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 CLEAN WATER ACTION | CLEAN WATER FUND

October 9, 2021

Fillmore and Piru Basins Groundwater Sustainability Agency
PO Box 1110
Fillmore, CA 93016

Submitted via email: evai@unitedwater.org

Re: Public Comment Letter for the Fillmore Basin Draft GSP

Dear Eva Ibarra,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Fillmore Basin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, drinking water users, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
 - a. Human Right to Water considerations **are not sufficiently** incorporated.
 - b. Public trust resources **are not sufficiently** considered.
 - c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.

3. Data gaps **are not sufficiently** identified and the GSP **needs additional plans** to eliminate them.
4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Fillmore Basin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A**.

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the basin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,



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Attachment A

Specific Comments on the Fillmore Basin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users

The identification of Disadvantaged Communities (DACs) and drinking water users is **insufficient**. The GSP provides a map of DACs by block group (Figure 2-1.4). However, the plan does not document the population for each DAC. The GSP also failed to include the population dependent on groundwater as their source of drinking water in the basin.

The GSP provides a density map of domestic wells in the basin. However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range) within the basin.

These missing elements are required for the GSA to fully understand the specific interests and water demands of these beneficial users, and to support the consideration of beneficial users in the development of sustainable management criteria and selection of projects and management actions.

RECOMMENDATIONS

- Include a map showing domestic well locations and average well depth across the basin.
- Provide the population of each identified DAC.
- Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems).

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the plan refers to a previous report by United Water Conservation District, included in the GSP as Appendix E. This Appendix describes a numerical model developed for a regional area that includes the Fillmore Basin.

The main text of the GSP presents a summary of annual depletions of ISW in the Fillmore Basin at two locations of the Santa Clara River. The ISW section of the GSP concludes with the statement (p. 2-59): "Data gaps remain regarding identifying the extent and timing of

interconnectedness of other stream channel areas (e.g., Sespe Creek and central portions of the Santa Clara River), due to a lack of paired groundwater level and surface water level monitoring sites. Stream conditions here are considered to vary between all three stream conditions depicted on Figure 2.2-29. The significance of interconnected surface water and groundwater conditions at these areas is less than that of the two primary areas of rising groundwater, because surface water exists in these reaches much less often (Figure 2.2-12), and therefore, provides less opportunity for beneficial uses related to aquatic habitat or surface water diversions.” However, no map is provided to show the stream reaches to which this statement refers. Without a map of labeled stream reaches in the basin, it is difficult to understand the location of these reaches, and whether the GSP has included them as potential ISWs in the GSP. In addition, it is unclear whether the GSP is only considering ISWs in areas with “rising groundwater” (gaining conditions). Under SGMA’s ISW definition¹, they must also include losing reaches that maintain a connection with the saturated zone at *any* point in time and space.

RECOMMENDATIONS

- Provide a map showing all the stream reaches in the basin, with reaches clearly labeled with stream name and interconnected or disconnected.
- Provide more discussion in the GSP about the groundwater elevation data and streambed elevation data used to verify interconnected reaches. Include a map of the interpolated groundwater elevations and spatial extent of groundwater monitoring wells used to produce the map. Discuss screening depth of monitoring wells and ensure they are monitoring the shallow principal aquifer.
- Overlay the stream reaches shown with depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. For the depth-to-groundwater contour maps, use the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a Digital Elevation Model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth to groundwater along streams and other land surface depressions where GDEs are commonly found.
- On the ISW map, clearly label the areas with data gaps. While the GSP clearly identifies data gaps and their locations in the text, we recommend that the GSP considers any segments with data gaps as potential ISWs and clearly marks them as such on maps provided in the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **incomplete**. We commend the GSA for their comprehensive evaluation of GDEs in the basin, as presented in the GDE Technical Memorandum (Appendix D). The GSP mapped GDEs and potential GDEs using multiple sources, including the NC Dataset (also referred to in the GSP as the iGDE database), California Department of Fish and Wildlife (CDFW) VegCAMP, US Department of Agriculture (USDA) CalVeg, and National Wetlands Inventory data. Table 2.2-5 describes the type of GDEs in

¹ “[Interconnected surface water] refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted.” [23 CCR §351(o)]

the basin with dominant flora species and acreage within the basin. Table 2.2-7 presents the critical habitat and special status species in the basin.

The Appendix states (p. 21): “In light of the limitations of the monitoring well data, the groundwater elevation data presented in this section are intended to illustrate general trends within GDE units. The spring 2019 depth to water surface (Section 2.1.2), as opposed to monitoring well data, is used to establish GDE connectivity with shallow groundwater.” The Appendix describes the challenges with using groundwater monitoring well data for some of the GDE units and explains that 2019 groundwater levels are conservative for GDE mapping. However, we would like to see additional discussion and use of groundwater data from the pre-SGMA benchmark date of 2015 where available (e.g., pre-drought 2011 water levels) to determine which GDE units are connected to groundwater.

Furthermore, we found that some mapped features in the NC dataset were improperly disregarded (i.e., coastal live oak (*Quercus agrifolia*) on slopes). NC dataset polygons were incorrectly excluded for mapped vegetation growing on a clear slope, based on landscape position and improbable connection to groundwater. However, without groundwater data, there is no way to confirm that these NC dataset polygons are not GDEs. If no data are available, then these polygons should be retained as potential GDEs.

RECOMMENDATIONS

- For GDE units where groundwater elevation data are available, we recommend the pre-SGMA period of 2005-2015 be used to verify a connection to groundwater. If complete data from this period are not available, consider the use of data from 2011 (a wet year) since it is before the SGMA benchmark date of 2015.
- Re-evaluate the NC dataset polygons that were removed based on their location on a slope. If groundwater elevation data are not available to verify connection to groundwater, retain these polygons as potential GDEs in the GSP.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required^{2,3} to be included in the water budget. The integration of native vegetation into the water budget is **sufficient**. We commend the GSA for including the groundwater demands of this ecosystem in the historical, current and projected water budgets. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATION

- State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

² “Water use sector’ refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.” [23 CCR §351(al)]

³ “The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.” [23 CCR §354.18]

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders⁴ is not fully met by the description in the Communication and Engagement Plan (Appendix B). We note the following deficiencies with the overall stakeholder engagement process:

- The opportunities for public involvement and engagement are described in very general terms. They include attendance at public meetings, a stakeholder email list, updates to the GSP website and social media, and information shared at meetings held by other local agencies and organizations. There is no specific outreach during the GSP development process described for environmental stakeholders and domestic well owners.
- The Communication and Engagement Plan does not include a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to environmental stakeholders.

RECOMMENDATION

- Include a more detailed and robust Communication and Engagement Plan that describes active and targeted outreach to engage DAC members, domestic well owners, and environmental stakeholders during the remainder of the GSP development process and throughout the GSP implementation phase. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results⁵ and establishing minimum thresholds.^{6,7}

⁴ "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

⁵ "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]

⁶ "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

⁷ "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP mentions impacts to DACs and domestic drinking water wells when defining undesirable results. The GSP states (p. 3-3): “Groundwater levels below the base of well perforations (or screen intervals) prevents beneficial uses (i.e., domestic) and users (i.e., DACs) from benefiting from the California Human Right to Water due to dry well conditions.” However, the GSP does not sufficiently describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results in the basin. The measurable objectives set for groundwater elevations do not consider DACs and drinking water users.

The GSP states (2-43): “Historically water quality chemicals (analytes or constituents) of concern (COCs) in the Fillmore and Piru basins have generally included, but are not necessarily limited to, the following analytes: Total Dissolved Solids (TDS), Sulfate, Chloride, Nitrate, and Boron.” The GSP further states (2-52): “Additional potential COCs in the Fillmore Basin were identified [as] Radiochemistry (gross alpha and uranium), Selenium, Lead, Iron, and Manganese.” The GSP states that the minimum thresholds for degraded water quality correspond with water quality objectives (WQOs) and maximum contaminant levels (MCLs) established by the Los Angeles Regional Water Quality Control Board (LARWQCB) Basin Plan and California Division of Drinking Water (DDW), respectively. However, they are not specifically provided in Section 3 (Sustainable Management Criteria) of the GSP.

For degraded water quality, the GSP does not discuss direct and indirect impacts on DACs or drinking water users when defining undesirable results for degraded water quality, nor does it evaluate the cumulative or indirect impacts of proposed minimum thresholds on these stakeholders. The GSP does not set any measurable objectives for the degraded water quality sustainability indicator.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe further the direct and indirect impacts on DACs and drinking water users when defining undesirable results for chronic lowering of groundwater levels.
- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs and drinking water users within the basin. Further describe the impact of passing the minimum threshold for drinking water users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

Degraded Water Quality

- Describe direct and indirect impacts on DACs and drinking water users when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to “Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act.”
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs and drinking water users.
- Include the minimum thresholds established for the identified COCs in Section 3 (Sustainable Management Criteria) of the GSP, instead of just stating that they align with drinking water standards.

- Set measurable objectives for the degraded water quality sustainability indicator.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

We commend the GSA for their comprehensive analysis of undesirable results for GDEs and ISWs. The GSP analyzes the impacts on GDEs when defining undesirable results for three sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, and depletions of interconnected surface waters).

For minimum thresholds, the GSP states (p. 3-9): “The MT for groundwater levels in the Cienega Restoration / Fish Hatchery area is set at the critical water level (Kibler, 2021 and Kibler et al., 2021), 10 ft below 2011 low groundwater levels (i.e., the MO). If/when this MT is exceeded, mitigation (Section 4) will be implemented to offset the undesirable result that would occur without adequate soil moisture.” The GSP does not, however, assess the impacts of minimum thresholds on the other GDEs in the basin.

The GSP notes that the Cienega Riparian Complex has historically shown the greatest degradation due to groundwater levels (p. 2-80). It also describes this impact as an undesirable result due to groundwater levels declining, resulting in (p. 3-4) “die off of riparian vegetation (e.g., cottonwood or willow species in the Cienega Riparian Complex GDE unit), due to groundwater level declines below the critical water level, that are attributable to groundwater pumping.” If the minimum threshold is exceeded, the referenced mitigation action will require months or years to implement. However, there is no discussion of interim pumping reductions or other actions that could have an immediate positive impact on the undesirable result.

RECOMMENDATIONS

- Provide explicit discussion of how the minimum threshold (10 feet below 2011 groundwater levels) will prevent undesirable results specifically for all GDEs in the basin, not just those in the Cienega Restoration / Fish Hatchery area.
- State directly what the depth to groundwater corresponds to under the GDEs for the proposed minimum threshold (10 feet below 2011 groundwater levels).
- Consider GDEs when establishing measurable objectives and evaluate the measurable objectives based on GDE water needs.

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations⁸ require integration of climate

⁸ “Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow.” [23 CCR §354.18(e)]

change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2070. However, the GSP does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

We acknowledge and commend the inclusion of climate change into key inputs (e.g., precipitation, evaporation, and surface water flow) of the projected water budget. Additionally, the sustainable yield is calculated based on the projected pumping with climate change incorporated. However, if the water budgets are incomplete, including the omission of extremely wet and dry scenarios, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extreme wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Points (RMPs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs and domestic wells in the basin.

Figure 2.1-8 (Existing Groundwater Elevation Monitoring Programs Map) and Figure 2.1-9 (Existing Groundwater Quality Monitoring Programs Map) show that no monitoring wells are located across portions of the basin near DACs and domestic wells. Beneficial users of groundwater may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network⁹.

The GSP provides comprehensive discussion of data gaps for GDEs and ISWs. Section 3.5.4.4.2 (Potential New Monitor Wells) discusses plans to include installation of new shallow monitoring wells to provide water level data around GDEs and ISWs, which is further described in Appendix D (Assessment of Groundwater Dependent Ecosystems for the Fillmore and Piru Basins Groundwater Sustainability Agency) and Appendix K (Monitoring Network and Data Gaps). However, this information is scattered across several locations in the GSP without a comprehensive set of maps provided.

⁹ "The monitoring network objectives shall be implemented to accomplish the following: [...] (2) Monitor impacts to the beneficial uses or users of groundwater." [23 CCR §354.34(b)(2)]

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of DACs and domestic wells to clearly identify potentially impacted areas. Increase the number of representative monitoring points (RMPs) in the shallow aquifer across the basin for the groundwater elevation and water quality groundwater condition indicators. Prioritize proximity to DACs and drinking water users when identifying new RMPs.
- Provide maps that overlay existing and proposed monitoring well locations with the locations of GDEs and ISWs to clearly identify potentially impacted areas.
- Describe further the biological monitoring that can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the basin. Appendix D discusses remote sensing of GDEs using NDVI or other data to monitor the health of GDEs through time, but few details are provided.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to beneficial users of groundwater such as DACs and drinking water users.

We commend the GSA for including several projects and management actions with explicit benefits to the environment. However, the GSP does not discuss the manner in which DACs and drinking water users may be benefitted or impacted by projects and management actions identified in the GSP. Potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

The plan's commitment to mitigate the undesirable result on the Cienega Riparian Complex GDE is insufficient. The plan is confusing in that the mitigation refers only to the Cienega Springs Restoration project and does not seem to propose any mitigation for the Cienega Riparian Complex GDE. Furthermore, it is not clear how proposed projects 1 & 2 would mitigate impacts to the Cienega Riparian Complex GDE even if it is part of the Cienega Springs Restoration project area.

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- For GDEs, include the following: 1) Add a map showing the locations of the Cienega Riparian Complex GDE and the Cienega Springs Restoration project, 2) Explain how

the proposed management actions will mitigate the undesirable result occurring at the Cienega Riparian Complex GDE, 3) Develop immediate and longer term management actions to address the undesirable result occurring at the Cienega Riparian Complex (e.g., immediate pumping reductions when the minimum threshold is reached, non-native vegetation removal should die-off occur).

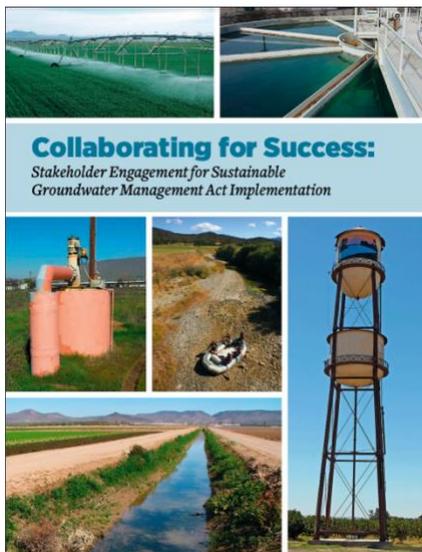
- Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the “Multi-Benefit Recharge Project Methodology Guidance Document”¹⁰.
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

¹⁰ The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: <https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/>

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called [Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation](#). It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

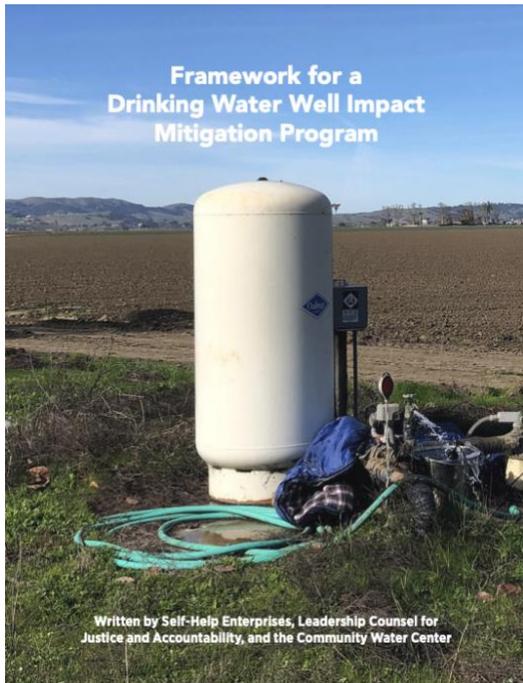
The Human Right to Water

Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

Review Criteria <i>(All Indicators Must be Present in Order to Protect the Human Right to Water)</i>		Yes/No
A Plan Area		
1	Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area? ²⁵ a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems. d. Private well communities.	
2	Land use policies and practices ²⁶ Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and zoning. c. Processes for permitting activities which will increase water consumption	
B Basin Setting (Groundwater Conditions and Water Budget)		
1	Does the groundwater level conditions section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the groundwater quality conditions section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances? ²⁷	
3	Does the groundwater quality conditions section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs? ²⁸	
4	Incorporating drinking water needs into the water budget. ²⁹ Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

The [Human Right to Water Scorecard](#) was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



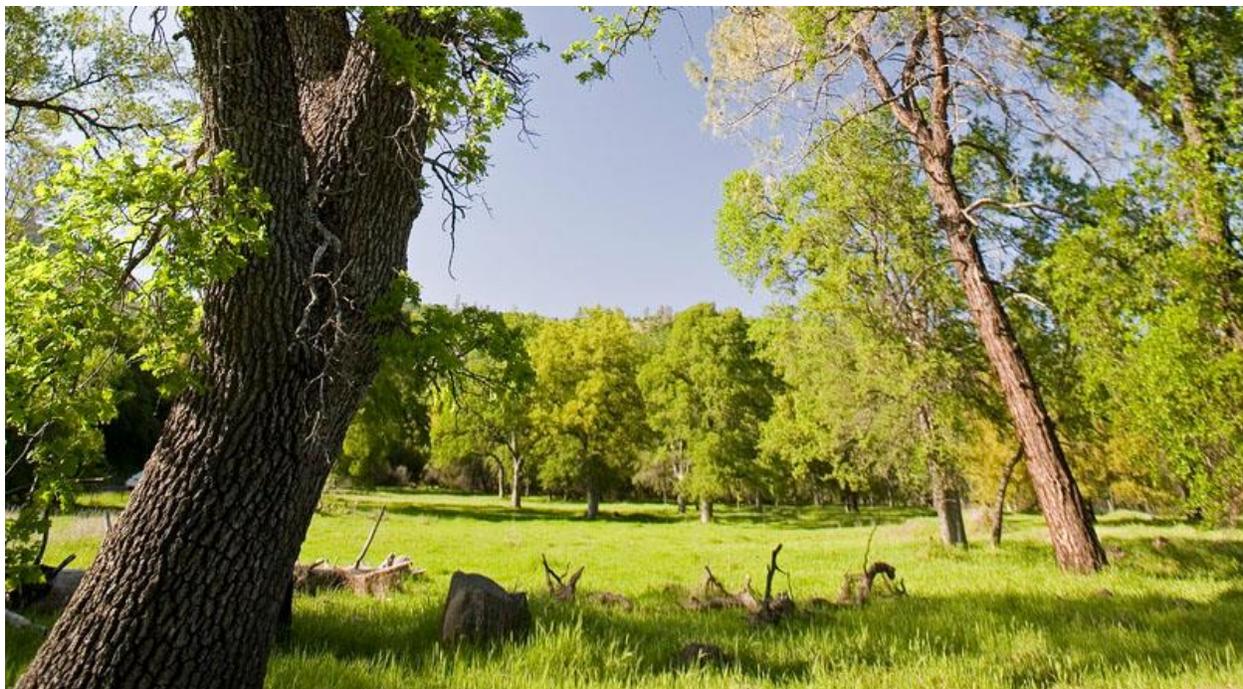
The [Drinking Water Well Impact Mitigation Framework](#) was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database



The [Plant Rooting Depth Database](#) provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and

availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater ([NC Dataset](#)) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes¹, is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to-groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

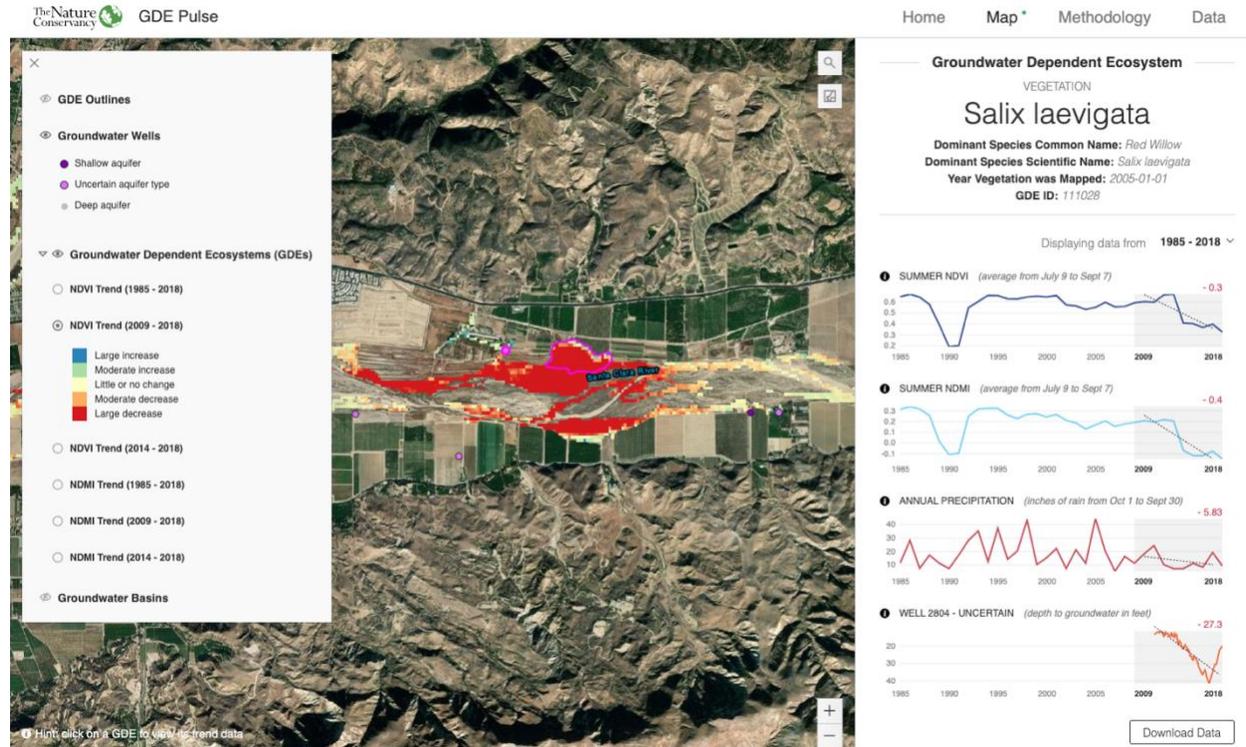
1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please [Contact Us](#) if you have additional rooting depth data for California phreatophytes.

¹ Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. *Oecologia* 108, 583–595. <https://doi.org/10.1007/BF00329030>

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

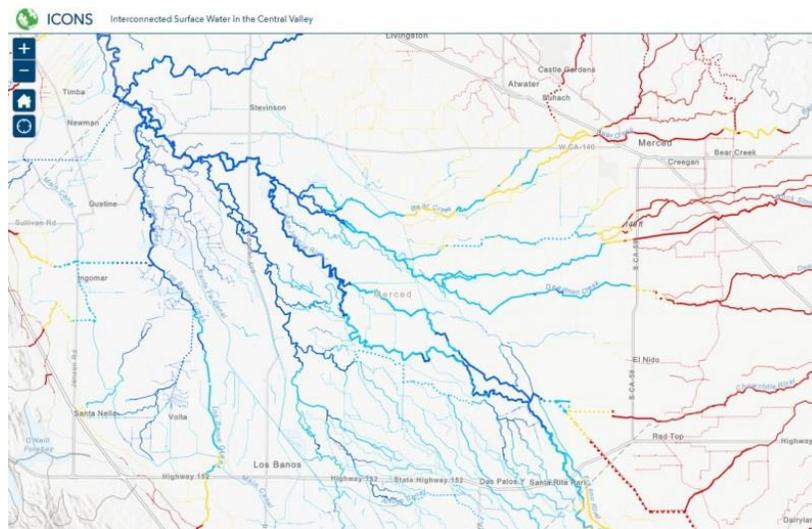
Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper Interconnected Surface Water in the Central Valley



ICONOS maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California’s Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data [available online](#) from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy’s ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Fillmore Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result “depletion of interconnected surface waters”, Attachment C provides a list of freshwater species located in the Fillmore Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015¹. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife’s BIOS² as well as on The Nature Conservancy’s science website³.

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
<i>Empidonax traillii extimus</i>	Southwestern Willow Flycatcher	Endangered	Endangered	
<i>Vireo bellii pusillus</i>	Least Bell's Vireo	Endangered	Endangered	
<i>Actitis macularius</i>	Spotted Sandpiper			
<i>Aix sponsa</i>	Wood Duck			
<i>Anas acuta</i>	Northern Pintail			
<i>Anas americana</i>	American Wigeon			
<i>Anas crecca</i>	Green-winged Teal			
<i>Anas cyanoptera</i>	Cinnamon Teal			
<i>Anas platyrhynchos</i>	Mallard			
<i>Anas strepera</i>	Gadwall			
<i>Ardea alba</i>	Great Egret			
<i>Ardea herodias</i>	Great Blue Heron			
<i>Botaurus lentiginosus</i>	American Bittern			
<i>Butorides virescens</i>	Green Heron			
<i>Cistothorus palustris palustris</i>	Marsh Wren			
<i>Egretta thula</i>	Snowy Egret			
<i>Empidonax traillii</i>	Willow Flycatcher	Bird of Conservation Concern	Endangered	
<i>Fulica americana</i>	American Coot			
<i>Icteria virens</i>	Yellow-breasted Chat		Special Concern	BSSC - Third priority

¹ Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoS ONE, 11(7). Available at: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710>

² California Department of Fish and Wildlife BIOS: <https://www.wildlife.ca.gov/data/BIOS>

³ Science for Conservation: <https://www.scienceforconservation.org/products/california-freshwater-species-database>

Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Nycticorax nycticorax	Black-crowned Night-Heron			
Phalacrocorax auritus	Double-crested Cormorant			
Plegadis chihi	White-faced Ibis		Watch list	
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Riparia riparia	Bank Swallow		Threatened	
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Vireo bellii	Bell's Vireo			
CRUSTACENAS				
Cyprididae fam.	Cyprididae fam.			
Hyaella spp.	Hyaella spp.			
FISHES				
Catostomus santaanae	Santa Ana sucker	Threatened	Special Concern	Endangered - Moyle 2013
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	Endangered	Endangered	Endangered - Moyle 2013
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus mykiss - Southern CA	Southern California steelhead	Endangered	Special Concern	Endangered - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Anaxyrus californicus	Arroyo Toad	Endangered	Special Concern	ARSSC
Pseudacris cadaverina	California Treefrog			ARSSC
Rana boylei	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondi	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis hammondi hammondi	Two-striped Gartersnake		Special Concern	ARSSC
Thamnophis sirtalis sirtalis	Common Gartersnake			

INSECTS & OTHER INVERTS				
Abedus spp.	Abedus spp.			
Ambrysus californicus				Not on any status lists
Ambrysus spp.	Ambrysus spp.			
Anax walsinghamsi	Giant Green Darner			
Argia agrioides	California Dancer			
Argia lugens	Sooty Dancer			
Argia nahuana	Aztec Dancer			
Argia spp.	Argia spp.			
Aturidae fam.	Aturidae fam.			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brechmorhoga mendax	Pale-faced Clubskimmer			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Choroterpes spp.	Choroterpes spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Corydalis texanus				Not on any status lists
Cricotopus bicinctus				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Cryptochironomus spp.	Cryptochironomus spp.			
Dicrotendipes spp.	Dicrotendipes spp.			
Enochrus spp.	Enochrus spp.			
Epeorus spp.	Epeorus spp.			
Ephydridae fam.	Ephydridae fam.			
Erpetogomphus lampropeltis lampropeltis	Serpent Ringtail			
Erpetogomphus spp.	Erpetogomphus spp.			
Eukiefferiella spp.	Eukiefferiella spp.			
Fallceon quilleri	A Mayfly			
Fallceon spp.	Fallceon spp.			
Hetaerina americana	American Rubyspot			
Hydropsyche spp.	Hydropsyche spp.			

Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Ischnura denticollis	Black-fronted Forktail			
Labrundinia spp.	Labrundinia spp.			
Larsia spp.	Larsia spp.			
Lepidostoma spp.	Lepidostoma spp.			
Mesocapnia spp.	Mesocapnia spp.			
Micrasema spp.	Micrasema spp.			
Microcyloopus spp.	Microcyloopus spp.			
Microtendipes pedellus				Not on any status lists
Microtendipes spp.	Microtendipes spp.			
Mideopsis spp.	Mideopsis spp.			
Neotrichia spp.	Neotrichia spp.			
Oecetis disjuncta	A Caddisfly			
Oecetis spp.	Oecetis spp.			
Optioservus spp.	Optioservus spp.			
Ostrocerca spp.	Ostrocerca spp.			
Oxyethira spp.	Oxyethira spp.			
Paltothemis lineatipes	Red Rock Skimmer			
Paltothemis spp.	Paltothemis spp.			
Paracladopelma spp.	Paracladopelma spp.			
Paraleptophlebia spp.	Paraleptophlebia spp.			
Peltodytes spp.	Peltodytes spp.			
Pentaneura spp.	Pentaneura spp.			
Petrophila spp.	Petrophila spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Polypedilum spp.	Polypedilum spp.			
Postelichus spp.	Postelichus spp.			
Procladius spp.	Procladius spp.			
Progomphus borealis	Gray Sanddragon			
Psephenus falli				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Serratella micheneri	A Mayfly			
Sialis spp.	Sialis spp.			
Sigara spp.	Sigara spp.			
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Stictotarsus eximius				Not on any status lists
Stictotarsus spp.	Stictotarsus spp.			

Sympetrum illotum	Cardinal Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
Thienemannimyia spp.	Thienemannimyia spp.			
Tinodes spp.	Tinodes spp.			
Tipulidae fam.	Tipulidae fam.			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus spp.	Tropisternus spp.			
Tvetenia spp.	Tvetenia spp.			
Zaitzevia spp.	Zaitzevia spp.			
Zavrelimyia spp.	Zavrelimyia spp.			
MAMMALS				
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Physa spp.	Physa spp.			
PLANTS				
Azolla filiculoides	NA			
Baccharis salicina				Not on any status lists
Berula erecta	Wild Parsnip			
Bidens laevis	Smooth Bur-marigold			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis montevidensis	Sand Spikerush			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Isolepis cernua	Low Bulrush			
Ludwigia hexapetala	NA			Not on any status lists
Ludwigia peploides peploides	NA			Not on any status lists
Lythrum californicum	California Loosestrife			
Persicaria lapathifolia				Not on any status lists
Persicaria punctata	NA			Not on any status lists
Phragmites australis australis	Common Reed			
Pluchea odorata odorata	Scented Conyza			
Stachys albens	White-stem Hedge-nettle			



IDENTIFYING GDEs UNDER SGMA Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online¹ to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)². This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

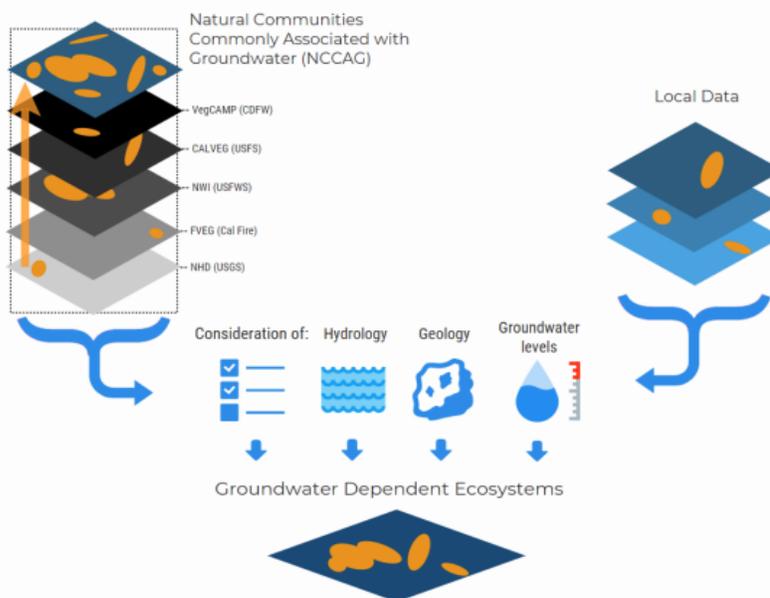


Figure 1. Considerations for GDE identification.
Source: DWR²

¹ NC Dataset Online Viewer: <https://gis.water.ca.gov/app/NCDataSetViewer/>

² California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf>

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California³. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset⁴ on the Groundwater Resource Hub⁵, a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should be done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer.*

³ For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf

⁴ "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: <https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/>

⁵ The Groundwater Resource Hub: www.GroundwaterResourceHub.org

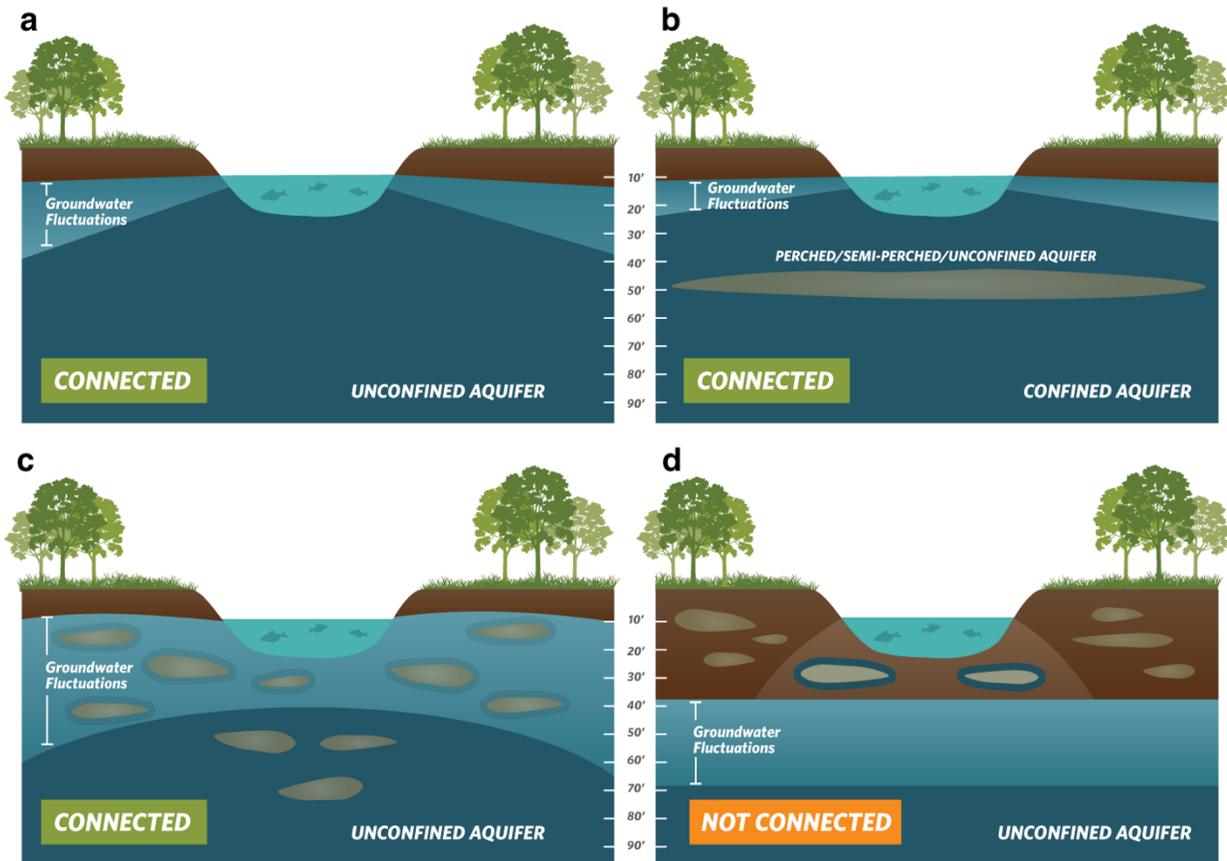


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. **Bottom: (c)** Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(d)** Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California’s climate. DWR’s Best Management Practices document on water budgets⁶ recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline⁷ could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach⁸ for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC’s GDE guidance document⁴, one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California’s Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California’s GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet⁴ of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer⁹. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

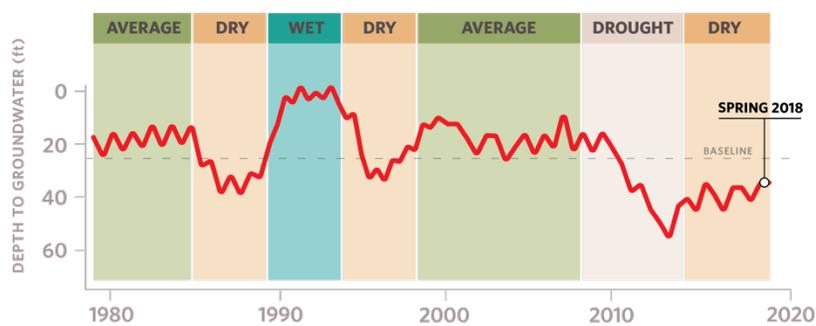


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

⁶ DWR. 2016. Water Budget Best Management Practice. Available at:

https://water.ca.gov/LegacyFiles/groundwater/sqm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

⁷ Baseline is defined under the GSP regulations as “historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin.” [23 CCR §351(e)]

⁸ Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs⁴).

⁹ SGMA Data Viewer: <https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer>

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals¹⁰, which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

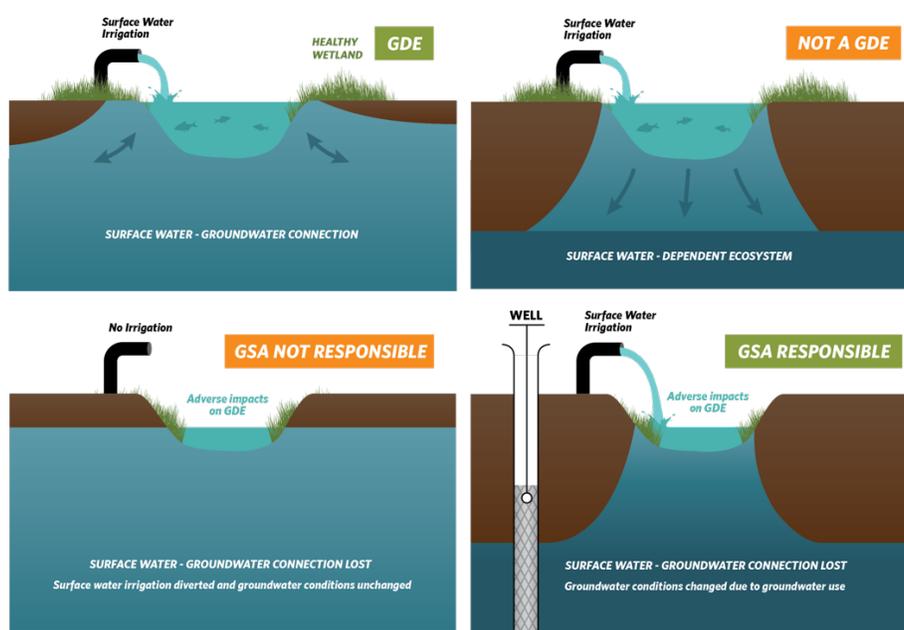


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

¹⁰ For a list of environmental beneficial users of surface water by basin, visit: <https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/>

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.
- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.
- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

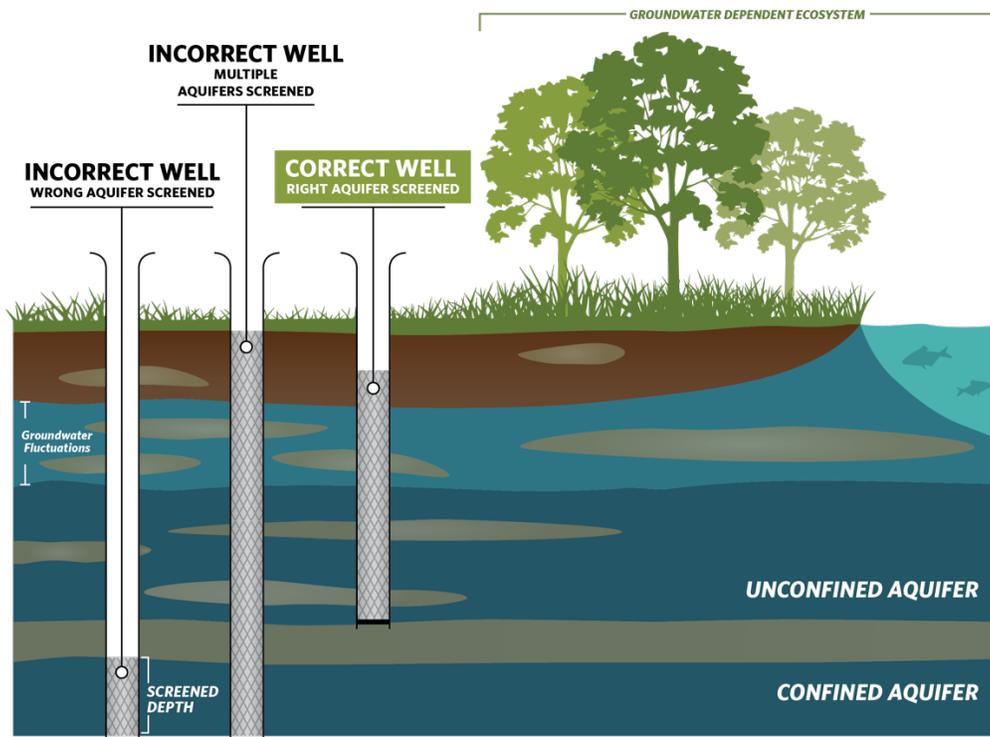


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)¹¹ to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

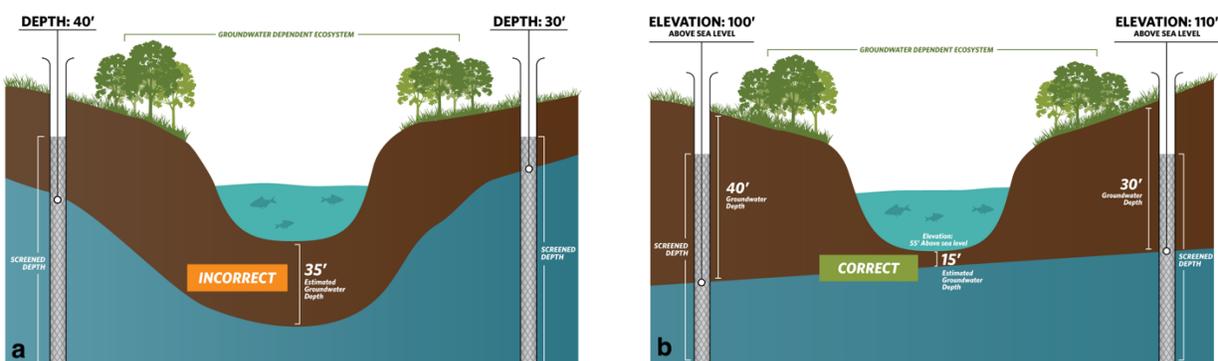


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

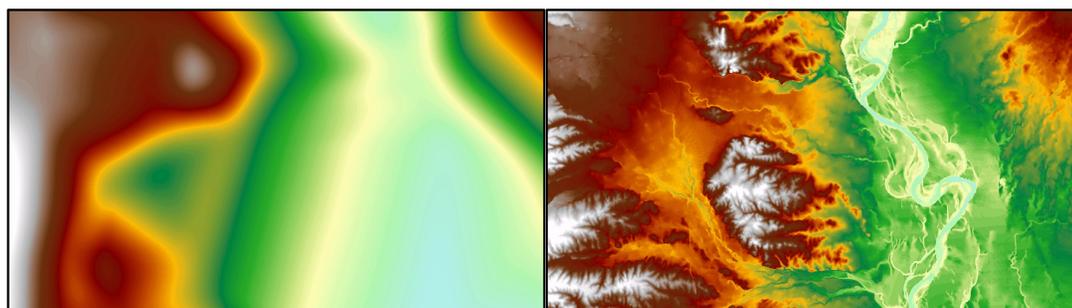


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

¹¹ USGS Digital Elevation Model data products are described at: <https://www.usgs.gov/core-science-systems/nep/3dep/about-3dep-products-services> and can be downloaded at: <https://iewer.nationalmap.gov/basic/>

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, **The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network.** Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.