unlike most other undesirable results, UR No. 4 is the subject of robust federal, state and local regulatory regimes carried out by a number of different entities. While the State and Regional Water Resources Control Boards have the broadest responsibilities to protect groundwater quality, many other agencies also have relevant responsibilities.

The other distinctive feature of UR No. 4 is that groundwater management that prevents chronic lowering of groundwater levels may be insufficient to prevent significant and unreasonable degradation of groundwater quality. For example, significant changes in groundwater pumping can potentially mobilize naturally occurring constituents or cause migration or expansion of contaminant plumes even when the extracted amount is within the basin's sustainable yield.

This Guide is intended to assist GSAs along with other agencies and stakeholders in understanding the meaning of UR No. 4, and to provide insights into how GSAs can successfully fulfill their legal responsibilities regarding groundwater quality. To avoid UR No. 4 under SGMA, this Guide recommends that GSAs do the following:

1. **Understand the existing regulatory regime for groundwater quality** and, as necessary, confer with entities that have regulatory authority over groundwater quality in their basins. (See Section 3 of this Guide).
2. **Consider existing federal, state and local groundwater quality standards when developing groundwater quality minimum thresholds in their basins.** Federal, state or local regulatory requirements were established after careful scientific study, legal review and procedural steps mandated by law. They are designed to protect public health and welfare, and they provide the clearest indication of the point beyond which there is a real risk of an undesirable result. (See Section 3.1).
3. **Work closely with their Regional Water Quality Control Boards** to address all groundwater quality issues. GSAs working in the Central Valley are especially encouraged to work with the Central Valley Regional Board to address salt and nutrient groundwater contamination. Programs in this region are continuing to evolve and will require that GSAs remain aware of changing regulatory requirements. Additionally, there are many groundwater quality monitoring efforts in this region that are generating a lot of groundwater quality data. These efforts should be aligned with any groundwater monitoring efforts being undertaken by GSAs. (See Sections 3.4.2 and 4.3.2).
4. **Use existing groundwater quality data and information** to (1) assess and prioritize groundwater quality issues in their basins, (2) meet requirements that GSPs include a description of current and historical groundwater conditions within the basin and (3) serve as either the basis for or a complement to local groundwater quality monitoring programs developed by GSAs. (See Sections 4 and 6).

5. **Consider the following approach (discussed in Section 3.2) if they identify groundwater quality problems that either arose or were exacerbated after January 1, 2015:**
 - **Where there is a significant groundwater quality problem that is clearly under the purview of another agency,** confer with that agency and seek to confirm a reasonable plan to address the groundwater quality problem. If such a plan exists, the water quality problem and the plan should be referenced in the GSP. Section 3 and Table 1 in the Guide provide information on existing regulatory programs and the agencies responsible for their enforcement.
 - **Where a significant groundwater quality problem is not clearly under the purview of another agency,** or the responsible agency is unable to confirm a reasonable plan to address the problem, confer with Regional or State Board staff, and perhaps affected parties, to identify a reasonable plan to address the problem. If no reasonable plan is identified, and remediating the problem is impractical, excessively wasteful of resources or otherwise infeasible, the GSA should include in the Plan an explanation of the problem and the reasons why remediation is impractical or infeasible.
6. **Consider the following approach (discussed in Section 5) if they are planning projects or actions that may affect groundwater quality:**
 - **Assess the potential impacts** that the projects or actions are likely to have on groundwater quality over time. If the GSA concludes that the proposed project or action could have unacceptable adverse impacts on water quality, GSAs should consider options such as revising the project to avoid or mitigate the project's impacts or developing alternative projects that avoid water quality problems.
 - **Ensure regulatory compliance** for any GSP management actions (e.g., recharge projects, water banking) that have the potential to negatively impact water quality in their basins or adjacent basins. (Sections 3 and 5 provide information on regulatory requirements and considerations associated with groundwater recharge and active basin management, respectively.)
7. **Develop supplemental groundwater monitoring networks where necessary.** Many basins being managed under SGMA have significant water quality data gaps. Thus, GSAs in many basins will likely need to develop or expand local groundwater quality monitoring networks. Decisions to do so should be informed by (1) the extent and quality of existing groundwater quality in the region, (2) the level of groundwater development, (3) the severity of existing groundwater quality issues and their proximity to domestic or irrigation wells, public water supply sources or other vulnerable users, (4) current or proposed groundwater management actions or projects, (5) local resources, and (6) the hydrogeologic complexity of the basin. (See Section 6).

GSAs are not responsible for enforcing existing water quality standards or collecting data to support existing water quality programs. However, they are responsible for avoiding “significant and unreasonable” degradation of water quality in their basins. Working with federal, state and local water quality monitoring and enforcement entities will help GSAs understand groundwater quality issues in their basins, enabling them to develop GSPs that avoid UR No. 4.

2 INTRODUCTION

In 2014, the state of California enacted the Sustainable Groundwater Management Act (SGMA) requiring that groundwater basins throughout the state be managed sustainably. SGMA defines “sustainable groundwater management” as “the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon¹ without causing [any of the six] undesirable results” listed in SGMA.^{2,3} This Guide is intended to assist GSAs, along with agencies and stakeholders, in understanding the meaning of “undesirable result” number four (UR No. 4), defined in SGMA as “significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies” caused by “groundwater conditions occurring throughout the basin.”⁴

In contrast to most other undesirable results, groundwater management that prevents chronic lowering of groundwater levels may not prevent UR No. 4. For example, significant changes in groundwater pumping can potentially mobilize naturally occurring constituents or cause migration or expansion of contaminant plumes even when the extracted amount is within the basin’s sustainable yield.

While measures aimed at improving sustainability – such as groundwater recharge projects and other active groundwater management initiatives – can ameliorate groundwater quality problems, there is also the possibility that they may negatively affect groundwater quality. Avoiding UR No. 4, therefore, will require GSAs to consider not only limits on extractions, but also whether actions taken pursuant to their GSPs may cause or contribute to water quality degradation.

The other distinctive feature of UR No. 4 is that groundwater quality is the subject of extensive federal, state and local regulatory regimes carried out by a number of different entities. The California Legislature has designated the State Water Resources Control Board (SWRCB), together with the Regional Water Quality Control Boards (Regional Boards) as “the principal state agencies with primary responsibility for the coordination and control of water quality” for both surface water and groundwater.⁵ In addition to the State and Regional Water Boards, other agencies with regulatory responsibility over groundwater quality include the United States Environmental Protection Agency (USEPA), and various state agencies including the California Department of Pesticide Regulation (DPR), Department of Conservation’s (DOC) Division of Oil, Gas, and Geothermal Resources (DOGGR) and Department of Toxic Substances Control (DTSC). Finally, counties and cities also have regulatory authority over some matters relating to groundwater quality, such as septic systems, well construction/destruction and storage/leakage of hazardous materials into the ground. SGMA does not directly address GSAs’ roles relative to these other entities with regulatory authority over groundwater quality.

1 Cal. Water Code § 10721(r). The planning and implementation horizon means a “50-year time period over which a groundwater sustainability agency determines that plans and measures will be implemented in a basin to ensure that the basin is operated within its sustainable yield.”

2 Cal. Water Code § 10721(v).

3 Cal. Water Code § 10721(x). The six “undesirable results” are the following effects caused by groundwater conditions occurring throughout the basin:

- (1) Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply;
- (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; and Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

4 Cal. Water Code § 10721(x)(4).

5 Cal. Water Code § 13001.

This Guide is intended to assist GSAs, and other agencies and stakeholders, in understanding the meaning of UR No. 4, and to provide insights into GSAs' responsibilities regarding groundwater quality under SGMA. In the Guide, we highlight the following:

1. The importance of GSAs understanding the regulatory regime for groundwater quality and collaborating with entities that have regulatory authority over groundwater quality in their basins;
2. The necessity for GSAs to gather all available groundwater quality data for their basins, and the potential need for additional groundwater quality monitoring. This is particularly important in groundwater basins being actively managed (e.g., undertaking groundwater recharge, changes in pumping patterns, conjunctive management);
3. The potential impact that degraded groundwater quality could have on GSAs' ability to achieve sustainability. Well-developed groundwater monitoring networks are likely to play an important role in helping GSAs identify water quality problems early, measure progress toward their water quality sustainability goal and avoid UR No. 4.

Section 3 of the Guide addresses federal, state and regional groundwater quality regulation. Section 4 identifies and summarizes groundwater quality related databases. It also provides a general roadmap to assist GSAs in navigating through the databases and locating the pertinent data. Section 5 focuses on aquifer management actions GSAs may undertake as part of GSP implementation that have the potential to reduce, create or exacerbate groundwater quality problems. Section 6 discusses the development of groundwater quality monitoring networks under SGMA and the conditions that are likely to require GSAs to collect supplemental groundwater quality monitoring data. Section 7 is the conclusion and recommendations.



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3 LEGAL REQUIREMENTS OF SGMA, AND OTHER FEDERAL, STATE AND LOCAL LAWS AND REGULATIONS PERTAINING TO GROUNDWATER QUALITY

3.1 SGMA's Approach to Water Quality⁶

As outlined above, the goal of SGMA is to achieve “sustainable management of groundwater basins.”⁷ To meet this goal SGMA requires GSAs to prepare GSPs that will achieve “sustainable groundwater management” within twenty years,⁸ and specifies the elements that are required to be in the GSPs as well as additional elements that must be included in the GSPs “where appropriate.”⁹

SGMA directs the California Department of Water Resources (DWR) to review GSPs to determine whether they contain the necessary and appropriate GSP elements and whether they are “likely to achieve the sustainability goal for the basin.”¹⁰ In doing so, DWR will consider “[w]hether the projects and management actions are feasible and likely to prevent undesirable results and ensure that the basin is operated within its sustainable yield.”¹¹

The SGMA Groundwater Sustainability Plans Emergency Regulations (GSP Regulations) lay out a road map of sustainability criteria to guide GSAs in crafting their GSPs. The regulations first define “sustainability indicator” as “any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results.”¹² They then specify “minimum thresholds” and “measurable objectives” as management criteria for each sustainability indicator.¹³ The minimum thresholds for each undesirable result “represent a point in the basin that, if exceeded, may cause undesirable results.”¹⁴ The GSP must define each undesirable result using a combination of one or more minimum thresholds.¹⁵ Measurable objectives “including interim milestones in increments of five years” are developed “to achieve the sustainability goal for the basin within 20 years of [GSP] implementation.”¹⁶

6 While UR No. 4 does not explicitly limit its focus to groundwater, we believe the primary focus of GSAs will be on groundwater rather than surface water quality. In situations where groundwater pumping causes surface water depletions that result in water quality concerns, that raises concerns about causing UR No. 6 – “significant and unreasonable impacts on beneficial uses of surface water,” a topic not addressed in this Guide.

7 Cal. Water Code § 10720.1.

8 Cal. Water Code §§ 10721(u), (v), (w) & (x), and § 10727.2(b)(1).

9 Cal. Water Code §§ 10727.2, 10727.4.

10 23 CCR § 355.4(b).

11 23 CCR § 355.4(b)(5).

12 23 CCR § 351(ah).

13 23 CCR §§ 354.28, 354.30. DWR Best Management Practices (BMP) for *Sustainable Management Criteria DRAFT* (SMC BMP), p.26, describes the relationship between “sustainability indicators,” “minimum thresholds,” and “undesirable results.”

14 23 CCR § 354.28(a). Minimum thresholds also serve the purpose of providing a quantitative metric that must be measured at a specified locations for the purpose of defining an undesirable result. 23 CCR §§ 354.28(a) and 354.36.

15 23 CCR §§ 354.26(c), 354.28(a).

16 23 CCR § 354.30(a).

Based on SGMA's inclusion of UR No. 4, it is clear water quality degradation must be addressed in a GSP. The GSP Regulations also make it clear that a GSA must develop minimum thresholds that address water quality degradation. A GSP, in its discussion of the minimum thresholds, must describe the facts and reasoning underlying the minimum thresholds, including “[h]ow state, federal or local standards relate to the relevant sustainability indicator.”¹⁷ If a minimum threshold differs from other applicable regulatory standards, the GSP must “explain the nature of and basis for the difference.”¹⁸ The GSP Regulations also list a number of other issues that must be addressed in the description of minimum thresholds.¹⁹

The GSP Regulations provide additional specific directions regarding minimum thresholds relating to water quality:

[t]he minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the [GSA] that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water or a location of an isocontour that exceeds concentrations of constituents determined by the [GSA] to be of concern for the basin. **In setting minimum thresholds for degraded water quality, the [GSA] shall consider local, state and federal water quality standards applicable to the basin** [emphasis added].²⁰

DWR, in both the GSP Regulations and its draft BMP for *Sustainable Management Criteria* (SMC BMP), recommends that GSPs discuss relevant standards that pertain to the sustainability indicator and elaborates on steps a GSA should take if it sets a minimum threshold for water quality that is different from a relevant federal, state or local regulatory standard:

[i]f the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.²¹

The SMC BMP goes on to recommend that:

[t]he minimum threshold metric for degraded water quality shall be water quality measurements that indicate degradation at the monitoring site. This can be based on migration of contaminant plumes, number of supply wells, volume of groundwater or the location of a water quality isocontour within the basin. Depending on how the GSA defines the degraded water quality minimum threshold, it can be defined at a site, along the isocontour line, or as a calculated volume.²²

17 23 CCR § 354.28(b)(5).

18 Id.

19 23 CCR § 354.28(b).

20 23 CCR § 354.28(c)(4).

21 23 CCR § 354.28(b)(5) and SMC BMP, p. 9. See <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-6-Sustainable-Management-Criteria-DRAFT.pdf>. BMPs are Best Management Practices; they are not regulations and thus not mandatory. DWR's *Framework* BMP (2016) at pg. 3 states: “BMPs are intended to provide clarification, guidance, and examples to help GSAs develop the essential elements of a GSP. . .The BMPs and Guidance Documents do not serve as a substitute for the GSP Regulations or the provisions in SGMA.” See <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-Framework.pdf>.

22 Id., p.10.

The SMC BMP then lists a number of additional considerations for GSAs in deciding what minimum thresholds to establish, including groundwater quality trends, the number of impacted wells, the volume of contaminated water, the sources of pollution, the steps being taken to address the problems and adjacent basins' minimum thresholds.²³

Based on the GSP Regulations and BMPs, in the vast majority of cases we recommend that minimum thresholds be set at levels no less strict than applicable federal, state or local regulatory requirements.

Federal, state and local regulatory requirements were established after careful scientific study, legal review and procedural steps mandated by law. They are designed to protect public health and welfare, and they provide the clearest indication of the point beyond which there is a real risk of an “undesirable result.” Only under exceptional circumstances, where a GSA identifies a reason grounded in both strong science and a sound legal basis, would it be appropriate to set a minimum threshold at a level less strict than applicable legal and regulatory requirements.²⁴ The GSA should also factor in all of the considerations listed in the BMP and the minimum threshold requirements of the GSP Regulations when determining which constituents are of concern in the basin. Potential for impairment due to other management decisions in the GSP, such as water level thresholds, or a GSP's implementing measures, should also factor into which constituents are of greatest concern in the basin.

Furthermore, in order for minimum thresholds to serve their purpose to help define undesirable results and ensure they are avoided, there must be a monitoring network that is capable of tracking compliance with those thresholds. In many cases, networks will have been set up by other agencies, but in some cases GSAs may have to create their own monitoring networks to supplement existing monitoring networks. Where an adequate network does not currently exist, we recommend that GSAs take the necessary steps to establish such a monitoring network at the earliest possible time.²⁵ The development of groundwater quality monitoring networks is discussed in Section 6 of this Guide.

3.2 GSAs' Responsibilities in Relation to Groundwater Quality Laws and Requirements

As discussed below, there is a large, robust regulatory structure – with federal, state and local components – already in place designed expressly to protect groundwater quality in California. The juxtaposition of the existing groundwater quality regulatory structure with SGMA's mandate that GSAs avoid “significant and unreasonable degraded water quality” presents GSAs with the question “to what extent are they – as opposed to the designated enforcement agency – responsible for ensuring compliance with groundwater quality laws and regulations?”

23 *Id.*, p.15.

24 A notable example where compliance with MCLs is unattainable at this time is nitrate concentrations in groundwater in the Tulare Lake Basin and Salinas Valley areas, which have been the focus of attention from both the state legislature and the State Board. Nitrate from fertilizer and animal waste has been accumulating in the groundwater in those locations for many decades. According to a UC Davis study, most nitrate detected in drinking water wells today was originally applied to the surface decades ago. Due to the lag time, “nitrate problems will likely worsen for decades” notwithstanding major efforts to address the problems. State Water Resources Control Board Report to the legislature “Recommendation Addressing Nitrate in Groundwater” (Feb. 20, 2013), p. 15. See https://www.waterboards.ca.gov/water_issues/programs/nitrate_project/docs/nitrate_rpt.pdf.

25 The GSP emergency regulations address monitoring networks in some detail. They require GSAs to have “a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal and long-term trends in groundwater and related surface conditions and yield representative information about groundwater conditions as necessary to evaluate Plan implementation.” 23 CCR § 354.34(a).

SGMA bestows broad powers on GSAs, authorizing them to “perform any act necessary or proper to carry out the purposes of [SGMA],”²⁶ and providing them with the “authority and the technical and financial assistance necessary to sustainably manage groundwater.”^{27,28} At the same time, SGMA expressly states that GSAs are not responsible for fixing undesirable results (including groundwater quality problems) that were already present before January 1, 2015.²⁹ It does not, however, directly address the degree to which GSAs might be obliged to address water quality problems that either arose before January 1, 2015 and since have been worsening, or that arose after January 1, 2015 and are not being adequately addressed by other regulatory entities. Because SGMA does not directly address these situations, GSAs are left to develop reasonable approaches that accord with the language and intent of SGMA and do not require that GSAs take over regulatory roles federal and state governments have assigned to others.

In the absence of explicit directions in SGMA, GSAs may consider taking the following approach, or something similar, when they identify groundwater quality problems that arose or were exacerbated after January 1, 2015, or that may arise from projects under consideration for implementation of the GSP (e.g., recharge projects, changing pumping patterns):

1. Where there is a significant groundwater quality problem that is clearly under the purview of another agency, confer with that agency and seek to confirm a reasonable plan to address the groundwater quality problem. If such a plan exists, the water quality problem and the plan should be referenced in the GSP.
2. Where a significant groundwater quality problem is not clearly under the purview of another agency, or the responsible agency is unable to confirm a reasonable plan to address the problem, confer with Regional Board or State Board staff, and perhaps affected parties, to identify a reasonable plan to address the groundwater problem. If neither State/Regional Board staff nor the GSA is able to identify a reasonable plan to address the problem, or if they conclude that remediating the problem is impractical, excessively wasteful of resources or otherwise infeasible, the GSA should include in the Plan an explanation of the problem and the reasons why remediation is impractical or infeasible. In cases where remediation is infeasible, GSAs may need to consider alternative water supplies, projects or actions to achieve their basins' sustainability goal.
3. Where the GSA is considering pursuing one or more projects or actions that may affect groundwater quality, it should:
 - assess those potential impacts to determine what they are likely to be and whether they will over time have a positive or negative impact on groundwater quality; and
 - if the GSA concludes that the proposed project or action could have unacceptable adverse impacts on water quality, GSAs should consider options such as revising the project to avoid or mitigate the project's impacts, or developing alternative projects that avoid water quality problems.

Pertinent federal, state and local water quality standards and the agencies responsible for their enforcement are summarized in Table 1 and Section 3.3 below.

26 Cal. Water Code § 10725.2(a).

27 Cal. Water Code § 10720.1(d).

28 SGMA also explicitly states that GSAs may “[t]ransport, reclaim, purify, desalinate, treat or otherwise manage and control polluted water, wastewater or other waters for subsequent use in a manner that is necessary or proper to carry out the purposes of this part.”

29 Cal. Water Code § 10727.2(b)(4). SGMA states that a GSP “may, but is not required to, address undesirable results that occurred before, and have not been corrected by, January 1, 2015.” *Id.*

3.3 Federal, State and Local Water Quality Standards Relating to Groundwater Quality

In this section, we set forth the federal, state and regional/local regulatory standards most relevant to minimum thresholds and avoidance of UR No. 4, with the important caveat that the regulatory requirements are constantly being updated and revised. They can be amended, eliminated or supplemented at any time by federal or state legislatures or other regulatory entities. GSAs are encouraged to keep abreast of changes to the regulatory requirements and programs discussed below.

Table 1. The regulating agencies and their jurisdiction.

Jurisdictions	Regulating agency	Guide Section: Legal	Guide Section: Data
Waste discharge requirements (WDRs and waivers); underground storage tanks; and groundwater clean-up programs	SWRCB	Sections 3.3.1, 3.4.2	Sections 4.2.1.1, 4.2.1.2
Overall groundwater quality (policies & enforcement); underground storage tanks; groundwater clean-up programs; Bay-Delta region; aquifer exemptions (SDWA)	SWRCB	Section 3.3.1	Sections 4.2.1.1, 4.2.1.2
Safe drinking water quality requirements	Division of Drinking Water (SWRCB, CalEPA)	Sections 3.3.2, 3.3.2.3	Sections 4.2.1.2., 4.2.1.2, 4.2.6
Hazardous waste management and remediation requirements	Department of Toxic Substances Control (CalEPA)	Section 3.3.3	Sections 4.2.1.1, 4.2.2
Superfund requirements; aquifer exemptions (SDWA)	United States Environmental Protection Agency	Section 3.3.4	Section 4.2.3
Underground injection wells (Class II); aquifer exemptions (under SDWA)	Division of Oil, Gas, and Geothermal Resources (DOC)	Sections 3.3.2.2, 3.3.6	Sections 4.2.1.1, 4.2.5
Pesticide use and reporting requirements	Department of Pesticide Regulation (CalEPA)	Section 3.3.5	Sections 4.2.1.1, 4.2.4
Well construction/destruction; wellhead protection; septic systems; storage/leaking of hazardous materials, etc.; pesticides; SDWA enforcement (where delegated by DDW)	Counties and cities	Section 3.4.3	Section 4.2.1.1

3.3.1 Federal Clean Water Act and California Porter-Cologne Water Quality Control Act

The most comprehensive federal law addressing water quality is the Clean Water Act, enacted in 1972 and administered by the USEPA in coordination with state and tribal governments.³⁰ The law applies to all “waters of the United States,” which are defined as surface waters and wetlands only – not groundwater.³¹ In contrast, California’s Porter-Cologne Water Quality Control Act (Porter-Cologne Act), including all its water quality requirements, applies to both groundwater (including saline water) and surface water.³² This Act sets a high standard for water quality protection, declaring that

the waters of the state shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible.³³

The Act designates the State Board, together with the nine Regional Boards, as the agency in charge of water quality, safe and reliable drinking water and water rights.³⁴ In carrying out those responsibilities, the State and Regional Boards implement requirements of both state law and the federal Clean Water Act. Unlike the federal Clean Water Act, the Porter-Cologne Act addresses both point source pollution and non-point source pollution of surface water and groundwater.

Each Regional Board adopts a Water Quality Control Plan, known as a “Basin Plan,” which sets forth the water quality requirements for the hydrologic region.³⁵ The overarching goal of Basin Plans is to protect the quality of groundwater and surface water for all beneficial uses. Each Basin Plan must be approved by both the State Board and USEPA.³⁶

Basin Plans must identify all beneficial uses of water (considering both present and future uses) and establish water quality objectives – the state equivalent of federal water quality standards – that will ensure the reasonable protection of the identified beneficial uses and the prevention of nuisance.³⁷ Basin Plans must also have an implementation program for achieving water quality objectives, which includes a time schedule and describes proposed monitoring activities to assess compliance with the objectives.³⁸

Anyone discharging waste³⁹ that could affect the quality of the surface water or groundwater of the state must submit a Report of Waste Discharge to the relevant Water Board and comply with State and Regional Board permitting requirements.⁴⁰ The State and Regional Boards’ regulatory tools to enforce groundwater quality requirements include Waste Discharge Requirements (WDRs), conditional

30 33 U.S.C. § 1251 et seq.

31 See 40 C.F.R. § 230.3(o)(2)(v).

32 Cal. Water Code § 13050(e).

33 Cal. Water Code § 13000.

34 Cal. Water Code §§ 174, 13001, 13225, 13240-13248.

35 The Central Valley Regional Water Quality Board is the only regional board with two separate Basin Plans – one for the Sacramento/San Joaquin Basin and another for the Tulare Lake Basin. The State Water Board adopts water quality control plans for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, coastal bays and estuaries and also adopts an Ocean Plan. https://www.waterboards.ca.gov/plans_policies/.

36 See Cal. Water Code §§ 13240-13248. USEPA approval is needed for only the portions of the Basin Plan that affect waters that fall under federal jurisdiction (otherwise known as “waters of the United States”) which do not include groundwater.

37 Cal. Water Code § 13241.

38 Cal. Water Code § 13242.

39 Waste is defined broadly to include sewage and all other liquid, solid, gaseous or radioactive waste substances. Cal. Water Code § 13050(d).

40 See, e.g., Cal. Water Code §§ 13260, 13263, 13243, 13269. Point source discharges to surface water that are regulated under the federal Clean Water Act require a federal National Pollutant Discharge Elimination System (NPDES) permit. The NPDES program has been delegated to the State to be implemented through the State and Regional Water Boards. Both state permits to discharge into groundwater and NPDES permits to discharge into surface water are referred to as Waste Discharge Requirement (WDR) permits.

waivers of WDRs and Basin Plan requirements and prohibitions. The most important of these is the WDR Program, which regulates both point and non-point “diffuse sources” discharges to land or to groundwater that could affect the quality of the groundwater,⁴¹ and which is implemented by both the State Board and the Regional Boards.⁴² The WDR Program permits and conditional waivers issued pursuant thereto must implement “any relevant water quality control plans,” including the Basin Plans.⁴³ Any party that violates conditions imposed by WDRs or WDR waivers may be subject to enforcement action. Importantly, all WDRs, except those that have been found not to pose a significant threat to water quality, must include individual, group or watershed-based monitoring.⁴⁴

Box 1. Types of groundwater pollution

Water quality is adversely impacted by pollutants that can be broadly sorted into two categories: point source pollution and non-point source pollution. Point source pollution originates from a single site, such as leaks from underground storage tanks, dry cleaners or other contaminated sites. Point source pollutants typically form distinct contaminant plumes that migrate through groundwater. Non-point source pollution comes from a variety of diffuse sources, including nitrate and other nutrients from fertilizer application; salts accumulated from irrigation waters; urban and agricultural pesticides; and car oil, sediment and other contaminants collected in urban stormwater. Non-point source pollutants occur at varying levels across significant areas of an aquifer and cannot typically be delineated into individual plumes.

WDRs and WDR waivers are among the most important state regulatory controls for ensuring protection of groundwater quality and compliance with Basin Plans. They regulate a wide array of discharges that could affect groundwater quality, including the following: agricultural runoff, domestic septic systems, injection wells, wastewater recycled for reuse or discharged to land, dairy operations and timber harvesting. The groundwater contaminants most frequently found to violate drinking water quality standards throughout the state are arsenic and nitrate, both of which pose significant health risks.⁴⁵

In addition to permitting authority over discharges to groundwater, the State and Regional Boards also have responsibility for cleanup and abatement of groundwater sites that were contaminated in violation of any WDR or other order from the Boards.⁴⁶ State and Regional Board groundwater site cleanups occur under four different regulatory programs: the Underground Storage Tank (UST) Program, the Site Cleanup Program (clean-up of non-federally owned sites where recent or historical unauthorized releases of pollutants occurred), the Department of Defense (DOD) Program (cleanup of federal facilities where releases of pollutants occurred) and the Land Disposal Program (cleanup of sites and facilities where waste was discharged to land).⁴⁷ In general, these programs are implemented by Regional Boards, which work with the responsible dischargers to establish schedules for investigation, cleanup and abatement.

41 WDRs are the state equivalent of USEPA permits for discharges into “waters of the United States” under the Clean Water Act, although federal permitting requirements apply only to point source discharges. See 33 U.S.C. §§ 1342, 1344. Conditional Waivers of WDRs, frequently used for non-point source or de minimis discharges such as irrigated lands discharges or small onsite wastewater treatment systems, are very roughly equivalent to the nationwide permits issued by USEPA under Clean Water Act § 404 for dredge or fill actions with minimal individual and cumulative adverse environmental impacts. For a description of EPA’s nationwide permit system, see <https://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/Nationwide-Permits/>.

42 Cal. Water Code §§ 13260-13276. See also SWRCB 2004 “Policy for Implementation and Enforcement of the Non-point Source Pollution Control Program.” https://www.waterboards.ca.gov/water_issues/programs/nps/docs/plans_policies/nps_iepolicy.pdf.

43 See Cal. Water Code § 13263(a).

44 Cal. Water Code § 13269(a)(2).

45 SWRCB, “Communities That Rely on a Contaminated Groundwater Source for Drinking Water – Report to the Legislature,” (Jan. 2013), p. 13. https://www.waterboards.ca.gov/water_issues/programs/gama/ab2222/docs/ab2222.pdf.

46 Cal. Water Code § 13304 et seq.

47 Cleanup of groundwater contamination sites also takes place under the purview of other state and federal agencies, including DTSC and USEPA (e.g., CERCLA, RCRA). See Sections 3.3.3 & 3.3.4 below.

Data on State and Regional Board cleanup and abatement programs are available in the Groundwater Ambient Monitoring and Assessment (GAMA) Groundwater Information System (discussed in Section 4.2.1.1 of the Guide). Through the GAMA Groundwater Information System, GSAs can learn where the groundwater contamination in their basins is controlled, not controlled or it is not known whether the contamination is controlled (“pending determination”).⁴⁸

3.3.2 Drinking Water Quality Requirements

3.3.2.1 Contaminant Limits for Public Water Systems

The federal Safe Drinking Water Act (SDWA)⁴⁹ is the federal law that protects public drinking water supplies – both surface water and groundwater. The SDWA protects drinking water through two primary mechanisms: (1) placing limits on the amount of contaminants allowed in public water supplies, and (2) ensuring that “underground sources of drinking water” (USDWs) are protected from contamination from underground injections.

The federal SDWA requires each state to assess the drinking water sources for all public water systems and, through the USEPA, establishes federal standards for drinking water contaminants in public water systems. These standards set the primary maximum concentration level (MCL) for specific contaminants in drinking water; states can adopt MCLs that are stricter than USEPA’s MCLs.⁵⁰

California has enacted its own Safe Drinking Water Act that implements the requirements of the federal Safe Drinking Water Act.⁵¹ Many of California’s MCLs are stricter than federal MCLs. The SWRCB’s Division of Drinking Water (DDW) enforces both federal and state drinking water quality requirements through a single program.

The SDWA (federal and state) MCLs are applicable only to “public water systems,” defined as systems that have either (1) 15 or more service connections, or (2) serve at least 25 individuals daily at least 60 days out of the year.⁵² Domestic wells and other systems providing drinking water that do not qualify as “public water systems” are not subject to these drinking water requirements.⁵³ “State small water systems” (those with 5 to 14 service connections and that do not regularly serve more than an average of 25 individuals per day over 6 months) are subject only to minimal water quality monitoring,⁵⁴ and domestic wells with 1 to 4 connections are not subject to any water quality regulation. In addition, the SWRCB may delegate to the local county health office the responsibility for enforcement of laws and regulations for public water systems with less than 200 service connections. As of July 2014, DDW had delegated SDWA enforcement responsibility to 30 of California’s 58 counties.⁵⁵

48 See, e.g., State Board’s Annual Performance Report for Fiscal Year 2016-17: https://www.waterboards.ca.gov/about_us/performance_report_1617/cleanup/41124_groundwater_contaminant_migration.shtml.

49 42 U.S.C. § 300f et seq.

50 EPA also establishes maximum contaminant level goals (MCLGs), which are non-enforceable, aspirational goals that allow for a margin of safety. Failure to meet MCLGs would not be considered UR No. 4.

51 Cal. H & S Code § 116270 et seq. See also Cal. H & S Code § 25249.5 et seq. (California Safe Drinking Water & Toxic Enforcement Act of 1986, also known as Prop 65).

52 Cal. Health & Safety Code § 116275(h).

53 In 2012, California enacted a Human Right to Water law recognizing that “every human being has the right to safe, clean, affordable and accessible water adequate for human consumption, cooking and sanitary purposes.” Cal. Water Code § 106.3. See Section 3.3.2.3. At this time, there are no explicit regulatory requirements associated with this law.

54 See 22 CCR §§ 64211 – 64217. The state may delegate permitting and oversight of state small water systems to counties. Cal. Health & Safety Code § 116330(a).

55 For a list of the counties and their delegation status, see “Safe Drinking Water Plan for California” (SWRCB) (June 2015), pp. 32-33: https://www.waterboards.ca.gov/publications_forms/publications/legislative/docs/2015/sdwp.pdf.

The state's MCLs and monitoring requirements are highly pertinent to SGMA implementation and avoidance of UR No. 4. California requires public water systems to sample drinking water sources, analyze them for regulated contaminants and determine compliance with the MCLs on a regular basis. Where USEPA and California have adopted different MCLs for a given contaminant, the stricter of the two MCLs (always the California standard) applies.⁵⁶ DDW electronically tracks the water quality monitoring done for regulated public water systems and determines whether those systems are in compliance with all MCLs.⁵⁷

There are many locations in the state where the data clearly demonstrate significant MCL exceedances in groundwater used for drinking.⁵⁸ Many of these groundwater quality problems are not directly subject to regulation under the federal and state SDWAs because they occur in domestic wells and other water systems too small to be covered by federal and state safe drinking water quality requirements. Most notable among these are large portions of the Central Valley, where groundwater found in many wells has significant salt and nitrate MCL exceedances resulting mainly from agricultural operations, but also from other discharges. The Central Valley Regional Water Quality Board has developed several regulatory programs to address these and other water quality issues. These programs are discussed in Section 3.4.2 of this Guide. Many of the groundwater basins with salt and nitrate MCL violations have also been designated by DWR as "critically overdrafted" basins.⁵⁹

As noted above, the SWRCB, through its DDW, or any local agency to which the SWRCB has delegated SDWA enforcement responsibility, is charged with enforcing the drinking water quality requirements.

GSA's are not responsible for enforcing drinking water requirements or for remediating violations of those requirements that were caused by others. However, GSA's are responsible for ensuring that their GSPs and the actions taken pursuant to those GSPs do not cause or contribute to exceedances of MCLs in water used for drinking, regardless of whether the water is regulated under the SDWAs. If a GSA believes it will be impossible for it to avoid creating or aggravating MCL exceedances in carrying out its GSP (through groundwater recharge, changes in pumping patterns, conjunctive management or other activities – see Section 3.2), we suggest that the GSA consult with the DDW and/or the relevant Regional Board to arrive at an agreed-upon strategy that will avoid, minimize and/or mitigate any anticipated harms.

Equally important, GSA's may seek from the SWRCB or the relevant Regional Board all available groundwater monitoring data obtained pursuant to the state and federal SDWAs. (See Section 4 for more information on existing state and regional groundwater quality databases).

56 For a list of applicable California and federal MCLs, see https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/ccr/MCLsEPAsDWP-2018-10-02.pdf. These enforceable MCLs are known as "primary" MCLs. EPA has also established non-mandatory "secondary" MCLs for 15 contaminants that do not pose a health risk. See <https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals>.

57 See https://www.waterboards.ca.gov/resources/data_databases/drinking_water.html.

58 See Section 3.3.2.3, "Human Right to Water," below.

59 See <https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization>.

3.3.2.2 *Underground Injection Wells and Protection of Drinking Water Aquifers*

The second regulatory program established in Part C of the SDWA protects USDWs from contamination by underground injection wells that dispose of waste underground.⁶⁰ Permits from USEPA are required for Class I, Class III and some Class V wells (injections including industrial and municipal, solution mining and non-hazardous fuel wastes). Permits from the California Department of Conservation (DOC), Division of Oil, Gas, and Geothermal Resources (DOGGR) are required for Class II wells. These include most oil and gas related injection wells, such as wells used to dispose of wastewater from oil and gas development, and enhanced recovery wells where fluids are injected to help recover oil and gas.⁶¹ The law and accompanying regulations set forth “minimum requirements for effective programs to prevent underground injection which endangers [USDWs].”⁶² The federal SDWA prohibits interfering with underground injection of brine or other fluids associated with oil or gas production, or any underground injection for secondary or tertiary recovery of oil or gas “unless such requirements are essential to assure that [USDWs] will not be endangered by such injection.”⁶³

USDWs are defined by USEPA as non-exempt aquifers containing groundwater with less than 10,000 mg/L total dissolved solids (TDS) at a quantity sufficient to supply a public water system.⁶⁴ An aquifer may be exempted only if (a) it does not currently serve as a source of drinking water, and (b) it cannot now and will not in the future serve as a source of drinking water.⁶⁵ In California, applications to exempt an aquifer from SDWA protections for purposes of oil and gas development must be approved by DOGGR, SWRCB and USEPA.⁶⁶

Unfortunately, DOGGR’s enforcement record in protecting drinking water aquifers from contamination by Class II injection wells has been poor, improving only recently in response to review, criticism and mandates from USEPA.⁶⁷ To comply with USEPA directives, the state (both the State Board and DOGGR) conducted a review of the approximately 50,000 Class II injection wells in California, and found that thousands of wells had been permitted for injection into a “potentially non-exempt underground source[s] of drinking water (USDW) aquifer,” contrary to the SDWA.⁶⁸ In general, the injection wells were drilled into deep aquifers containing TDS levels between 3000 and 10,000 mg/L.

In response to the review, the state adopted regulations setting forth a schedule for reviewing all suspect permitted injection wells, starting with those that posed the greatest near-term danger of harming drinking water sources, and setting deadlines from October 2015 to February 2017 by which the suspect wells would have to cease injection unless and until an aquifer exemption was approved for the location the injection was occurring.⁶⁹ As of early 2017, the state had stopped injection at 630 wells, both the State Board and USEPA were reviewing exemption proposals for approximately 1,650 wells and the agencies anticipated full compliance with SDWA Class II injection well requirements shortly thereafter.⁷⁰

60 42 U.S.C. § 300h; 40 C.F.R. Pts. 124, 144, 146.

61 See Cal. Health & Safety Code § 25159.10 et seq. (Toxic Injection Well Control Act of 1985); Cal. Pub. Res. Code §§ 3130-3161. The federal SDWA underground injection control program expressly excludes hydraulic fracturing wells that do not use diesel fuels from its requirements. 42 U.S.C. § 300h(d)(1)(B). Other oil and gas wells used for disposal of produced and flowback waters, enhanced recovery and hydrocarbon storage are Class II wells subject to SDWA permitting requirements. The SWRCB estimates there are approximately 55,000 oil and gas related injection wells in California, most of which are in Kern County.

62 42 U.S.C. § 300h(b)(1).

63 42 U.S.C. § 300h(b)(2).

64 40 C.F.R. § 144.3.

65 40 C.F.R. § 146.4.

66 Cal. Pub. Res. Code § 3131.

67 See January 17, 2017, letter from State Water Resources Control Board and DOGGR to U.S.E.P.A. Region IX. See https://www.conservation.ca.gov/dog/general_information/Documents/L_Michael%20Montgomery_UIC%20Well%20Review_01-17-17.pdf (“SWRCB/DOGGR January 2017 letter”). See also US EPA’s webpage titled “Oversight of California’s Underground Injection Control (UIC) Program: EPA and State Correspondence,” <https://www.epa.gov/uic/epa-oversight-californias-underground-injection-control-uic-program-epa-and-state-correspondence>.

68 Id.

69 14 CCR §§ 1760.1, 1779.1.

70 SWRCB/DOGGR January 2017 letter.

The vast majority of injection wells drilled into protected aquifers – around 80% – are located in Kern County.⁷¹ While the aquifers into which these wells were drilled are not currently used for drinking water or other human needs, they could be needed sometime in the future, especially where climate change impacts on water supplies are the greatest. GSAs in Kern County and other areas where injection wells are located should be aware of these problems and ensure the wells are adequately monitored so that contamination of potential drinking water aquifers does not occur.

3.3.2.3 Human Right to Water

Over 21 million people in California live in communities that rely on contaminated groundwater for their drinking water.⁷² According to the California Department of Public Health (CDPH), 265 communities that rely on contaminated groundwater had at least one MCL violation between 2002 and 2010.⁷³ Most of the systems that had MCL violations are located in the Southern California Inland Empire, the east side of the San Joaquin Valley, the Salinas Valley and the Santa Maria Valley. These numbers do not include state small water systems or domestic wells, which are not subject to MCL requirements. UC Davis scientists estimate that in Tulare Lake Basin and Salinas Valley, about 254,000 people are “currently at risk for nitrate contamination of their drinking water,” 34,000 of whom are served by domestic wells or other systems below the threshold for water quality regulation.⁷⁴ Many more people served by state small water systems and domestic wells elsewhere in the state also likely receive contaminated water.

In 2012, California became the first state in the nation to enact a law recognizing the human right to water. That law, codified in Cal. Water Code § 106.3, recognizes that “every human being has the right to safe, clean, affordable and accessible water adequate for human consumption, cooking and sanitary purposes.” The law’s intent is to underscore the importance of people having access to clean water and to direct state agencies to explicitly “consider” the human right to water in their actions. Specifically, agencies must consider the safety, affordability and accessibility of water “when revising, adopting or establishing policies, regulations and grant criteria” related to domestic water use.

In February 2016, the State Water Board adopted a resolution making the human right to water a “core value,” and adopting the “realization of the human right to water” as a top priority for the Water Boards.⁷⁵ The resolution underscored the Boards’ intent to consider the human right to water in carrying out their various water quality responsibilities.

The Human Right to Water law does not directly apply to any entities other than state agencies, and thus does not place any requirements directly on GSAs. Nevertheless, both DWR and the State Board (and other state agencies with regulatory responsibility over groundwater quality) are governed by Section 106.3 in carrying out all their responsibilities, including their responsibilities for implementing SGMA and reviewing GSPs. The Central Valley Regional Water Board’s approval in May 2018 of a Basin Plan amendment with provisions requiring permittees to “address the immediate needs of those drinking groundwater that exceeds the drinking water standard for nitrate,” underscores the Boards’ commitment to implement Section 106.3 in their regulatory actions.

71 Horsley Witten Group, “California Class II Underground Injection Control Program Review,” (June 2011) p. ES-3. <https://www.conservation.ca.gov/dog/Documents/DOGGR%20USEPA%20consultant's%20report%20on%20CA%20underground%20injection%20program.pdf>.

72 See generally, “Communities that Rely on Contaminated Groundwater (Draft),” State Water Resources Control Board (Feb. 2012), available at https://www.waterboards.ca.gov/gama/ab2222/docs/cmntes_rely_gw.pdf.

73 Id. at 74.

74 Thomas Harter, et al., “Addressing Nitrate in California’s Drinking Water: With a Focus on Tulare Lake Basin and Salinas Valley Groundwater – Report for the SWRCB Report to the Legislature,” University of California, Davis, Center for Watershed Sciences (January 2012), p. 3. See <http://groundwatermitrate.ucdavis.edu>.

75 SWRCB Resolution No. 2016-0010 “Adopting the Human Right to Water as a Core Value and Directing its Implementation in Water Board Programs and Activities.” https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2016/rs2016_0010.pdf.

Given that contaminated groundwater is the cause of the vast majority of instances where people lack access to “safe, clean, affordable and accessible” drinking water, we believe the best course of action for GSAs is to act as if they were state agencies and explicitly consider the human right to water in their actions. Accordingly, they should collaborate with their Regional Boards and any other relevant agencies to understand any threats to drinking water quality and seek assurance that appropriate steps are being taken to address those threats.⁷⁶ Following this course of action will ensure that neither DWR nor the State Board, in reviewing the GSPs, will find that they do not adequately address the human right to water.

GSAs undertaking groundwater recharge, conjunctive management, changing in pumping or other management actions that have the potential to mobilize contaminants or otherwise impact groundwater quality should consider the potential impacts of these actions on water quality in nearby domestic wells and other wells supplying drinking water systems. If contamination of those wells is expected and cannot be avoided or mitigated, GSAs may need to consider providing an alternate source of water.

3.3.3 Requirements Relating to Hazardous Waste in Groundwater

Federal and state requirements under the federal Resource Conservation and Recovery Act (RCRA)⁷⁷ and related state laws and regulations place controls on all phases of management of hazardous wastes, including generation, treatment, storage, transportation and disposal. DTSC is responsible for enforcement of RCRA and related state law hazardous waste requirements. California’s Hazardous Waste Control Law is the state’s equivalent of RCRA.⁷⁸ DTSC’s Hazardous Waste Management Program⁷⁹ and Site Mitigation and Restoration Program⁸⁰ both address groundwater protection through oversight of hazardous waste management and remediation. In addition, DTSC also is responsible for enforcement of the Toxic Injection Well Control Act of 1985, which requires monitoring and other requirements to protect against migration of toxic substances,⁸¹ and the Toxic Pit Cleanup Act of 1984, which is aimed at ensuring surface impoundments with liquid hazardous wastes are made safe or closed.⁸²

76 As noted elsewhere in this Guide, GSAs are not responsible for remediating groundwater quality problems that arose prior to January 1, 2015. In all likelihood the great majority of contaminated drinking water falls into this category. SGMA is less clear on a GSA’s responsibility to remediate groundwater quality issues that arose prior to January 1, 2015, but that are continuing to get worse.

77 42 U.S.C. § 6901 et seq. (1976).

78 Cal. Health & Safety Code § 25100 et seq. The California Hazardous Waste Control Law was enacted in 1972 and has been amended multiple times since then. In general, it is stricter than RCRA and regulates some non-RCRA wastes. California has also enacted various other laws relating to hazardous wastes, such as the Hazardous Waste Management Act of 1986 (re: landfill bans), and the Hazardous Waste Treatment Permitting Reform Act of 1992 (establishing a permitting program for treatment of hazardous waste by a waste generator). DTSC, as the state’s hazardous substances enforcement agency, is the primary repository of data on hazardous materials and waste.

79 See <https://www.dtsc.ca.gov/HazardousWaste/>.

80 See <https://www.dtsc.ca.gov/SiteCleanup/>.

81 Cal. Health & Safety Code § 25159.10 et seq.

82 Cal. Health & Safety Code § 25208 et seq.

As with the SDWA, the first and most important step for GSAs to take when considering hazardous waste pollution of groundwater is to investigate data contained in the California Environmental Protection Agency's (CalEPA's) Regulated Site Portal to ensure sufficient knowledge of sites in their basins that may pose a threat to groundwater quality. If a GSA is considering including in its GSP measures such as groundwater recharge, active aquifer management or the like that have the potential to mobilize contaminant plumes, the GSA will need to obtain all available data on such plumes and analyze the potential impacts of the proposed actions prior to submitting its Plan to DWR. A GSP that calls for actions that are found likely to exacerbate damage from underground toxic plumes is at risk of not being approved.

3.3.4 Requirements Relating to Superfund Sites

The federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund)⁸³ enacted in 1980 establishes a program to clean up uncontrolled or abandoned hazardous waste sites as well as accidents, spills and other emergency releases of pollutants and contaminants. The law established a federal "Superfund" to help fund the clean-ups and also authorized USEPA to seek cooperation and funding from "potentially responsible parties." The law addresses sites with the potential to release hazardous substances to air, surface water or groundwater. USEPA's National Priority List (NPL)⁸⁴ is a list of sites found to pose sufficient risk to public health and/or the environment as to qualify for long-term remediation under CERCLA.

The Superfund program is a federal program enforced by USEPA. The analogous California state program was created by the Carpenter-Presley-Tanner Hazardous Substances Account Act.⁸⁵ It governs primarily petroleum cleanup sites that are exempt from CERCLA. The state equivalent of the NPL is known as either the "Hazardous Waste and Substances Site List" or the "Cortese List."⁸⁶ This list is updated annually by CalEPA and is maintained on DTSC's EnviroStor website (which is part of CalEPA's Regulated Site Portal) as well as on CalEPA's website. Unfortunately, the Superfund program is severely underfunded, and as a result many toxic waste sites on the list are unlikely to be cleaned up in the foreseeable future.

GSA concerns regarding potential actions that could mobilize toxic plumes at the sites on the Superfund list are the same as those discussed above relating to hazardous waste groundwater pollution. The importance of avoiding mobilization and/or expansion of toxic plumes requires that GSAs obtain all available information regarding existing groundwater contamination so that their GSPs will not be likely to exacerbate these problems.

83 42 U.S.C. § 9601 et seq. (1980).

84 The NPL and a map of all the sites in the U.S. listed on the NPL, as well as a list of proposed NPL sites, are available at: <https://www.epa.gov/superfund/superfund-national-priorities-list-npl>.

85 Cal. Health & Safety Code § 25300 et seq. (1981).

86 See Cal. Government Code § 65962.5. A discussion of the Cortese List and the actual list itself may be found at: <https://calepa.ca.gov/sitecleanup/cortese/section-65962-5a/>. See also https://www.dtsc.ca.gov/SiteCleanup/Cortese_List.cfm. In addition, Health & Safety Code § 2536(b)(1) requires DTSC to publish and annually update a list of hazardous substance release sites subject to response actions.

3.3.5 Requirements Relating to Use of Pesticides

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)⁸⁷ mandates federal regulation of pesticide distribution, sale and use. The California Department of Pesticide Regulation (DPR) is responsible for enforcement of FIFRA and related state laws and regulations.⁸⁸ DPR plays a significant role in monitoring groundwater to avoid or limit pesticide contamination of groundwater. County agricultural commissioners are in charge of enforcement and permitting for use of restricted pesticides. DPR does regular surface water and groundwater sampling to monitor for pesticide contamination.

In 1985, after detection of pesticides in groundwater from legal pesticide use, California enacted the Pesticide Contamination Prevention Act.⁸⁹ The law requires that DPR take steps to protect groundwater from pesticide pollution if a pesticide is found in groundwater but continued use of the pesticide is allowed. DPR does this through its groundwater protection program, whereby it (1) identifies pesticides with potential to pollute groundwater, specifies "trigger values" for them and places them on its Groundwater Protection List;⁹⁰ (2) develops and maintains a database of wells sampled for pesticides; (3) identifies areas sensitive to pesticide contamination (known as groundwater protection areas); and (4) develops mitigation measures to prevent their movement in those areas.⁹¹ More than 3,700 GWPA cover about 2.3 million acres in the state.⁹²

Currently, DPR conducts three types of groundwater monitoring.⁹³ In addition to its databases of pesticide sampling in groundwater, DPR provides summaries of annual sampling and detections to the state legislature.⁹⁴

Identification of the GWPA⁹⁵ within each groundwater basin can help GSAs to design GSPs that will not exacerbate problems from any pesticides known to be in groundwater. GSAs can find DPR's annual well sampling reports and well inventory database and identify the locations of DPR's GWPA and mitigation measures on DPR's website.⁹⁶

3.3.6 Requirements Relating to Oil, Gas and Geothermal Development

In addition to regulating underground injection control (UIC) wells (discussed above in section 3.3.2.2), Regional Boards regulate well development drilling fluid and mud disposal and produced water disposal and reuse. Produced water discharges include discharges to ponds, discharges to roads for dust control and use of produced water as irrigation water. These discharges are regulated under individual and general WDRs. DOGGR consults with Regional Boards on WDRs or conditional waivers of WDRs

87 7 U.S.C. § 136 et seq. (1996).

88 See, e.g., the Pesticide Contamination Prevention Act, Cal. Food & Agricultural Code §§ 13141-13152; 3 CCR § 6000 et seq. for pesticide regulations in general and 3 CCR §§ 6800-6806 for groundwater protection pesticide regulations.

89 Cal. Food & Agricultural Code §§ 12141-13152.

90 The Groundwater Protection List (3 CCR § 6800[a]) may be found at: <https://www.cdpr.ca.gov/docs/legbills/calcode/040101.htm#a6800>.

91 See 3 CCR §§ 6487.3 – 6487.5.

92 A Guide to Pesticide Regulation in California (2017 Update) by California Department of Pesticide Regulation, p. 90. See: <https://www.cdpr.ca.gov/docs/pressrls/dprguide/dprguide.pdf>.

93 These are:

- 1) Monitoring for pesticides on a DPR-determined groundwater protection list, which lists pesticides with the potential to pollute groundwater;
- 2) Four-section survey monitoring to verify a reported detection and to help determine if a detected pesticide resulted from legal agricultural use; and
- 3) A well monitoring network. To track the effectiveness of regulations, DPR monitors the concentrations of pesticide residues in more than 60 specific domestic wells known to be contaminated. These wells are located in Fresno and Tulare Counties. Personal communications, DPR (2019).

94 Id.

95 A GWPA designation refers only to the **vulnerability** of groundwater to pollution rather than the **existence** of pollution. GWPA may or may not have existing pollution. See https://www.cdpr.ca.gov/docs/emon/grndwtr/gwpa_locations.htm.

96 See https://www.cdpr.ca.gov/docs/emon/grndwtr/gwpa_locations.htm and https://www.cdpr.ca.gov/docs/emon/grndwtr/gwp_sampling.htm.

for discharges from oil and gas operations to land. In 2017, the Central Valley Regional Board issued General Orders⁹⁷ addressing three different categories of WDRs for different types of oil field discharges to land.⁹⁸ There are many locations where waste fluids from oil and gas operations were disposed of in surface sump ponds in California; many of these sumps have been shown to cause contaminated groundwater quality plumes. GSAs can identify locations of these in the GAMA Groundwater Information System and determine whether pumping and recharge activities might affect nearby subsurface flow gradients.

Another step being taken to understand and address water quality in areas of oil and gas development is the Water Quality in Areas of Oil and Gas Production – Regional Groundwater Monitoring Program undertaken by the State Board.⁹⁹ The purpose of the program is to gain a greater understanding of the location of protected groundwater resources, the threats posed to them by oil and gas operations, the extent to which there is contamination from oil and gas development and the pathways or processes responsible for the contamination.¹⁰⁰ The data obtained from this program are discussed in Section 4.2.5.2 of this Guide.

3.4 State, Regional and Local Regulatory Programs and Policies Addressing Specific Groundwater Quality Issues

As noted above, groundwater quality requirements are included in each of the nine regions' Basin Plans. The State Board establishes overall policy regarding water quality laws and regulations, leaving the Regional Boards to adopt and incorporate into their Basin Plans specific policies and requirements tailored to each of their jurisdictions.

The two most pervasive groundwater quality problems in the critically overdrafted basins are excessive nitrate and salt. Highlighted below in Sections 3.4.1 and 3.4.2 are both statewide and regional programs addressing these problems. The Central Valley is the epicenter of these contamination problems. Because of the extensive measures being taken or under development in the Central Valley to address these issues, we describe the Central Valley's approaches to these issues in Section 3.4.2.

3.4.1 Other State Actions Addressing Groundwater Quality

3.4.1.1 Recycled Water Policy and Salt and Nutrient Management Plans

The State Board's "Policy for Water Quality Control For Recycled Water" (Recycled Water Policy),¹⁰¹ adopted in 2009 and revised in 2013 and again in 2018, requires each Regional Board to periodically (every five years) evaluate each basin or subbasin in its region to identify where salts and nutrients are a threat to water quality and require management planning to achieve water quality objectives. Those basins and subbasins identified as threatened must have a salt and nutrient management plan (SNMP) or a groundwater plan that is functionally equivalent to an SNMP, that includes implementation measures.¹⁰² The Policy encourages collaborative work to develop the SNMPs, with ultimate responsibility for adoption of the plans placed on the Regional Boards. The intent is both to encourage increased water recycling and at the same time to make certain that salts and nutrients from all

97 "General orders" issued by the State or Regional Boards apply to general categories of permits, discharges, or other matters, in contrast to regular orders that generally address specific matters brought to the Boards.

98 See "Waste Discharge Requirements General Order for Oil Field Discharges to Land," General Order Numbers R5-2017-0034, R5-2017-0035, and R5-2017-0036 at https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/#General.

99 See https://www.waterboards.ca.gov/water_issues/programs/groundwater/sb4/regional_monitoring/index.html.

100 See <https://ca.water.usgs.gov/projects/oil-gas-groundwater/index.html> and https://www.waterboards.ca.gov/water_issues/programs/groundwater/sb4/regional_monitoring/index.html.

101 See https://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/.

102 SWRCB Resolution No. 2018-0057 and "Amendment to the Policy for Water Quality Control for Recycled Water." See https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2018/rs2018_0057.pdf and https://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/docs/2018/121118_7_final_amendment.pdf.

sources are managed on a basin-wide or watershed-wide basis in a manner that ensures the attainment of applicable water quality objectives and protection of beneficial uses set forth in the Basin Plan.

The SNMPs may address contaminants other than salts and nutrients. They must include, among other things, measures to manage salt and nutrient loading on a sustainable basis, antidegradation measures¹⁰³ and a monitoring plan for salts, nutrients and constituents of concern or of emerging concern. Where water quality objectives for salts or nutrients are being exceeded or threatened to be exceeded, the Regional Water Board must consider incorporating the SNMP into the Basin Plan within one year of receiving the SNMP.¹⁰⁴

3.4.2 Central Valley Regional Water Board's Regulatory Approach to Groundwater Quality

3.4.2.1 Background

According to estimates by the United States Geological Survey (USGS), the Central Valley contains about one-sixth of the irrigated land in the United States and pumps about one-eighth of the groundwater pumped in the United States.¹⁰⁵ It produced 250 different crops with an estimated value of 17 billion dollars per year as of 2002.¹⁰⁶ About 83% of California's total agricultural groundwater use and 74% of its total groundwater use is extracted from Central Valley aquifers.¹⁰⁷ 90% of Central Valley residents rely at least to some extent on groundwater wells (either directly or through a water system that has groundwater as part of its portfolio) for drinking water, some of which are now unsafe.¹⁰⁸

DWR has designated the vast majority of groundwater basins in the Central Valley as "high priority"¹⁰⁹ under SGMA, due to factors such as the large amount of irrigated acreage and number of wells, the degree to which people rely on groundwater as their primary source of water and documented adverse impacts to groundwater. The majority of groundwater basins designated as "subject to critical conditions of overdraft" are located in the Central Valley.¹¹⁰

Salt accumulations in the Central Valley have resulted in 250,000 acres being taken out of agricultural production and 1.5 million acres being declared salinity impaired.¹¹¹ In the San Joaquin Valley alone, six million tons of additional salt accumulate every year.¹¹² Studies have found that maximizing current salt management practices would address only about 15% of the salt load, with roughly 85% of the accumulating salt remaining unmanaged, negatively affecting agricultural, municipal and domestic water uses.¹¹³

103 See https://www.waterboards.ca.gov/plans_policies/antidegradation.html.

104 See https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2013/rs2013_0003_a.pdf.

105 Thomas Reilly, Kevin Dennehy, William Alley and William Cunningham, United States Geological Survey, "Ground-Water Availability in the United States (Circular 1323)" (2008) ("USGS 2008 Groundwater Report"), p. 44. <https://water.usgs.gov/watercensus/AdHocComm/Background/Ground-WaterAvailabilityintheUnitedStates.pdf>.

106 Id.

107 California Natural Resources Agency, "California's Groundwater Update 2013" (April 2015), p.6. See

108 CV SALTS, Central Valley Salinity Alternatives for Long-Term Sustainability (2019), p. 3. See <https://www.cvsalinity.org/docs/committee-document/publc-education-and-outreach-docs/3963-outreachbrochure-high-resolutionenglish-revised-82718/file.html>.

109 See Draft 2018 SGMA Basin Prioritization Process and Results (May 2018) at p. 11. <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Basin-Prioritization/Files/2018-SGMA-Basin-Prioritization-Process-and-Results-Document.pdf?la=en&hash=5514FC9614BEE3BE0179626F7CF57C8BB0B6AF1A>. DWR released the final basin prioritization in January 2019. See <https://water.ca.gov/Programs/Groundwater-Management/Basin-Prioritization>.

110 See https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Critically-Overdrafted-Basins/Files/COD-basins_2016_Dec19.pdf?la=en&hash=639C9A1C3F7605858832DBF00764E62F82C8B6A4.

111 See Amendments to the Water Quality Control Plans for the Sacramento River and San Joaquin River Basins and Tulare Lake Basin to Incorporate a Central Valley-Wide Salt and Nitrate Control Program Final Staff Report (May 2018) ("CV Basin Plan Amendments") at p. 6. https://www.waterboards.ca.gov/rwqcb5/water_issues/salinity/2018_0531_sncp_bpa_final_stfrpt.pdf.

112 See "Overview of CV-SALTS Prioritization and Optimization Study (Sept. 2018). See <https://www.cvsalinity.org/docs/agendas-notes-and-materials/meeting-materials/3968-prioritizationoptimizationstudyfinaldraft-9-11-18/file.html> and <https://www.csus.edu/envs/for%20students/Gereghy.finalthesis.spring18.pdf>.

113 See CV Basin Plan Amendments, p. 11.

Excessive nitrate accumulations are also a major problem in the Central Valley and Salinas Valley, in some areas violating MCLs and rendering drinking water supplies unusable.^{114,115} Agricultural fertilizers and animal wastes applied to cropland are by far the largest regional contributors to nitrate in groundwater.¹¹⁶

3.4.2.2 CV-SALTS and Salt and Nitrate Control Program

The Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) program,¹¹⁷ a collaborative stakeholder effort initiated by the Central Valley Regional Board in 2006, was designed to develop a plan for sustainable salt and nitrate management in the Central Valley. After an extensive multi-year study, CV-SALTS developed a Salt and Nitrate Management Plan (SNMP) with both near- and long-term strategies for managing salts and nitrates in both groundwater and surface water.¹¹⁸ This SNMP was submitted to the Central Valley Regional Board in January 2017. The SNMP “provides an overarching framework for managing salt and nitrate in the Central Valley” through proposed strategies, policies and clarifications to the Basin Plans.¹¹⁹ The top priorities of the SNMP were to (1) ensure a safe drinking water supply, (2) achieve balanced salt and nitrate loadings, and (3) implement long-term and managed aquifer restoration programs where reasonable, feasible and practicable.

After receiving the SNMP, the Regional Board directed staff to develop plan amendments to incorporate recommendations from the SNMP into the Basin Plans to address the salt and nitrate water quality concerns in the Central Valley.¹²⁰ The result was a set of proposed amendments to the Basin Plans that would establish a Salt and Nitrate Control Program and provide recommendations for permitting and control of both salt and nitrate discharges to groundwater. The proposed Salt Control Program would be implemented in three phases, each of which is ten to fifteen years long, with priorities identified in Phase I that will inform Phases II and III. Two alternative permitting approaches are provided: a “Conservative Salinity Permitting Approach” and an “Alternative Salinity Permitting Approach” that requires participation in the Phase I Prioritization and Optimization Study and allows more flexibility through performance-based measures.

The first priority of the Nitrate Control Program is to ensure safe drinking water supplies, with an emphasis on “prioritized basins and sub-basins.” Where a permittee is causing an exceedance of nitrate (violating an MCL) in the groundwater in a public water supply or domestic well, the permittee must submit an Early Action Plan to address the immediate drinking water needs of those affected by the nitrate exceedance.¹²¹ The Program provides two pathways for compliance: individual permitting or, for dischargers that cannot meet the nitrate individual permitting requirements, creation of “management zones.” The management zones consist of multiple permittees and other local stakeholders in a defined area, e.g., a portion of a larger groundwater basin or subbasin, working collectively to ensure that people impacted by nitrates have safe drinking water while best practices and nitrogen

114 Final SNMP for Central Valley Water Board Consideration (2016), p. 1-1. See <https://www.cvsalinity.org/docs/committee-document/technical-advisory-docs/conceptual-model-development/3680-snpm-section-1-introduction-122016/file.html>.

115 Harter, T. and J.R. Lund (2012). Addressing Nitrate in California’s Drinking Water: With a Focus on Tulare Lake Basin and Salinas Valley Groundwater. Report for the State Water Resources Control Board Report to the Legislature, January 2012. Available at: http://watermanagement.ucdavis.edu/files/2214/5886/6964/Harter_et_al_2012_Addressing_Nitrate_in_CA_Drinking_Water.pdf.

116 Id.

117 For information on CV-SALTS, see, e.g., https://www.waterboards.ca.gov/centralvalley/water_issues/salinity/ and <https://www.cvsalinity.org>.

118 See Central Valley Regional Board Resolution R5-2018-0034, p.2 https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/resolutions/r5-2018-0034_res.pdf and <https://www.cvsalinity.org/docs/central-valley-snpm/final-snpm.html>.

119 Central Valley Regional Board, “Amendments to the Water Quality Control Plans for the Sacramento River and San Joaquin River Basins and Tulare Lake Basin to Incorporate a Central Valley-wide Salt and Nitrate Control Program – Final Staff Report (May 2018), p.5. See Central Valley Regional Board Resolution R5-2018-0034. See https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/resolutions/r5-2018-0034_res.pdf and https://www.waterboards.ca.gov/centralvalley/water_issues/salinity/2018_0531_sncp_bpa_final_stfrpt.pdf.

120 See id., and https://www.waterboards.ca.gov/centralvalley/water_issues/salinity/#cvsalts_overview for a discussion of this process.

121 Central Valley Regional Board, Attachment 1 to Resolution R5-2018-0034, pp. 26-27. https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/resolutions/r5-2018-0034_res.pdf.

management plans are implemented.¹²² Both the Salt and Nitrate Control Programs include an offsets policy, which allows the use of offset projects to comply with WDRs for groundwater.

The Central Valley Regional Board adopted the proposed amendments on May 31, 2018.¹²³ These amendments are currently awaiting consideration by the State Board.¹²⁴ As of the time of this Guide's publication, the State Board had not yet taken action on the amendments. Assuming these amendments or something similar is eventually adopted by the State Board, this approach to salt and nitrate contamination is likely to serve as a model in the future for other basins encountering significant salt and/or nitrate contamination problems.

CV-SALTS could potentially serve a helpful role in implementing SGMA in the Central Valley, as both undertakings involve the same stakeholders and address some similar problems. CV-SALTS could help coordinate implementation of the SNMP with implementation of SGMA, saving time and resources for agricultural landowners who are members of both coalitions and GSAs.

3.4.2.3 Irrigated Lands Regulatory Program

Prior to 2002, a statewide blanket waiver for agricultural waste discharges was in place, exempting discharges from any water quality permitting requirements. In response to legislation enacted in 1999, the blanket waivers were terminated in 2002. Shortly thereafter, the Central Valley Water Board established the Irrigated Lands Regulatory Program (ILRP) setting forth WDRs for agricultural discharges to surface waters. In 2012, the Central Valley Water Board extended the program to include agricultural discharges to groundwater.¹²⁵ ILRP enrollment is now required for all commercial irrigated agricultural operations unless they are covered under another program (e.g., dairy, poultry or bovine).¹²⁶ Farmers have the option of either enrolling through a coalition that assists growers with WDR compliance or enrolling individually.

Under the ILRP, growers are required to monitor discharges to either surface water or groundwater from their property, "with the coalitions monitoring representative wells for an aquifer and growers enrolled in the individual order monitoring their own wells onsite,"¹²⁷ although monitoring requirements vary in different locations.¹²⁸ In most cases, compliance and enforcement activities are carried out informally. Data from the ILRP are reported in the GAMA Groundwater Information System.

In other parts of the state where agricultural discharges have been found to cause or contribute to violations of groundwater quality requirements, Regional Boards have taken various approaches to the problem. All of the regions have orders addressing contamination of waters of the state from commercial irrigated agricultural lands, although the Regional Boards' WDR requirements are not all the same and not all programs address discharges to groundwater.

3.4.2.4 Waste Discharge Requirements for Dairies and Confined Animal Facilities

The association of dairies and other animal confinement facilities with elevated salts and nitrate in the groundwater in California and elsewhere has been known for decades. In response, the Central Valley Regional Board issued a general order with WDRs for dairies in 2007, under which dairies were required to prepare waste management plans and nutrient management plans, and to perform

122 Id.

123 Id.

124 The current Central Valley Basin Plans may be found at: https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/#basinplans.

125 SWRCB, "Irrigated Lands Regulatory Program – Frequently Asked Questions" (November 2016) ("SWRCB ILRP FAQ"). See https://www.waterboards.ca.gov/rwqcb5/water_issues/irrigated_lands/ilrp_faq.pdf.

126 See https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/regulatory_information/#howtoapply.

127 See SWRCB ILRP FAQ, fn. 125.

128 For example, on February 7, 2019, the Central Valley Regional Board amended IRLP General Orders for Growers in coalitions in the Central Valley, except for the Eastern San Joaquin River Watershed Area. See https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/ and https://www.waterboards.ca.gov/centralvalley/board_decisions/tentative_orders/1902/07_ilrp_go_amends/02_ilrp_wdrs_res.pdf.

groundwater monitoring on existing dairy wells, in addition to providing annual reporting.¹²⁹ The Board updated and strengthened those requirements in 2013.¹³⁰ The non-profit Central Valley Dairy Representative Monitoring Program, whose members represent over 1,000 Central Valley dairies, was created in 2010 to develop a representative monitoring and research program that identifies groundwater quality impacts and management practices that address groundwater degradation and reduce monitoring costs for dairies.¹³¹

In 2016, the Central Valley Regional Board adopted waste discharge requirements for poultry operations¹³² and in 2017 the Regional Board issued an order with requirements for non-dairy cattle facilities known as “Confined Bovine Feeding Operations,” which were similar to those in the previous dairy orders.¹³³ Some of the other Regional Boards with dairies have issued WDRs or conditional waivers of WDRs, some of which require groundwater monitoring, often on a case by case basis.¹³⁴ Some of the monitoring data resulting from these orders are included in the GAMA Groundwater Information System.

3.4.3 Local Regulation of Groundwater Quality

The vast majority of groundwater quality regulation is, as described above, addressed by federal and state laws and requirements. To a limited extent, however, local regulation also has a role in curtailing groundwater contamination. The most common county or city groundwater requirements relate to regulation of septic systems, well drilling, capping and destruction, wellhead protection and storage and/or leaking of hazardous materials. In some cases, local governments may require groundwater monitoring, for example, when a container of hazardous materials is known to be leaking or susceptible to leaking.

Section 13801 of the Water Code requires counties, cities and water agencies to “adopt a water well, cathodic protection well and monitoring well drilling and abandonment ordinance that meets or exceeds the standards contained in [DWR’s] Bulletin 74-18.” Those standards address well construction and destruction.¹³⁵ Water Code sections 13808-13808.8 require cities or counties overlying critically overdrafted groundwater basins to impose additional requirements on applications for well permits. These requirements will no longer apply after January 30, 2020.

Section 10727.4 of SGMA states that GSPs

shall include, where appropriate and in collaboration with the appropriate local agencies, elements addressing, all of the following [emphasis added]:

* * *

- (b) Wellhead protection areas and recharge areas.
- (c) Migration of contaminated groundwater.
- (d) A well abandonment and well destruction program.

* * *

- (g) Well construction policies.

* * *

- (k) Processes to review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity.

129 See https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2007-0035.pdf.

130 See https://www.waterboards.ca.gov/rwqcb5/board_decisions/adopted_orders/general_orders/r5-2013-0122.pdf.

131 See <http://www.cvdmp.org/index.html>.

132 See https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2016-0087.pdf.

133 See https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2017-0058.pdf.

134 See https://www.waterboards.ca.gov/santaana/water_issues/programs/dairies/docs/R8-2018-0001_General_WDR_CAF0.pdf; https://www.waterboards.ca.gov/northcoast/water_issues/programs/dairies/#DPU19; https://www.waterboards.ca.gov/rwqcb7/board_decisions/adopted_orders/orders/2013/0800cafo.pdf; https://www.waterboards.ca.gov/sandiego/board_decisions/adopted_orders/2008/r9_2008_0130.pdf; https://www.waterboards.ca.gov/northcoast/water_issues/programs/dairies/; and https://www.waterboards.ca.gov/coloradoriver/water_issues/programs/cafo/.

135 See https://water.ca.gov/LegacyFiles/pubs/groundwater/water_well_standards_bulletin_74-90_/ca_well_standards_bulletin74-90_1991.pdf.

Consultation is encouraged between GSAs and their respective county and city officials, and any other local entity with authorities relevant to groundwater protection, to ensure that adequate monitoring requirements and regulatory protections are in place. As described above, where current measures are not adequately protective, GSAs may want to collaborate with their local partners to ensure necessary measures to protect groundwater quality are established and enforced, either by the local agencies or by the GSAs through implementation of their GSPs.



Photo Credit: CA DWR

4 STATE, REGIONAL AND LOCAL INFORMATION PERTAINING TO GROUNDWATER QUALITY AND VULNERABILITY

This section of the Guide provides an overview of existing groundwater data and information that GSAs may find useful for characterizing groundwater quality in their basins. Specifically, this information may be useful in complying with the GSP Regulations requiring that GSPs include a description of current and historical groundwater conditions within the basin, including “groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes.”¹³⁶ Additionally, this information is likely to serve as either the basis for or a complement to local groundwater quality monitoring programs developed by GSAs. Additional information on monitoring networks, data gaps and management areas can be found in Section 6 of this Guide.

While GSAs are not responsible for enforcing existing water quality standards or collecting data to support existing water quality programs, they are responsible for avoiding “significant and unreasonable” degradation of water quality in their basins which occurred after Jan. 1, 2015. GSAs can benefit from working with federal, state and local water quality monitoring and enforcement entities to develop an understanding of existing water quality issues in their basins and the programs regulating them.

To avoid UR No. 4, GSAs can set up data collection and monitoring practices that proactively identify groundwater quality problems that require immediate or near-term attention or have the potential to limit groundwater management activities or projects outlined in their GSPs. The primary focus will be on avoiding or remediating legal or regulatory violations where they exist. However, UR No. 4 may occur even where there is no legal or regulatory violation (e.g., degradation of water quality in domestic wells). GSAs that identify a groundwater quality problem requiring immediate action or that has the potential to limit planned groundwater management actions will benefit from working with the relevant regulating agency to understand the extent of the issue and existing remediation efforts, and to develop a strategy to avoid exacerbating existing water quality issues.

4.1 Overview of Statewide Datasets Pertaining to Groundwater Quality

This section of the Guide provides a summary of existing information and data sources pertaining to groundwater quality in California, including tables with an overview of data sources, types of information, data accessibility and site links. Information and data listed in these tables are constantly changing, with new data or analyses being added or updated. We suggest that GSAs regularly revise datasets being used in GSP planning and implementation and update them with newly available information.

The authors have not conducted an analysis of the quality of information included in this section of the report. As per DWR recommendations, GSAs are encouraged to evaluate all existing water quality datasets prior to using them in their GSPs to ensure that they meet the Data Quality Objective (DQO) process outlined in the *USEPA Guidance on Systematic Planning Using the Data*

¹³⁶ 23 CCR § 354.16(d).

Quality Objective Process,¹³⁷ regulatory requirements¹³⁸ and data collection protocols outlined in DWR's guidance.^{139,140}

At the outset, it is important to note that interpretation of groundwater quality data is complex. Utilizing existing groundwater data is likely to help GSAs better understand existing groundwater quality issues in their basins; however, GSAs must take care to ensure that the data being integrated into their GSPs is of sufficient quality. Also, many of these data have received additional quality control and assurance, and in some cases, analyses – which may hinder their integration with other datasets. GSAs are encouraged to focus their analyses on groundwater quality trends and the methods used to calculate these trends rather than integrating data from a variety of sources.

As outlined in *DWR's BMP 1 Monitoring Protocols, Standards, and Sites*, GSAs should clearly define sustainability goals, minimum thresholds and measurable objectives for each sustainability indicator; basin boundaries, including any areas outside of the basin that may impact water quality in the basin; and the level of precision needed to accurately monitor progress toward basin goals.¹⁴¹ This information should serve as the basis for including groundwater quality information and data into GSPs.

Additionally, GSAs will benefit from a thorough analysis of groundwater quality information being integrated into their GSPs to ensure that they are aware of differences in spatial sampling density, temporal sampling frequency, sampling methodology, data analysis or the numerous other factors that may affect data quality, functionality and the ability to integrate information across datasets.

This section does not list all of the databases or tools that provide groundwater quality information. Rather, the authors have chosen to reference data portals that (1) contain information from a variety of sources, (2) include analysis of data that is likely to be useful for GSAs (e.g., GAMA - Priority Basin Project data and trends analysis), or (3) are not included in other sites.

4.2 Statewide Groundwater Quality Information

4.2.1 Broadly Applicable Groundwater Quality Information

Table 2 summarizes the broadly applicable groundwater quality datasets described in Sections 4.2.1.1 to 4.2.1.4.

137 See <https://www.epa.gov/sites/production/files/2015-06/documents/g4-final.pdf>.

138 23 CCR § 354.34 broadly and 23 CCR § 354.34(c)(4), which is specific to water quality.

139 DWR (2016). BMP 1 Monitoring Protocols, Standards, and Sites, p.5. See <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-1-Monitoring-Protocols-Standards-and-Sites.pdf>.

140 DWR (2016). BMP 2 Monitoring Networks and Identification of Data Gaps, p.5. <http://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-and-Identification-of-Data-Gaps.pdf>.

141 DWR (2016). BMP 1 Monitoring Protocols, Standards, and Sites, p.5. See <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-1-Monitoring-Protocols-Standards-and-Sites.pdf>.

4.2.1.1 GAMA Groundwater Information System

The SWRCB's GAMA program was developed to monitor and assess groundwater quality in basins that account for approximately 95% of the state's groundwater use.¹⁴² The program focuses on interagency collaborations; thus the GAMA Groundwater Information System includes data from:

- DPR
- DWR
- Water Board monitoring wells, including data from the following regulatory programs: confined animal facilities (CAF), oil and gas monitoring sites, leaking underground storage tanks, ILRP monitoring data, Cleanup Program Sites, and WDR sites
- GAMA – Domestic wells
- GAMA – Special studies
- GAMA – Priority basin project (PBP) (see Section 4.2.1.2)
- Public water system wells
- USGS National Water Information System (NWIS).^{143,144,145}

The GAMA Groundwater Information System includes numerous datasets that GSAs are likely to find useful in identifying pressing groundwater quality issues in their basins resulting from both point source and non-point source pollutants, including data from State and Regional Water Board regulatory programs.¹⁴⁶ Information in the GAMA Groundwater Information System can be searched by dataset (e.g., DPR, SWRCB Regulated Sites, etc.), data category (wells with groundwater quality data, groundwater elevation data, etc.), location or area filters (e.g., GSA boundaries), well depths (including screened interval), chemical constituent or other variables.

Data can be downloaded from the GAMA Groundwater Information System as text files and KML files for specific user identified areas or chemical constituents or in bulk statewide datasets. Statewide well location data can also be downloaded as GIS compatible files.

In addition to the GAMA Information System, the State Board has developed a GAMA online tool page that provides links to USGS data, a groundwater age data viewer, a Salt and Nutrient Management Plans Webmap and more.¹⁴⁷

142 See https://www.waterboards.ca.gov/water_issues/programs/gama/about.html.

143 See http://geotracker.waterboards.ca.gov/gama/gamamap/public/dataset_information.asp.

144 See http://geotracker.waterboards.ca.gov/gama/dataset_information.

145 State Board and USGS are currently working to integrate information from the Oil and Gas Regional Monitoring Program (Section 4.2.5.2) into the GAMA Groundwater Information System.

146 Geotracker (included in and referred to in the GAMA Information System as the “Monitoring Wells (Water Board Regulated Sites)” database) integrates data from the State and Regional Board regulatory programs, including:

- Cleanup Program Sites (note that this includes “non-federally owned” sites, including pesticide and fertilizer facilities, mine sites, drycleaners, landfills and many others);
- ILRP monitoring data;
- Data from cooperative groundwater monitoring programs implemented by agricultural facilities that are regulated by the State Board;
- Discharge from Confined Animal Facilities (CAF) regulated by the State Board and/or one of the Regional Boards;
- Leaking Underground Storage Tank Cleanup Sites and Permitted Underground Storage Tank Facilities;
- Oil and Gas Monitoring Sites; and
- Waste Discharge Requirement (WDR) sites. See: https://geotracker.waterboards.ca.gov/site_type_definitions.

147 See https://www.waterboards.ca.gov/water_issues/programs/gama/online_tools.html.

4.2.1.2 GAMA Priority Basin Project

One of the challenges in using the GAMA Information System is characterizing groundwater conditions within principal aquifers. The State Board and USGS have partnered on the California GAMA-Priority Basin Project (PBP) to develop a comprehensive set of information on groundwater quality in groundwater basins in California.¹⁴⁸ This analysis includes both public and domestic supply wells, which are used to characterize deep and shallow groundwater aquifers, respectively.¹⁴⁹

In addition to providing data and trends analysis, the GAMA-PBP provides detailed water quality reports that provide the fraction of the aquifer volume used by public supply wells above, near and below regulatory thresholds and explain why the constituents of concern appear at elevated levels. GSAs should know which wells in their basins currently exceed or are at risk of exceeding existing drinking water standards. Having a sufficient understanding of “at-risk areas” can help GSAs prioritize management actions or projects to improve water quality in those areas or, at a minimum, ensure that actions do not exacerbate existing water quality issues.

GAMA-PBP water quality reports can be accessed through the GAMA Groundwater Publication Webmap. Reports can be queried by location, project type and aquifer study unit.¹⁵⁰

The USGS is also developing a groundwater trends analysis tool, which is due to be released in Spring 2019.

4.2.1.3 SGMA Data Viewer

DWR's SGMA Data Viewer includes information and links to data specific to each of SGMA's six “undesirable results”. For groundwater quality, the SGMA Data Viewer provides links to the GAMA online tool pages referenced in Section 4.2.1.1 above and the Water Quality Portal, a cooperative data service supported by USGS, USEPA and the National Water Quality Monitoring Council.¹⁵¹

4.2.1.4 USGS Datasets

The USGS provides a wealth of federal, state and local information related to groundwater. All USGS groundwater quality data, regardless of the program under which they were collected, are available through the National Water Information System (NWIS) portal. This site includes records of surface water, groundwater, water quality and more.¹⁵² Data can be queried by state, county, site type, constituent type or many other variables. NWIS data can be accessed using a query feature or using a map viewer and can be downloaded as text or CSV files.

148 See <https://ca.water.usgs.gov/projects/gama/water-quality-results/>.

149 See <https://ca.water.usgs.gov/projects/gama/>.

150 See <https://waterboards.maps.arcgis.com/apps/webappviewer/index.html?id=1ea24606744847f3b7f1222289264e53>.

151 See <https://www.waterqualitydata.us/>.

152 See <https://waterdata.usgs.gov/nwis>.

Table 2. Broadly applicable groundwater information tools or databases.

Tool or database	Data	Data sources	Data downloadable?	Notes
State Board				
<i>GAMA Groundwater Information System</i> ^a	<ul style="list-style-type: none"> GW elevation data and Water quality data from: Public water supply wells, DPR sampling data, GAMA - project wells, including domestic and public water supply wells, State Board regulated sites, including data from: oil and gas, DOD, USTs, and ILRP, NWIS data, and DWR monitoring wells. 	<ul style="list-style-type: none"> USGS DWR DPR LLNL GAMA datasets DDW State Board 	Yes, data are available as text or excel files. Site data are available are GIS-compatible files.	<ul style="list-style-type: none"> GAMA Groundwater Information System integrates and displays groundwater monitoring and quality data from a variety of sources. Data can be queried by data type, chemical constituent, timeframe, location, or map area. Data and concentration summaries and links to local reports are also available. Well construction information is not available for all wells.
<i>GAMA Priority Basin Project (PBP)</i> ^b	<ul style="list-style-type: none"> Water quality data, including DOC, fecal coliform, major ions, field parameters, nutrients, arsenic and iron speciation, radioactivity and other parameters. 	<ul style="list-style-type: none"> Domestic and public supply wells sampled by the USGS for the California GAMA-PBP 	Yes, data are available as text or excel files.	<ul style="list-style-type: none"> Data can be queried by well type, analysis type, or chemical constituent. Public supply wells are used to assess deep groundwater resources. Domestic wells are used to assess shallow groundwater resources.
<i>GAMA Groundwater Publications Webmap</i> ^c	<ul style="list-style-type: none"> Publications and sampling details for deep and shallow well study units from the GAMA-PBP. 	<ul style="list-style-type: none"> Domestic and public supply wells sampled by the USGS for the California GAMA-PBP. 	Yes, reports can be linked to and downloaded as pdf files.	<ul style="list-style-type: none"> Provides information about GAMA Project areas and links to publications that characterize groundwater quality and trends in all major groundwater aquifers in California. Data can be searched by deep or shallow aquifer study units or location.
DWR				
<i>SGMA Data Viewer</i> ^d	<ul style="list-style-type: none"> GW levels GW storage Water quality Land subsidence Interconnected surface water Water budget Hydrogeologic conceptual model Boundaries 	<ul style="list-style-type: none"> Data specific to water quality from the GAMA Groundwater Information System and Water Quality Portal. 	Includes links to original data sources, many of which are publicly available and downloadable.	<ul style="list-style-type: none"> Spatial datasets related to undesirable results under SGMA. Some data can be displayed graphically. In some cases (e.g., water quality) links are provided to original data sources.
USGS				
<i>National Water Information System</i> ^e	<ul style="list-style-type: none"> Groundwater and surface quality data Water level/Flow parameters Meteorological parameters Physical parameters 	<ul style="list-style-type: none"> USGS NWIS 	Yes, data can be displayed in NWIS viewer or downloaded as graphs, tables, or tab-separated files.	<ul style="list-style-type: none"> Includes current and historical data. Data can be filtered by location, contaminant, site type or other variables. Data can be accessed through a queryable database or map viewer.

a. GAMA Groundwater Information System – <http://geotracker.waterboards.ca.gov/gama/gamamap/public/>

b. GAMA Priority Basin Project (PBP) – <https://ca.water.usgs.gov/projects/gama/water-quality-results/>

c. GAMA Groundwater Publications Webmap – <https://waterboards.maps.arcgis.com/apps/webappviewer/index.html?id=1ea24606744847f3b7f1222289264e53>

d. SGMA Data Viewer - <https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer>

e. National Water Information System - <https://waterdata.usgs.gov/nwis>

4.2.2 Information on Hazardous Waste

Table 3 summarizes datasets related to hazardous waste that may be useful for GSAs. Sections 4.2.2.1 to 4.2.2.3 provide descriptions of these datasets.

4.2.2.1 Regulated Site Portal

CalEPA's Regulated Site Portal integrates information about environmentally regulated sites and facilities in California from state and federal sources, including:

- CalEPA's California Environmental Reporting System (CERS), which tracks hazardous materials and waste;
- SWRCB's California Integrated Water Quality System (CIWQS), which manages information pertaining to sites discharging to surface water;
- DTSC's EnviroStor system, which tracks hazardous waste facilities and sites with known or suspected contamination;
- SWRCB's Geotracker site (see footnote 146 for details);
- SWRCB's Stormwater Multiple Application and Report Tracking System (SMARTS), which collects information on industrial and construction storm water management; and
- the Toxics Release Inventory (TRI) that contains information on chemicals managed by industrial or other facilities in California.¹⁵³

Data in the portal can be searched by location, regulatory program, violations or numerous other criteria and can be downloaded as a CSV file.¹⁵⁴ The portal also includes site summary reports.

4.2.2.2 Superfund National Priorities List

The USEPA's Superfund National Priorities List (NPL) is a list of all current, proposed or deleted sites of "national priority" among the sites of known or threatened releases of hazardous substances, pollutants or contaminants throughout the U.S.¹⁵⁵ This list can be viewed either as a list or in map view. Table 3 links to the homepage for the NPL list, which provides links to both the list and map view.

The graphical interface can be searched by state, NPL status, site name or other variables. Site descriptions include a summary site report and a Hazard Ranking System (HRS) score that provides information on the relative potential of sites to pose a threat to human health or the environment.¹⁵⁶ Summary reports of current, proposed or deleted NPL sites can be downloaded directly from the map view. NPL lists can be downloaded from the Superfund NPL homepage.¹⁵⁷

153 See <https://siteportal.calepa.ca.gov/nsite/about>.

154 See <https://siteportal.calepa.ca.gov/nsite>.

155 See <https://www.epa.gov/superfund/superfund-national-priorities-list-npl>.

156 See <https://www.epa.gov/superfund/introduction-hazard-ranking-system-hrs>.

157 See <https://www.epa.gov/superfund/superfund-national-priorities-list-npl>.

4.2.2.3 Cortese List

The Cortese List is a set of lists of hazardous or potentially hazardous sites compiled and submitted at least annually to CalEPA by DTSC, SWRCB and the California Integrated Waste Management Board.¹⁵⁸ Of specific interest to GSAs is (1) information pertaining to unauthorized leaks from underground storage tanks, which can be found on the State Board's GAMA Groundwater Information System site, (2) active cease and desist orders, or clean-up or abatement orders which can be found at the link included in Table 3, and (3) Hazardous Waste and Substance Sites, which are reported in the EnviroStor database and the Regulated Sites Portal outlined in Section 4.2.2.1 above.¹⁵⁹

As discussed in Sections 3.3.3, 3.3.4 and 5.2, the greatest risk related to hazardous materials in groundwater is that the GSA, in implementing its GSP, might take actions that mobilize underground toxic substances and exacerbate the harm from them. GSAs should be familiar with hazardous plumes in their basins and should coordinate with local regulators to ensure that management actions undertaken during GSP implementation do not negatively impact existing regulatory efforts.

The databases listed above are among the most useful and comprehensive, providing an excellent starting point for characterizing local groundwater quality conditions in a basin.

Table 3. Information on hazardous waste in groundwater.

Tool or database	Data	Data sources	Data downloadable?	Notes
CalEPA				
<i>Regulated Site Portal</i> ^a	Environmentally regulated sites and facilities, including: <ul style="list-style-type: none"> • hazardous waste and materials, • hazardous waste facilities and sites, and • storm water management sites. 	<ul style="list-style-type: none"> • CERS • CIWQS • DTSC • State Board • TRI 	Yes, data are available as CSV files.	<ul style="list-style-type: none"> • Data can be filtered by county, regulatory agency or program, or enforcement type. • Includes links to site summary reports. • Data can be plotted on the site's graphic interface or downloaded as CSV files.
<i>Cortese List</i> ^b	Lists released by EPA annually, at a minimum, of (issuing agency: <ul style="list-style-type: none"> • hazardous waste and substance sites (DSTC), • leaking USTs (SWRCB), • Solid waste disposal sites with waste constituents above hazardous water levels outside of water management units (SWRCB), and • "Active" CDO and CAO sites (SWRCB). 	<ul style="list-style-type: none"> • DTSC • State Board • Local enforcement agencies 	Yes, data are available in different formats from the different enforcement agencies.	

¹⁵⁸ Cal. Gov. Code § 65962.5

¹⁵⁹ See <https://calepa.ca.gov/sitecleanup/corteselist/>.

Tool or database	Data	Data sources	Data downloadable?	Notes
Environmental Protection Agency				
Superfund National Priorities List^c	<ul style="list-style-type: none"> All current, proposed or deleted sites of national priority resulting from known or threatened releases of hazardous substances, pollutants or contaminants. 	<ul style="list-style-type: none"> USEPA 	No	<ul style="list-style-type: none"> Graphically displays and lists all current and proposed NPL sites. Information can be sorted by state, region, proposed versus listed sites and other variables. Site descriptions include summary reports.

- Regulated Site Portal – <https://siteportal.calepa.ca.gov/nsite>
- Cortese List – <https://calepa.ca.gov/sitecleanup/corteselist/>
- Superfund National Priorities list – <https://www.epa.gov/superfund/superfund-national-priorities-list-npl>

4.2.3 Information on Drinking Water Quality

The DDW provides current and historical chemical data from water suppliers statewide available as database files. Data (and supporting files) from 1974 to present are available as database and word files.¹⁶⁰ See Table 4 for more information and links to the database files.

Additionally, the GAMA-PBP (see Table 1) focuses on groundwater aquifers that are used for drinking water supplies (public and domestic). Analyses from GAMA-PBP are particularly important because finding information from “state small water systems” and domestic wells, which are subject to minimal or no water quality monitoring or regulation, can be challenging. At present, the GAMA-PBP has a complete set of interpretive reports for the deep/public supply portion of aquifers and is currently developing domestic well/shallow water assessments to complement the public supply information.¹⁶¹

Table 4. Information on drinking water quality.

Tool or database	Data	Data sources	Data downloadable?	Notes
State Board				
Water Quality Analysis Database Files^a	<ul style="list-style-type: none"> Statewide current and historical chemical data from water suppliers. 	<ul style="list-style-type: none"> DDW 	Yes, data are available as database files.	<ul style="list-style-type: none"> Provides current and historical (1974 to present) chemical data from water suppliers as database files intended for use in a database software program.
GAMA-PBP^b	See Table 1 for information			

- Water Quality Analysis Database Files – https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/EDTlibrary.html
- GAMA-PBP – <https://ca.water.usgs.gov/projects/gama/water-quality-results/>

¹⁶⁰ See https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/EDTlibrary.html.

¹⁶¹ See <https://waterboards.maps.arcgis.com/apps/webappviewer/index.html?id=1ea24606744847f3b7f1222289264e53>.

4.2.4 Information on Pesticide Use Pertaining to Groundwater Quality

The GAMA Groundwater Information System includes data from the DPR’s groundwater sampling program. However, GSAs may also find other information and resources provided by DPR useful, including the California Pesticide Information Portal (CalPIP), which contains pesticide use reporting (PUR) data, which details information on the pesticides being used, and the crops and locations they are being used on. CALPIP also includes information on Groundwater Protection Areas (GWPA)s¹⁶² which can be used to identify areas that are prone to pesticide contamination.¹⁶³ PUR data from CALPIP can be searched by year, location, site, crop type or chemical type and downloaded as a tab-delimited text file or HTML table.¹⁶⁴ DPR also provides GWPA maps, shapefiles and KML files.¹⁶⁵ Table 5 provides links and descriptions of the data tools described above.

Table 5. Information on pesticide use pertaining to groundwater quality.

Tool or database	Data	Data sources	Data downloadable?	Notes
Department of Pesticide Regulation				
California Pesticide Information Portal ^a	<ul style="list-style-type: none"> Pesticide use reporting (PUR) data, and Groundwater Protection Areas (GWPA)s. 	DPR	<ul style="list-style-type: none"> Yes, PUR data can be downloaded as text files or HTML tables. Yes, GWPA)s can be downloaded as maps, shapefiles, or KML files. 	<ul style="list-style-type: none"> PUR Data can be queried by location, chemical type, year, product or other variables. GWPA data can be queried by location. Lists and pdf maps of GWPA)s by county are also available.
Groundwater protection areas ^b	<ul style="list-style-type: none"> GWPA maps and county lists 	DPR	<ul style="list-style-type: none"> Yes, GWPA)s can be downloaded as maps, shapefiles, or KML files. 	<ul style="list-style-type: none"> GWPA)s can be searched through the California Pesticide Information Portal. Lists and pdf maps of GWPA)s by county are also available.

a. California Pesticide Information Portal – <https://calpip.cdpr.ca.gov/main.cfm>

b. Groundwater protection areas – https://www.cdpr.ca.gov/docs/emon/grndwtr/gwpa_locations.htm

4.2.5 Information on Oil and Gas

Table 6 provides information on groundwater quality in areas of oil and gas production, oil and gas well locations and well simulation sites.

162 A GWPA is a one-square mile section of land that has been identified as “sensitive to the movement of pesticides. Pesticide use is restricted in these areas. For more information on GWPA)s see: https://www.cdpr.ca.gov/docs/emon/grndwtr/gwpa_locations.htm.

163 See <https://calpip.cdpr.ca.gov/main.cfm>.

164 Id.

165 See https://www.cdpr.ca.gov/docs/emon/grndwtr/gwpa_locations.htm.

4.2.5.1 Department of Geothermal and Gas Regulation

As discussed in Sections 3.3.2.2 and 3.3.6, DOGGR has state and federal authority to regulate UICs. The disposal of well development fluids is regulated by the Regional Boards in consultation with DOGGR. Oil and gas monitoring data from DOGGR is included in the GAMA Groundwater Information System (Section 4.2.1.1). However, well location data can also be accessed directly through DOGGR's online mapping application Well Finder.¹⁶⁶

Well stimulation permits¹⁶⁷ and stimulated well sites can be searched using DOGGR's graphical CalStim'D tool¹⁶⁸ or the well stimulation treatment (WST) disclosure search site.¹⁶⁹ Wells can be searched by location or API number in CalStim'D or by date range or chemical constituent in the WST disclosure site, respectively. Note that as required under SB4 regulations, these sites only include well stimulation disclosures beginning on Jan. 1, 2014, or later.¹⁷⁰

4.2.5.2 Water Quality in Areas of Oil and Gas Production – Regional Groundwater Monitoring Program

In addition to the data collected by DOGGR, the State Board has partnered with the USGS to implement a Water Quality in Areas of Oil and Gas Production – Regional Groundwater Monitoring Program (RGMP) focusing on the oil and gas activities that have the potential to contaminate groundwater.¹⁷¹ While referred to as a regional program, the goal of the RGMP is “to systematically and comprehensively collect and interpret information that will support management and protection of waters designated for any beneficial use, while prioritizing the monitoring of groundwater that is or has the potential to be a source of drinking water.”¹⁷²

RGMP criteria were adopted in 2015.¹⁷³ As a result, only preliminary analyses and exploratory data from the program are available at this time. Data from RGMP can be downloaded as excel files and are currently being integrated into the GAMA Groundwater Information System.¹⁷⁴ USGS reports on salinity mapping and preliminary analyses of exploratory data are also available. These reports focus on the Los Angeles Basin and the southern San Joaquin Valley. Datasets and interpretive reports are updated as new information and analyses become available.¹⁷⁵

166 See <https://maps.conservation.ca.gov/doggr/wellfinder/#openModal/-118.94276/37.09381/6>.

167 Includes well stimulation information beginning on Jan. 1, 2014. Well stimulations disclosed between Jan. 1, 2014 and Jun. 30, 2015 were submitted under an interim version of regulation 14 CCR § 1788. Well stimulations disclosed after Jun. 30, 2015, have been submitted under the final implementation of the regulations.

168 See <https://maps.conservation.ca.gov/doggr/calstimd/#openModal>.

169 See <https://secure.conservation.ca.gov/WSTDisclosure>.

170 See https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB4.

171 See https://www.waterboards.ca.gov/water_issues/programs/groundwater/sb4/regional_monitoring/index.html#overview.

172 Id.

173 See https://www.waterboards.ca.gov/water_issues/programs/groundwater/sb4/area_specific_monitoring/docs/model_criteria_final_070715.pdf.

174 See https://www.waterboards.ca.gov/water_issues/programs/groundwater/sb4/regional_monitoring/index.html#overview.

175 See <https://ca.water.usgs.gov/projects/oil-gas-groundwater/>.

Table 6. Information on groundwater quality in areas of oil and gas production.

Tool or database	Data	Data sources	Data downloadable?	Notes
Department of Conservation				
<i>Well Finder</i> ^a	<ul style="list-style-type: none"> Oil and gas well locations, information and records Information about other oil and gas facilities 	<ul style="list-style-type: none"> DOGGR through third party reporting 	<ul style="list-style-type: none"> Yes, well locations can be exported as excel files. Well data and reports can be downloaded as pdf or tif files. 	<ul style="list-style-type: none"> Includes well status and type that can be filtered by location. Data can be viewed graphically.
<i>CalStim'D</i> ^b	<ul style="list-style-type: none"> Well stimulation permits and sites Oil and gas field locations 	<ul style="list-style-type: none"> DOGGR 	No	<ul style="list-style-type: none"> Well stimulation sites and permits can be searched by location or API number. Includes well stimulation disclosures from Jan. 1, 2014 to present.
<i>Well Stimulation Treatment Disclosure Search</i> ^c	<ul style="list-style-type: none"> Well stimulation permits and sites 	<ul style="list-style-type: none"> DOGGR 	No	<ul style="list-style-type: none"> Well stimulation sites and permits can be searched by date or chemical constituent. Includes well stimulation disclosures from Jan. 1, 2014 to present.
State Board				
<i>Water Quality in Areas of Oil and Gas Production – Regional Groundwater Monitoring Program</i> ^d	<ul style="list-style-type: none"> Salinity mapping Produced water characterization Groundwater potential risk zone analysis 	<ul style="list-style-type: none"> USGS Produced water data State and Regional Boards, DOGGR and others. 	Yes, data can be downloaded for individual regional study area as excel files. Report files are available as pdf files.	<ul style="list-style-type: none"> There are several reports resulting from exploratory sampling, including reports from Los Angeles Basin and southern San Joaquin Valley, as well as reports on salinity mapping of 31 oil fields and adjacent aquifers. Data from Kern County, southern San Joaquin and other regions are available for download.

a. Well Finder – <https://maps.conservation.ca.gov/doggr/wellfinder/#openModal/-118.94276/37.11133/6>

b. CalStim'd – <https://maps.conservation.ca.gov/doggr/calstimd/#openModal>

c. Well Stimulation Treatment Disclosure Search – https://secure.conservation.ca.gov/WSTDisclosure/?BeginDate=&EndDate=01%2F01%2F2014&Chemical=&ChemCASNumber=&CASNumber=&TradeName=&DataBaseSource=Both&wellInfoDataTableID_length=10

d. Water Quality in Areas of Oil and Gas Production – Regional Groundwater Monitoring Program – https://www.waterboards.ca.gov/water_issues/programs/groundwater/sb4/regional_monitoring/index.html#overview

4.2.6 Vulnerability Assessment Tools

Table 7 provides an overview of two vulnerability assessment tools that GSAs may find helpful in assessing potential risks to groundwater. These tools are summarized below in Sections 4.2.6.1 and 4.2.6.2.

4.2.6.1 EnviroScreen

The CalEPA's Office of Environmental Health Hazard Assessment has developed EnviroScreen, an online tool that displays maps of pollution burden scores, as well as composite indicators. Of particular interest to GSAs are the drinking water contaminant index,¹⁷⁶

176 See <https://oehha.ca.gov/media/downloads/calenviroscreen/report/ces3report.pdf#page=45>.

the groundwater threat indicator¹⁷⁷ and the pesticide exposure indicator.¹⁷⁸ This tool may provide GSAs with an overview of potential impacts to groundwater quality in their basins and the datasets to aid in assessing them. Data from the site can be downloaded in a variety of formats depending on data type.

4.2.6.2 Drinking Water Vulnerability Tool

The Community Water Center (CWC) is currently developing the Drinking Water Vulnerability Tool. The tool assesses the vulnerability of domestic and community water supplies to changes in water levels resulting from chronic groundwater declines, drought and other factors, as well as water quality impacts. A first version of the tool is set to be released in Winter 2019.

Table 7. Information on vulnerability assessment tools pertaining to groundwater.

Tool or database	Data	Data sources	Data downloadable?	Notes
Office of Environmental Health Hazard Assessment				
<i>CalEnviroScreen</i> ^a	<ul style="list-style-type: none"> • CalEnviroScreen scores for all California census tracts. • Scores for pollution burden, including groundwater threats, drinking water contamination, clean ups, pesticides, and other indicators of pollution burden, and population characteristics by census tract. 	<ul style="list-style-type: none"> • Various data sources. • Information about the tools and the methods used to calculate the CalEnviroScreen scores can be accessed from the site. 	Yes, data are available in a variety of formats depending on data type.	<ul style="list-style-type: none"> • Screening tool to help identify communities burdened by or susceptible to multiple sources of pollution. • CalEnviroScreen scores can be viewed graphically by census tract. • CalEnviroScreen scores are calculated from the scores of two indicator groups: Pollution Burden and Population Scores. • Indicators scores can also be viewed individually by census tract. • Extensive documentation on indicator development can be accessed from the site.
Community Water Center				
<i>Drinking Water Vulnerability Tool</i>	<ul style="list-style-type: none"> • Domestic well communities • Community water systems • Groundwater quality estimation • Water supply estimation • Community demographics 	<ul style="list-style-type: none"> • Various data sources. 		<ul style="list-style-type: none"> • Release of this tool is anticipated in Winter 2019.

a. CalEnviroScreen – <https://oehha.ca.gov/calenviroscreen/maps-data>.

177 See <https://oehha.ca.gov/media/downloads/calenviroscreen/report/ces3report.pdf#page=81>.

178 See <https://oehha.ca.gov/media/downloads/calenviroscreen/report/ces3report.pdf#page=54>.

4.3 Regional and Local Information Pertaining to Groundwater Quality

4.3.1 Regional Boards

As mentioned above, California has nine Regional Boards. These Boards are semi-autonomous and have water quality basin plans and regulatory programs specific to each region. GSAs are encouraged to reach out to and work with Regional Boards with jurisdiction over their basins.

Section 3.4.2 of the Guide provides an overview of Central Valley Regional Board programs regulating discharges to groundwater. These include the ILRP, confined animal facilities and the CV-SALTS and SNMP. Data and information resulting from the ILRP and confined animal facilities are discussed in Sections 4.3.2.1 and 4.3.2.2, respectively.

The proposed amendments to integrate SNMP recommendations into the Central Valley Basin Plans, including monitoring efforts, are well described in Section 3.4.2 of this Guide. Because these amendments are currently awaiting consideration by the State Board,¹⁷⁹ we do not discuss associated monitoring efforts below.

4.3.2 Central Valley Regional Water Quality Board Groundwater Quality Monitoring Data

4.3.2.1 Monitoring Data from the Irrigated Lands Regulatory Program

ILRP requires all commercial agricultural operations unless they are covered under another program (e.g., dairy, poultry or bovine) to have a WDR for discharges to surface water and groundwater.¹⁸⁰ Under the ILRP, monitoring and reporting are done through third-party groups (coalitions) or by individual growers.¹⁸¹

Note that in May 2017, the Central Valley Regional Board revised the ILRP Monitoring and Reporting Program Orders to allow all agricultural coalitions, or other third parties, to participate in a “Regional Groundwater Quality Trend Monitoring Group” in lieu of individual third-party groundwater quality trend monitoring programs.¹⁸² This revision prompted the development of the Central Valley Groundwater Monitoring Collaborative (CVGMC) (a collaborative program, which currently is comprised of ten agricultural coalitions and covers most of the San Joaquin Valley) that seeks “to determine current water quality conditions of groundwater in the third-party areas, and to develop long-term groundwater quality information that can be used to evaluate the regional effects of irrigated agriculture and its practices.”¹⁸³

The CVGMC’s Groundwater Quality Trend Monitoring Program, which lays out a three-phase approach for monitoring program development, was conditionally approved by the Central Valley Regional Board in November 2017.¹⁸⁴ The Phase 1 Technical Work Plan was submitted to Central Valley Regional Board in May 2018¹⁸⁵ and is currently pending review.

179 The current Central Valley Basin Plans may be found at: https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/#basinplans.

180 See https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/regulatory_information/#howtoapply.

181 Id.

182 See https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/eo_decisions/2017_0505_gtmp_group_eo_aprvl.pdf. See also Central Valley Groundwater Monitoring Collaborative, Oct. 2017, p. 4. https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/water_quality/coalitions_submittals/trend_monit_groups/2017_1031_cvgmc_concept_wrkpln.pdf.

183 See https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/eo_decisions/2017_0505_gtmp_group_eo_aprvl.pdf, pg. 1.

184 See https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/water_quality/coalitions_submittals/trend_monit_groups/2017_1117_cvgmc_cond_aprvl.pdf.

185 See https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/water_quality/coalitions_submittals/trend_monit_groups/2017_1117_cvgmc_cond_aprvl.pdf.

4.3.2.2 Monitoring Data from Dairies and Confined Animal Facilities

As noted above in Section 3.4.2.4, the Central Valley Regional Board regulates several types of confined animal facilities, including dairies, feedlots, poultry operations and horse facilities.¹⁸⁶ Dairies are required to perform groundwater monitoring on dairy wells and to submit annual reports to the Regional Board. These efforts are supported by the Central Valley Dairy Representative Monitoring Program, which conducts representative groundwater monitoring and submits annual reports to the Central Valley Regional Board on behalf of its member dairies.

Poultry Operations¹⁸⁷ are required to monitor surface water and groundwater “to identify discharges resulting from runoff or leaching of irrigation water and/or storm water from cropland, and from drift of chemicals applied to cropland, associated with Poultry Operations.”¹⁸⁸ Similarly, Confined Bovine Feeding Operations¹⁸⁹ are required to “to identify discharges associated with Confined Bovine Feeding Operations resulting from runoff or leaching of irrigation water and/or storm water from cropland, and from drift of chemicals applied to cropland.”¹⁹⁰ Monitoring data from confined animal facilities, including dairies, are reported in the GAMA Groundwater Information System in the “Monitoring Wells (Water Board Regulated Sites)” database.

GSA's managing groundwater in the Central Valley are encouraged to work with the ILRP coalitions, Central Valley Dairy Representative Monitoring Program, the Central Valley Regional Board and other groundwater quality monitoring entities to ensure that: (1) they are familiar with data from these programs, and (2) any groundwater quality monitoring networks established by the GSA are not duplicative of monitoring efforts being conducted by these entities. Data from the ILRP and CAFs are reported in the GAMA Groundwater Information System in the “Monitoring Wells (Water Board Regulated Sites)” database.

186 See https://www.waterboards.ca.gov/centralvalley/water_issues/confined_animal_facilities/.

187 Poultry Operations are defined in Order R5-2016-0087 as operations having the equivalent of 2 Animal Units (2,000 pounds of poultry at any given time). It does not apply to seasonal facilities, backyard operations, or poultry kept for domestic use. See: https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2016-0087.pdf.

188 See https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2016-0087.pdf.

189 Confined Bovine Feeding Operations are defined in Order R5-2017-0058 as “commercial operations where cattle (cows, bulls, steers, heifers, or calves) representing 6 or more Animal Units (AU) [1 AU equals 1000 pounds of animal weight] are confined and fed or maintained for a total of 45 days or more in any 12-month period, and where vegetation is not sustained over a majority of the confinement area during the normal growing season.” See: https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2017-0058.pdf.

190 See https://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2017-0058.pdf.

5 GROUNDWATER RECHARGE AND ACTIVE GROUNDWATER MANAGEMENT

5.1 Introduction

Section 3 of this Guide describes the federal, state and local regulatory regime governing groundwater quality. As discussed, agencies other than GSAs have the legal responsibility to enforce these groundwater quality requirements. At the same time, GSAs' broad mandate to achieve groundwater sustainability requires that they avoid "significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies."

GSAs have direct responsibility for complying with groundwater quality requirements where their GSPs call for groundwater recharge, water banking, significant changes in pumping patterns, conjunctive management or any other form of active aquifer management to achieve and maintain sustainability.

Groundwater recharge and other forms of active aquifer management are important tools for sustainable groundwater management, with potential to improve both groundwater supplies and groundwater quality. They may help address groundwater quality problems and threats by, for example, diluting salts and nutrients. At the same time, some research also indicates that groundwater recharge via recharge ponds and/or direct injection has the potential to mobilize naturally occurring constituents,^{191,192,193} and/or to mobilize or expand contaminant plumes.¹⁹⁴ In some cases, groundwater recharge projects may do both – causing a near term worsening of legacy loading but longer term water quality improvement.

GSAs undertaking groundwater recharge, significant changes in pumping volume or location, conjunctive management or other forms of active management as part of GSP implementation will need to develop a sufficient understanding of the interaction between subsurface geology, geochemistry and GSP projects in their basin.

This section of the Guide provides a brief overview of potential groundwater quality issues associated with groundwater recharge. In addition to complying with any regulatory requirements, GSAs undertaking recharge or other active management actions should consider developing a sufficient understanding of the interactions between subsurface geology, geochemistry and GSP projects in their basin. The development of sufficient monitoring networks, capable of detecting changes in groundwater quality conditions related to active management, will be critical to understanding these interactions. Groundwater quality monitoring networks are discussed in Section 6 of the Guide.

191 Vanderzalm, J.L., P.J. Dillon, K.E. Barry, K. Miotlinkski, J.K. Kirby, and C. Le Gal La Salle. (2011). Arsenic mobility and impact on recovered water quality during aquifer storage and recovery using water in a carbonate aquifer. *Applied Geochemistry*, (26):1946-1955.

192 Fakhreddine, S., J. Dittmar, D. Phipps, J. Dadakis, and S. Fendorf. (2015). Geochemical triggers of arsenic mobilization during managed aquifer recharge. *Environ.Sci. Technol.*, (49):7802-7809. doi:10.1021/acs.est.5b01140.

193 nlzbicki, J, M.T. Wright, W.A. Seymour, R. B. McCleskey, M.S. Fram, K. Belitz, and B.K. Esser. (2015). Cr(VI) occurrence and geochemistry in water from public supply wells in California. *Applied Geochemistry*, 63:203-217. doi: <https://doi.org/10.1016/j.apgeochem.2015.08.007>.

194 DWR, Flood-MAR – Using Flood Water for Managed Aquifer Recharge to Support Sustainable Water Resources (June 2018 White Paper), pp. 26-27. See https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/All-Programs/Flood-MAR/DWR_FloodMAR-White-Paper_06_2018_updated.pdf?la=en&hash=350DBD68452230C5CF1706C3E8EB1E3E3E613C25.

Together Environmental Defense Fund, Stanford University and Lawrence Berkeley National Laboratory are in the process of developing guidance on naturally occurring constituents as they relate to groundwater management under SGMA. This report is expected out in the Spring of 2019.

5.2 Groundwater Recharge and Active Groundwater Management

Projects and initiatives, such as on-farm recharge, dedicated recharge ponds or basins, controlled floodwater recharge, groundwater banking, aquifer storage and recovery wells and other types of artificial or managed groundwater recharge need to comply with all applicable groundwater quality requirements, depending on project type and design.

Aquifer recharge projects that do not have the potential to “affect the quality of the waters of the state” would not have to get WDRs or waivers. Those projects could simply be required to submit reports to the Board that demonstrate that the project is not causing any effects.

Many types of groundwater recharge projects, however, likely will have to comply with State and Regional Boards’ waste discharge requirements by obtaining either a WDR permit or a waiver from the appropriate Regional Board, as described in Section 3.3.1. There are numerous examples of successful groundwater banking or recharge projects. These include, for example, the Kern Water Bank operated by the Kern Water Bank Authority (using shallow recharge ponds over 70,000 acres); Santa Clara Valley Water District groundwater recharge initiative (using local and imported surface water to recharge the aquifer through facilities including recharge ponds and creeks); and Orange County Water District (using surface water and recycled water that is recharged through dedicated recharge basins and direct injection wells). Projects such as these have operated successfully for decades, banking many hundreds of thousands of acre-feet in local aquifers.

To achieve and maintain groundwater sustainability, there will have to be a major increase in groundwater recharge in California. DWR’s white paper on its Flood-MAR initiative describes both the advantages and the risks regarding water quality impacts of groundwater recharge projects:

Flood-MAR can improve groundwater quality by increasing the amount of water in storage and potentially diluting impaired or contaminated aquifers, especially with respect to salts and nutrients. . . . [D]ilution may provide significant benefits (this would not apply to many industrial and urban point-source pollution cases). . . . On the other hand, flooding recharge areas could mobilize surface/soil pollutants from current or past land uses and contaminate aquifers. Increasing recharge could also further spread contaminated groundwater contaminant plumes by altering rates and direction of groundwater flow. It is anticipated that any potential adverse water quality changes will be short term and local, followed by long term and regional benefits as a result of dilution.¹⁹⁵

Given the potential for groundwater recharge via recharge ponds and/or direct injection to affect groundwater quality, GSAs considering pursuing one or more projects or actions that may affect groundwater quality are encouraged to assess those impacts to determine (1) what they are likely to be, and (2) whether they will over time have a positive or negative impact on groundwater quality over time. If a GSA concludes that a proposed project or action could have unacceptable adverse impacts on water quality, it may consider options such as revising the project to avoid or mitigate the project’s impacts or developing alternative projects that avoid water quality problems

195 Id.

Additionally, it should be noted that recharge projects using recycled water (referred to in the regulations as Groundwater Replenishment Reuse Projects (GRRPs)) are subject to significant additional regulatory requirements. The statutory and regulatory provisions governing injection of recycled water to replenish groundwater are set forth in Cal. Water Code §§ 13520 – 13529.4 and 22 CCR §§ 60320.100 – 60320.230, respectively. There are extensive monitoring and reporting requirements for permittees, including both pre-project baseline monitoring and ongoing post-project water quality monitoring of at least downgradient wells, as well as ongoing monitoring of the quality of the recycled water being injected into the groundwater.¹⁹⁶



Photo Credit: CA DWR

¹⁹⁶ 22 CCR §§ 60320.220 & 60320.226.

6 GROUNDWATER QUALITY MONITORING NETWORKS

6.1 Establishing Groundwater Quality Monitoring Networks

Groundwater monitoring networks are a critical component of sustainable groundwater management. They enable GSAs to monitor changes to the basin over time and provide insight into how management actions and projects are affecting basin conditions as tracked through compliance with minimum thresholds, measurable objectives and interim milestones. Importantly, well-planned monitoring networks can serve as early warning systems, identifying changes in the basin conditions that if left untended could result in undesirable results. This is particularly important with groundwater systems, which have longer lag times than surface water systems¹⁹⁷ and where the treatment or remediation of groundwater can be extremely expensive or in extreme cases cost prohibitive.

Specifically, developing a sufficient groundwater level and groundwater quality monitoring network will provide GSAs with an improved understanding of changing water quality and flow conditions in the basin. This information may be helpful in a number of respects, including:

- (1) determining the impacts or benefits of management actions on water quality in the basin;
- (2) providing data to build and calibrate contaminant transport models that can be used to understand the potential impacts and benefits of management actions on water quality;
- (3) identifying trends in contaminants so that GSAs can collaborate with land use and other regulatory agencies to understand existing or planned remediation strategies; and
- (4) facilitating conversations with regulators about potential management actions to be undertaken during GSP implementation or where existing contamination is impacting a GSA's ability to meet their sustainability goal.

SGMA recognizes the value of data for basin characterization and evaluation of a basin's progress toward sustainability goals, and places significant emphasis on the development of monitoring networks capable of demonstrating short-term, seasonal and long-term trends in groundwater conditions.¹⁹⁸ Monitoring networks established under SGMA must do the following:

- (1) Demonstrate progress toward achieving measurable objectives described in the Plan.
- (2) Monitor impacts to the beneficial uses or users of groundwater.
- (3) Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.
- (4) Quantify annual change in water budget components.¹⁹⁹

Additionally, monitoring networks must be designed and implemented to meet criteria specific to each sustainability indicator. Water quality monitoring networks under SGMA must "[c]ollect sufficient spatial and temporal data from each applicable **principal aquifer** [emphasis added] to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues."²⁰⁰

197 See <https://www.eea.europa.eu/publications/92-9167-023-5/page013.html>.

198 23 CCR § 354.34(a).

199 23 CCR § 354.34(b).

200 23 CCR § 354.34(c)(4).

To meet these regulatory requirements, GSAs need to understand existing water quality issues in their basins. As outlined in Sections 3 and 4, this can be done by developing and maintaining relationships with federal, state and local regulatory and monitoring entities and integrating their water quality datasets into GSP planning.

Working with existing regulatory entities and groundwater quality information can help GSAs to (1) better understand the water quality issues of critical importance in their basin, (2) understand current and planned mitigation efforts, and (3) work collaboratively with these agencies to ensure that management actions and projects undertaken during GSP implementation comply with existing regulatory requirements.

Using existing groundwater quality information will also reduce the burden of developing or expanding a groundwater quality monitoring network in basins without a sufficient network. Some basins may be able to rely on existing water quality monitoring. However, many basins being managed under SGMA have significant water quality information gaps. Thus, many GSAs may need to expand existing groundwater quality monitoring networks in their basin.

GSAs should focus initial data collection efforts on identifying and assessing existing water quality datasets. The initial focus of this analysis should be to identify and prioritize areas in their basins with groundwater quality issues that may constitute an undesirable result or that may affect a GSA's ability to implement a management action or project. As discussed in Section 4, GSAs using data from any external source are encouraged to evaluate the data prior to use to ensure they meet the Data Quality Objective (DQO) process outlined in the USEPA Guidance on Systematic Planning Using the Data Quality Objective Process,²⁰¹ regulatory requirements and data collection protocols outlined in DWR's *BMP 2 Monitoring Networks and Identification of Data Gaps*.²⁰²

6.2 Filling Data Gaps: When is Supplemental Monitoring Necessary?

As noted above, in basins where existing monitoring networks are deemed insufficient or there is a high degree of uncertainty resulting from poor spatial or temporal monitoring coverage, GSAs may need to develop supplemental groundwater quality monitoring data.

An important aspect of monitoring network development is determining the adequacy of data to meet management objectives.²⁰³ Monitoring network development is likely to be a complex calculus based on: 1) the available resources, 2) existing monitoring programs, 3) the level of groundwater development in the basin and reliance on the resource, 4) the hydrogeologic complexity of the system, 5) the groundwater management actions or projects being undertaken or proposed in the basin and 6) the proximity of groundwater management projects to domestic or irrigation wells, public water supply sources or other vulnerable users.^{204,205}

GSAs operating in basins with a high level of groundwater development, complex hydrogeology or vulnerable users, or that are undertaking groundwater management actions that have the potential to create or exacerbate water quality issues will require a robust monitoring network to ensure that they do not cause undesirable results in their basins. Most GSAs are likely to require at least some supplemental groundwater quality monitoring.

201 See <https://www.epa.gov/sites/production/files/2015-06/documents/g4-final.pdf>.

202 DWR (2016). *BMP 2 Monitoring Networks and Identification of Data Gaps*, p. 8. <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-and-Identification-of-Data-Gaps.pdf>.

203 Id. p.2.

204 Id.

205 See <https://www.eea.europa.eu/publications/92-9167-023-5/page013.html>.

Note that SGMA and other programs have related groundwater quality monitoring objectives. The development of a robust groundwater monitoring program for one group of agencies, such as the CV-SALTS, ILRP or CAFs (see Sections 3.4.2 and 4.3), may be extended to include GSP objectives through coordinated monitoring and assessment, thereby reducing duplicative monitoring efforts. GSAs in California's Central Valley developing or supplementing existing groundwater quality monitoring networks in their basins are encouraged to work with the ILRP coalitions, Central Valley Dairy Representative Monitoring Program, the Central Valley Regional Board and other groundwater quality monitoring entities to ensure that their efforts are not duplicated.

As discussed in Section 5, GSAs undertaking groundwater recharge, significant changes in pumping volume or location, conjunctive management or other forms of active management as part of GSP implementation will need to develop a sufficient understanding of the interaction between subsurface geology, geochemistry and GSP projects in their basins. Developing well-designed monitoring networks capable of capturing water quality trends may serve as an early warning system for GSAs, enabling them to modify or halt management actions before they create problems.

DWR's *BMP 2 Monitoring Networks and Identification of Data Gaps* provides guidelines and resources on developing supplemental groundwater quality monitoring networks that GSAs may find helpful, including recommendations for spatial and temporal sampling frequency. Recommendations on constituents to be sampled are included in DWR's *BMP 1 Monitoring Protocols, Standards, and Sites*.

Briefly, a determination of the **spatial** coverage of a groundwater monitoring network should consider the level of development and use in each principal aquifer and the complexity of the subsurface geology. DWR recommends between two to ten monitoring wells per 100 square miles, depending primarily on the pumping volume in the basin.^{206,207} With respect to **temporal** sampling, DWR's *BMP 2 Monitoring Networks and Identification of Data Gaps* recommends collecting groundwater quality samples twice annually to correlate with the seasonal high and low in groundwater levels, or more frequently where necessary.²⁰⁸

DWR's *BMP 1 Monitoring Protocols, Standards, and Sites* makes limited recommendations on water quality constituents to be sampled. However, groundwater quality guidelines developed by the European Environmental Agency recommend sampling for (1) descriptive parameters, including temperature, pH, etc. (2) major ions (3) heavy metals (4) organic substances (5) pesticides and (6) microbes.²⁰⁹

Groundwater monitoring networks are a critical component of sustainable groundwater management, providing the information necessary to understand factors affecting groundwater basin conditions over time. Continuing to update and refine these networks will enable GSAs to make informed decisions regarding groundwater quality and other sustainability indicators.

206 Id., p. 10. <http://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-and-Identification-of-Data-Gaps.pdf>.

207 DWR (2010). Groundwater Elevation Monitoring Guidelines, p. 3. <https://water.ca.gov/LegacyFiles/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/CASGEM/Files/CASGEM-DWR-GW-Guidelines-Final-121510.pdf>.

208 DWR (2016). BMP 2 Monitoring Networks and Identification of Data Gaps, p. 16. <http://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-and-Identification-of-Data-Gaps.pdf>.

209 See Table 10.2 <https://www.eea.europa.eu/publications/92-9167-023-5/page013.html>.

7 CONCLUSION AND RECOMMENDATIONS

Avoiding “significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies” (UR No. 4) poses unique challenges to GSAs on both a technical level and a legal/regulatory level. This Guide is intended to assist GSAs and other agencies in understanding what is needed to comply with this aspect of SGMA, and their roles and responsibilities within that process. To help avoid UR No. 4 under SGMA, this Guide recommends that GSAs do the following:

1. **Understand the existing regulatory regime for groundwater quality** and, as necessary, confer with entities that have regulatory authority over groundwater quality in their basins.
2. **Consider existing federal, state and local groundwater quality standards when developing groundwater quality minimum thresholds in their basins.** Federal, state or local regulatory requirements were established after careful scientific study, legal review and procedural steps mandated by law. They are designed to protect public health and welfare, and they provide the clearest indication of the point beyond which there is a real risk of an undesirable result.
3. **Work closely with Regional Water Quality Control Boards** to address all groundwater quality issues. GSAs working in the Central Valley are especially encouraged to work with the Central Valley Regional Board to address salt and nutrient groundwater contamination. Programs in this region are continuing to evolve and will require that GSAs remain aware of changing regulatory requirements. Additionally, there are many groundwater quality monitoring efforts underway in this region that are generating a lot of groundwater quality data. These efforts should be aligned with any groundwater monitoring efforts being undertaken by GSAs.
4. **Use existing groundwater quality data and information** to (1) assess and prioritize groundwater quality issues in their basins, (2) meet requirements that GSPs include a description of current and historical groundwater conditions within the basin, and (3) serve as either the basis for or a complement to local groundwater quality monitoring programs developed by GSAs.
5. **Consider the following approach if they identify groundwater quality problems that either arose or were exacerbated after January 1, 2015:**
 - **Where there is a significant groundwater quality problem that is clearly under the purview of another agency, confer with that agency** and seek to confirm a reasonable plan to address the groundwater quality problem. If such a plan exists, the water quality problem and the plan should be referenced in the GSP. Section 3 and Table 1 in the Guide provide information on existing regulatory programs and the agencies responsible for their enforcement.
 - **Where a significant groundwater quality problem is not clearly under the purview of another agency,** or the responsible agency is unable to confirm a reasonable plan to address the problem, confer with Regional or State Board staff, and perhaps affected parties, to identify a reasonable plan to address the problem. If no reasonable plan is identified, and remediating the problem is impractical, excessively wasteful of resources or otherwise infeasible, the GSA should include in the Plan an explanation of the problem and the reasons why remediation is impractical or infeasible.
6. **Consider the following approach if they are planning projects or actions that may affect groundwater quality:**
 - **Assess the potential impacts** that the projects or actions are likely to have on groundwater quality over time. If the GSA concludes that the proposed project or action could have unacceptable adverse impacts on water quality, GSAs should consider options such as revising the project to avoid or mitigate the project’s impacts or developing alternative projects that avoid water quality problems.
 - **Ensure regulatory compliance** for any GSP management actions (e.g., recharge projects, water banking) that have the potential to negatively impact water quality in their basins or adjacent basins.

7. **Develop supplemental groundwater monitoring networks** where necessary. Many basins being managed under SGMA have significant water quality data gaps. Thus, GSAs in many basins will likely need to develop or expand local groundwater quality monitoring networks. Decisions to do so should be informed by (1) the extent and quality of existing groundwater quality in the region, (2) the level of groundwater development, (3) the severity of existing groundwater quality issues and their proximity to domestic or irrigation wells, public water supply sources or other vulnerable users, (4) current or proposed groundwater management actions or projects, (5) local resources, and (6) the hydrogeologic complexity of the basin.



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