State Water Resources Control Board

March 21, 2022

Craig Altare
Supervising Engineering Geologist
Sustainable Groundwater Management Office
Department of Water Resources
craig.altare@water.ca.gov

MADERA GROUNDWATER SUSTAINABILITY PLANS, GROUNDWATER SUBBASIN NO. 5-022.06

The State Water Resources Control Board (State Water Board) staff (staff) is providing these comments in support of the Department of Water Resources' (DWR) review pursuant to the Sustainable Groundwater Management Act (SGMA) (Water Code § 10720 et seq.) and the regulations implementing SGMA (Cal Code Regs., tit. 23, § 350 et seq.) of the Madera Subbasin Joint GSP (Joint GSP), the Root Creek Water District GSP (Root Creek GSP), the Gravelly Ford Water District GSP (Gravelly Ford GSP), and the New Stone Water District GSP (New Stone GSP) and the Coordination Agreement for the Madera Subbasin (subbasin).

Our comments on the GSPs focus on the following areas:

- Coordination Agreement
- Water Budgets
- Groundwater Levels and Potential Drinking Water Impacts
- Groundwater Quality
- Depletions of Interconnected Surface Water
- Projects and Management Actions
- Engagement

The comments made here are not exhaustive and staff may have additional comments.

General Comments

The following comments apply to multiple GSPs in the subbasin. Comments regarding individual GSPs begin on page 14.

Coordination Agreement

1. Although the GSAs all sign on to some shared, basic assumptions about the basin-wide water budget in the coordination agreement (despite different water budget analyses), the sustainable management criteria (SMC) and monitoring networks detailed in the GSPs do not appear coordinated. This may result in a situation where groundwater management under one GSP interferes with successful implementation of another GSP. For example, two GSPs appear to use the same California Statewide Groundwater Elevation Monitoring Program well as a representative monitoring site (RMS) for water levels in the Upper Aquifer, but have vastly different (different by over 200 feet) measurable objectives (MOs) and minimum thresholds (MTs) for that RMS (see #3). Given the relatively small areas covered by the Root Creek GSP, the New Stone GSP, and the Gravelly Ford GSP, the subbasin's GSAs could potentially avoid these potential conflicts and improve their likelihood of success by joining together to develop a single GSP to cover the entire subbasin.

Water Budget

2. The three GSPs that cover smaller areas (Gravelly Ford GSP, New Stone GSP, and Root Creek GSP) have common issues in their water budget analyses. Data and methods are not clearly documented, and not all of the methods used for developing estimates are appropriate. The water budget summary tables in these three GSPs do not present clear mass-balance accountings of the inflows, outflows, and storage changes for the Land and Surface Water Systems or the Groundwater System. In addition, their projected water budgets include unexplained increases in surface water supply and reductions in demand. See GSP-specific comments below for more details.

Groundwater Levels and Potential Drinking Water Impacts

3. The GSPs do not describe how water levels at or near the MOs or MTs may impact domestic wells, public water systems, other beneficial users, or land use and property interests, as required in the GSP regulations. (Cal. Code Regs., tit. 23, §354.26, subd. (b)(3).) Nor do the GSPs describe how these users were considered in setting the MOs and MTs. (Water Code § 10723.2.) Rather than basing SMC on avoiding a significant and unreasonable depletion of supply for groundwater users, the GSPs each took different approaches to setting groundwater level SMC:

- The Joint GSP sets MTs by modeling future water level lows expected between 2020 – 2090, assuming a 10-year drought and successful implementation of projects and management actions proposed in the GSPs.

- The Gravelly Ford GSP does not describe the basis for its MTs in much detail, but the MTs appear related to continued historical rates of groundwater level decline and the maximum historical variance in groundwater depth from average.

- The New Stone Water District GSA sets its MTs at -235 feet above mean sea level with little explanation; this is more than 200 feet below current water levels and the MOs (NSWD GSP Table 4-1, p. 4-9). The GSP states the MTs and MOs would allow 175 to 278 feet of operational flexibility (i.e., the difference between the MO and MT at each RMS), depending on the RMS. This difference is the equivalent of more than 58 years of continuous water level decline at the current annual average rate of decline (3 feet/year). At these water levels, the Upper Aquifer above the Corcoran Clay would be drained and any domestic well screened above the Corcoran Clay would be dewatered, unless the decline is mitigated.

- The Root Creek Water District GSA sets MTs at an elevation that assumes historical rate of groundwater pumping and groundwater level decline for 10 years and groundwater levels decline at half the historical rate for an additional 10 years, with consideration of historical lows (RCWD GSP p. 4-5).

Estimates of wells that may be affected at groundwater elevation MOs and MTs in Central Valley GSPs are publicly available.[1] These technical resources are available for consideration by the GSAs. State Water Board staff conducted its own analysis for the subbasin by comparing the depths of wells[2] with well completion reports in DWR's Online System for Well Completion Reports (OSWCR) database to the MOs and MTs presented in the GSPs for the subbasin. This analysis excluded wells that were estimated to have already been dry in 2015.[3] Given uncertainties in the OSWCR data, staff present a range of values based on

---

[1] See reports and analyses by Pauloo, R., Bostic, D., Monaco, A. and Hammond, K., The Water Foundation and EKI; and UC Davis Center for Regional Change

[2] Where available, staff used the bottom of the well screen to represent well depth; otherwise, staff used the bottom of the well.

[3] Detailed methodology available upon request.

domestic and public water system well records with location and depth information. The lower bounds represent wells installed after 1991[4] and the upper bounds represent all wells regardless of installation date. The results of this analysis are summarized below.

Above or outside the extent of the Corcoran Clay:

- Of the 2,654 to 3,578 domestic wells, 26 to 60 (1% to 2%) may go dry at MOs and 895 to 1399 (34% to 39%) may go dry at MTs.
- Of the 39 to 71 public water system wells, 8 to 10 (21% to 14%) may go dry at MTs.

SMC appear to be set below the bottom of the Corcoran Clay in some areas in this analysis:[5]

- Of the 34 to 57 domestic wells completed below the Corcoran Clay, MTs are below zero to 8 wells (0% to 14%).
- No public supply wells are recorded below the bottom of the Corcoran Clay.

If water levels are allowed to drop below the Corcoran Clay, this would result in the near-surface unconfined aquifer being completely dewatered in this area. Additionally, subsidence could occur due to dewatering of the clays. The GSP should evaluate SMC set below the Corcoran Clay and consider whether the SMC are appropriate.

Note that this analysis assumed groundwater levels declining to MTs at all RMSs, whereas the Joint GSP states an undesirable result would only occur if water levels at more than 30 percent of RMS wells fall below MTs for two consecutive years at the same wells; accordingly, the GSP's definition of an undesirable result could allow for more wells to fail than described above, particularly in dry and critically dry years.

---

[4] See discussion of well retirement age on page 12 of the [UC Davis Center for Regional Change's analysis].

[5] Staff identified at least one RMS (Joint GSP MCW RMS-1) at which recent potentiometric surface readings are <u>above</u> the Corcoran Clay, but with an MT set <u>below</u> the Corcoran Clay.

Staff recommends that the GSAs conduct an independent analysis of the potential impacts of proposed MOs and MTs and projected groundwater management outcomes on active domestic wells and public water supply wells at the subbasin scale, update the GSPs and coordination agreement with this information, and consider how those effects compare with the GSAs' definition of an undesirable result related to declining groundwater levels. Additionally, the GSAs should estimate and describe the population served by the wells in the subbasin which are not protected at MTs.

4. If a reasonable conclusion, drawn from (1) the GSAs' evaluation and projections including the analysis described in #3 and (2) consideration of beneficial users and uses, is that the proposed allowable decline in groundwater levels could constitute a significant and unreasonable depletion of supply, the GSAs should adjust MTs (and amend the analysis described in #3) or otherwise mitigate for impacts to wells. Mitigation could prevent a potential undesirable result from being significant and unreasonable. For mitigation, the GSAs could develop and implement a mitigation plan that would lessen the significance of the impact by replacing or repairing domestic or drinking water system wells impacted by groundwater level declines; the Joint GSP already includes a framework for a potential well mitigation program (Joint GSP Appendix 3.D). The GSAs could also support expansion of public water system boundaries to private well communities or consolidation of smaller drinking water systems dependent on at-risk wells with larger public water systems. This would involve identifying vulnerable areas where consolidation or extension of service is feasible. Consolidation efforts may include: (1) providing financial assistance, particularly for low-cost intertie projects that are adjacent to larger systems, (2) working with county planning agencies to ensure that communities served by at-risk wells are annexed into the service areas of larger water systems to limit barriers to future interties, and (3) facilitating outreach and introductions between small water systems and owners of domestic wells and larger water systems to assist in developing future partnerships.

5. Staff suggests inclusion of vulnerable local public supply wells and representative vulnerable domestic wells in local groundwater level monitoring programs so that mitigation programs and re-evaluation of MT can be used where appropriate to avoid undesirable results before impacts occur.

Groundwater Quality

6. SGMA regulations require that undesirable results be defined consistently throughout the subbasin. (Cal. Code Regs, tit. 23, §354.20, subd. (a).) Therefore, SMC and monitoring networks should be coordinated. Several constituents with Maximum Contaminant Level (MCL) exceedances are generally widespread in the

subbasin, including total dissolved solids (TDS), arsenic, nitrate, uranium, DBCP, and 1,2,3-TCP, as shown in Figures 1 through 6 (in Appendix); however, the GSPs do not share a consistent set of analyte MTs (see Table 1 below). Groundwater pumping and projects and management actions under the GSAs' authority may have the potential to influence groundwater concentrations and distributions of widespread contaminants within the subbasin, including these.

Table 1. Minimum Thresholds. Concentrations in mg/L unless otherwise noted.

Analyte	Joint GSP	Gravelly Ford GSP	New Stone GSP	Root Creek GSP
Nitrate as NO3	no MT	no MT	45	no MT
Nitrate as N	10	no MT	no MT	30 for Ag; 10 for Municipal
TDS	500	no MT	no MT	1,200 for Ag; 500 for Municipal
Electrical Conductivity	no MT	no MT	2,700 umhos/cm	no MT
Arsenic	10 ug/L	no MT	no MT	10 ug/L
Chloride	no MT	no MT	no MT	250 for Municipal
Sulfate	no MT	no MT	no MT	250 for Municipal
Iron	no MT	no MT	no MT	0.3 for Municipal
Manganese	no MT	no MT	no MT	0.05 for Municipal
Dibromo-Chloropropane (DBCP)	no MT	no MT	no MT	0.2 ug/L for Municipal
Ethylene Dibromide (EDB)	no MT	no MT	no MT	0.05 ug/L for Municipal

Note: Root Creek GSP states that MTs are set at Title 22 MCLs for all municipal wells, including for constituents not listed in the table. Constituents listed here are from Root Creek GSP Table 4-3.

Staff recommends the GSAs coordinate to define undesirable results consistently for the subbasin, manage for the same set of constituents in SMC, and have coordinated monitoring well locations and sampling frequencies. Based on their prevalence within the subbasin, all of the GSPs should include, at minimum, SMC for TDS, arsenic, nitrate, uranium, dibromochloropropane (DBCP), and trichloropropane (1,2,3-TCP), or provide a rationale for why these constituents are not included. Additional information on the prevalence of DBCP, 1,2,3-TCP, and uranium are provided below.

a. *DBCP and 1,2,3-TCP.* DBCP and 1,2,3-TCP have been detected in groundwater at concentrations above MCLs in the northern-central to southern area of the subbasin. Both are legacy contaminants caused by applications of fumigant pesticides before the early 1980s, but are persistent and have migrated downwards through irrigation recharge and groundwater pumping. The state's Groundwater Ambient Monitoring and Assessment (GAMA) Program's Priority Basin Project shows that approximately 29 percent of the shallow groundwater resources (by volume) used for domestic drinking water in the Madera and Chowchilla subbasins have MCL exceedances in fumigant chemicals (DBCP, EDB and 1,2,3-TCP).[6] In addition, the GAMA Program's online database shows the California MCLs for DBCP and 1,2,3-TCP were exceeded in eight and 20 municipal wells, respectively, between 2010 and 2019 in the subbasin.[7]

b. *Uranium.* Uranium concentrations above MCLs (i.e., US EPA MCL of 30 micrograms per Liter [ug/L] and California MCL of 20 ug/L) have been found in shallower wells (depth to top of well perforations less than 235 feet) in Chowchilla-Madera.[8] Elevated uranium concentrations in groundwater in the eastern San Joaquin Valley are likely caused by uranium leaching of shallow sediments by irrigation water enriched with bicarbonate in the root zone and

---

[6] Fram, M.S. and J.L. Shelton, 2018, Groundwater Quality in the Shallow Aquifers of the Madera–Chowchilla and Kings Subbasins, San Joaquin Valley, California. U.S. Geological Survey Open-File Report 2017-1162.
[7] GAMA Groundwater Information System Map.
[8] Shelton, J.L., M.S. Fram, K. Belitz, and B.C. Jurgens, 2013, Status and Understanding of Groundwater Quality in the Madera-Chowchilla Study Unit, 2008—California GAMA Priority Basin Project. U.S. Geological Survey Scientific Investigations Report 2012–5094, 86 p.

further transporting to the primary aquifer depths through the combined effect of recharge and pumping.[9] The GAMA Program's Priority Basin Project shows that approximately nine percent of the shallow groundwater resources used for domestic drinking water in the Madera and Chowchilla subbasins have MCL exceedances in radioactive constituents (uranium, gross alpha-particle activity, and gross beta-particle activity).[10] In addition, the GAMA Program's online database shows California MCL exceedances for uranium in five municipal wells between 2010 and 2019 in the subbasin. [11]

In deciding which water quality constituents to consider when setting SMC, a GSA should consider the best available water quality information for the basin, including data used to develop the hydrogeologic conceptual model, geochemistry of geological formations (for the potential of mobilization of natural constituents), and groundwater uses in the vicinity of the RMSs and the basin as a whole. Different constituents may cause undesirable degradation of water quality in different areas based on the purposes for which groundwater is beneficially used. Not all water quality impacts to groundwater must be addressed in the GSPs, but significant and unreasonable water quality degradation that was not present prior to January 1, 2015, and that is due to groundwater management conditions occurring throughout the subbasin must be addressed in the GSPs' MTs. Both groundwater extraction and the implementation of projects to achieve sustainability may cause impacts from migration of contaminant plumes, changes in the concentration of contaminants due to reduction in the volume of water stored in the basin, or release of harmful naturally occurring constituents. A GSA should particularly consider whether any groundwater quality constituents in the basin may impact the established policy of the State that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes (Water Code, §106.3). Coordination by the GSAs with agencies

---

[9] Jurgens, B.C., Fram, M.S., Belitz, K., Burow, K.R., and Landon, M.K., 2010, Effects of groundwater development on uranium: Central Valley, California, USA. *Groundwater*, 48(*6*), 913-928. https://doi.org/10.1111/j.1745-6584.2009.00635.x.

[10] Fram, M.S. and J.L. Shelton, 2018, Groundwater Quality in the Shallow Aquifers of the Madera–Chowchilla and Kings Subbasins, San Joaquin Valley, California. U.S. Geological Survey Open-File Report 2017-1162.

[11] GAMA Groundwater Information System Map.

that oversee the remediation of existing groundwater contamination is highly recommended, both in setting MTs and developing a plan of implementation.

Staff has attached maps from the State Water Board's GAMA Program's database (https://gamagroundwater.waterboards.ca.gov/) showing their widespread impacts in subbasin groundwater (Figures 1 through 6 in Appendix).

7. Recently published research by the US Geological Survey (USGS) speaks to how management of groundwater levels may affect groundwater quality at drinking water wells.[12] USGS scientists found that increased pumping from wells during drought can pull shallow, contaminated groundwater down to depths commonly tapped for public drinking-water supply. Staff recommends the GSAs consider these findings in discussions of how groundwater elevation SMC will guide groundwater management that may affect beneficial users of groundwater.

8. The GSAs may bolster the GSPs' water quality discussion with data from the State Water Board's Drinking Water Watch database (https://sdwis.waterboards.ca.gov/PDWW/), which can be queried by public water system name or system number, and the Human Right to Water Violations Tool (https://www.waterboards.ca.gov/safer/dw_systems_violations_tool.html). These tools include information on public water system treatment technologies, water quality violations, historical and recent water quality monitoring data at public water system wells, and other information relevant to groundwater quality issues for drinking water users.

9. The GSPs should outline the process and the criteria the GSAs would use to decide whether GSP implementation caused or exacerbated an MT exceedance for water quality. The Gravelly Ford GSP, New Stone GSP, and Root Creek GSPs do not discuss the issue. The Joint GSP states that case-by-case evaluation of monitoring data will be conducted to distinguish water quality impacts related to its actions from those related to other causes, and that "future exceedances of the MT may occur due to activities or conditions unrelated to the GSP, in which case they would not constitute an MT exceedance that contributes to an undesirable result" (Joint GSP p. 3-31).

---

[12] Levy, Zeno F., et al. "Critical aquifer overdraft accelerates degradation of groundwater quality in California's Central Valley during drought." *Geophysical Research Letter* (2021): e2021GL094398.

In addition, the GSPs should provide the data supporting the conclusions, which will allow reviewing regulatory bodies to consider how adequately the GSPs address undesirable results related to water quality degradation. The GSAs should also coordinate and share the data with other local and regional groundwater monitoring efforts.

Depletions of Interconnected Surface Water

10. The GSPs do not define SMC for depletions of interconnected surface water (ISW). There is evidence, below, of some interconnection in the subbasin between groundwater and surface water in the San Joaquin River, particularly along the Root Creek Water District GSA's southern boundary. Moreover, as the San Joaquin River Restoration Program is implemented, potential exists for interaction with San Joaquin River Restoration Program flows. Consequently, staff does not believe the GSPs have demonstrated that depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water are not present and not likely to occur in the subbasin. (Cal. Code Regs., tit. 23, §354.26.)

    a. The Root Creek GSP notes that the San Joaquin River Restoration Program's two monitoring wells along the San Joaquin River at Highway 41 indicate the groundwater is hydraulically connected with the river, at least at high flow conditions (RCWD GSP pp. 129 & 248).

    b. In addition, water levels in Ag Well 022, located approximately one-half mile from the San Joaquin River and within the Root Creek GSP area, suggest possible interconnection between regional groundwater flow and the river: groundwater levels in 2017 were no more than 30 to 40 feet lower than the riverbed (RCWD GSP pp. 113, 114 & 248) and levels were approximately 10 feet higher in 1998 (RCWD GSP p. 115).

    c. The Joint GSP attributes isolated areas of shallow groundwater along the San Joaquin River to perched aquifer conditions but acknowledges there has never been confirmation of an unsaturated zone below the readings.

    d. While the Root Creek GSP cites evidence that the reach of the San Joaquin River south of its boundaries is a losing reach, the GSP also notes that none of the studies it cites concluded that the river is disconnected in this area (RCWD GSP p. 129).

    e. The part of the Kings subbasin covered by the North Kings GSA and the Madera subbasin share a border along the San Joaquin River. The North Kings GSP provides evidence of interconnection with shallow groundwater at some sections along that stretch of the San Joaquin River (e.g., upstream of the Copper Avenue Alignment, and between Highway 145 and downstream of Gravelly Ford within the borders of North Kings GSA) (North Kings GSP (January 2020), pp. 3-77 through 3-80).

The GSAs should either more thoroughly demonstrate that undesirable results related to ISW are not occurring in the subbasin and are unlikely to occur in the future; or develop SMC for depletions of ISW. If developing SMC, the GSAs should outline a plan and timeline to fill data gaps regarding the location (extent), quantity, and timing of interconnection in the subbasin. The GSAs should reach out to surface water users and the California Department of Fish and Wildlife for input in the development of these SMC.

11. Board staff recognizes that a significant portion of the Friant release is lost before reaching Gravelly Ford due to surface water diversion and infiltration. For instance, the loss was over 33 percent for more than 90 percent of the time during the first 162 days of 2020. Board staff recommends the GSAs improve management of surface water diversion reporting and monitoring of possible pumping depletions along this reach so they can better understand the effects on the subbasin.

Projects and Management Actions

12. The GSAs expect to bring an additional 60,000 acre-feet per year (AFY)[13] of additional water to the subbasin through projects (Joint GSP p. ES-9). Implementing some of the projects identified in the Madera GSPs may require new or amended water rights. If a project would rely on existing water rights, the GSAs should identify the water right identification numbers and other relevant details. It may be unreasonable for the GSPs to assume that projects that currently lack adequate water rights for implementation can obtain either new water rights or modifications to existing water rights within a timeframe that will allow the project to contribute to the GSPs achieving sustainability. For the GSPs to demonstrate a likelihood of attaining the sustainability goal, the GSPs should discuss the timing for obtaining approvals and describe any uncertainties, such as water availability in source streams (e.g.: Will less surface water be available with projected Bay-Delta Plan implementation? Is the source declared to be a fully appropriated stream? Can

[13] This would represent approximately 36 percent of the estimated subbasin overdraft of 165,900 AFY.

potential protests be anticipated from downstream water users?). Below is information on obtaining new surface water rights or modifying existing rights:

a. New surface water right permits: An applicant must gather all information necessary to complete the application; this could be extensive. Once the State Water Board publicly notices an application, other water right holders may protest the project based on potential injury to their water rights. Parties may also protest if the project has the potential to harm public trust resources. The GSAs should contact the Division of Water Rights' Permitting and Licensing Division or consult the Division's Permitting and Licensing Frequently Asked Questions (https://www.waterboards.ca.gov/waterrights/water_issues/programs/applications/faqs.html) to develop an informed timeline for project implementation that includes necessary water right actions.

b. Amendment of an existing surface water right: The time required to amend an existing water right depends on multiple factors, including but not limited to whether the change is minor, major, or controversial. The GSAs can learn more from the Division of Water Rights' Petitions Frequently Asked Questions (https://www.waterboards.ca.gov/waterrights/water_issues/programs/petitions/faqs.html).

Note that there is a pending surface water adjudication of Fresno River water rights, which could result in determinations that may affect the feasibility of some of the proposed projects.

13. Given there is no certainty that a particular water right permit or petition will ultimately be approved, or when, it is important the GSPs clarify proposed timelines for projects and management actions and consider how changes in those timelines could impact the subbasin's ability to achieve sustainability by 2040. Staff notes the Madera County GSA has already taken steps towards implementing groundwater allocations for extractors within its management area. The remaining GSAs should also identify alternative groundwater management strategies to achieve sustainability (e.g., demand reduction), if anticipated water supplies such as purchases or new or amended water rights are unsuccessful. Clear timelines, alternative strategies, and triggers for those strategies would ensure the GSAs can effectively evaluate when they should move towards implementing such contingency projects or management actions if primary projects or management actions are not implemented on projected timelines.

14. The GSPs describe well permitting processes in each applicable county, and the Joint GSP mentions coordination with Madera County (Joint GSP Section 2.1.3.3, p. 2-18). The Gravelly Ford Water District GSA may consider requiring new wells to be

registered with the GSA (GFWD GSP Section 2.1.4, p. 2-12). However, the GSPs lack specific information regarding the events that would lead the GSAs to adopt these types of policies, how the GSAs will evaluate new permits, address possible impacts from new permits, or work with the county to address concerns. Staff recommends that GSAs work with county governments for alignment between the GSPs and county well permitting programs. As encouraged by the SGMA, GSAs should request counties forward permit requests for new wells, for enlarging of existing wells, or for reactivation of abandoned wells. (Water Code, §10726.4.) As new wells are drilled in the subbasin, patterns of extraction and groundwater decline may shift. These shifts may cause groundwater level declines and effects on users in new areas of the subbasin not currently well-represented by an RMS. Increased production from these wells may also make it more difficult for the GSAs to avoid undesirable results and achieve sustainability within the implementation period.

Engagement

15. The GSP should be more explicit about how the concerns of local beneficial users, particularly disadvantaged communities reliant on groundwater and other stakeholders, were integrated into development of SMC and monitoring networks and selection of RMS and projects and management actions. SGMA requires consideration of the interests of diverse, social, cultural, and economic elements of the populations within the subbasin during plan development. Collaborative and inclusive processes can make plans more resilient by increasing buy-in and trust, improving compliance, and enhancing the quality of information on which plans are based. It is important that GSAs send appropriate notices; hold meetings in times, places, and manners that support effective engagement; acknowledge issues raised and modify the GSP as appropriate in response. GSAs should consult with individuals or groups when actions may impose direct or indirect costs on those entities. Good governance can build trust and reduce regulatory compliance risks. Consultation, for example, could help a GSA avoid or mitigate an action that might directly or indirectly cause a drinking water system to violate its permit or face new compliance costs due to reduced availability of water or lower water quality.

16. The GSAs should engage with all public water systems that rely on groundwater in the subbasin to ensure the GSP protects drinking water users. To facilitate this, State Water Board staff has attached a list of public water systems with wells in the subbasin as of November 2021. Please contact the Board's [Division of Drinking Water (https://www.waterboards.ca.gov/drinking_water/programs/)](https://www.waterboards.ca.gov/drinking_water/programs/) at DDW-SAFER-NAU@waterboards.ca.gov with any questions.

17. The GSPs do not describe the GSAs' process for identifying or reaching out to Tribes with potential interests in groundwater management in the subbasin. Without

this information, it is difficult to discern whether the GSA appropriately considered the interests of California Native American Tribes in developing the GSP (Water Code, §10723.2(h)). The Joint GSP lists the names of eight Tribes located in the region, but no further discussion of Tribal interests is provided. The GSPs should elaborate on their GSAs' tribal engagement efforts. If the GSAs have not already done so, the GSAs should consult with the Native American Heritage Commission (NAHC) to obtain information about Tribes that have current and ancestral ties in the subbasin. To request this information, the GSAs can email the NAHC at nahc@nahc.ca.gov.

Joint GSP Comments

Groundwater Levels and Potential Drinking Water Impacts

18. In further developing the well mitigation program, the Joint GSP GSAs should describe specific success criteria for the program, with clear links to the both SMC and the GSAs' definitions of undesirable results. The GSAs should also (1) clearly identify who qualifies as a "pumper" for fee assessments; and (2) develop an outreach program for all domestic well owners that outlines estimated impacts of the GSP and mitigation options. The outreach program should describe both how GSAs will reach out to well owners before water shortages occur as well as how well owners can report water supply shortages to the GSAs. Results of analysis and discussion as outlined in #3 above would provide better data in support of this option.

19. It is difficult to evaluate the feasibility of the proposed potential well impact mitigation program. The program estimates the cost of implementation assuming deepening of 120 wells (or 240 wells considering data gaps in available well completion reports) at $25,000 per well, but the Joint GSP does not describe any clear funding commitments from the GSAs or well owners to implement the plan. Moreover, some of the assumptions behind the cost estimates may be inaccurate: The estimates of the total number of potentially impacted wells are based on questionable assumptions (see #3). The $25,000 value also does not include any costs or fees associated with permitting or administration (Joint GSP p. A3.D-2), and the plan does not discuss increased energy costs to be borne by well-owners pumping from deeper in the aquifer. Finally, the total annual proposed budget for the well mitigation program ($277,000) (Joint GSP p. A3.D-5) could only cover the cost of installing 11 wells per year, not including permitting and administration fees. The GSP does not discuss how this replacement rate aligns with the rate at which wells may need to be replaced as water levels decline.

20. The Joint GSP lacks RMSs for water levels in certain areas with higher densities of domestic wells.[14] Three nested well sites are proposed in the northern portion of this area, which could help fill monitoring gaps; however, the GSP does not describe whether, when, or how MOs and MTs will be set for these sites. As a result, it is difficult to set a baseline for domestic wells now and evaluate impacts to domestic wells during the GSP implementation period. The GSP should explain how MTs and MOs will be set at these RMSs.

Groundwater Quality

21. The Joint GSP notes that implementation of GSP projects or management actions could result in significant and unreasonable degraded water quality (Joint GSP p. ES-12); however, the GSP does not mention other potential causes of groundwater quality degradation subject to SGMA, such as those which could be caused by declining groundwater levels. The GSP should more broadly consider how groundwater extraction and management exacerbate groundwater quality problems for beneficial users. See #6 and #7.

22. The Joint GSP generally sets MT concentrations at the MCL for a particular constituent; however, constituent concentrations at some water quality RMSs already exceeded the applicable MCLs in 2015. In these cases, the GSP sets the MOs at the most recent concentration for the constituent and the MTs at the most recent concentration plus 20 percent. For example, the MO and MT concentrations for arsenic at one public supply well RMS (2010801-001) are set at 15 ug/L and 18 ug/L, respectively (the MCL is 10 ug/L). The GSP does not explain how the 20 percent buffer was selected and proposes uniform application of the buffer, rather than considering the historical trends of a particular analyte or the beneficial uses at a specific location. Staff recommends the GSP either better explain how the 20 percent buffer relates to avoiding an undesirable result or propose a different approach that more clearly relates to avoiding an undesirable result.

23. The Joint GSP proposes a number of new nested monitoring wells to fill monitoring network gaps; however, the GSP does not identify any RMSs in the Upper Aquifer in the northwestern area of the subbasin (near Berenda and Dry Creeks), where

---

[14] Some of the RMSs in this area designated for either the Composite or Lower Aquifer are indeed screened in intervals overlapping with typical domestic well depths; however, the GSP does not clearly identify which RMSs are appropriate for monitoring groundwater levels for domestic wells.

nitrate concentrations have historically been high (Joint GSP Figure 3-2, p. 3-59). The historical nitrate concentration contour maps show MCL exceedances in both shallow and deep wells in this area (Joint GSP pp. A2.E.c-20 through A2.E.c-23). This area also has TDS concentrations exceeding 500 ug/L (Joint GSP pp. A2.E.c-18 through A2.E.c-19). The edge of the Corcoran Clay runs through this area, which underscores the need for monitoring in the Upper Aquifer. Several severely disadvantaged communities also rely on groundwater in the nitrate hotspot (Joint GSP Figure 3-2, p. 3-59). However, the GSP does not specifically discuss nitrate or TDS issues in this area and has no RMS for water quality degradation in the area.

Staff recommends the GSP add further discussion of existing water quality issues in this area and the adequacy of its water quality monitoring network and propose additional RMSs in the Upper Aquifer, if appropriate. In addition, staff recommends the GSP further evaluate the spatial distributions of key contaminants discussed above (DBCP, 1,2,3-TCP and uranium) and add or modify RMSs where appropriate.

24. Staff commends the Joint GSP GSAs' proposal to evaluate data from the Irrigated Lands Regulatory Program and other public supply wells as part of assessing the sustainability indicators and their relationship with the Joint GSP projects and management actions. Incorporating these data into the GSP analysis will help fill in gaps in the spatial coverage of the RMSs, considering the heterogenous nature of subsurface contamination. Staff recommends the GSAs develop a more explicit plan for leveraging these data and incorporating them into its SMC. For example, the GSP does not specify whether MO and MT concentrations will be defined for these sites or how the data will be incorporated with those of the RMSs to collectively define undesirable results.

25. The Joint GSP does not consider specific projects or management actions in the event water quality degradation worsens due to groundwater extractions or GSP implementation. Access to safe drinking water in the subbasin can be impacted by nitrate or other existing contaminants (e.g., arsenic, DBCP, 1,2,3-TCP, and Uranium), which may migrate or increase in concentration due to groundwater pumping or the GSP's recharge projects. One option would be to expand the well mitigation program to also cover domestic or public supply wells at which contaminant concentrations become unsafe due to pumping or GSP implementation. The GSP's potential well mitigation framework discusses water quality issues insofar as it mentions mitigation actions proposed under State Water Board or Regional Water Board programs, but the framework appears to rely on those programs to mitigate for water quality degradation rather than describe the GSAs' responsibilities under the GSP. For example, the program notes that the

Water Quality Control Plan for the Sacramento and San Joaquin River Basins "includes new regulatory actions focused on managing nitrates locally while providing interim and long-term solutions for providing safe drinking water" (Joint GSP p. A3.D-6).

Water Budget

26. The GSP acknowledges the high uncertainty of subsurface flow from adjacent basins and attributes it to significant data gaps in water levels near basin boundaries. Staff noted additional important data gaps and issues in model assumptions and calibrations, below. Staff recommends the GSAs update or better explain certain assumptions and calibration choices in their model and include a plan and timeline for filling the more fundamental data gaps in its water budget.

    a. Most calibration wells have an unknown aquifer designation. There was insufficient spatial coverage by wells with known aquifer designation, and calibration errors are on average larger at wells with known aquifer designation.

    b. The rationale of assigning the water level at each well to a model layer was not explained.

    c. It is unclear how the vertical distributions of pumping were decided, and how these decisions impacted the calibration.

    d. The calibration is biased for the Lower Aquifer, resulting in overestimates of water levels at low water levels and underestimates of water levels at high water levels.

    e. The assumptions behind the model's future general-head boundary water levels were not documented, making it difficult to understand the increased net subsurface inflows estimated during 2020-2040.

27. The GSP appears to underestimate historical and current overdraft by double-counting San Joaquin River seepage to the subbasin as both recharge to the groundwater system from "boundary seepage" and as subsurface inflow from the Kings subbasin. Because the San Joaquin River is located immediately south of the subbasin boundary, the GSP calculates half of the San Joaquin River seepage along the southern boundary as "Boundary Infiltration of Surface Water" (see footnote on Joint GSP pp. 2-69 through 2-70). The GSP implicitly includes it again as part of the "Net Subsurface Groundwater Inflow" through groundwater modeling (see Joint GSP Table 2-26). When calculating the historical and current overdraft (see Joint GSP Tables 2-29 and 2-30), this amount of water is counted in both "Infiltration of Surface Water" (Column "d," equivalent to the sum of the last three

columns in Table 2-22) and “Net Subsurface Groundwater Inflow” (Column “a”). The San Joaquin River seepage to the subbasin was 59,945 AFY while the “Net Subsurface Inflow” was modeled as 69,435 AFY during 1989-2014 (Joint GSP Table 2-22). The “Net Subsurface Inflow” averages 69,675 AFY and includes 65,328 AFY inflow from the Kings subbasin during 1989-2015 (Joint GSP p. A6.D-D-10). The San Joaquin River seepage constitutes the majority of the “Net Subsurface Inflow.”

The GSP’s overdraft estimation should be modified to remove either the “Net Subsurface Inflow” or the “Boundary Infiltration of Surface Water” component, considering the double counting of the San Joaquin River seepage to the subbasin and the high uncertainty in the “Net Subsurface Inflow.”

Gravelly Ford GSP Comments

General

28. The GSP does not provide meaningful definitions of undesirable results or quantitative MT or MOs for reduction of groundwater storage, degraded groundwater quality, land subsidence, or depletions of interconnected surface water, making it impossible to know how the GSA will monitor groundwater conditions for the sustainability indicators and what conditions would trigger a response from the GSA. In addition, the GSP does not describe or map any monitoring well locations for these undesirable results, making it difficult to assess whether conditions are adequately characterized in the Basin Setting of the GSP or how well conditions will be monitored in the future.

Groundwater Quality

29. The GSP does not cite the source of the data used to describe existing water quality the basin setting, does not identify data gaps, and only discusses the water quality needs of agricultural beneficial users.

Depletions of Interconnected Surface Water

30. The GSP does not consider how groundwater management may affect interconnected surface waters and associated beneficial uses and users. Instead, the GSP defines its MO for interconnected surface water as “utilization for irrigation and groundwater recharge of the maximum available surface water each year” (GFWD GSP p. 3-3). SGMA requires that GSAs manage for depletions of interconnected surface water, not identify priorities for diversions of surface water. The GSA should revisit its SMC for this sustainability indicator.

Water Budget

31. The overdraft estimates in the GSP are internally inconsistent. The GSP refers to two sets of water budgets for the area covered by the GSP: one conducted for the Joint GSP, and the other conducted by the GFWD. The GSP uses water budget values from both analyses together without differentiating the historical, current, and future conditions. This causes confusion. For example, the GSP defines “overdraft” using several different values from the two budgets that range from zero to 1,700 AFY (GFWD GSP pp. 2-15 through 2-16; pp. 2-22 through 2-23; p. 2-35; Appendix B pp. 21 through 22). The GSA should correct the contradictions and present a cohesive water budget using the same data and methods as the other subbasin GSPs.

32. The water budget misrepresents the relationship of flows between the Land and Surface Water System and Groundwater System. The water budget table (GFWD GSP Table 2-6) summarizes the total inflows and total outflows of the area covered by the GSP, but fails to break down the inflows and outflows by water budget system (i.e., the Land and Surface Water System, and Groundwater System). This joining together of different systems and inconsistent categorization of different inflows and outflows likely leads to the GSP’s mistakes in how different components of the water budget were characterized as inflow or outflow. The approach also leads to an overall incorrect mass balance accounting for the GSP area. For example:

    - “Groundwater Extraction” (from pumpers within the GSA), which would normally be described as an outflow from the Groundwater System and an inflow to the Land and Surface Water System, was mistakenly counted as part of the total inflow that appear to add up individual inflow components of the two systems, but not part of the total outflow.

    - “Infiltration of Precipitation Loss/Surface Water Loss/Applied Water Loss” items were counted as part of the total outflow but not part of the total inflow, whereas they would normally be described as outflow of the Land and Surface Water System, and inflow to the Groundwater System.

    These components are internal flows between the Land and Surface Water System and the Groundwater System, and therefore should cancel each other out in the mass balance.

    Also, a typo appears to have been carried into the water budget mass balance: the subsurface inflow is listed as 500 AFY in Table 2-6, which is inconsistent with the “Groundwater Inflow” of 5,200 AFY in Table 2-7. The 500 AFY value appears to be a typo, but the GSP uses the 500 AFY value in calculating the total inflow and storage change in Table 2-6.

33. The GSP does not explain a significant increase in surface water supply in its projected water budget. The native flow of surface water (i.e., Cottonwood Creek Diversions, see Table 2-1) to the subbasin is projected at 6,000 AFY, despite it averaging 1,200 AFY in the historical water budget (GFWD GSP Table 2-6). In addition, the GSP counts on the SJRRP to provide an added 1,600 AFY of increased streambed recharge and subsurface inflow to the GSP area, but does not provide evidence to support this assumption

New Stone GSP Comments

Groundwater Levels and Potential Drinking Water Impacts

34. Staff is concerned that the SMC do not appropriately consider beneficial users and uses of water in the subbasin. More specifically, staff has concerns with how the GSAs define an undesirable result, MTs, and MOs (MTs and MOs are discussed in #3 above). The New Stone GSP states that chronic lowering of groundwater levels is significant and unreasonable if groundwater pumping has caused 25 percent of wells in the New Stone Water District to go dry. The GSP does not explain why 25 percent was determined as the significant and unreasonable metric or how beneficial uses or users in the subbasin were considered in setting the metric there.

    Moreover, the New Stone GSP did not explicitly consider drinking water uses in setting its SMCs. The GSP mentions the existence of domestic wells in the district (NSWD GSP p. ES-2) but states elsewhere that groundwater is not used for drinking water supply in the GSP area (NSWD GSP p. 3-38). There is some evidence of domestic well use within the GSP area. APN 041-042-001—a parcel in the GSP area—has a domestic well that was completed in 2019, according to the Department of Water Resources Online System of Well Completion Reports. Also, although the GSP's well density map (NSWD GSP Figure 2-5) does not distinguish among domestic, agricultural, or domestic water supply wells, the Joint GSP's domestic well density map identifies domestic wells in several of the sections within New Stone Water District GSA. Moreover, SGMA requires GSAs to consider the interests of all beneficial uses and users of groundwater (Cal. Water Code § 10723.2), and neither the statute nor the GSP regulations narrows that responsibility to consideration of just the beneficial uses and users within the part of the subbasin covered by an individual GSP.

Groundwater Quality

35. The New Stone GSP sets quantitative criteria for managing for degradation of water quality but does not discuss approach for managing for water quality degradation may not fully account for the effects of groundwater pumping and GSP implementation.

    a. The water quality sampling frequency described in the GSP is inadequate for tracking potential water quality degradation associated with pumping and GSP implementation. In the water quality monitoring network section, the GSP states that sampling will occur every three years using three monitoring wells (NSWD GSP pp. 5-9 through 5-10). The GSP justifies having a small network with low monitoring frequency because there are no known contaminant plumes to monitor within the GSA area. State Water Board staff disagrees and does not think the monitoring network size and frequency are sufficient to determine if water quality is being degraded.

    b. The SMC for water quality degradation is based on protecting water quality for crops rather than existing water quality standards.

Water Budget

36. The water budget is not well-documented and therefore difficult to assess. Values in the water budget table (NSWD GSP Table 3-9, p. 3-84) are not substantiated by data, parameters, or equations, even though the GSP is using simple analytical methods that could be easily documented. As a result, it is difficult to validate the values of water budget components in the GSP. The GSP should include the data and calculations behind its water budget analysis.

37. The methods used to calculate subsurface flow in the water budget are unclear. The GSP states that subsurface inflow and outflow were both calculated through transmissivity values, groundwater level contours (i.e., gradients) and district boundaries (i.e., lengths) (NSWD GSP pp. 3-78 through 3-79), but does not present the parameters used or the final calculations. The water budget table (NSWD GSP Table 3-9) shows 4,500 AFY of subsurface inflow and zero subsurface outflow, but the GSP does not explain how it arrived at this number. Staff speculates the GSP calculated the net subsurface inflow, which is likely derived through mass balance of water budget components in the groundwater system (i.e., based on storage change and net recharge). On the other hand, the GSP contradicts itself by stating in the Executive Summary (NSWD GSP p. ES-2) that groundwater inflow and outflow were assumed to be equal due to lack of data. The GSP should clarify how the subsurface flow estimate was derived.

38. Staff noted additional important data gaps and issues, below, in the New Stone GSP's projected water budget (see NSWD GSP Table 3-9). Staff recommends the GSA update or better explain certain assumptions and values in their projections.

    a. The projected water budget assumes a 10 percent reduction in demand but does not explain the rationale.

    b. The GSP considers climate change in its projected budget (p. 3-88), but not potential land use change.

    c. The storage increment of 4,600 AFY in Table 3-9 contradicts other values in the table. A mass-balance accounting for the Projected Groundwater System Water Budget based on values in Table 3-9 shows a storage increase of only 1,100 AFY.

    d. The projected water budget has a mass-balance error in the Land System that may warrant adjustment. Staff's mass-balance accounting for the Projected Land System shows the total inflow exceeds the total outflow by 1,100 AFY. In a correctly balanced accounting, the Land System storage change would be negligible.

Root Creek GSP Comments

Groundwater Quality

39. Chapter 4 of the Root Creek GSP states that water quality SMC will be set in the GSP's 5-year update when more data are obtained to establish the baseline, and that MOs will not exceed the baseline. Chapter 5, however, sets specific MTs and MOs at some agricultural and municipal wells, though does not provide an MT or MO for rural residential use. Instead, the GSP states that a rural residential MT and MO will be determined over the next 5-year period (RCWD GSP pp. 4-28, 4-30). Staff recommends the Root Creek GSA resolve the conflicting statements in the GSP and set a numerical MT and MO for rural residential, which the GSA can then adjust as appropriate in future 5-year updates based on any new information. See also #6.

40. The Root Creek GSP describes a water quality monitoring network, but does not specify well types, screen intervals, or which wells will be sampled for which analytes. Without this information, it is difficult to assess whether the monitoring network will successfully capture water quality degradation impacts to all beneficial users.

41. The Root Creek GSP describes a numerical MO for municipal use and a qualitative MO for agricultural use. The GSP's MT for nitrogen is set at 30 mg/L for agricultural wells and at 10 mg/L, the MCL for nitrogen, for municipal wells; however, agricultural wells and municipal wells pump at similar depths and can share the same area. The GSP does explain how the GSA could functionally manage for such different water quality levels at depths used by both municipal and agricultural wells.

Water Budget

42. The water budget is not well-documented and therefore difficult to assess. The Root Creek GSP does not validate the values in the water budget table (RCWD GSP Table 3-9, p. 3-86) by data, parameters, or equations, even though the GSP is using simple analytical methods that could be easily documented with data, parameters and equations of calculation. For example, the GSP does not substantiate its subsurface inflow or outflow values with the parameters (i.e., transmissivity, gradient and length of boundaries) and calculations used to produce them, even though the GSP acknowledges those values are the most uncertain. Staff recommends that the GSP include the data and calculations underlying its water budget analysis.

43. State Water Board staff recommends the Root Creek Water District GSA clarify pieces of the Root Creek GSP's water budget (see RCWD GSP Table 3-9):

    a. The sources and amounts of surface water supply are not detailed, making it difficult to understand how the values in the table were developed. Because the GSP relies on increased surface water supply to alleviate the overdraft, it is important to ensure these surface water supplies are substantiated and feasible.

    b. The GSP does not explain the difference between the historical overdraft value of 8,400 AFY in Table 3-9 and the estimate of 3,100 AFY for average water level decline (RCWD GSP p. 3-83).

    c. It is unclear whether San Joaquin River seepage is included in the Root Creek GSP's water budget. The GSP states that seepage is calculated based on gage data and water diversions along the river (RCWD GSP p. 3-77), but does not present data or values for the seepage and does not list it out in the water budget table (RCWD GSP Table 3-9). It is also unclear whether this recharge is a portion of the 17,000 AFY of subsurface inflow ("groundwater inflow"). The Joint GSP, by contrast, lists 3,700 AFY of "local stream/river recharge" in the water budget provided by the Root Creek Water District GSA.

d. The projected water budget appears to have a mass balance error in the Land System that may warrant adjustment. Staff's mass-balance accounting for the Projected Land System shows the total inflow exceeds the total outflow by 2,300 AFY. In a correctly balanced accounting, the Land System storage change would be negligible.

If you have questions regarding these comments, please do not hesitate to contact State Water Board Groundwater Management Program staff by email at SGMA@waterboards.ca.gov or by phone at 916-322-6508.

Sincerely,

Natalie Stork

Natalie Stork
Senior Engineering Geologist
Chief, Groundwater Management Program Unit I
Office of Research, Planning, and Performance

Enclosures: Appendix – Select constituents in Madera Subbasin wells

Public water systems with wells in the Madera Subbasin as of December 2021 (see .xlsx attachment within PDF file)

Appendix – Select constituents in Madera Subbasin wells (December 2021)

Non-detects are green, detections are yellow and orange, and MCL exceedances are red. Figures developed from State Water Board [Groundwater Ambient Monitoring and Assessment (GAMA) Program's database (https://gamagroundwater.waterboards.ca.gov/)](https://gamagroundwater.waterboards.ca.gov/).

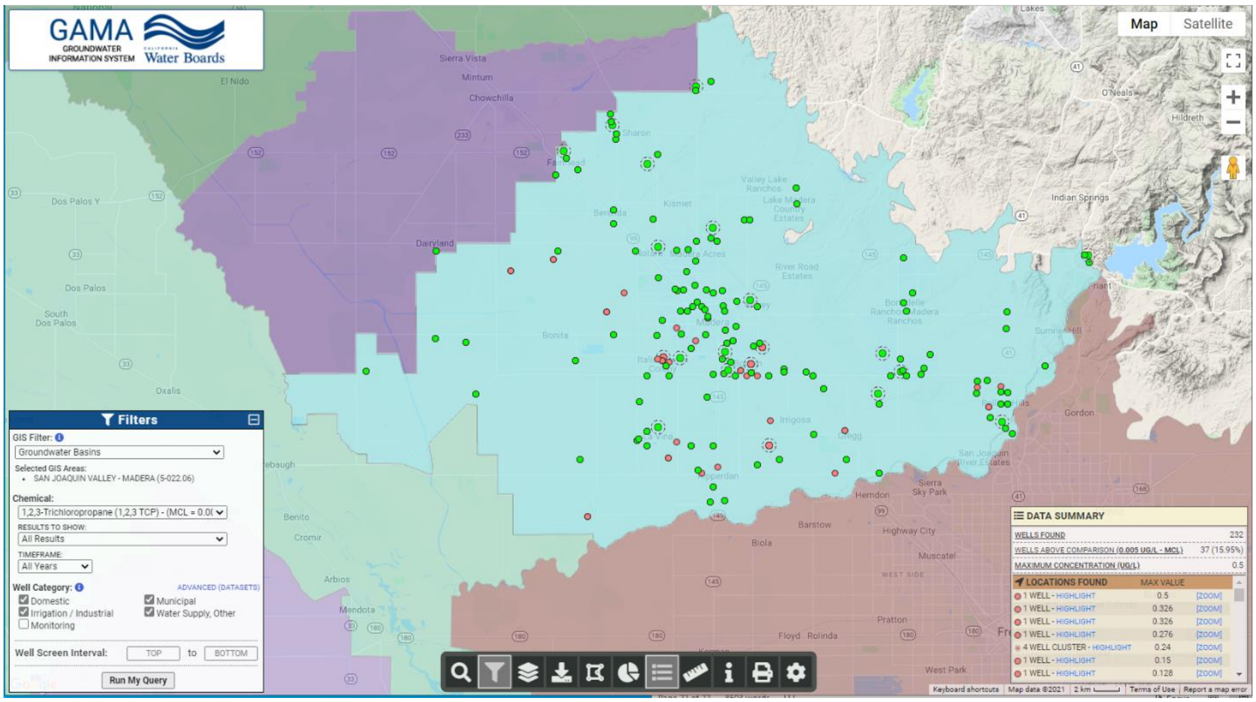

Figure 1. 1,2,3-Trichloropropane in Madera Subbasin wells

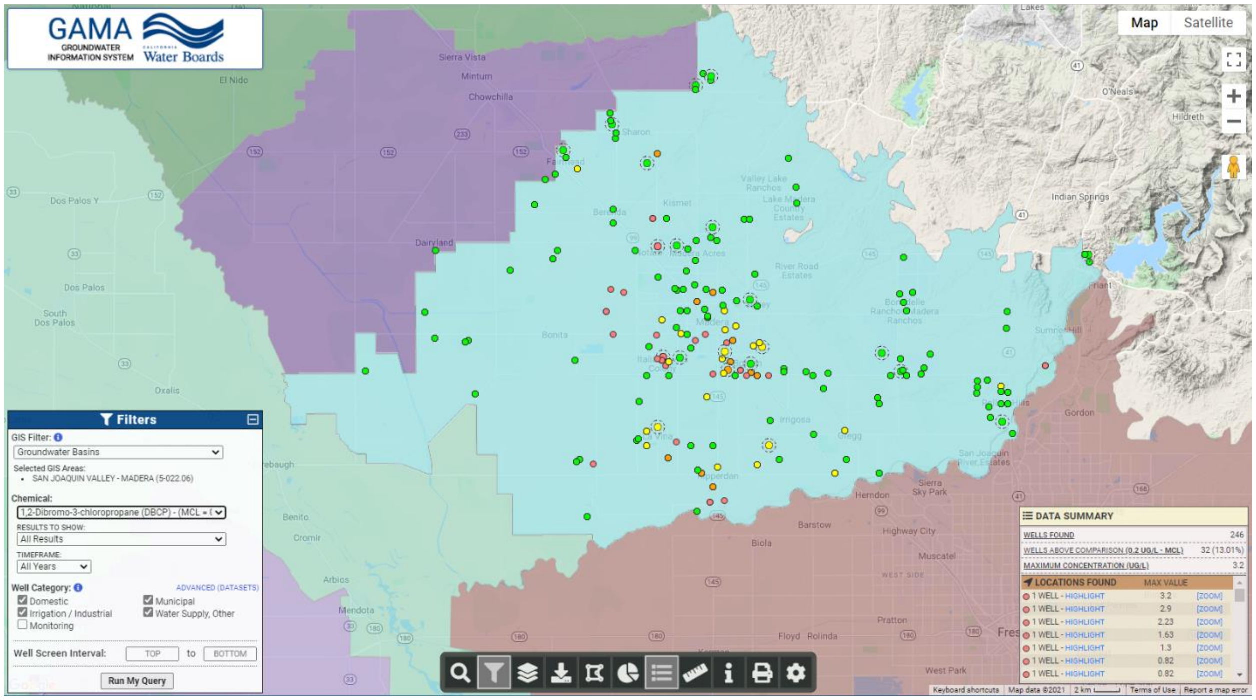

Figure 2. DBCP in Madera Subbasin wells.

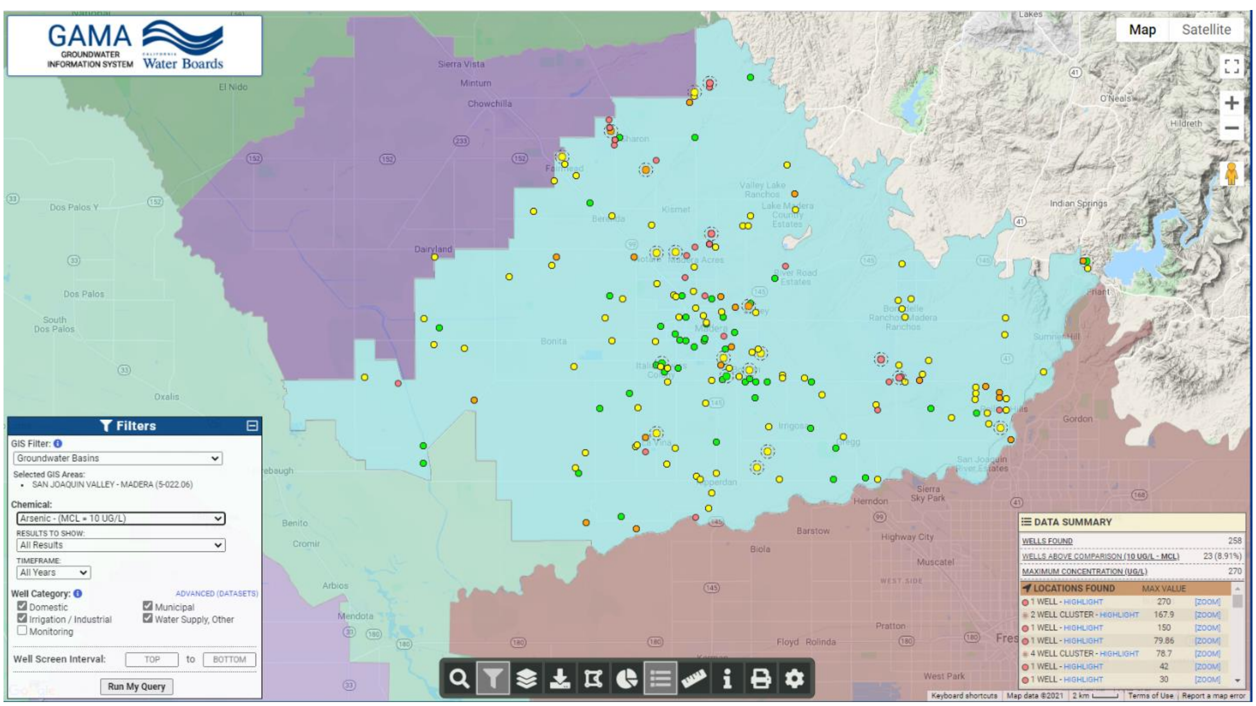

Figure 3. Arsenic in Madera Subbasin wells

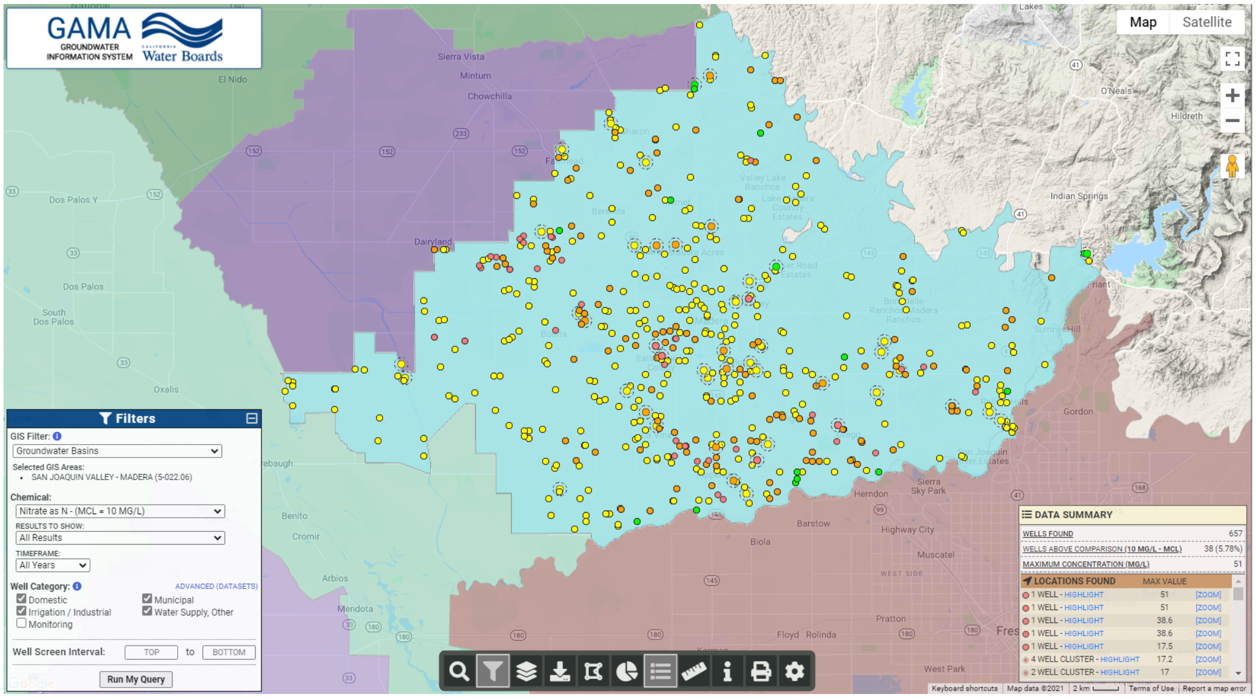

Figure 4. Nitrate in Madera Subbasin wells.

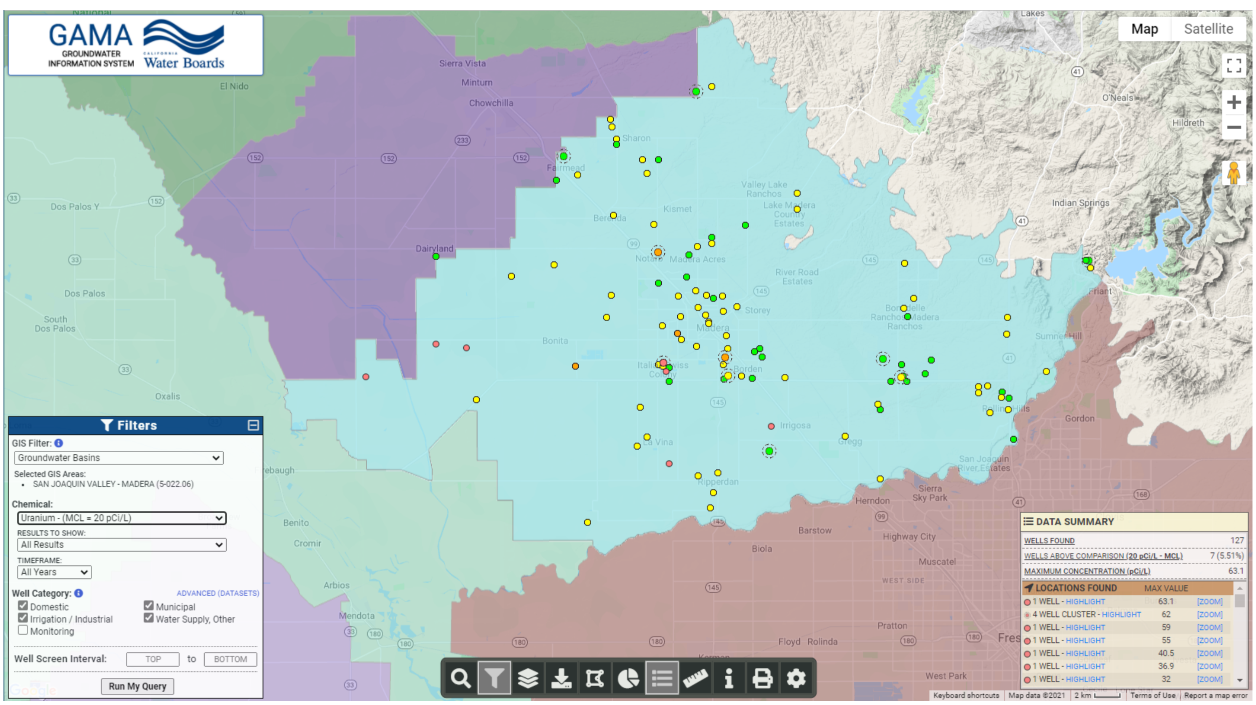

Figure 5. Uranium in Madera Subbasin wells.

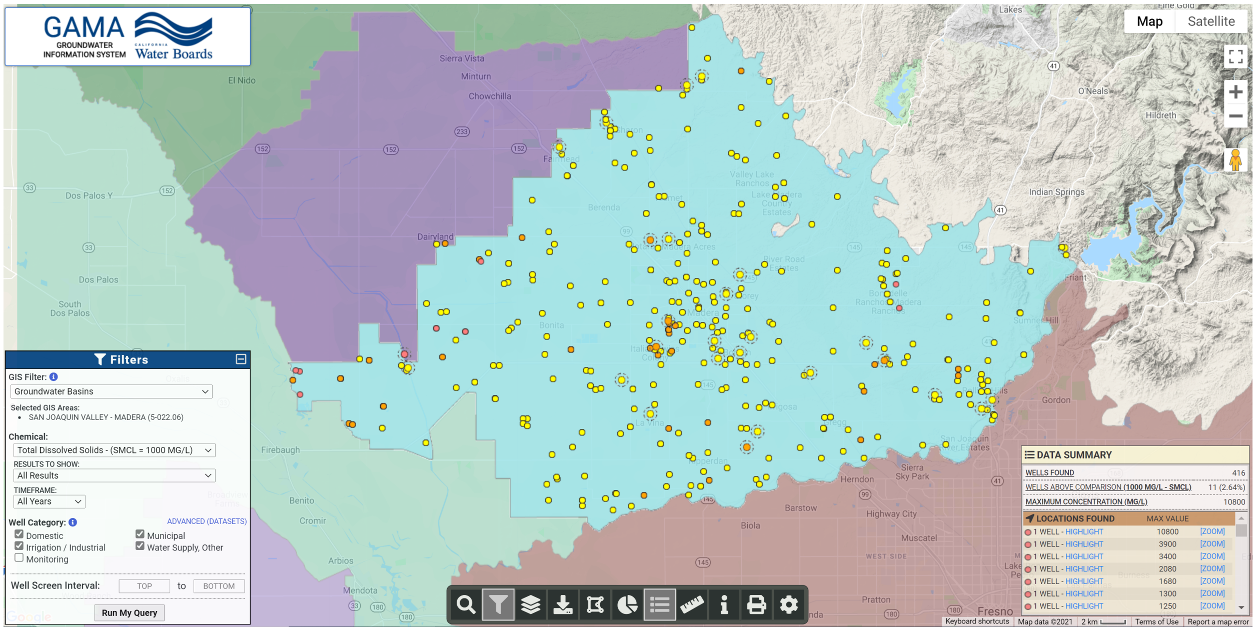

Figure 6. TDS in Madera Subbasin wells.