Humboldt County Farm Bureau

5601 So. Broadway, Eureka, CA 95503
Serving Agriculture Since 1913

County of Humboldt
Groundwater Sustainability Agency
1106 Second Street
Eureka, Ca 95501

December 24, 2021

Attn: Hank Seemann

Re: Comments on Administrative Draft Groundwater Sustainability Plan, Eel River Valley

Dear Mr. Seemann:

The Humboldt County Farm Bureau would like to maintain the integrity of the Eel River Basin for the beneficial use of all those who dependent on it. Aligned with the Sustainable Groundwater Management Act's (SGMA) intention of informed, researched, and thoughtful local oversight by a Groundwater Sustainability Agency (GSA), we support the public discovery, debate, and implementation of the sustainability indicators and development of thresholds of undesirable results.

Humboldt County's Board of Supervisors and Staff, working as our GSA has determined the Eel River Groundwater Basin to be displaying characteristics of a basin interacting with its users and the year-to-year changes in precipitation. Based on this research, the basin fluctuates and continues to return to prior levels indicative of a system that is able to support its use by all benefactors in the past, now, and into the future.

In the agricultural community, we have continued to seek more efficient methods of water use. Today, we are more efficient than ever before and strive to conserve water and not use more water than is necessary to grow and provide for our livestock and forages. With the assistance of many water-efficient grants and programs, farmers are continuing to improve their water use and conservation. We hope to avoid undue burdens to all community members by any actions that do more harm than good in the correction of a potential undesirable result in the future.

We continue to be interested in supporting research and data collection and look forward to working with you in the future.

Sincerely,

Joseph Alexandre

Joseph Alexandre
Farm Bureau President

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FRIENDS OF THE EEL RIVER

Working for the recovery of our Wild & Scenic River, its fisheries and communities.

Friday, December 24, 2021

Hank Seeman
Humboldt County
via email

Re: Comments on Draft Groundwater Sustainability Plan

Dear Hank and Groundwater Team:

Thank you for the informative presentation on the draft GSP last Friday. The following brief notes and comments may help to improve the final plan.

At this writing, several technical memos remain outstanding. We may comment on them when they are posted.

The draft GSP taught me Townsend's big-eared bats drink water.

The final GSP should note that Northern California summer steelhead were listed by the California Fish and Game Commission this summer as Endangered under the California Endangered Species Act.

As we noted Friday, one of our key concerns is the way the sustainable management criteria for depletion of interconnected surface water is stated. Any action that "… threatens the viability of a special-status species…" would, for species like Chinook salmon and steelhead listed under the federal Endangered Species Act, be an action that jeopardize those species. The threshold for impacts to listed species should be lower than jeopardy or, for that matter, take.

If the threshold for impacts to listed species were take, then the county would need to be prepared to immediately curtail pumping that could affect surface flows. Instead, the rest of the Significant and Unreasonable use statement says "… and reasonable reductions or limitations in groundwater pumping could avoid these effects without jeopardizing other beneficial uses of groundwater." That looks like a rule that says groundwater pumpers never have to stop pumping if they don't want to.

We would suggest that the undesirable result that should trigger analysis is depletion of surface flows such that beneficial uses are impaired. If restricting groundwater extraction could help diminish impacts to public trust resources, the county has a duty to consider how such restrictions can be imposed.

The draft GSP estimates evapotranspiration from natural vegetation and from irrigated agriculture, but then presents those results as part of the same category. What proportion of evapotranspiration is from irrigated agriculture alone?

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In its analysis of salt intrusion and sea level rise, the draft GSP uses a figure of 0.5 feet of sea level rise by 2030 and 1.48 by 2070. These estimates seem improbably conservative. How would the analysis change if you doubled those figures? Note for example that recent reports suggest the Thwaites Ice Shelf is likely to collapse in the next three to five years, entraining several feet of sea level rise from the resulting speedup in the Thwaites Glacier behind the ice shelf:

> *The failure of the shelf would not immediately accelerate global sea level rise. The shelf already floats on the ocean surface, taking up the same amount of space whether it is solid or liquid.*
>
> *But when the shelf fails, the eastern third of Thwaites Glacier will triple in speed, spitting formerly landlocked ice into the sea. Total collapse of Thwaites could result in several feet of sea level rise, scientists say, endangering millions of people in coastal areas.* (See washingtonpost.com/climate-environment/2021/12/13/thwaites-glacier-melt-antarctica/)

Similar reports from Greenland suggest Humboldt is likely to see at least three feet of sea level rise well before 2070. The GSP should note that the lower Eel and Humboldt Bay is now seeing sea level rise at the highest rate in coastal California, because the land at the coastal margin is sinking due to tectonic forces at about the same rate that saltwater is presently rising.

The draft GSP notes in several areas the relative proportion of wells in various categories without ever revealing the actual numbers behind those proportions, e.g. agricultural uses account for 86.4% of groundwater use. How many agricultural wells are we talking about? What are their capacities? Where are they located? How much water have they been pumping? The county has that information or has the power to require that information be disclosed.

It would be much easier to understand the economics and impacts of groundwater pumping if we had a clearer picture of who is using how much water, when, and why. Maps showing densities of wells per square mile are harder to prepare than maps of the actual wells. Why obscure the details of water use in the lower Eel? How has pumped groundwater been used, ie at what rates on what crops? Similarly, the final GSP should detail the history of well drilling in the lower Eel over the last several decades, or at a minimum the last 10 years. How many new wells have been drilled, where, and to what depths?

The draft GSP notes that CASGEM well readings are ‘generally stable.’ Please report the outlier numbers as well as the broader trends. The draft GSP notes that the flows of the Eel River are key to maintaining groundwater levels in the Lower Eel. At what point would diminishing flows in the Eel begin to reduce groundwater levels in the basin?

With respect to the county’s well permitting process, the draft GSP is not clear how or by what standards the county evaluates proposed wells. How does the county insure that wells are not improperly sited, for example not sunk in areas where they would tap subsurface flows? And how does the county consider the potential effects, including cumulative effects, of approving well permits and operations?

The Water Year Type chart on page 72 of the draft GSP presents the last 30 years of water year data at Ferndale as a color-coded bar chart, with annual precipitation varying from a low of just over 20 inches in 2014 to a high of about 65 inches in 1998 and 2017. Five of the first fifteen

years were below average water years. Ten of the second fifteen years were below average. This trend shows that even on the coast we are not immune from the effects of climate change, including the collapse of the assumptions of hydrological stationarity that have been the premise of water management over the last century.

Of course, given the relationship between flows in the Eel River and the lower Eel groundwater basin documented in the draft GSP, precipitation in Ferndale should be considered together with related data, including the even steeper decline in precipitation and increase in temperatures in the inland portions of the Eel River basin. As well, given the increase in groundwater demand associated with higher temperatures, the GSP should present data regarding temperature changes both in the lower Eel basin and the interior which affect not only crop demands but snow melt, vegetation uptake and transpiration, and impacts on salmonid populations.

We are heading into a future where the lack of precipitation alone is likely to continue to create hostile conditions in our rivers and streams for native fish. As the draft GSP documents at page 24, groundwater diversions are higher in drier and warmer years. Those are of course the years in which potential impacts to fisheries and other beneficial uses of surface water can be critical, not to mention significant.

The draft GSP explains that parts of Humboldt county and indeed parts of the lower Eel Groundwater basin are disadvantaged communities such that the California Department of Water Resources judged it appropriate to grant the county funds to support this planning effort without a cost-matching requirement. It would be difficult to support that argument on the basis that the people who own the land and run the irrigation pumps are disadvantaged.

It seems clear the draft GSP is written to insure the irrigating community is in no way inconvenienced by any requirement that it change, or even report, its groundwater use. Treating the uses of the lower Eel River valley's land and water that have become entrenched over the last century as entitlements does not make them sustainable. Practices which ensure native species can continue to thrive are those which can be sustained.

Thank you for all of your work on this plan and the technical material supporting it.

Sincerely yours,

/s/
Scott Greacen
Conservation Director

County of Humboldt
Groundwater Sustainability Agency
1106 Second Street
Eureka, CA 95501

December 24, 2021

Attn: Hank Seemann

RE: Comments on Administrative Draft Groundwater Sustainability Plan, Eel River Valley

Dear Mr. Seemann,

My name is Ronald Vevoda and I am member of the Humboldt County Farm Bureau as well as a dairy farmer in Ferndale, California. After reading the draft of the Groundwater Sustainability Plan of the Eel River Valley, it is my opinion that plan would be beneficial to all affected members of the valley. I believe that the county has done a thorough job with their research and findings and I support the plan at this time.

Dairies across the Eel River Valley strive to become more efficient every year with our water use. As advances continue to be made in the area of water conservation, we (dairy farmers) have adapted our water usage so that we are using what only what we need. As research and programs continue to provide information, we plan on using that information to help inform our decisions with water usage. Water is vital to our livelihood and it only makes sense for us to be conservative as we continue to grow. We hope other members of the Eel River Valley feel the same way and are planning to work together to save this precious commodity.

I look forward to the further research, data and findings that the Sustainability Plan of the Eel River Valley finds in the upcoming years.

Sincerely,

Ronald Vevoda

December 23, 2021

Hank Seemann
Humboldt County Department of Public Works
1106 Second Street
Eureka, CA 95501

Re: Eel River Valley Sustainability Plan (administrative draft)

Ha'wa'lou (Greetings) Hank Seemann

The Eel River Valley Groundwater Basin is within the ancestral territory of the Wiyot Tribe and protecting the groundwater supply and groundwater-dependent ecosystems is a priority for the Wiyot Natural Resources Department (WNRD). The WNRD applauds the Humboldt County Groundwater Sustainability Agency (HCGSA) for completing the administrative draft of Eel River Valley Groundwater Sustainability Plan but has concerns regarding inputs to the minimum thresholds, criteria of an Undesirable Result, and the reaction if an Undesirable Result occurs.

The WNRD believes that the minimum thresholds developed should consider the importance of groundwater seepage to cold-water fishes (Ebersole et al. 2003). Groundwater seepage into rivers, tributaries, and estuaries create persistent discontinuous patches of cool water providing thermal refuge for trout and salmon. Minimum thresholds for groundwater pumping need to consider the impact to available habitat with suitable temperatures, often referred to as thermal refugia, for culturally important fishes, including steelhead trout, Chinook salmon, and Coho salmon.

Furthermore, the WNRD has concerns regarding criteria for an event to be classified an "Undesirable Result". More specifically, the second scenario for an Undesirable Result to occur requires minimum thresholds to be broken for two sequential years despite negative impacts to groundwater-dependent ecosystems possibly occurring immediately. The WNRD recommends that the temporal component for this scenario be removed with an immediate response to be enacted.

Moreover, the WNRD would like the HCGSA to clarify the response if an Undesirable Result occurs. The plans current response (below) does not include the type of further analysis, any type of time frame, or if any tangible actions will be taken.

> "If one of these two scenarios occurs, then further analysis would determine if beneficial uses of the interconnected surface water are degraded or the viability of special status species are threatened, and whether reasonable reductions or limitations in groundwater pumping could avoid these effects without jeopardizing other beneficial uses of groundwater." (6.11.5-pg. 121)

Additionally, without any baseline monitoring of the "interconnected surface waters" or the "special status species", it would be challenging to determine if/how they are "degraded" or what caused degradation. Also, the phrase "could avoid these effects without jeopardizing other beneficial uses of groundwater" implies that reduction measures will only be considered if there are no economic consequences and takes priority away from resources that are culturally important to the Wiyot Tribe.

Thank you for taking the time to consider these concerns for public review.

Rra'dutwas (with kindness),

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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

December 22, 2021

Hank Seemann
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SUBJECT: CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE COMMENTS ON THE EEL RIVER VALLEY BASIN DRAFT GROUNDWATER SUSTAINABILITY PLAN

Dear Hank Seeman:

The California Department of Fish and Wildlife (Department) appreciates the opportunity to provide comments on the Humboldt County Groundwater Sustainability Agency (GSA) Eel River Valley (Basin) Draft Groundwater Sustainability Plan (GSP) prepared pursuant to the Sustainable Groundwater Management Act (SGMA). The Basin is designated as medium priority under SGMA and must be managed under a GSP by January 31, 2022.

The Department is writing to support ecosystem preservation and enhancement in compliance with SGMA and its implementing regulations based on Department expertise and best available information and science. As trustee agency for the State's fish and wildlife resources, the Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of such species (Fish & Game Code §§ 711.7 and 1802).

Development and implementation of GSPs under SGMA represents a new era of California groundwater management. The Department has an interest in the sustainable management of groundwater, as many sensitive ecosystems, species, and public trust resources depend on groundwater and interconnected surface waters (ISWs), including ecosystems on Department-owned and managed lands within SGMA-regulated basins.

SGMA and its implementing regulations afford ecosystems and species specific statutory and regulatory consideration, including the following as pertinent to GSPs:

- GSPs must **consider impacts to groundwater dependent ecosystems** (GDEs) (Water Code § 10727.4(l); see also 23 CCR § 354.16(g));

- GSPs must consider the interests of all beneficial uses and users of groundwater, including environmental users of groundwater (Water Code § 10723.2) and GSPs must **identify and consider potential effects on all beneficial uses and users of groundwater** (23 CCR §§ 354.10(a), 354.26(b)(3), 354.28(b)(4), 354.34(b)(2), and 354.34(f)(3));
- GSPs must **establish sustainable management criteria that avoid undesirable results** within 20 years of the applicable statutory deadline, including **depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water** (23 CCR § 354.22 *et seq*. and Water Code §§ 10721(x)(6) and 10727.2(b)) and describe monitoring networks that can identify adverse impacts to beneficial uses of interconnected surface waters (23 CCR § 354.34(c)(6)(D)); and
- GSPs must **account for groundwater extraction for all water use sectors,** including managed wetlands, managed recharge, and native vegetation (23 CCR §§ 351(al) and 354.18(b)(3)).

Furthermore, the Public Trust Doctrine imposes a related but distinct obligation to consider how groundwater management affects public trust resources, including navigable surface waters and fisheries. Groundwater hydrologically connected to surface waters is also subject to the Public Trust Doctrine to the extent that groundwater extractions or diversions affect or may affect public trust uses. (*Environmental Law Foundation v. State Water Resources Control Board* (2018), 26 Cal. App. 5th 844; *National Audubon Society v. Superior Court* (1983), 33 Cal. 3d 419.) The GSA has "an affirmative duty to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible." (*National Audubon Society*, *supra*, 33 Cal. 3d at 446.) Accordingly, groundwater plans should consider potential impacts to and appropriate protections for ISWs and their tributaries, and ISWs that support fisheries, including the level of groundwater contribution to those waters.

In the context of SGMA statutes and regulations, and Public Trust Doctrine considerations, groundwater planning should carefully consider and protect environmental beneficial uses and users of groundwater, including fish and wildlife and their habitats, GDEs, and ISWs.

The Department recommends the GSP Sustainable Management Criteria include consideration of environmental beneficial uses and users of groundwater, better quantify groundwater extraction, and better characterize surface water-groundwater connectivity. The Department is providing additional comments and recommendations as notated in Attachment A.

If have any questions related to the Departments comments and/or recommendations on the Eel River Valley Basin GSP please contact Senior Environmental Scientist Specialist Monty Larson at monty.larson@wildlife.ca.gov or (707) 496-2292.

Sincerely,

DocuSigned by:
Robert Hawkins
F8D52F774C764C2...

Tina Bartlett, Regional Manager
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Enclosures (Attachment A)

ec: California Department of Water Resources

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Attachment A

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE COMMENTS ON THE EEL RIVER VALLEY BASIN (BASIN) GROUNDWATER SUSTAINABILITY PLAN (GSP)

COMMENTS AND RECOMMENDATIONS
The Department's comments are as follows:

1. Comment #1- Agricultural groundwater use is largely unknown (GSP section 2.4.1, pages 21-24).
    a. Issue: The GSP states that agricultural groundwater use was estimated from just 4% of the irrigated land with most metered groundwater irrigators located in the western portion of the basin. Water use was highly variable with nearly an order of magnitude difference between the largest and smallest application on a per acre basis.
    b. Recommendation: The Department recommends the GSA extend the agricultural groundwater use monitoring network to include 25% of the groundwater irrigated acres representative of all groundwater irrigated portions of the Eel River Valley Basin (ERVB), soil types, and irrigation methods to provide greater accuracy in estimated agricultural groundwater use.
2. Comment #2- Groundwater use estimates in the Hydrogeologic Conceptual Model may not represent actual use (GSP section 3.6.5, pages 42 and 43).
    a. Issue: The Hydrogeologic Conceptual Model may not accurately represent groundwater flow without more accurate groundwater extraction information (see Comment #1).
    b. Recommendation: The Department recommends the GSP include additional agricultural and irrigation use data in the Hydrogeologic Conceptual Model to more precisely represent total groundwater use.
3. Comment #3- Hydrogeologic Conceptual Model Technical Memorandum (GHD 2021).
    a. Issue: The Department finds the Hydrogeologic Technical Memorandum cited in Section 3 of the GSP provides incomplete well construction information. Some of the wells used to characterize water surface elevations within the alluvial system and underlying Carlotta Formation have incomplete well construction information. The GSP provides multiple figures and tables indicating the wells used to characterize water levels, but does not include pertinent well construction information (well depth and screen intervals) associated with the observation points. Some of the

wells used to characterize water levels have deeper well completions and well screen intervals below the alluvial aquifer system. In addition, to calculate a result for groundwater levels and storage within the alluvial aquifer system, the modeling should be parameterized on observed groundwater elevations (i.e. 2003 spring water levels). The GSP utilizes wells that have well perforation completion depths within different aquifer systems or wells that have well screen perforations over multiple aquifer systems (i.e. alluvium and Carlotta Formation). The Department finds that such wells are poor candidates for calculations of water levels or storage within an individual aquifer. Independent of historic water level observations, if well data are not exclusively completed within the alluvial aquifer system, the best result to be expected is a general or composite water level elevation within the basin.

   b. Recommendation: The Department recommends the Hydrogeologic Conceptual Model clarifies or adds the necessary well construction information for the observation points to provide a more accurate depiction of groundwater occurrence within the basin and specifically within the identified aquifer systems within the basin.

4. Comment #4- Hydrogeologic Conceptual Model Technical Memorandum (GHD 2021).
   a. Issue: The Department finds the Hydrogeologic Conceptual Model Technical Memorandum and GSP does not characterize the subbasin geologic and hydrogeologic framework within the basin (23 CCR 354.14). The Department finds the GSP lacks specific information regarding the extent (lateral and vertical) of confinement within the basin. The location and the extent of confining units will have an impact regarding aquifer specific parameters (i.e., storability, transmissivity, hydraulic connectivity) and water level occurrence. The GSA has installed several paired monitoring wells that indicate the presence of depth specific monitoring well completions (shallow and deep) and associated water levels. The water level observations from these points indicate different hydraulic heads and provides a brief discussion on vertical gradients associated with these points. The significance of these observations is that water may move vertically (up or down) within the aquifer systems within the basin.
   b. Recommendation: The Department recommends the GSP identify the lateral and vertical extent of confinement within the basin (i.e., to include additional characterizations of locations and associated parameters), as these occurrences have the potential to influence water level surface in the basin where wells are connected through construction or where semi-confined to unconfined conditions exist. The Department recommends the

GSP provides additional characterization of these locations and associated parameters.

5. Comment #5- The proposed water budget does not rely on the best available data to provide an estimate of sustainable yield per 23 CCR 354.18 (GSP Section 5.2, pages 70-72).
    a. Issue: The Department finds the water year type is based on rainfall in Ferndale and not does not include rainfall gages representative of the entire Eel River watershed. The Department finds that reliance on a single rainfall gauge/ location may not accurately reflect recharge to groundwater and availability for extraction or lack thereof.
    b. Recommendation: The Department recommends the water year type for the purpose of water budgeting should be based on an index of rainfall gages throughout the Eel River watershed to provide an estimate of sustainable yield.
6. Comment #6- Groundwater-Surface Water Model predictions (5.3, pages 75).
    a. Issue: The Department is concerned the hydrologic model of groundwater levels as interpreted in the GSP appears to suggest that water is not being drawn from the Eel River into the alluvial aquifer. In addition, the model does not consider the impact of surface water withdrawal on beneficial users of groundwater. Analysis from several reports associated with the GSP indicate there are significant groundwater-surface water interactions and the Eel River is losing surface flow to the groundwater system every year under all water year types analyzed during the irrigation season (SHN 2019, SHN 2021, Thomas Gast and Associates 2021).
    b. Recommendation: The Department recommends the hydrologic model is reconfigured to accurately reflect groundwater surface water interactions. These modifications should be completed before the model is used to predict future groundwater extraction scenarios or is used to evaluate potential significant and unreasonable results (23 CCR 354.26).
7. Comment #7- The sustainability goal does not account for Interconnected Surface Water (ISW) and may not sufficiently protect Groundwater Dependent Ecosystems (GDEs) and species (Section 6.3, page 97).
    a. Issue: The Department is concerned the basin is not being managed sustainably, as stated in the GSP. The Department finds that groundwater extraction in the basin is depleting ISW in the Eel River near Fortuna (SHN 2019, Thomas Gast and Associates 2021) and impacting adjacent GDEs. The Department finds that groundwater extraction of ISW has resulted in lowering and maintaining groundwater levels that are below the rooting depth for several species of trees dependent on groundwater

including Black Cottonwood (*Populus trichocarpa)* and Red Alder (*Alnus rubra*) (SHN 2021).

b. Recommendation: The Department recommends the GSP revises the sustainability goal to include undesirable results that occur due to groundwater extraction and include how groundwater will be managed to prevent significant and unreasonable results including depletion of ISW. In addition, the Department recommends the sustainability goal is revised to specify the reasons behind the goal and a realistic path to achieving the goal, including specific consideration of GDEs, species and habitats (23 CCR § 354.24). Minimum thresholds for the sustainability goal should be established that are protective of ISW flows that will maintain juvenile salmonid passage depths (0.4 feet) through all critical riffles.

8. Comment #8- The sustainable management criteria for chronic lowering of groundwater levels defines significant and unreasonable results and minimum thresholds that only consider impacts to groundwater wells and the ability to continue extraction and excludes GDEs (Section 6.6, pages 101-106).
    a. Issue: The Department is concerned the significant and unreasonable results for groundwater lowering excludes potential impacts to GDEs. The Department is further concerned the identified minimum thresholds are not likely to maintain existing GDEs. Water level data collected in Fall 2020 and Spring 2021 at the City of Fortuna disposal monitoring well site west of the Eel River indicate that groundwater levels were below the rooting depth of all GDE plant species. It is likely that groundwater levels in the adjacent GDEs have remained below the rooting zone of representative GDE plant communities for more than a year. Groundwater depths comparatively greater than the rooting depth will likely cause progressively adverse impacts to this GDE, such as reduced growth, reduced reproduction, or increased mortality (Rohde 2018). GDEs consisting mostly of mature trees with low rates of reproduction and recruitment are at risk of future ecosystem if baseline groundwater levels are at depths greater than seedlings and saplings can access to take root and replace mature trees.
    b. Recommendation: The Department recommends the minimum thresholds for groundwater reflect levels that are protective of GDEs and species, as well as maintain groundwater levels that are accessible to groundwater dependent species within GDEs in the basin.
9. Comment #9- As the sustainable management criteria for reduction in groundwater storage does not define minimum thresholds or measurable objectives, the Department cannot evaluate whether these criteria will avoid

undesirable results or avoid significant or unreasonable conditions (23 CCR 354.28) (Section 6.7, page 106).

a. Issue: The Department is concerned the GSP fails to consider undesirable results resulting from the minimum thresholds given the highly interconnected groundwater/surface water system.
b. Recommendation: The Department recommends minimum thresholds and measurable objectives be developed to include a description of each minimum threshold and how they were established for each of the six sustainability indicators; inclusive of how they will prevent adverse impacts to GDEs and aquatic ecosystems dependent on interconnected surface waters.

10. Comment #10- The sustainable management criteria for depletion of interconnected surface water minimum thresholds are insufficient to ensure avoidance of significant and unreasonable adverse impacts (undesirable results) to fish and wildlife and beneficial users of groundwater (Section 6.11, pages 115-120).
    a. Issue: The Department finds the description of potential impacts to groundwater-dependent ecosystems does not adequately describe the range of effects of groundwater pumping on streamflow depletion. The GSPs consideration of 130 cubic feet per second as suitable for upstream migration does not adequately protect fisheries.
    b. Recommendation: The Department recommends the GSA conducts data driven analyses on fish passage, habitat connectivity, and optimum flows for all life stages of anadromous fish in the basin.
11. Comment #11- The sustainable management criteria for depletion of interconnected surface water minimum thresholds using groundwater levels as a proxy for surface water depletion (Section 6.11.3.2, pages 118-120).
    a. Issue: The Department is concerned that average fall groundwater elevation data derived from a single point in time may not accurately represent the minimum fall groundwater level and may obscure impacts of groundwater extraction on interconnected surface waters. The Department also finds the GSP has not developed criteria to evaluate the proposed minimum threshold which includes documentation on how the minimum threshold may affect environmental beneficial uses and users of groundwater or valid methods for quantitatively measuring minimum thresholds (23 CCR 354.28).
    b. Recommendation: The Department recommends that groundwater wells used to define the minimum threshold for surface water depletion (GSP Table 24. page 120) install continuous monitoring devices to accurately define groundwater levels and minimum thresholds. Installation of

continuous monitoring devices will provide the GSA with data to assess impacts, manage minimum thresholds, and help ensure regional groundwater extractions do not lead to significant and adverse impacts on fish or wildlife resources.

12. Comment #12- The sustainable management criteria for depletion of interconnected surface water measurable objectives have not been developed (Section 6.11.4, page 120).
    a. Issue: The Department finds the GSP is unclear on whether the measurable objective will or will not result in undesirable results.
    b. Recommendation: The Department requests clarification of how the GSP will establish attainable measurable objectives for each sustainability indicator that reflect fish and wildlife needs with a reasonable margin of operational flexibility and safety for each measurable objective (not risking undesirable results) that considers dynamic hydrology, climate, etc.
13. Comment #13- The Department finds that many sections of the Draft GSP are yet to be developed. Due to the incomplete nature of the GSP the Department cannot comment on these sections. The lack of a complete Draft GSP may result in additional comments on the Final GSP.
14. Comment #14– The GSP does not adequately account for state jurisdictional boundaries within Section 2 (Description of Planning Area) or its associated maps (Description of Planning Area, General Land Use Characteristics and Jurisdictional Areas [Section 2.5, pg. 25-26]).
    a. Issue: The Department finds that CDFW lands including the Eel River Wildlife Area and Table Bluff Ecological Reserve are not explicitly included in the planning area description or figures as required by 23 CCR § 354.8(a).
    b. Recommendation: The Department recommends the GSP includes and accounts for all state lands, including CDFW lands, in the jurisdictional boundaries described in Section 2 of the GSP and relevant figures.

CONCLUSION

In conclusion, though the Eel River Valley Basin GSP does provide an initial assessment of groundwater use and potential impacts of that use, it does not comply with all aspects of SGMA statutes and regulations. Given this, the Department deems the GSP insufficient in its consideration of fish and wildlife beneficial uses and for the users of groundwater and interconnected surface waters. The Department recommends the Humboldt County GSA address the above comments to avoid a potential ‘incomplete’ or ‘inadequate’ GSP determination per 23 CCR § 355.4(b)(1), (2), and (4), as assessed by the Department of Water Resources, for the following reasons derived from regulatory criteria for GSP evaluation:

1. The assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are not reasonable and/or not supported by the best available information and best available science (23 CCR § 355.4(b)(1)). (See Comments #1, 2, 3, 4, 5, 6).
2. The sustainable management criteria and projects and management actions are not commensurate with the level of understanding of the basin setting, based on the level of uncertainty, as reflected in the GSP (23 CCR § 355.4(b)(3)) (See Comment #1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12).
3. The interests of the beneficial uses and users of groundwater in the basin, and the land uses and property interests potentially affected by the use of groundwater in the basin, have not been considered (23 CCR § 355.4(b)(4)) (See Comment #7, 8, 9, 10, 14).

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1655 Heindon Road
Arcata, California 95521-4573

December 20, 2021 **Refer to NMFS #:** 10012WCR2021AR00040

Mr. Hank Seeman
Humboldt County Groundwater Sustainability Agency
Humboldt County Department of Public Works
1106 Second Street
Eureka, California 95501

Re: National Marine Fisheries Service's Comments and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Recommendations for Humboldt County Groundwater Sustainability Agency regarding the Eel River Valley Groundwater Sustainability Plan

Dear Mr. Seeman,

This letter communicates the National Marine Fisheries Service's (NMFS) comments and essential fish habitat (EFH) conservation recommendations regarding the Humboldt County Groundwater Sustainability Agency's (GSA) proposed Eel River Valley Groundwater Sustainability Plan (GSP) to satisfy the requirements of the Sustainable Groundwater Management Act (SGMA). NMFS is the lead federal agency responsible for the stewardship of the nation's offshore living marine resources and their habitats, and implements the Endangered Species Act (ESA) and the Magnuson Stevens Fishery Conservation and Management Act (MSA) to fulfill its mission of promoting healthy ecosystems. Federally-managed living marine resources provide an important source of food and recreation for the nation, as well as thousands of jobs and a traditional way of life for many coastal communities. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the associated physical, chemical, and biological properties that are used by fish (50 CFR 600.10).

EFH has been designated within the GSP area by the Pacific Fishery Management Council (PFMC) for three Federal Fishery Management Plans or FMP's: Pacific Coast Salmon FMP (PFMC 2016); Pacific Coast Groundfish FMP (PFMC 2019b); and Coastal Pelagic Species FMP (PFMC 2019a). The Eel River estuary is EFH for all three FMP's, while the freshwater portion of the Eel River (and Van Duzen River) is EFH for the Pacific Coast Salmon FMP. The Eel River Valley GSP also overlaps with the critical habitat of three species of Pacific salmon listed under the ESA: Southern Oregon/Northern California coho salmon, California Coastal Chinook salmon, and Northern California steelhead.

The GSP contains great detail and has provided insight into how the Eel River Valley aquifer functions and provides for crucial cold water inputs during the warm and low flow summer and early fall season. The GSP suggests that the "sustainability goal is currently being met", which

appears to be unfounded, and directly contradicts the California Department of Water Resources (DWR) groundwater evaluation process that assigned a "medium" priority to the Eel River Valley sub-basin. Per DWR guidance, if the GSP intends to claim that the basin is currently being sustainably managed, then it must demonstrate and provide evidence that the effect of each undesirable result "does not exist and cannot occur" (DWR 2017). Regarding the effect streamflow depletion has on migration, spawning and rearing habitat within the basin, the draft GSP fails this requirement by not addressing streamflow depletion impacts during summer. If the draft GSP continues with this assertion, it should fully explain, in detail, why the historically high streamflow depletion rates that correspond to their proposed sustainable management criteria will avoid significant and unreasonable impacts to surface water beneficial uses.

The GSP has criteria (Sustainability Management Criteria, or SMC) for 'Depletion of Interconnected Surface Water' (SMC-6), in which the GSP has focused on adult passage or migration as the most sensitive life stage. The assertion that "fish passage is considered one of the most sensitive of surface water beneficial uses" should be justified; as variations in summer base-flow representing less than a tenth of one cubic foot per second have been shown to influence juvenile coho salmon survival (Obedzinski et al. 2018). The GSP relies on 130 cubic feet per second (cfs) as an adequate passage flow and then identified a pumping scenario that might cause a 0.1 foot reduction (while flows are at or above 130 cfs during September or October). The results indicate that pumping could occur at 150% over the baseline rate of usage before causing a 0.1 foot reduction during these high flows (130 cfs). This approach discounts the timing of critical flow conditions in the Eel River, which generally occur during the summer months (when flows are well below 130 cfs). The GSP fails to identify any thresholds to ensure that groundwater usage does not significantly affect summer and fall surface water flows and degrade the viability of listed species and their habitat.

Undesirable results are already occurring in the GSP area during the summer months. As noted in the draft GSP, the Van Duzen River is often dry at its confluence with the Eel River, preventing migration of all life stages. This is an undesirable result that is having significant and unreasonable impacts on surface waters and their beneficial uses, occasionally leading to stranding and mortality of adult Chinook salmon. The GSP evaluated the reductions in surface flows that result from groundwater pumping using models, which indicated that the Eel River near monitoring location ME-7 likely experiences reductions in flow of up to 14 cfs in the summer months. The historical record at the Scotia gage indicates that minimum flows range from 15-27cfs in August. This modelled reduction in flow near ME-7 is attributed to groundwater use and may be removing a majority of the flow in the Eel River during the summer and early fall, leading to disconnected and dry reaches, like what occurred in September of 2014 when a large stretch of the Eel River went dry (Press Democrat 2014). Restricting or precluding upstream migration of adult salmon and steelhead should be considered a significant and unreasonable condition in and of itself

Ensuring that a proportion of the surface waters remain in all GSP waterways throughout the entire year is vital to support water quality, ameliorate disease, and ensure pool and riffle sequences remain wetted and connected to each other to accommodate passage of all life stages of listed species. The GSP fails to reconcile the historic impacts of groundwater use within the Van Duzen and Eel Rivers, which the GSP indicate are already experiencing unreasonable

conditions and contributing to reductions in the viability of sensitive species listed under the ESA or managed under the MSA.

Essential Fish Habitat Conservation Recommendations

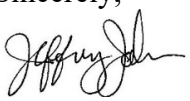
NMFS believes that the proposed GSP may cause significant adverse effects to EFH for the Pacific Coast Salmon FMP, and have adverse effects to the function of designated critical habitat for Coastal Chinook salmon. It does not appear that the draft GSP will achieve sustainable groundwater management in the Eel River Valley within the next 20 years, and groundwater use will continue to have negative effects on the viability of listed species and the greater ecosystem in general, as evidenced by all of the unreasonable conditions occurring already (the Van Duzen River confluence being dry, the Eel River going dry, disease outbreaks and stranding mortality events for Chinook salmon). Implementing these conservation recommendations would minimize the adverse and unreasonable effects to EFH and fulfill the obligations under Section 305(b) of the MSA.

1. The GSP should address the already significant and unreasonable reductions in surface flow in the Eel and Van Duzen Rivers during the most sensitive summer and fall months. The GSA should refocus the approach for SMC-6 and develop criteria that would not significantly degrade interconnected surface waters, or have negative effects on the viability of listed or managed species during the critical summer period.

2. The GSP should limit groundwater use to no more than 100% of baseline usage during the summer and fall months of June, July, August, September, and October, and ensure that there is no more than a 0.1 foot reduction in surface waters at any point during the water year, and most importantly, during the summer and fall months where low flows have been impacting listed adult Chinook salmon for many years.

Please let us know how we can assist the GSA, as well as fulfill our obligations to provide EFH conservation recommendations to the State as required by MSA Section 305(b)(4)(A). Please contact Matt Goldsworthy at Matt.Goldsworthy@noaa.gov.

Sincerely,



Jeffrey Jahn
South Coast Branch Chief
Northern California Office

Ccs: Ian Espinoza- California Department of Water Resources
Kerry Griffen- Staff Officer, Pacific Fishery Management Council
Monty Larson- Water Rights Coordinator, California Department of Fish and Wildlife
Bryan McFadin- North Coast Regional Water Quality Control Board
Christopher Watt- North Coast Regional Water Quality Control Board

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December 20, 2021

Humboldt County GSA
c/o Humboldt County Department of Public Works
1106 Second Street
Eureka, CA 95501-0579

Submitted via email: hseemann@co.humboldt.ca.us

Re: Public Comment Letter for Eel River Valley Draft GSP

Dear Hank Seemann,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Eel River Valley 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 **does not have a plan** 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 Eel River Valley 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,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Eel River Valley 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,[1] 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, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. The GSP identifies and maps the locations of Economically Distressed Areas (EDAs) (Figure 3 of the Stakeholder Engagement Plan) and provides the population of each EDA within the basin. The plan also provides a map of domestic well locations and the depths of these wells within the basin. However, we note the following deficiencies with the identification of these key beneficial users:

- The GSP identifies tribal communities that have cultural and traditional ties within the basin. However, the plan fails to map the locations of tribal lands or tribal interests in the basin.
- The GSP fails to identify the DAC population dependent on groundwater as their source of drinking water in the basin. Specifics should be provided on how much each DAC community relies on a particular water supply (e.g., what percentage is supplied by groundwater).

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

- Provide a map of tribal lands for the Bear River Band of the Rohnerville Rancheria and the Wiyot Tribe in the basin.
- Provide maps of DACs and SDACs within the basin and clarify if the definition of DACs and EDAs within the basin are the same.

[1] Our letter provides a review of the identification and consideration of federally recognized tribes (Data source: SGMA Data viewer) within the GSP from non-tribal members and NGOs. Based on the likely incomplete information available to our organizations for this review, we recommend that the GSA utilize the California Department of Water Resources' "Engagement with Tribal Governments" Guidance Document (https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents) to comprehensively address these important beneficial users in their GSP.

- 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. The GSP primarily uses groundwater elevation data from 2020 and 2021 (both dry years) in the ISW analysis. However, using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. In California's Mediterranean climate, groundwater interconnections with surface water can vary seasonally and interannually, and that natural variability needs to be considered when identifying ISWs. Furthermore, we recommend that the GSP discuss the screening depths of wells used in ISW analysis to illustrate the connectivity between the shallow principal aquifer and stream reaches in the basin.

We recommend the GSP discuss the gaps in data needed to adequately characterize the interaction between groundwater and surface water within the basin. The GSP should consider any segments with data gaps as potential ISWs and clearly marked as such on maps provided in the GSP.

RECOMMENDATIONS

- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.
- Overlay the basin's stream reaches on depth-to-groundwater contour maps to illustrate groundwater depths and the groundwater gradient near the stream reaches. Show the location of groundwater wells used in the analysis and discuss the screening depths of the wells.
- 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.
- Describe data gaps for the ISW analysis. 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**. The GSP mapped GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset) and other sources, including Classification and Assessment with Landsat of Visible Ecology Groupings (CalVeg) data and National Agriculture Imagery Program (NAIP) imagery. However, we found that some mapped vegetation features were improperly disregarded. Vegetation polygons were incorrectly removed in areas with direct precipitation inputs or very

local shallow subsurface flows. However, this removal criteria is flawed since GDEs, in addition to groundwater, can rely on multiple water sources simultaneously and at different temporal/spatial scales. Vegetation receiving precipitation inputs or very local shallow subsurface flows can still potentially be reliant on shallow groundwater aquifers, and therefore should not be removed from consideration as a GDE solely based on their proximity to these additional water supplies.

We commend the GSA for the comprehensive and detailed description of vegetation communities, critical habitat, and special-status species specific to each GDE subarea in the basin. The GSP could be further improved by confirming that depth-to-groundwater measurements under GDEs are corrected for land surface elevations.

RECOMMENDATIONS

- Re-evaluate the vegetation polygons with direct precipitation inputs or very local shallow subsurface flows. Refer to Attachment C of this letter for best practices for using local groundwater data to verify whether vegetation polygons are supported by groundwater in an aquifer.
- For the depth-to-groundwater contour maps, note 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.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[2,3] The integration of native vegetation into the water budget is **insufficient**. The GSP text discusses evapotranspiration from riparian habitats, but it is grouped into a category with all evapotranspiration in the water budget tables. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

RECOMMENDATIONS

- Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.
- 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 stakeholders is not fully met by the description in the Stakeholder Communications and Engagement Plan.[4]

We note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in general terms for listed stakeholders. Public notice and engagement activities include attendance at Humboldt County GSA Board meetings, Eel River Groundwater Working Group meetings and discussions, direct conversations with Humboldt County GSA Board members and staff, providing written comments to the Humboldt County GSP, and DWR Stakeholder Surveys. The GSP does not state whether there was direct engagement with DACs, tribal stakeholders, or environmental stakeholders.

- The GSP notes that the Eel River Groundwater Working Group is meant to encourage the active involvement of the population during GSP development and implementation and is open for all interested stakeholders. However, the GSP does not include a list of current members.

- The GSP mentions potentially developing a Groundwater Resource Advisory Committee but fails to clearly state if it has already been created or provide a description of its members.

- The plan does not include documentation on how stakeholder input from the above-mentioned outreach and engagement was solicited, considered, and incorporated into the GSP development process.

- Section 9 of the GSP (Implementation), including a section entitled 'Communication and Stakeholder Engagement,' states that the section will be developed for the final plan. As this section of the GSP is finalized, include a detailed plan for continual opportunities for engagement through the implementation phase of the GSP that is specifically directed to DACs, domestic well owners, tribes, and environmental stakeholders within the basin.

RECOMMENDATIONS

- In the Stakeholder Communications and Engagement Plan, describe active and targeted outreach to engage DACs, drinking water users, tribes, and environmental stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

[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)]

- Provide information on whether the GSA has initiated contact with tribal stakeholders in the basin during GSP development, and how tribal concerns were considered during the GSP development process.
- Provide documentation on how stakeholder input was incorporated into the GSP development process.
- Clearly describe the membership of the Eel River Groundwater Working Group and the Groundwater Resource Advisory Committee.
- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the basin.[5]

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 results and establishing minimum thresholds.[6,7,8]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP presents an analysis of the impacts of groundwater levels on wells in the basin. The GSP states (p. 102): *"The total number of wells in the initial well inventory was 221 and included all water supply wells (domestic, agricultural, industrial, public). Of these, wells that had total completed depths of less than 30 feet (14 wells) and/or wells that were constructed prior to 1965 (67 wells) were filtered out to establish the final well dataset for analysis, herein referred to as the 'study wells' (140 total)."* Minimum thresholds were established at groundwater levels at which 10% of the wells within each of two regions would have less than ten feet of water above the bottom of the well. The resulting minimum thresholds are as follows (p. 103): *"For the West Threshold Region, the minimum threshold in each well was set at 13 feet below the average Fall groundwater elevation for that well. For the East Threshold Region, the minimum threshold in each was set at four feet below the average Fall groundwater elevation for that well."* By grouping all water supply wells together, the true impacts to domestic wells have not been determined. Therefore, the GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users, especially given the absence of a domestic well mitigation plan in the GSP. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe

[5] Engagement with Tribal Governments Guidance Document. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/Guidance-Doc-for-SGM-Engagement-with-Tribal-Govt_ay_19.pdf

[6] "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)]

[7] "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)]

[8] "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)]

how the groundwater level minimum thresholds are consistent with Human Right to Water policy and will avoid significant and unreasonable impacts on these beneficial users.[9]

The GSP states (p. 105): *"An undesirable result would exist if one of the following scenarios occurs: 1. Groundwater levels in four or more representative monitoring sites fall below their minimum thresholds over the course of any one year. 2. Groundwater levels in two or more representative monitoring sites fall below their minimum thresholds for two sequential years."* Using this definition of undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during single dry years will not result in an undesirable result. This is problematic since the GSP is failing to manage the basin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years. Furthermore, the requirement that four monitoring wells exceed the minimum threshold before triggering an undesirable result means that areas with high concentrations of domestic wells may experience impacts significantly greater than the established minimum threshold because the four-well threshold isn't triggered.

For degraded water quality, the GSP only establishes SMC for arsenic. The GSP states (p. 113): *"For this GSP, one constituent of concern, arsenic, was selected as a precautionary measure. The level of concern is the drinking water MCL. The minimum threshold for degraded water quality is set as follows: Two supply wells exceeding the arsenic MCL of 10 ug/L."* According to the state's anti-degradation policy,[10] high water quality should be protected and is only allowed to worsen to the MCL if a finding is made that it is in the best interest of the people of the State of California. No analysis has been done and no such finding has been made. Furthermore, the GSP's Water Quality Technical Memorandum discusses other constituents of concern (COCs), both naturally occurring and those associated with industrial activities. Significantly, nitrate is an acute contaminant which, at levels above the maximum contaminant level, can affect public health. This is a particular concern for domestic wells, as nitrate exceedances do not affect the taste or smell of the water. All COCs in the basin that may be impacted or exacerbated by groundwater use and/or management should be included in the SMC, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.
- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users, DACs, and tribes within the basin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.
- Consider minimum threshold exceedances during single dry years when defining the groundwater level undesirable result across the basin.

[9] California Water Code §106.3. Available at: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=WAT&sectionNum=106.3

[10] Anti-degradation Policy https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/1968/rs68_016.pdf

Degraded Water Quality

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality.[11] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[12]
- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.
- Set minimum thresholds and measurable objectives for all water quality constituents within the basin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management.
- Set minimum thresholds that do not allow water quality to degrade to levels at or above the MCL trigger level.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing SMC for chronic lowering of groundwater levels.

For depletion of interconnected surface water, the GSP describes impacts to fish passage when establishing SMC. The GSP states (p. 116): *"Because fish passage is considered one of the most sensitive indicators of surface water beneficial uses and a quantitative framework for riffle depth is available, the potential change in river stage relative to minimum fish passage depth was selected as the basis for setting minimum thresholds for surface water depletions."* The GSP continues (p. 118): *"A reduction in stage of 0.1 feet was set as a conservative benchmark for potential impact on riffle depth and fish passage. Exceedance of this benchmark does not mean that beneficial uses of the interconnected surface water are degraded or the viability of special-status species are threatened but provides a starting point for analysis. Simulation modeling using a number of conservative assumptions indicated that groundwater pumping could increase by 150% above current conditions before the stage of the Eel River would be reduced by 0.1 feet at the downstream end of the study reach (sub-region ME-7) when fish passage conditions exist."* The GSP also establishes seven wells as representative monitoring sites for monitoring protective water levels associated with potential impacts to interconnected surface waters. We recommend that as the SMC for depletion of interconnected surface water are refined in the future, the GSA further describes what significant and unreasonable effects are for ISWs. We also recommend that the GSP provide discussion that adaptive changes in SMC for ISWs will be made, if groundwater, streamflow, or biological monitoring reveals that existing SMC are not protective of surface water beneficial users.

[11] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

[12] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

RECOMMENDATIONS

- When establishing SMC for the basin, consider that the SGMA statute [Water Code §10727.4(l)] specifically calls out that GSPs shall include "impacts on groundwater dependent ecosystems."

- Evaluate impacts on GDEs when establishing SMC for chronic lowering of groundwater levels. When defining undesirable results, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin.[13] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[14]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the basin are reached.[15] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[8,16]

- Provide discussion that adaptive changes in SMC for ISWs will be made, if groundwater, streamflow, or biological monitoring reveals that existing SMC are not protective of surface water beneficial users.

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 Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[17] The effects of climate change will intensify the impacts

[13] "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)]

[14] 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)]

[15] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[16] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[17] "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)]

of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[18] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors for 2030 and 2070. However, the plan does not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the basin. While these extreme scenarios may have a lower likelihood of occurring and their consideration is not required (only suggested) by DWR, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

The GSP fails to clearly illustrate how climate change impacts key inputs (e.g., changes in precipitation, evapotranspiration, and surface water flows) of the projected water budget. While precipitation inputs are stated to be adjusted for climate change in Section 5.7 of the GSP, the plan does not quantify these changes in precipitation in text or in tables for the projected water budget. The plan also fails to provide a sustainable yield for the basin. The sustainable yield should be calculated based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, omission of projected climate change effects on key inputs, and omission of sustainable yield calculated based on the projected water budget with climate change incorporated, 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, tribes, and domestic well owners.

RECOMMENDATIONS

- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Illustrate how climate change is projected to modify precipitation, evapotranspiration, and surface water flow inputs and include the values in projected water budget tables.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

[18] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of plans to increase the Representative Monitoring Sites (RMSs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around GDEs, tribes, domestic wells, and DACs in the basin. These beneficial users 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 network.[19]

Figure 39 (Representative Monitoring Sites for Well Impacts) shows sufficient spatial representation for DACs and drinking water users for groundwater elevation monitoring, however depth representation cannot be verified with information provided in the GSP. The GSP does not provide a figure of the water quality monitoring network, therefore we cannot verify the representation of DACs, drinking water users, and tribes for water quality monitoring within the basin.

The GSP does not discuss data gaps for GDEs and ISWs in the Monitoring Network or Project and Management Actions sections of the GSP, despite recognition of sparse groundwater elevation data for some GDE units (e.g., Upper Eel GDE Unit) in the GDE Technical Memorandum. We recommend that the GSP further discuss these data gaps and provide specific plans, such as locations and a timeline, to fill them.

RECOMMENDATIONS

- Provide maps that overlay current and proposed monitoring well locations with the locations of DACs, domestic wells, tribes, and GDEs to clearly identify monitored areas.
- Increase the number of RMSs in the shallow aquifer across the basin as needed to map ISWs and adequately monitor all groundwater condition indicators across the basin and at appropriate depths for *all* beneficial users. Prioritize proximity to DACs, domestic wells, tribes, GDEs, and ISWs when identifying new RMSs.
- Ensure groundwater elevation and water quality RMSs are monitoring groundwater conditions spatially and at the correct depth for *all* beneficial users - especially DACs, domestic wells, tribes, and GDEs.
- Describe 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.

[19] "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)]

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, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, tribes, and drinking water users. Therefore, 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.

We note that the plan does not include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.

RECOMMENDATIONS

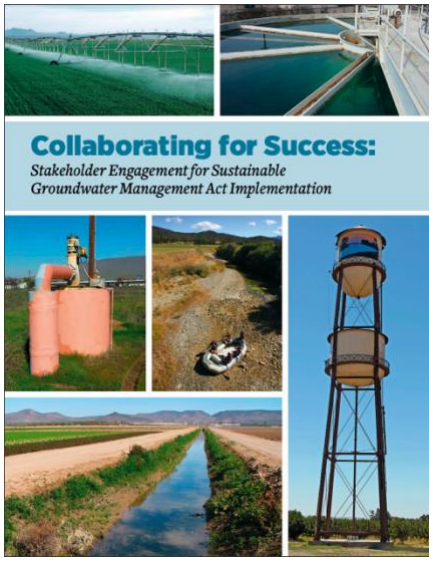
- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.
- For DACs 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.
- Recharge ponds, reservoirs, and facilities for managed aquifer 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."[20]
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

[20] 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



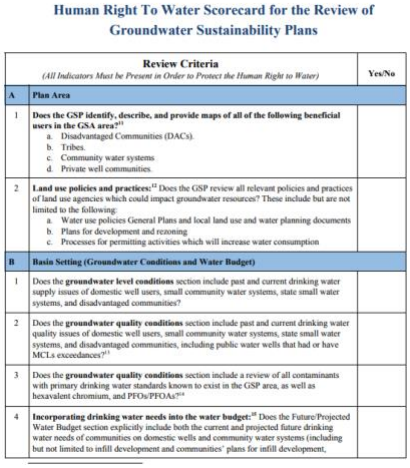
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement 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

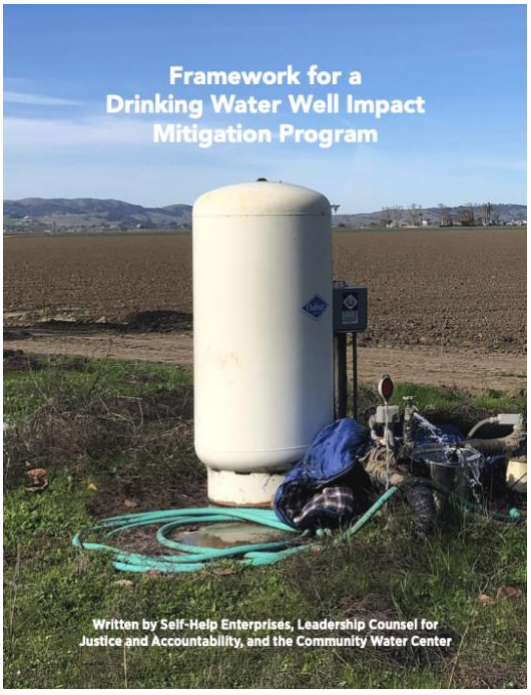


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	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?**[43] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems. d. Private well communities.	
2	**Land use policies and practices:**[44] 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 rezoning 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?[45]	
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?[46]	
4	**Incorporating drinking water needs into the water budget:**[48] 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,	

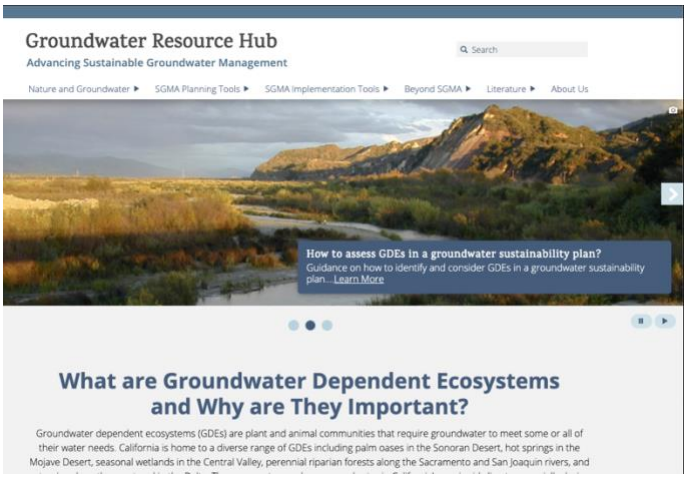
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in 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 phreatophytes[1], 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.

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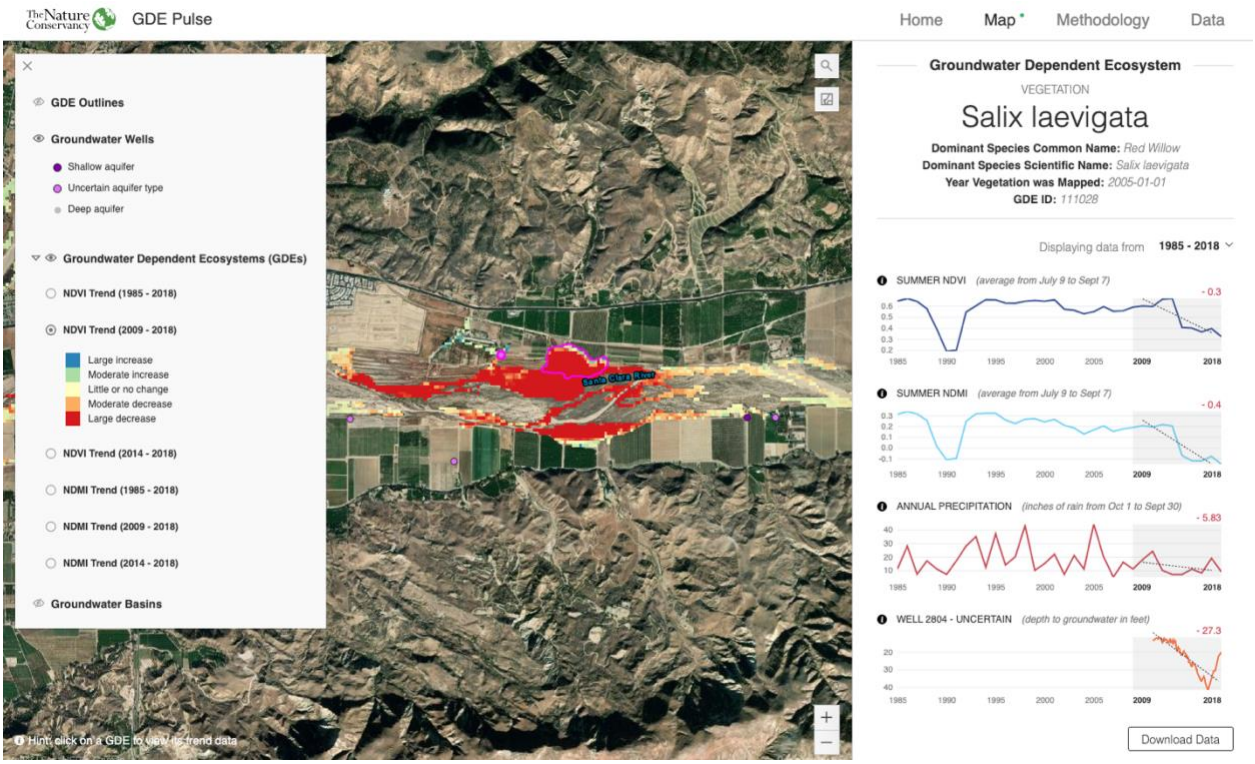
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

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.

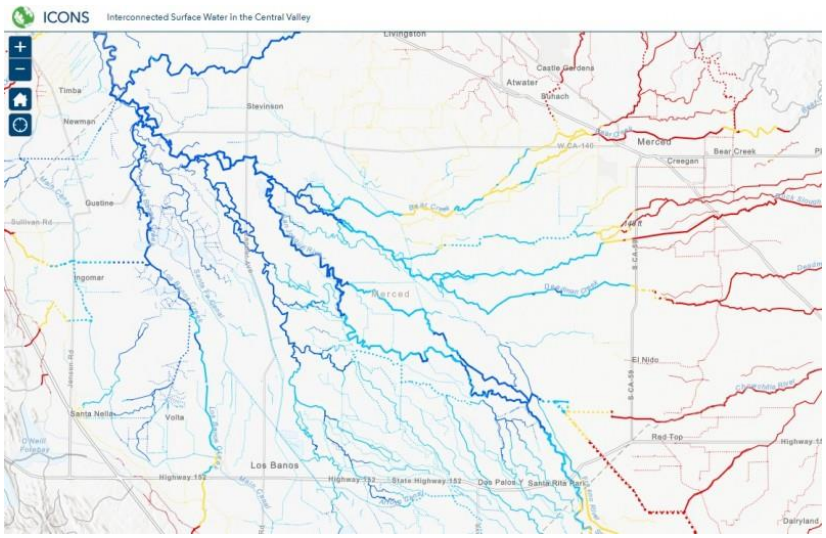
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water 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



ICONS 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 Eel River Valley Subbasin

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 Eel River Valley Subbasin. 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. 2015[1]. 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 BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo	Candidate - Threatened	Endangered	
Riparia riparia	Bank Swallow		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			
Aythya affinis	Lesser Scaup			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 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

Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cinclus mexicanus	American Dipper			
Cistothorus palustris palustris	Marsh Wren			
Cygnus buccinator	Trumpeter Swan			
Cygnus columbianus	Tundra Swan			
Cypseloides niger	Black Swift	Bird of Conservation Concern	Special Concern	BSSC - Third priority
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			

Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oreothlypis luciae	Lucy's Warbler		Special Concern	BSSC - Third priority
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Americorophium salmonis				Not on any status lists
Americorophium spinicorne				Not on any status lists
FISH				
Eucyclogobius newberryi	Tidewater goby	Endangered	Special Concern	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Oncorhynchus mykiss - NC summer	Northern California coast summer steelhead	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - NC winter	Northern California coast winter steelhead	Threatened		Near-Threatened - Moyle 2013
Oncorhynchus tshawytscha - CCC fall	California Coast fall Chinook salmon	Threatened	Special	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC

Ambystoma gracile	Northwestern Salamander			
Anaxyrus boreas boreas	Boreal Toad			
Ascaphus truei	Coastal Tailed Frog			
Dicamptodon tenebrosus	Pacific Giant Salamander			
Rana aurora	Northern Red-legged Frog		Special Concern	ARSSC
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rhyacotriton variegatus	Southern Torrent Salamander		Special Concern	ARSSC
Taricha granulosa	Rough-skinned Newt			
Thamnophis sirtalis sirtalis	Common Gartersnake			
Dicamptodon ensatus	California Giant Salamander			ARSSC
Thamnophis atratus atratus	Santa Cruz Gartersnake			Not on any status lists
Thamnophis elegans terrestris	Coast Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Amiocentrus aspilus	A Caddisfly			
Anax junius	Common Green Darner			
Antocha monticola				Not on any status lists
Antocha spp.	Antocha spp.			
Archilestes californica	California Spreadwing			
Argia agrioides	California Dancer			
Argia emma	Emma's Dancer			
Argia lugens	Sooty Dancer			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Baetis tricaudatus	A Mayfly			
Brillia flavifrons				Not on any status lists
Brillia spp.	Brillia spp.			
Calineuria californica	Western Stone			
Centroptilum album	A Mayfly			
Centroptilum spp.	Centroptilum spp.			
Chaetocladius spp.	Chaetocladius spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus anonymus				Not on any status lists
Chironomus spp.	Chironomus spp.			

Cladotanytarsus marki				Not on any status lists
Cladotanytarsus spp.	Cladotanytarsus spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus annulator				Not on any status lists
Cricotopus spp.	Cricotopus spp.			
Dicosmoecus gilvipes	A Caddisfly			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Dixidae fam.	Dixidae fam.			
Eukiefferiella claripennis				Not on any status lists
Eukiefferiella spp.	Eukiefferiella spp.			
Glossosoma alascense	A Caddisfly			
Glossosoma spp.	Glossosoma spp.			
Gomphus kurilis	Pacific Clubtail			
Gumaga griseola	A Bushtailed Caddisfly			
Gumaga spp.	Gumaga spp.			
Hesperoperla pacifica	Golden Stone			
Hetaerina americana	American Rubyspot			
Heterotrissocladius oliveri				Not on any status lists
Heterotrissocladius spp.	Heterotrissocladius spp.			
Hydropsyche alternans				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila ajax	A Caddisfly			
Hydroptila spp.	Hydroptila spp.			
Hydroptilidae fam.	Hydroptilidae fam.			
Laccobius acutipenis				Not on any status lists
Laccobius spp.	Laccobius spp.			
Lepidostoma spp.	Lepidostoma spp.			
Lestes dryas	Emerald Spreadwing			
Lestes stultus	Black Spreadwing			
Libellula luctuosa	Widow Skimmer			
Libellula saturata	Flame Skimmer			
Macromia magnifica	Western River Cruiser			
Malenka bifurcata				Not on any status lists
Malenka spp.	Malenka spp.			

Micropsectra nigripila				Not on any status lists
Micropsectra spp.	Micropsectra spp.			
Microtendipes caducus				Not on any status lists
Microtendipes spp.	Microtendipes spp.			
Nanocladius anderseni				Not on any status lists
Nanocladius spp.	Nanocladius spp.			
Nemouridae fam.	Nemouridae fam.			
Ophiogomphus bison	Bison Snaketail			
Optioservus canus	Pinnacles Optioservus Riffle Beetle		Special	
Optioservus spp.	Optioservus spp.			
Oreodytes abbreviatus				Not on any status lists
Oreodytes spp.	Oreodytes spp.			
Orthocladius appersoni				Not on any status lists
Orthocladius spp.	Orthocladius spp.			
Paltothemis lineatipes	Red Rock Skimmer			
Paracladopelma alphaeus				Not on any status lists
Paracladopelma spp.	Paracladopelma spp.			
Paratanytarsus grimmii				Not on any status lists
Paratanytarsus spp.	Paratanytarsus spp.			
Pentaneura spp.	Pentaneura spp.			
Phaenopsectra dyari				Not on any status lists
Phaenopsectra spp.	Phaenopsectra spp.			
Polycentropus spp.	Polycentropus spp.			
Polypedilum albicorne				Not on any status lists
Polypedilum spp.	Polypedilum spp.			
Procladius barbatulus				Not on any status lists
Procladius spp.	Procladius spp.			
Progomphus borealis	Gray Sanddragon			
Pseudochironomus richardsoni				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Radotanypus spp.	Radotanypus spp.			
Rheotanytarsus hamatus				Not on any status lists
Rheotanytarsus spp.	Rheotanytarsus spp.			

Rhionaeschna californica	California Darner			
Rhyacophila spp.	Rhyacophila spp.			
Sialis arvalis				Not on any status lists
Sialis spp.	Sialis spp.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Sperchon spp.	Sperchon spp.			
Sperchon stellata				Not on any status lists
Stictotarsus aequinoctialis				Not on any status lists
Stictotarsus spp.	Stictotarsus spp.			
Sublettea spp.	Sublettea spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Tanytarsus angulatus				Not on any status lists
Tanytarsus spp.	Tanytarsus spp.			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Tropisternus californicus				Not on any status lists
Tropisternus spp.	Tropisternus spp.			
Tvetenia spp.	Tvetenia spp.			
Tvetenia vitracies				Not on any status lists
Wormaldia anilla	A Caddisfly			
Wormaldia spp.	Wormaldia spp.			
Zaitzevia parvula				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
Ameletus majusculus	A Mayfly			
MAMMALS				
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Ferrissia fragilis	Fragile Ancylid			CS
Ferrissia spp.	Ferrissia spp.			
Margaritifera falcata	Western Pearlshell		Special	
Physa acuta	Pewter Physa			Not on any status lists
Physa spp.	Physa spp.			

Pisidium casertanum				Not on any status lists
Pisidium spp.	Pisidium spp.			
PLANTS				
Carex lyngbyei	Lyngbye's Sedge		Special	CRPR - 2B.2
Montia howellii	Howell's Miner's-lettuce		Special	CRPR - 2B.2
Alnus rubra	Red Alder			
Alopecurus saccatus	Pacific Foxtail			
Carex arcta	Northern Clustered Sedge		Special	CRPR - 2B.2
Carex nudata	Torrent Sedge			
Cotula coronopifolia	NA			
Crypsis vaginiflora	NA			
Eryngium aristulatum aristulatum	California Eryngo			
Euthamia occidentalis	Western Fragrant Goldenrod			
Glyceria elata	Tall Mannagrass			
Jaumea carnosa	Fleshy Jaumea			
Populus trichocarpa	NA			Not on any status lists
Ranunculus repens	NA			
Ranunculus sardous	NA			
Salix exigua exigua	Narrowleaf Willow			
Salix lasiolepis lasiolepis	Arroyo Willow			
Sequoia sempervirens				
Spartina foliosa	California Cordgrass			
Stachys ajugoides	Bugle Hedge-nettle			
Stachys rigida quercetorum				Not on any status lists
Typha latifolia	Broadleaf Cattail			

Attachment D

The Nature Conservancy

July 2019

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) online[1] 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.

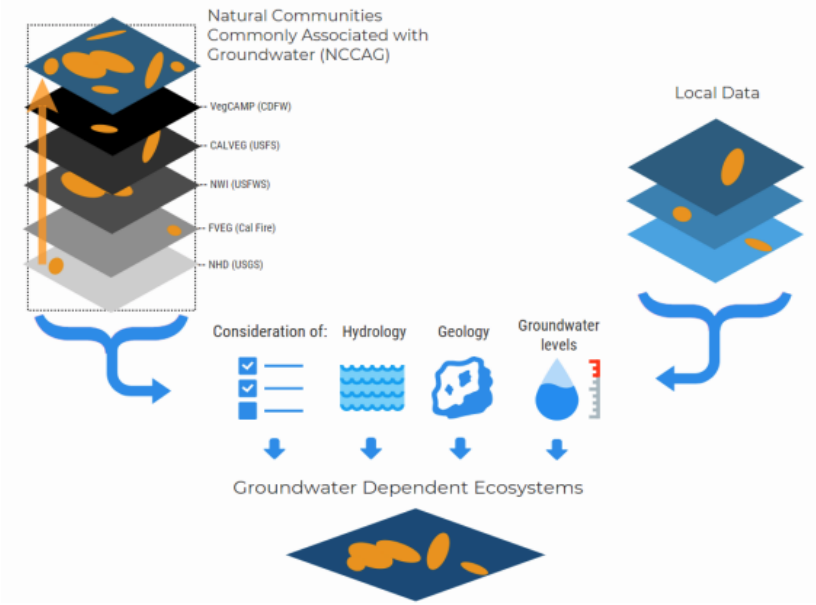


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[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 California[3]. 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 dataset[4] on the Groundwater Resource Hub[5], 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 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

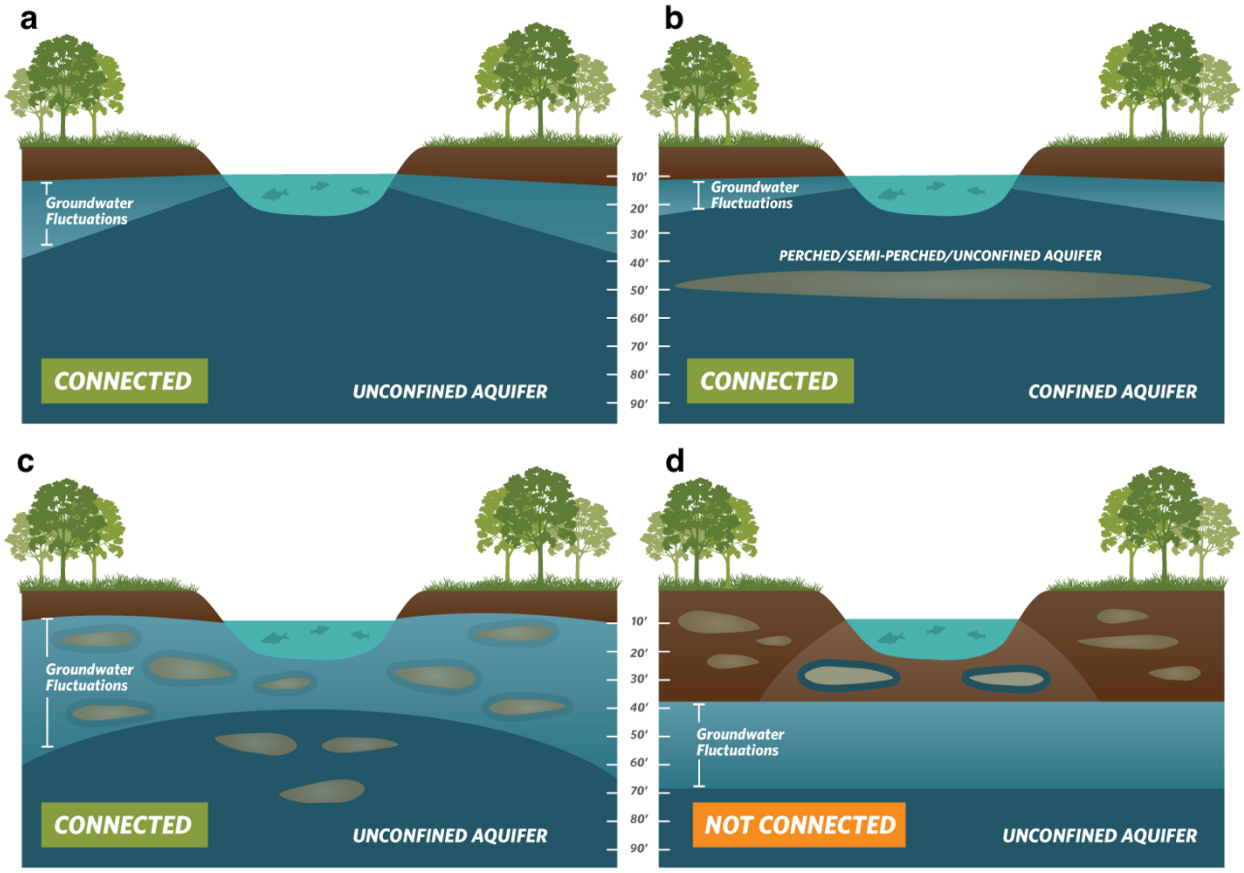


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying 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 budgets[6] 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 baseline[7] 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 approach[8] 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 document[4], 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 feet[4] 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 Viewer[9]. 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).

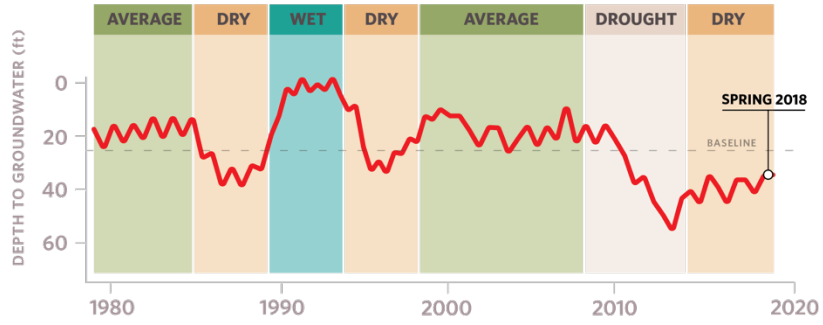


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so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

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/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 GSPs[4]).

[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 animals[10], 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).

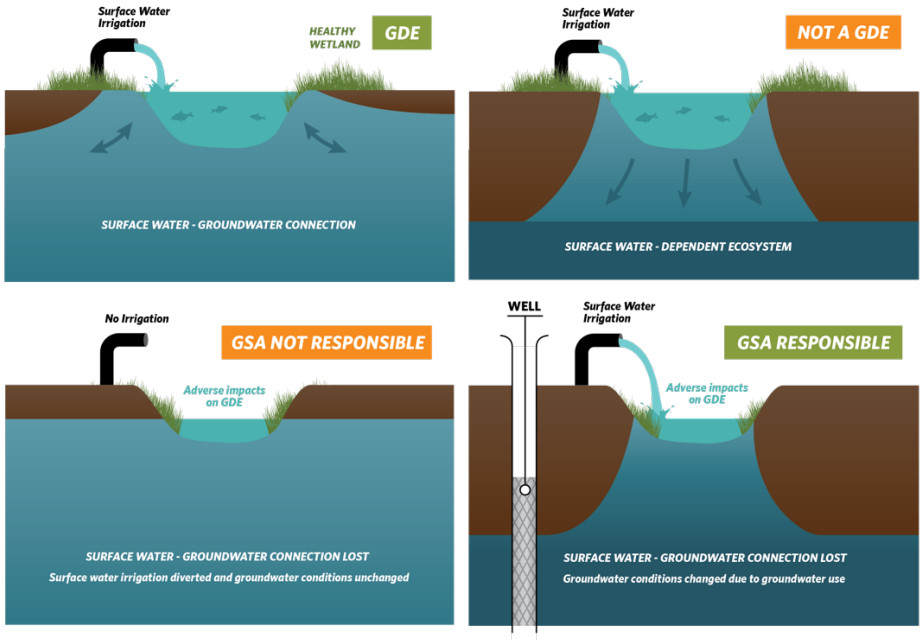


Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **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.

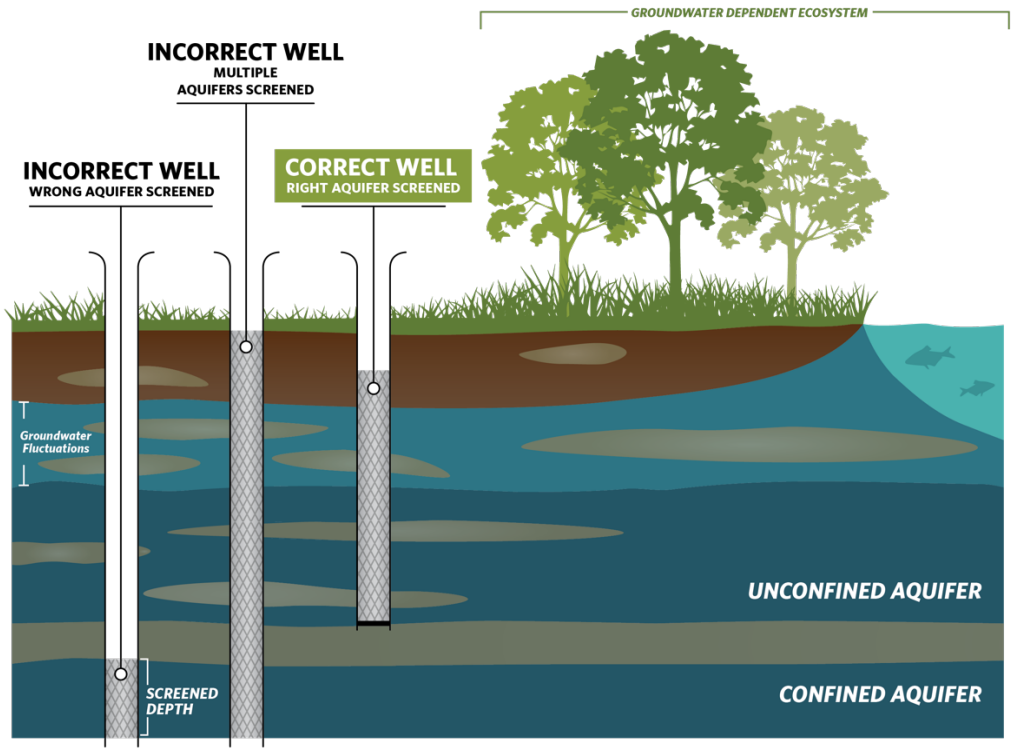


Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

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.

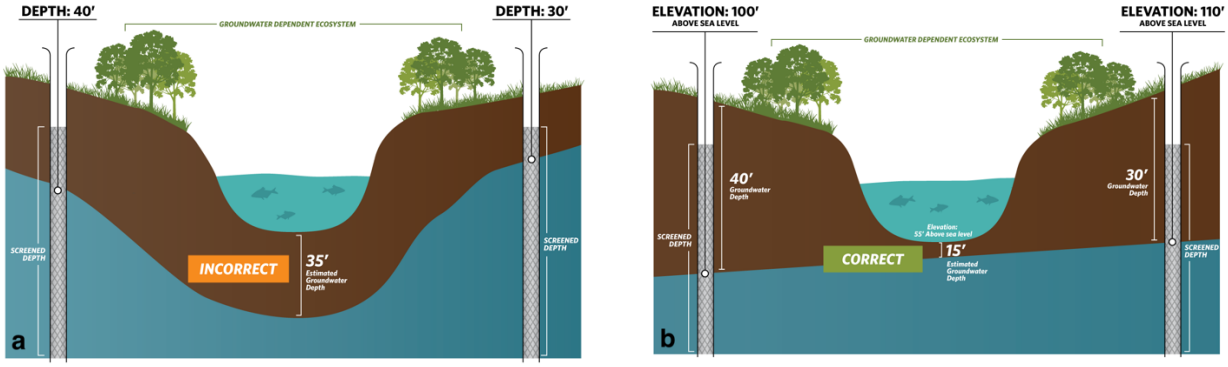


Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

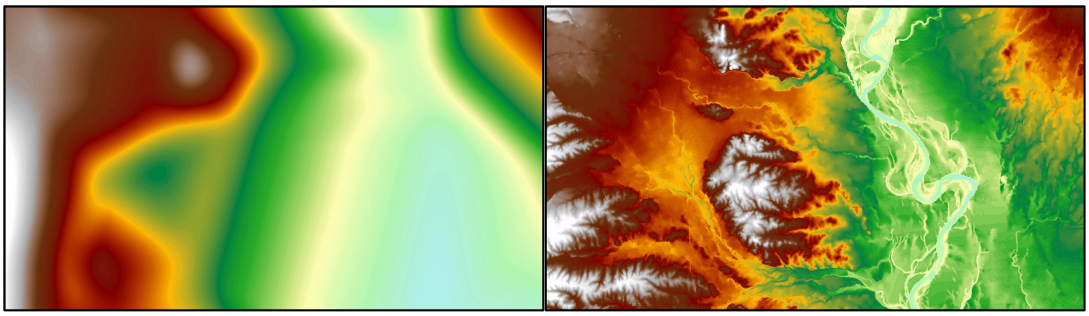


Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation 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/ngp/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.